The Enterprise Systems Implementation:
An Integrative Framework

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ABSTRACT

In the recent past several years many organizations have initiated Enterprise Systems (ES) projects, leads to a major paradigm shift. The adoption requires the examination of the factors that precipitate a search for systems that will provide a solution to the current information systems, structured around previous thinking as motivation for investment in information systems for business. The process considers the attributes applicable to the decision for adopting ES once it has emerged as a contender to acquire. The failure to do this successfully can be extremely costly as demonstrated by an array of failure cases reported. The paper outlines the significance of ES and analyses the adoption related issues. The study provides a framework for the selection process of ES which can be useful in identifying critical factors for further research and supporting managers considering ES projects.

INTRODUCTION

As the pace of change accelerates in the twenty-first century as a result of technological opportunities, liberalization of world markets, demands for innovation, and continually decreasing life cycles, organizations are finding that they have to continuously re-adjust and re-align their operations to meet all these challenges. This pace of change has increasingly forced organizations to be more outward looking, market-oriented, and knowledge driven. A useful tool that businesses are turning to, in order to build strong capabilities, improve performance, undertake better decision-making, and achieve a competitive advantage is Enterprise Systems (ES) software. (Al-Mudimigh A., et al., 2001)

However, it has been estimated that about half of ES implementations fail to meet expectations (Appleton, 1997). Other reported figures show that more than 70 percent of ES implementation fails to achieve their estimated benefits. According to a survey (Themistocleous et al. 2001), organizations adopting ES certainly acquire benefits such as an increase suppliers' and customers' satisfaction and an increase in productivity but the level of return on investment (ROI) is rather low. Other findings of the same survey suggest that many organizations adopting ES have serious conflicts with their business strategies and the majorities of ES projects are often characterized by delays and cost overruns.

The important issue concerning managers is the appropriateness of ES to meet organization's needs. The study provides a research framework of the critical issues involved in ES adoption process, which can assist managers considering their ES projects and stimulate further research in ES acquisition issues.

METHODOLOGY

This paper is based on three sources of data. The first source has been an academic literature review, the second has been articles drawn from the web and the respected practitioners' magazines reporting ES selection cases, and the third has been personal semi-structured interview and structured interviews conducted through e-mails with eleven ES consultants and project implementation leaders. The size of the sample is rather small but not unusual for this kind of qualitative research. The interviews served as a means to test the validity of the theoretical framework proposed in this paper. The textual data of the transcribed interviews with the ES consultants are combined into single file and analyzed by calculating frequency with which words or small phrases appeared in the text. It should be noted

that the required validity of the findings of this analysis is mainly dependent upon the coherence of the interpretation (Weber, 1990). It should be also noted that Shang and Seddon (2000) have been argued, convincingly, that ES case studies reported in the trade press and the web can provide reliable data to conduct academic research and can be used as a starting point for understanding the benefits and the costs involved in ES projects.

DISCUSSION OF ISSUES IDENTIFIED

Given the organizational, technological and behavioral impact of ES, a broad perspective of ES adoption process is needed. Technological, business and organizational contexts should be studied in a unified way, which encourages the examination of interrelated key success factors. The certain issues specific to these systems have to be taken into account, such as unsuitability, most of the time, of ES modifications to meet institutionalized business operations and the extent of business processes re-engineering required prior to the implementation of the software. In traditional IS development theory, the software has to fit in to certain business processes, probably adopting and reproducing organizational inefficiencies. In ES implementation the reverse course is usually effective. Due to complexity of the system, enterprise prefer to adapt their business processes to software's in-built best business practices. In order to develop a framework of ES adoption following issues should be considered. Modification of the standard ES configuration options to fit business processes is costly, risky, time consuming and difficult. (Devenport, 1996)

ES Characteristics

ES is both strategic and operational. Strategic systems aim at making the organization more flexible and responsive to customer needs. The goal of rendering the enterprise readily adaptable to changing competitive conditions makes strategic systems fundamentally different from back office applications. The evaluation of strategic systems has to be based on cost (Clemons, 1991). Moreover, as has been argued by Kaplan (cited by Clemons, 1991), financial techniques such as discounted cash flow, are constantly misused when applied to evaluation of strategic IT decisions, due to difficulty of quantification of the value of strategic systems. ES are at the same time both strategic and operational. ES software's operational costs and benefits are more easily identifiable and quantifiable than the strategic ones.

