Evolution of the Philosophy of Investments in IT Projects

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Abstract

This paper discusses the changes in Information Technology (IT) investment philosophy of both private and public sector companies. Based on the available published material in scholarly journals and magazines, our analysis is focused on the USA and the UK. The paper analyzes the past and current behaviors of business investments in technology and the factors that have prompted companies to change their IT investment patterns. The paper discusses how the success of IT can not be measured with traditional methods of calculating return on investments (ROI) but must be evaluated in other ways. It highlights specific points proving that IT has slowly evolved over the years from an uncontrollable technological change to a strategic management tool that creates and increases competitiveness. In this strategic role, investment in IT has become a tool of meeting business objectives for the companies.

Keywords: IT Investments, ROI, Information Technology, Failed IT Projects

Introduction

For the past decade, economists and information technology specialists have argued back and forth whether IT investments have generated return on investments and increased national output of goods and services. Businesses, fueled by high expectations on productivity growth generated by IT investments, heavily invested into computing power between the mid 1980s and the 1990s. It was generally accepted that IT spending would prove to be a valuable investments and would pay for itself in the long run. Growth and high return on investment were expected. A few years later, managers and business leaders were beginning to question the gains in productivity, which at best seemed to be in a state of status quo (Brynjolfsson, 1993). Though a few success stories were recorded and praised, for most, information technology became a source of frustration and disillusion. The notion of the productivity paradox emerged. Companies, learning from the wasted billions in questionable IT investments, had to reinvent the way they did business to integrate their IT investments into their strategic planning. Today IT resources are specialized, tailored and customized to the needs of the company, and optimized to maximize companies' efficiency and output level. This transition has been slow, lengthy, and painfully costly.

This paper presents an analysis of the evolution of the philosophy of investments in IT projects - by both pubic as well as private sector companies. The paper discusses the empirical evidence – both at macro and micro levels - that led to questioning of the contribution of IT investments to productivity gains and

other measurable returns such as ROI (return on investment), an analysis of three major examples of high profile failed IT projects, and four periods of evolution of IT investments starting from the time of euphoria when no one questioned IT investments to the current (fourth) period of the total (IT) integration management.

Questioning the Return on IT Investments

In recent years computers have revolutionized the way companies do business with customers and other businesses; yet business data and other productivity statistics do not reflect any added growth. To solve this mystery, academic economists and scholars began collecting macro-economic data.

The focus of the research mainly concerned many factors and labor productivity statistics. Economists discovered that both indices and the GDP dropped after 1973 when the first main-frame was introduced in the business world (Hubbard, 2003). In the late 1990s, the threatening Y2K bug forced companies to invest even more in IT resources to prevent a massive loss of data that many IT specialists predicted. Nothing happened and companies had more technology than needed and productivity growth was not seen.

Many have written books and articles explaining this paradox. A great deal of time was also spent on detailing how to measure productivity. Economists just could not assess whether technology contributed to growth or negatively affected it. Productivity and GDP were still growing but at a much slower pace. Many argued that most analysts measured macro data when computer contribution can only be noticed on a micro level (Devaraj & Kohli, 2002). Finally, the argued theories of the old economy and the new economy did not answer the problem or explain the paradox.

Researchers came to the conclusion that this paradox exists due to seven factors that mask proper measurements and analysis. These factors are: (1) IT investments only represent a small share of GDP. (2) Computers have a rapid rate of depreciation and obsolescence. (3) Old measurements do not apply in the new economy. (4) Poor analogy exists between the service sector (where productivity slowed down the most) and its heavy reliance on computers. (5) Computers have provided many intangible benefits. (6) A time lag exists between technology arrival and productivity benefits. (7) Web surfing, instant messaging and other nonproductive computer related activities have offset gains (Misra, 2003).

The attention given to measurements and assessments of IT contributions to the economy has changed the attitude towards investments in IT related projects. In the beginning, IT expenditures were not subjected to major scrutiny. In the nineties, the bullish market pushed companies and businesses into a spending euphoria stage and expansion phase. IT spending was expensive, but due to the state of growth of the economy between mid-eighties and late nineties, few analysts, financial advisors and investors questioned the estimated payoffs of the IT investments. Today, however, growth has been succeeded by need to survive, and companies' strategic goals, choices and overall expenditures are under constant scrutiny from investors, shareholders and regulatory institutions. Time calls for conservation, savings and management to achieve economic profit. In order to remain solvent companies have had to optimize all factors of production and resource allocation. Most companies have adopted the "do more with less" policy and many have restructured, laying-off employees and changing or adjusting their business strategies and goals. Most companies strived to yield positive earnings in the past couple of years. Many industries such as the airline industry or the general retail industry have consolidated, strengthened and developed new strategic alliances to achieve such goals; yet only few have succeeded. The bearish economy increased the level of competition in a given industry, forcing each business to focus on increasing (at least holding) its market share rather than its size. New strategies have developed to establish, strengthen and augment a company's competitive advantage. This has resulted into a greater

coupling of IT strategy with the business strategy.

