

Impact of ERP Implementation on Supply Chain Management

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Abstract— This paper documents the effect of implementation of an ERP system within a firm and its impact on supply chain system. Supply chain design is becoming a core competency, and the enterprise resource planning (ERP) system is expected to be an integral component of supply chain management (SCM). Although an Enterprise Resource Planning (ERP) software provides different tools that can support supply chain integration but at the same time it has several features that obstruct the integration with various business functions. Installing an ERP system is, however, expensive and risky. IT managers must decide how to use their limited resources and invest in the right product. Another important aspect that has been highlighted is impact of forecasting in supply chain. Although the effect seems to be broad but has its own shortcomings.

Keywords- ERP; Supply chain; Enterprise systems; Organisational Factors; Forecasting

I. INTRODUCTION

Becoming Lean has been a goal for most companies over the last few years. With globalization of competition the term Lean is becoming popular. Lean delivers what companies really need in today's highly competitive world - shorter lead times, improved quality, reduced cost, increased profit, improved productivity and better customer service. Firms are facing tough competitions to stay afloat in the market especially with economic slowdown period still lurking around countries like U.S and Europe, these firms have realized the importance of establishing highly responsive supply chains, with up-, mid-, and downstream partners. How to best improve corporate SCM capabilities in order to improve overall supply chain performance has therefore become an important issue in corporate management (Park et al., 2005; Whit et al., 2005). As Kuei et al. (2002) have pointed out, SCM is a network of autonomous or semi-autonomous business entities collectively responsible for procurement, manufacturing and distribution activities associated with one or more families of related products. Enterprises in the supply chain are likely to increase control over their suppliers and enhance their SCM competencies by gaining power from information. To

meet these new challenges and the need for a competent supply chain, companies around the world have invested heavily in Information Technology (IT), and take advantage of IT systems to radically alter the conduct of business in both domestic and global markets. In particular, many firms have implemented company-wide systems called ERP systems, which are designed to integrate and optimize various business processes, such as order entry and production planning, across the entire firm (Mabert et al., 2001). Enterprise Resource Planning (ERP) and its predecessor, Manufacturing Resource Planning (MRP II) are helping to transform our industrial landscape. It's making possible profound improvements in the way manufacturing companies are managed. It is a strong contributor to America's amazing economic performance of the 1990s and the emergence of the New Economy. A half century from now, when the definitive industrial history of the twentieth century is written, the evolution of ERP will be viewed as a watershed event. (Akkermans et al., 2003; Hsu et al., 2009; Sanders, 2007).

An ERP system can be described as set of management tools that balances demand and supply, containing the ability to link customers and suppliers into a complete supply chain, employing proven business processes for decision-making, and providing high degrees of cross-functional integration among sales, marketing, manufacturing, operations, logistics, purchasing, finance, new product development, and human resources, thereby enabling people to run their business with high levels of customer service and productivity, and simultaneously lower costs and inventories; and providing the foundation for effective e-commerce. The term ERP has been sloppily used to label enterprise-wide transaction processing software systems as ERP. The correct term that can be used to refer to the software is ES which stands for Enterprise Systems or Enterprise Software. These are packages of computer applications that support many, even most, aspects of a company's information needs. It must be fair to say that an ERP system may or may not be part of ES and an ES may not even contain all parts of an ERP system as shown in Fig.1(ERP: Making It Happen). The

major advantage of these systems is that they provide a common integrated software platform for business processes. These systems have two important features: firstly, they facilitate a causal connection between a visual model of business processes and the software implementation of those processes, and secondly they ensure a level of integration, data integrity and security, which is not easily achievable with multiple software platforms.