As far as the strategic aspect is concerned, a key factor is the identification of the degree to which the adoption of an ES contributes to business strategy of the organization (Fitzgerald, 1998). While this degree is difficult to assess in quantitative terms, a qualitative assessment is nevertheless possible by interviewing, for example, senior managers or by using other qualitative techniques such as Likert type scales and cognitive mapping. Various methods can also be employed for assessing the relative importance of alternative options. It has been argued (Clemons, 1991) that, sometimes, when alternative outcomes can be ranked in a structured manner, decisions that cannot be based on numerical data can be made rationally and analytically without having precise estimates of the individual courses of actions. Simulation, probability and sensitivity analysis can be extremely helpful under these circumstances. Although some overlapping between strategic and operational factors is inevitable. For example, business processes integration is a strategic activity as long as (successful) integration has an impact on the competitive position of the organization, while at the same time is also operational as long as it results in cost reductions in the daily activities of the organization.

Stakeholders Analysis

A number of ES's stakeholders operate outside the organization's boundaries (customers, suppliers, business partners in the value chain). For achieving the full potential of ES, especially under collaborative business structures such as Supply Chain Management (SCM), the co-operation between business partners is essential. Other contemporary business paradigms, such as Customer Relationship Management (CRM), require the cooperation with the organization's customers. In that respect, the evaluators should consider the impact of Enterprise Systems on external stakeholders, specifically the customers, suppliers and business partners. In fact, alliance is one of the strategic benefits incurring from ES implementations (Shang & Seddon, 2000). Successful ES cases demonstrate the importance of estimating ES's effects on external stakeholders.

For example, Coca-Cola company's Information Technology (IT) strategy was to extend its enterprise by extending SAP R/3 to its independent bottling partners under a single master license it controls, with partners sharing the relevant costs (Violino, 1999). The goal, the increase in revenues by communicating more easily and rapidly with the business partners, could not be achieved without evaluating ES's costs and benefits on the company's external partners.

Cost And Benefit Analysis

There is a high percentage of intangible costs and benefits. According to Brynjolfsson and Yang (1997), there is empirical evidence to suggest that up to nine-tenths of the costs and benefits of computer capital are embodied in intangible assets. Intangible assets are created by investments in software, training and organizational transformations induced by IT. These assets, although not measured financially, have the potential of increasing the value of IT investments. The estimation of the value of these assets in monetary terms is clearly a very difficult endeavor. However, it is important that both tangible and intangible assets and hidden costs should be taken into account from the outset when considering ES projects. For example, reductions in transaction systems and technical support personnel, cost savings resulting from better inventory management or value chain optimization, and savings from not upgrading legacy systems can be calculated. Other benefits, such as perceived customer satisfaction and benefits arising from rapid decision making are more difficult to be calculated, but nevertheless existent.

Intangible or hidden and underestimated costs are also a major concern among ES specialists (Slater, 1998). Underestimation of the time it takes to implement an ES is very common in ES projects. Consultants' fees, personnel training, data conversion, software's integration testing and self developed software (Slater, 1998; Rosemann & Wiese, 1999) to name but a few, can be a very heavy burden on the budget for supportive activities. In fact, according to some estimates, services by ES support industry can exceed the initial software cost by a factor of seven to ten (Martin, 1998; Hecht, 1999). Other costs, characterized by a behavioral aspect, are difficult to be identified and estimated. Such costs, for example, include the lack of commitment to change, which can lead to a dysfunctional operating environment and user resistance resulting in increased operational costs.