At the micro level, a long history of failed IT projects world wide (Bupa, 2005; Chua & Lam, 2005; Pearce, 2003) has cast a further shadow on the return of these projects in the face of completing these projects well above the original estimated costs.

Research Method

We conducted initial search in two popular online databases, ProQuest (ABI/INFORM) and Emerald, using the search terms "Failed IT Projects" The ProQuest search yielded 54 results and the Emerald search yielded 1052 results. A closure examination revealed a few noteworthy papers. One scholarly paper (Ewusi-Mensah, 1997) on failed IT projects discussed what could have been done to avoid the failure and what some of the critical issues were. The two others were related to the related fields such as Knowledge Management (Chua & Lam, 2002) and Project Management (Aiyer, Rajkumar, and Havelka, 2005); hence, had a discipline specific angle to the analyses. Another paper (Duggal, 2002) discussed the global issues with technology management. Then, we expanded our search to trade magazines (CIO in particular) and government publications. We found all three cases discussed in the next section in these publications. Also we found a wealth of information on the UK government websites regarding failed public sector projects.

Multi-Case Analysis of Failed IT Projects

In order to understand the conditions that created changes in the attitude towards IT investment decision making, one needs to understand the causes of IT projects failures. We will discuss three prominent failed IT projects pointing out the key factors potentially responsible for their failure.

The Case of Medicare Processing System in the Health Care Financing Administration

"Medicare Transactions: A $50 Million Lesson in Project Management," (Friel, 2000) reported the case of the Health Care Financing Administration (HCFA) which spent six years, from 1991 to1997, developing a new IT system. This system was supposed to combine 14 Medicare systems located at 60 different sites and operated by more than 70 contractors. Each system was developed in different computing languages, different computing platforms and by different service providers between the 1960s and 1980s. After several years of debate, the agency concluded the systems were becoming unmanageable and decided to build one large, integrated system, which would handle all the agency's systems and programs. The new system was expected to generate huge cost savings over time once the system was implemented 5 years down the road. Although the inspector general of the HCFA warned the administration to develop a clearer strategy for MTS (Medicare Transaction System) before jumping into building a system, the administration went ahead and granted the development of the new system to GTE Government Services. GTE developed a strategy to link these systems together; however, it became rapidly evident that HCFA was not clear on the needs and wants of the new system. In addition, GTE was not given enough information about Medicare complex processing. In 1994 and 1995 HCFA ignored the recommendations of the inspector general who warned of the danger of not giving GTE enough information. In 1996, due to considerable over-budget spending, Congress scheduled a hearing. HCFA ordered GTE to stop working on the project. The General Accounting Office estimated that HCFA spent $80 million on project and the projected costs ballooned from $151 million to $1 billion. Furthermore, GTE estimated the project completion date not to be before the year 2000. In August of 1997, HCFA canceled the contract with GTE, and the MTS project was scrapped. During the congressional hearing, the General Accounting Office attributed the failure of the project to HCFA's lack of planning, strategic management, performance measurement and

cost benefit analysis which would have allowed the administration to continually track the progress of GTE. HCFA was incapable of keeping track of its spending on the project while maintaining that it only spent $50 million of the project.

The Case of Russ Berrie and Company

Russ Berrie & Company, the New Jersey based teddy bear manufacturer, also suffered from failed IT implementation (Songini, 2003). In 1999, the bear maker contracted SAP AG to develop and implement a system that would migrate old applications such as homegrown distribution, financial and customer service systems toward Y2K compliant packaged ERP applications. The implementation of the project failed. As a consequence, the company was forced to "resurrect its aging Digital Equipment Corp system." and had to ensure that it was Y2K compliant. This process greatly strained both the IT department and the business units. The ordeal lasted three years and the total estimated cost of the failed project was $10.3 million. This represented quite an investment for a company that had annual revenues averaging only $230 million. In 2002 the company needed a working ERP and had to allocate new funds to the development of a new project. Even though it is not clearly stated in the case, one can easily conclude that the lack of strategic planning especially through the implementation phase was one of the key elements leading to failure.