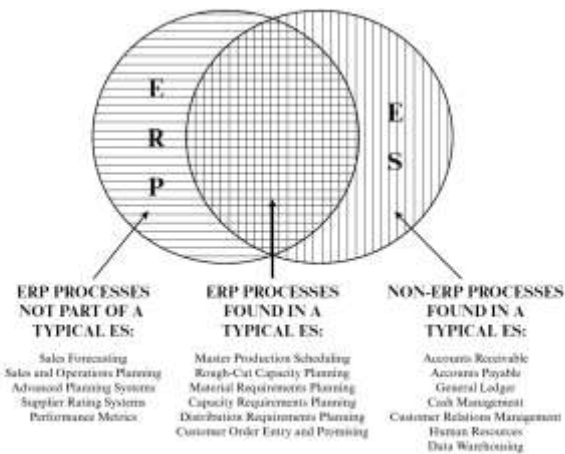


Figure 1. ERP Processes

The vendors of fully integrated software offer software that is capable of processing all commercial functions of any company, no matter how large, diverse or geographically disparate the company's components may be. Moreover, the software is not limited to specific industry sectors: it can be configured for retail industries, mining companies, banks, airlines etc. ERP market leaders (Piszczalski *et al.*) are SAP AG (39% of the world market) Oracle Corporation, PeopleSoft Inc., Baan Co and Ramco Systems Ltd. The main aim of this paper is to analyze the impact of ERP on SCM in terms of ERP benefits and SCM competencies.

II. ERP BENEFITS AND ITS IMPACT ON SCM

For years organizations have striven to realize the benefits of ERP, ES and IT investments. Integrated ERP systems affect all aspects of a business. It has been found that real benefits reside not within the IT domain but, rather, in the changes in the organizational activities that the IT system has enabled.

Several researchers have classified the types of ERP benefits, and have indicated that some approaches may be appropriate techniques for evaluating the performance or benefits of ERP systems. Irani and Love (2001) proposed a framework for meeting the challenges associated with categorizing benefits that is based on the work of Harris (1996). Mabert *et al.* (2000) surveyed

about 500 business executives, and revealed the following performance outcomes of ERP: quickened response time, increased interaction across the enterprise, improved order management, improved customer interaction, improved on-time delivery, improved supplier interaction, lowered inventory levels, improved cash management, and reduced direct operating costs. Many researchers have given many theories and competency constructs to argue that firm's ERP competency must be used effectively in order to truly harness the capabilities of an ERP system for competitive advantage. Several authors have classified the different types of ERP benefits into five groups as follows: IT infrastructure, operational, managerial, strategic and organizational benefits.

In recent years, supply chain design and its competencies and performance have received much attention from researchers and practitioners. From the Resource-Based Viewpoint, all firms have capabilities; however, a firm will usually focus on certain capabilities consistent with its strategy, and the firm's most important capabilities are called competencies. Accordingly, competencies emphasize technological and production expertise at a specific point along the value chain. Although the initial focus of ERP is "within the organization," many organizations have addressed supply chain challenges with their ERP systems. Several studies have demonstrated a relationship between ERP benefits and SCM. Although there is no analytical framework for measuring the impacts of ERP systems on SCM competencies, several researchers have examined how the antecedents, IT department technical quality, IT plan utilization, and top management of IT positively affected IT impact on the supply chain. Some researchers have critically examined that ERP plays a modest role in improving future supply chain effectiveness, and a clear risk of ERP actually limiting progress in SCM.

Researchers have defined the operational process involves the processes that facilitate order fulfillment and replenishment across the supply chain. Effective order fulfillment requires coordination both within a firm and among supply chain partners. Within the operational process, firm competencies include customer integration, internal integration, and supplier integration. Extending the relations from simple buyer-supplier cooperation to a whole supply network from raw material suppliers to final customers provides several advantages that include for the buyers a large pool of suppliers, reduced transaction costs, market transparency, purchase transparency, lower prices, dynamic pricing models, control of maverick, buying, and lower inventory costs. For the suppliers the benefits among others are large pools of buyers, real time information, time to market, aggregation of small orders,

efficient fund transfer. Today's ERP solutions offer even more benefits. Many vendors have begun to enhance their offerings with extended supply chain applications in an effort to create a seamless, integrated information flow, from suppliers through manufacturing and distribution. However for this supply chain cooperation there are some potential disadvantages like for the buyers unqualified suppliers, miscommunication, failed promises, hidden switching costs, missed value-creating opportunities; for the suppliers the disclosure of confidential information, pressure for price reductions, easy supplier switching, loss of established relationships, high initial investment. ERP is a suite of application modules that can link back-office to front-office operations, as well as internal and external supply chains. Since ERP systems can automate business processes and enable process changes, one would expect them to improve the SCM competencies in operational process and improve customer responsiveness.