Organizational Impact

ES adoption/implementation results in a major organizational change. A major implication of ES deployment is that it involves drastic changes in the organizational structure, business processes and the people of an organization. These changes are the source of both costs and benefits, tangible and intangible. The re-engineering exercise is undertaken with the aim of achieving the optimization and integration of business processes according to the software's inbuilt best practices. Thus, in so far change management is effective, competitive advantage and financial returns on investment are expected. However, the estimation of the effectiveness of change management is not straightforward as it is dependent on the analysis of many uncontrollable factors related to human resources and the psychological climate of the organization (Stafyla, 2000).

PROPOSED INTEGRATIVE FRAMEWORK FOR ES ADOPTION

Clarification Of The Business Vision

The first phase of the proposed framework, the clarification of the business vision, is a starting point for Enterprise Systems initiation/acquisition. Investment in ES is a strategic action, which can have significant consequences for the competitive position of the organization. It has been argued that effective IT/IS project implementation requires a clear business vision, which clarifies the organization's direction, the goals, and the business model behind the implementation of the project (Holland & Light, 1999). It was explained above that ES requires substantial business process re-engineering and as Davenport and Short (1990) have pointed out, the first step in IT enabled process re-engineering is to develop the business vision and process objectives.

Comparing Needs vs. Capabilities And Constraints

The decision concerning the adoption of an ES has to be made according to both the current and the future status of the enterprise, which is constrained by various technological, organizational and financial inefficiencies. Therefore, at this stage, a detailed critical ES functionality and enhancements requirements matrix, followed by a list regarding the organizational and technological changes required for the successful implementation of the ES system should be developed and evaluated according to certain criteria. This is, for example, exactly what Gillette India had to do with its re-engineering exercise. For this company, re-engineering for ES involves extracting the best finance, logistics and sales practices from multiple divisions and then standardizing them into an integrated ES system that could provide business consistency, such as credit terms, across all company's divisions. Martin, 1998 and Moss, 2000 after describing a Baan software implementation case, concludes that to achieve the goal of business support by implementing an ES system, companies should avoid the design of a system that the ES software is capable of providing but which is beyond the capabilities of the company to absorb as a daily routine. For companies wishing to achieve this goal, a well defined set of objectives and an on-going commitment to meeting them are essential from the outset of an ES project.

Business Requirements

Both current and future business needs, arising mainly from external competitive pressures, have to be balanced against various technological, work and organizational constraints. Companies engaging in e-commerce or supply chains operate in a sophisticated business and technological environment. In such cases, the effectiveness of ES, which span beyond traditional organizational boundaries, require collaboration between partners, coordination of decisions, as well as accurate and real-time information flow in a network of enterprises. There is a great likelihood that the examination of needs and constraints will reveal that for a successful ES implementation, a radical change in business processes, towards simplification and efficiency, must take place. Such is the case, for example, when developing systems with a customer perspective or adopting best practices from industry (Avison & Fitzgerald, 1995, p 387). Therefore, a critical factor that should be considered at this stage is the desire and the commitment to continuous change not only by top management but also by the steering committee, the systems' users and by all members of the project's implementation team. It is also likely that ES acquisition will have to be postponed or rejected in view of the high risks involved (Stefanou, 2000). An example of this final option is provided by the well known case of Dell Computer Corp, in which the implementation of SAP R/3 had to be terminated, in view of the company's CIO's conviction that a single monolith software could not keep pace with the company's growth (Slater, 1999).

Constraints

The constraints are classified in five categories: technical, organizational, human, financial and time constraints.

Technical Constraints

Costs incurring from using multiple hardware and software platforms could be significantly reduced if there were a common IT architecture, including software and hardware platform, networking and communications, and applications development. Scalability and flexibility of the IT infrastructure is critical in order to support additional applications and systems and it should be assured before proceeding to the ES procurement process. Changes in the IT infrastructure may be necessary in order to support the ES system and any other additional applications. This poses another major evaluation problem, because the IT infrastructure is a supportive IT investment with no immediate measurable benefits by its own, but it still needs to be evaluated as far as alternative solutions or vendors are concerned (Fitzgerald, 1998).