F.B.I.'s $170 Million Virtual Case System

FBI Director Mueller told the Congressional subcommittee hearings on March 8, 2005 that the virtual case system project suffered from technical, management and scheduling problems. If the system were allowed, he said, to be completed, it would have been an outdated system. He did not elaborate on what he meant by this. But, it can be safely assumed that the system would not have worked. He pointed out that the agency underestimated the required level of project/contract management skills and hence failed to assign the right people for the project. The Virtual Case File project was the third and last phase of a $581 million effort to overhaul the embedded computer systems. Representative Frank R. Wolf of Virginia, chair of the subcommittee that oversees F.B.I. financing, has announced that his staff was opening a formal investigation into why the project failed. As the investigation of this case goes on, it will be interesting to find out the level of actual losses. Previously, Office of Inspector General has issued an audit report in February 2005 ("The Federal Bureau of Investigation's," 2005).

United Kingdom's Public Sector 25 IT Projects

Going back to 2000, the failure of many public sector (government) projects led to many investigations ("Getting IT Right for Government," 2000; "Review of Major Government IT Projects," 2000). These projects were either delivered late or not at all, came over budget, did not have the required functionalities. The first report was prepared by IT companies (part of the Computing Services and Software Association (CSSA)) that do business with the UK government. It concluded that a strong connection is needed between the business objectives and IT Projects (something we discuss in the next section). Report also pointed out that the public sector lacks business oriented project managers. What is most frustrating is that a decade of the steps (Cross, 2000) undertaken to better manage IT projects has not yielded satisfactory results. 28% of the UK government IT projects are in the red, 50% are amber and only 22% are green.

Analysis

Unfortunately these scenarios of failed IT projects are not unusual. A study of IT Projects in the 1980's and 1990's (Johnson, 1995) made by the Standish Group of the IT projects in the 1980's and 1990s reported that 31% of new IS projects were canceled before completion, costing a com-

bined bill of $81 billion. In addition, nearly 53% of completed projects were 189% over the estimated budget, costing companies an excess of $59 billion.

Another analysis of failed projects (Ewusi-Mensah, 1997) identified some major and recurrent factors leading to project cancellation and implementation problems. The first was the lack of a clear statement of the new system's purpose and objectives, which changed during the project development, decreasing further the chance of satisfying the need of the organization. The second element leading to project cancellation was an inherent problem rooted deep into the organization of the development team. Three sub-components were identified as part of the problem: (1) lack of structure and organizational purpose in the teams' efforts, (2) lack of leadership in the team and (3) lack of interaction between team members, often due to unclear lines of communication that created misunderstanding about requirements and design decisions, which encouraged individualism instead on team effort and synergy. The third element was the lack of system development methodology, which encompassed phase lifecycle approach and which guided project team members through the development of each stages of the project. The absence of rigorous structures led to a status quo in the development of the project. Loose management and control of the development team was the forth reason for development and implementation failure.

Often managers and executives (Ewusi-Mensah, 1997) did not monitor and assess the progress of the task. Problems were not identified early and only became bigger as the project development advanced. For obvious reasons, the technical knowledge and aptitude of the team should have been a must in the development of such project; yet many teams were under-qualified to develop the projects or the size of the project was too big for their competencies. He further stated that the size of the project was directly related to its level of difficulty. As the difficulty increased, so did the risks undertaken by the development team. Lastly, one of the last reasons for failure was the lack of cooperation and involvement from senior management executives in the development, assessment and progress of the project. Sufficient information and data were not given to the development team, and too often objectives were changed or new options were added considerably increasing the complexity of the projects and the risks of failure.

These failed IT projects quickly became a source of discontent and unease among senior executives and chief information officers. The main problem came from their inabilities to evaluate return on investment effectively as well as their failures to strategically plan and manage such project. The lack of "adult supervision" (Cramm, 2001) of IT projects was responsible for their failure. Not enough attention was given to the payback of the IT investments. Executives adopted the "build it and revenue will come" philosophy for investment in technology. The executives' lack of understanding of the technology and their excessive faith in it gave them the authority to hold information technology above the common investments code of conducts which always required investment justification and measurements of expected returns.

Many books and articles began referring to IT investment as a necessary evil rather than a strategic management tool. Unquestioned faith (Cramm, 2001) on the virtues of technology made managers ignore the well established rules of justifying the investments. However, after billions of dollars were wasted on failed projects and uncontrolled budgets, companies were more than ever dependent on computers and the needed information technology systems were still needed. Disclosures of many failed IT projects led to the questioning by the researchers and practitioners of the approval process used by the executives... Between the 1980s and mid 1990s, non-IT executive were in charge of approving IT projects. Due to subjective performance assessments, lack of relevant ROI measurements and investment management framework, IT became an expense to be minimized instead of an investment to be optimized (Cramm, 2001). Incompatibility, lack of training or incurred mainframe upgrades cascaded into one problem or another. As a consequence $5,000 software expenses lead to a $50,000 or $100,000 decision ("Folio: Plus," 1999). Realizing that IT investments were complicated and could not be treated as one time decisions, senior ex-

ecutives designated CIO's to be responsible for IS developments. "It fell to them to wrestle back into reality the overblown promises and overrun budgets of information technology (Varon, 2003)." Project development became for the first time an incalculable risk. Uncertainty and incalculable risks forced IT development managers to rely less on science to evaluate potential value. It became an art. This new concept was the beginning of the so-called revolution (Andrew & Johnson, 2002) in making IT investment decisions.

(R)Evolution of Investment Decision Making in IT Projects

After reviewing many of the failed projects, we observe that IT investment decisions have evolved through four eras. The first era was the age of euphoria and extreme optimism when not much attention was given to the return. Their success was taken for granted. The first era evolved to the second era in the aftermath of failed projects and disappointments. IT projects in order to get approved had to have detailed ROI justifications; life cycle costs (LCC) and total costs of operations (TCO) had to be accounted for. However, this did not improve the success of IT projects and people started to question the assumptions behind the calculations of ROI, LCC and TCO. The whole notion of justifying IT projects on financial returns came under attack. They did not do justice to the contribution of IT projects since they did not include (IT's) strategic contributions to company's business. The second era evolved to yet another era - the third era. The decision matrix of IT investments included, in addition to the quantitative measures, an assessment of the impact on strategic factors (GAO, 2000). The IT industry is still in this era even though there are signs to expand the scope of the era three decision matrix. We are calling it era four – the era of total integrated (IT) Impact. "It involves linking and influencing every segment of a firm's supply, production, distribution and service chains into a coherent whole using information technology," (Rapp, 2002). We are going to expand on each of these eras next.

This revolution of information strategy management has been a long and very costly process. Billions of dollars have been wasted and more than a decade passed before companies realized that they could not sustain such frivolous spending and not rely on the subjective art of senior executives' evaluation system to assess the added value of their investments. IT investment became a necessary evil. Due to their high development failure rate, companies faced serious doubt concerning the actual and real value of such projects.

The lack of success and the billions spent on IT development raised many questions. Many tried to understand this phenomenon however asked the wrong questions: Why doesn't this work? What's the problem? How can we fix it? Most of these questions were reactive questions and lacked scope and perspective. The projects were poorly designed and structured and as consequence, implementation could not be executed or completed. It became apparent that strategic planning and strict project management were necessary to get control of these exuberant spending over the project life cycles. Projects needed to become highly structured. First hand managers had to strictly review and closely supervise goals, scope, target and logic behind the strategy. Companies came to the conclusion that there was no alternative to IT and was necessary for the company to remain competitive. Now companies desperately tried to reduce failure rates of IT projects, overall costs, increase viability and gain (or sustain) competitive advantage through information technology.

The primary driving force that resulted in revolutionizing IT investment decisions came from analyzing the managers' past wrong doings. The Waterfall effect (Andrews & Johnson, 2002, pp. 19, 31-35, 177) comprised of five "unrealistic assumptions" which managers tend to make during the development of an IT project. The first assumption was the expectations that the business environment would remain constant during the project. In the new information era, such conditions