Organizational Constraints

These include, among others, the degree of the decentralization, the management structure, the style of leadership, the rigidity of business processes, and the company's culture. Resistance to change, prestige, job security feelings and departmental politics are also involved (Bancroft et al., 1998). It should be noted that organizational and cultural factors seem to be very important for successful implementation of ES and Supply Chain Management (SCM) systems (Stefanou, 1999).

Human Resources Constraints

A cross functional implementation team consisting of both business and IT people and of internal personnel and external consultants can be very effective in implementing ES software. However, the lack of experienced external consultants and trained and educated employees in ES philosophy represents a serious constraint that could jeopardize the implementation project.

Financial And Time Constraints

Any project of the scale of ES systems implementation should have adequate financial resources. A lot of hidden costs, such as the period of training required and unanticipated fees of external consultants, may prove to be a barrier to successful implementation. One final constraint is the time allowed for the selection and implementation process. Unrealistic time frames and deadlines may add unnecessary pressure and lead to project failure.

Product, Vendor And Support Services Evaluation

The phase considers the selection of ES modules that support critical business functions and of any other needed additional application, such as for example SCM. Certain weighted criteria for the selection of *vendor*, *product* and *implementation partner* should be set and evaluated at this phase (Travis, 1999). According to a recent International Data Corp (IDC) survey (Moss, 2000), users, who implemented ES systems, rate the ability of the vendor to deliver the promised system on time and on budget as the most important issues involved in the ES process. Other important buying criteria are the scalability and flexibility of the ES solution and the confidence in both the solution and the provider. Although every one of the established ES packages offers a broad functionality, they certainly exhibit individual strengths and weaknesses compared to individual business requirements. Certain packages are regarded as having an exceptional functionality in some of their modules, as is the case, for example, with PeopleSoft's Human Resources module. Other vendors are regarded as specializing in certain industries, supporting industry specific best practices, as for example SAP in Chemicals and Pharmaceuticals, Oracle in Energy and Telecommunications and Baan in Aerospace and Defense industries. The availability and functionality of additional applications to support current and future business needs such as SCM or CRM is an important factor in ES software selection. It should be also examined if the packages under consideration support a certain business practice or operation, which is considered critical, such as make-to-order or make-to-stock manufacturing. Certain characteristics, such as multi-language and multicurrency capabilities can be the key drivers for selection of an ES (Bancroft et al., 1998). Among other factors considered in selecting an ES is the availability of experts in the system, the partnering company that will assist in the implementation, the training courses available by the vendor or third parties as well as vendor's financial position and pricing models.

All-In-One vs. Best-Of-Breed ES Software

Enterprises searching for competitive advantage have the option of acquiring an all-in-one or a best-of-breed ES. Additional applications can be acquired from the vendor of the ES, from another vendor closely collaborating with the first, from a third party vendor, built-in-house or outsourced. An example of an all-in-one approach is provided by the multinational Colgate-Palmolive's SAP R/3 solution, which integrated the processes of the company and connected ten thousand users worldwide after a 5-year implementation effort. Worries about the risk of relying on only one vendor were put aside as the company was convinced that this integrated environment offers systems robustness and the additional required functionality to support the company's operations. On the other hand, in an

attempt at achieving increased functionality, the Boeing Commercial Airplane Group has adopted the best-of-breed approach by implementing demand-forecasting software by i2 Technologies, ES by Baan and product data management by Structural Dynamics Research. It has been reported that industry watchers agree that about 80% of companies will adopt the all-in-one solution but the remaining 20% will demand best-of-breed applications from multiple software vendors (Stein, 1999). Obviously, substantial empirical work is needed in order to identify the merits of these two approaches.

CONCLUSIONS

A large variety of ES core and extended modules and supporting services are being offered by established Es vendors and third party companies. The decision to acquire an ES and the adoption process is becoming increasingly complex in a changing and competitive environment. Enterprises pursuing systems integration should evaluate and select systems that contribute to this goal without of course sacrificing the functionality of applications they believe are crucial for their business. Careful adoption process of vendors, products and services provided is necessary but the final decision has to be made considering the amount of organizational change required for the adoption and the implementation of the selected ES.

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