were unrealistic. The Internet has opened the doors to instant communication and access to desired information, considerably reducing the bounded rationality effect. As a consequence the business environment has constantly changed and evolved. Such assumption could have been made prior to the late 80s but not after that. Many managers still kept the same mentalities and failed to realize this constant evolution. The second assumption was that end users could exactly define in advance what they needed. Project failures and over budgeting cases have one common trend: users always want more. The third managerial assumption was that intricate problems could be entirely resolved on the first attempt. According to these authors, "classic methodologies assume a linear process where the problem is defined, a plan is created, the solution is implemented and victory is declared." Complex problems require much more than a linear solving process and are much more demanding on the knowledgeable people and resources. An answer might not be found right away or not at all depending on the complexity of the problem. The fourth assumption implied that managers expected requirements to be known and defined before the software could be selected. Due to assumptions one and two, these requirements often changed and one specific type of software bundle could not be defined. Managers often choose one specific package and had to modify it due to the changing environment and customers' needs. The switching costs were tremendous. The fifth and final assumption was that changes would be universally and happily accepted in the company. Once again experience and common sense should have dictated otherwise.

Over the past two decades, managers have had tremendous trouble linking IT projects to positive financial growth. Typical return on investment measurements does not seem to apply to IT projects. Return on investment has been in center of the economic debate that raged between economists and analysts during the 1980s and 1990s. Measurements along with the various factors affecting those measurements were scrutinized and criticized; yet no one gave tangible reasons why IT benefits could not be aggregately measured. IT returns (Solovy & Chaiken, 2003) could be of three different types. The first type is financial, which either directly increases revenue or reduces overall cost. Operation returns are the second type of returns. Processes are done more efficiently, various errors are eliminated and the company's overall daily operations are improved. The third type is structural. It resembles the operation type. It is slightly different because it involves improvement of customer care and services. These different types of returns render ROI method obsolete and require managers to re-evaluate what they expect from a project.

For many years the classical ROI calculations have limited the field of visions of managers. Specifically, two major shortcomings presented significant concerns from tactical and strategic points of view. ROI calculations (Northrop, 2003) are based on "assumptions of possible project revenues and are often baseless, inflated or inaccurate," and "the ability to accurately predict the investment component is highly questionable." Due to these shortcomings, a transformation of ROI analysis was required. ROI are based on assumptions that often are not true. These assumptions were often based on an assumption of a static business environment. Furthermore, ROI analysis has proved to be of little use due to the failure and cost overruns in developing IT projects in the 1990s.

These traditional assumptions, which are the basis of ROI, cannot be applied to IT project development due to the simple fact that IT investment creates and improve many intangible benefits that cannot be measured. Mindsets are however in general difficult to change. Today, some managers still believe that if a strategy cannot show a positive return within the first three years, it is a failure. IT has constantly challenged these managerial perceptions and expectations of various projects and development, therefore many managers have been forced to change their classical project evaluation methods.

We contend that there was no "IT revolution", as claimed by some (Guidoni, 1993). A revolution is a spontaneous and sudden change in behavior, patterns or regime. Changes in IT project man-

agement were slow, costly and have not been completely achieved. Undeniably, the environment and mentalities have changed and so have expectations of IT returns and use. However, IT project development processes and financial return measurements have not been revolutionized they have evolved and transformed. Evolution is a slow and rigorous process constituted of trials and errors. It comes after chaos and brings stability. Stability is achieved due to drastic control measures. The survival of the fittest has been evolution's main control tool for billion of years. From a business viewpoint, IT investments and IT project development were chaotic between the mid 1980s and the 1990s. As previously mentioned, billions of dollars were wasted on failed projects and over budgeting. The explosion of the technology bubble and the following world wide recession brought rigorous control on project developments.

The evolution of IT investments has left many business managers discontented and burned because it has come at great financial costs. After the billions spent, no one can deny that IT investment has generally brought little tangible returns. At this point one may wonder the use of IT investments is and why one would spend more IT development. These questions are legitimate and many managers may wonder the same; yet it is very difficult to conceive the business world without technology and information technology. It is clear that information technology investments brought new elements; however, it is hard to pin point exactly what and measure it. One may look at the evolution of the business environment in the past two decades and may conclude that most of the IT contributions to the business environment are intangible elements.

A few examples are Internet banking, supply chain management, the music industry and information accessibility. Undeniably, technology has become a greater part of our lives over the years. IT investments have not brought financial returns but have certainly brought value, growth, knowledge and increased customer care in more than one way. These intangible elements are extremely important in today's economy and can create sustainable competitive advantage over competitors. It is very difficult to evaluate the impact and benefit of IT investments on Wal-Mart's supply chain; yet it is undeniable that the company has managed to save billions in inventory costs and logistics. These savings have been passed on to customers who enjoy the company's everyday low price strategy. Such IT investments create distinct and sustainable competitive advantage for Wal-Mart. K-mart back in the late 1990's could not compete on such low margin and had to declare bankruptcy.

The business management strategy called Balanced Score Card (Kaplan & Norton, 1996) could help answer these questions. This business strategy favors growth and emphasizes business improvement through development of intangible assets. The balance score card helps company develop competitive advantage and create real customer value. It "provides executives with a comprehensive framework that can translate a company's vision and strategy into a coherent and linked set of performance measures...used to articulate the strategy of the business, to communicate the strategy of the business and to help align individual, organizational and cross departmental initiatives to achieve a common goal." Over the years, companies' focuses changed from revenue growth and beating the street's analysis to meeting and exceeding customers' expectations through learning, internal and customer strategic goals. These goals are then linked to financial elements to ensure the viability of such initiatives.

Only a handful of companies focused on future value and customers' needs during the 80's and 90's. The trend was one of revenue growth and beating analysts' forecasts to increase shareholder's equity. Today revenue and economic profits are difficult to achieve, and companies must find different ways of growing. Companies have turned there attention toward intangible assets. "Branding, knowledge, customers and innovation are nearly impossible to numerically quantify, yet have a very significant impact on an organization's success and growth" (Northrop, 2003). Information technology has developed and increased many of these areas for example online banking or logistics and many others. Managers are beginning to understand this concept and are

now developing new strategy to integrate IT into increasing customer value and customer service. For instance, Wendy's recently announced that it would allow customers to use credit card to purchase hamburgers and fries. Customers will be allowed to use technology to simplify their transactions for their convenience. Wendy's strategy is to attract new customers and retain a greater number to ultimately increase market share and overall revenue.

Companies have taken proactive measures to link IT projects and business strategies. To fulfill this purpose, IT steering committees have been formed in many companies and have become widespread in the business world. These committees, while providing CEOs with information about IT usefulness, contribution and linkage to the company, ensure that “CEOs agree that IT has strategic importance to their company” (Varon, 2003). These committees help decision makers to analyze more relevant data and simplify and clarify the decision making process. Overall, they help IT organization to concentrate on better execution of strategies.

Steering committees are not the only way CIOs and top managers can reach better decisions when it comes to IT investments and how to use IT to enhance strategies. In the mid 1980s, Congress was growing wary of the lack numerical proof of economical growth due to IT involvement. Many were concerned of the IT paradox. Considerable amount of government investment were spent on IT projects; yet no empirical data proved the investment to be worthwhile. Congress passed the Information Technology Management Reform Act on February 10, 1996. It is also know as the Chief Information Officers Act. It was enacted to reduce IT projects financial waste and "provide CIOs with several identified set of realistic and attainable actions to be taken to show American Tax Payers that IT investment are having a clear positive impact on outcomes."

In the recent years, the notion of Total Integrated (IT) Impact has emerged. “It involves linking and influencing every segment of a firm’s supply, production, distribution and service chains into a coherent whole using information technology,” (Rapp, 2002). Such integration allows for cost cutting as well as better designed and more efficient delivery of products and increased customer satisfaction. It affects a firm’s environment through increase relationship between its suppliers and customer care after sale and provides a tool to tie both sides closer to the firm’s strategies to create new strategic partnership. Competitive advantage is gained through that process due to increased shared information between suppliers and the firm, reducing inventory cost. Customers’ needs and expectations can be assessed faster and the company can adapt quicker and more efficiently its products to the tastes of consumers.

Conclusion

In conclusion, this paper has shown that information technology investment decisions have evolved over the past twenty years. Some called it an IT revolution; however, we disagree because it delivered results only three decades after its development. Through various examples we have shown that the transition was not only extremely costly to companies but also very slow and lengthy. Revolutions are spontaneous and involve radical changes. Gradual change over several decades cannot be revolutions. It is clear that much can still be done to further improve its effectiveness and efficient use throughout an organization to further improve every aspect of the current business operations of companies. Return on investment will undoubtedly be difficult to evaluate and analyzed because IT mostly benefits companies’ intangible assets such as customers service or brand recognition. Information technology investment should get the same level of scrutiny like any other financial investment. Its scope and impact should be well diversified. Managers should however not expect a fifteen percent return on investment. They should focus their attention instead on increasing market share, brand recognition, customer satisfaction and care as well as overall length reduction of their supply chains and its management.

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Biography

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