III. ERP IMPLEMENTATION AND ITS CHALLENGES

The success of implementing an ERP system within an organization has to be analyzed, both, for short- and long impact. In the past decade, nearly all literature on ERP has focused on reasons for implementation and on the challenges of the implementation project itself. Although the initial focus of ERP was "within the organization," many organizations have addressed supply chain challenges with their ERP. Several studies have demonstrated a relationship between ERP benefits and SCM. The implementation of ERP enables the companies to move towards an extended enterprise business model that enhances value across the total supply chain. In order to gain supply chain efficiencies, companies need to exchange large amount of planning and operational data, ranging from information for annual contracts and periodic progress reporting to real-time delivery and invoicing data

There are many factors which are essential for successful implementation of ERP within an organization. Some of them are discussed as follows;

(1) *Support from Top Management.* If top management is not actively backing an all-pervasive project like an ERP implementation, there is little hope for it. This is especially so in the early stages of such a project. It would be unwise to say that the top management has outmost power but the middle management has least power though they have crucial roles to play in different stages of ERP implementation.

(2) *Interdepartmental co-operation.* As ERP systems are really about closely integrating different business functions; this is what sets them apart from many other IT efforts. Therefore, close co-operation between these business functions would seem to be a natural prerequisite. Indeed, one recent study found closer

interdepartmental collaboration as one of the main post-ERP implementation benefits.

(3) *Clear goals and objectives.* It has long been common knowledge that the first phase of an IT project should start with a conceptualization of goals and ways to accomplish these. However this can be problematic as at the outset of an ERP project, it is often very difficult to determine them in a clear-cut manner. Hence it will be fair to say ERP initiatives as new business ventures, rather than as IT projects.

(4) *Interdepartmental communication.* The importance of communication across different business functions and departments is well known, in fact, according to one author on IT project management, 'communication is the oil that keeps everything working properly' in these contexts. As noted above, this need for communication across functional boundaries is all the more important in an ERP context since the primary objective of ERP systems is to integrate business functions.

(5) *Project Management.* The complexity of ERP implementation is very high, given the vast combination of hardware, software and organizational issues. One need to overcome the complexity of ERP implementation is to stress the importance of methodological techniques and planning. Improvising of techniques with time should also be kept in mind for project managers of ERP.

(6) *Customer Requirement Management.* Successfully managing user expectations has long been known to be important for successful implementations of IT systems in general. Misalignment of expectations is common, for instance through overselling of the vendor or by underestimation of the complexity of ERP implementation by the organization. Therefore, management of expectations remains important through all stages of the implementation life.

(7) *Careful package selection.* ERP vendors may claim that their systems are overlapping in functionality but they are not, at least not in full. For instance, some packages are more suited for larger firms, some more for smaller ones. Some packages have become a *de facto* industry; some have a stronger presence in certain parts of the world. And then, once the choice for the package is made there is the decision to be made as to what versions or modules of the package would best fit the organization. In short, if the wrong choices are made, and these choices have to be made very early on, the company faces either a misfit between package and business processes and strategy, or a need for major modifications, which are time-consuming, costly and .

Extensive research have been carried out regarding the issues that arises during implementation of ERP systems and its subsequent benefits, in various types of firms and many research papers have been published

regarding the same. Through the work of several researchers it has been found out that there are some common problems that the firm faces during implementation of ERP system. They are;

- (1) Although ERP packages strive to integrate all the major processes of a firm, customers discover that some essential functionality is lacking.
- (2) Traditional ERP infrastructures failed to support an extended business model across the supply chain.
- (3) The challenge is to figure out what, how, where, who, when, and why manufacturing operations can feed the ERP.
- (4) Since ERP philosophy is process based, rather than function based, it necessitates disruptive organizational changes.
- (5) ERP systems mostly adopt a myopic view of planning, based on pure deterministic planning methods.

ERP provides several tools; the two most important for supply chain integration are the real-time transaction tracking and the internal process integration. However these two parameters also face some obstacles. For instance, real-time transaction tracking is an important tool for information sharing. However two major obstacles are faced by this tool. First major obstacle is the unwillingness of the firm to share information with the ERP vendors, and, second is the availability of large amount of detailed information which may not be required to that extent. The most important groups of data to share include:

- Operations information (Production schedules, Order tracking, Return status, Volume of operations, Inventory levels)
- Planning information (Forecasting, Sales, Production plans)
- Customer requirement information
- Financial information

The monetary benefits and savings involved during information exchange can be used to motivate the companies for sharing information. However one may observe that the obstacles can be viewed as opportunities for ERP vendor since they are continuously trying to enhance their software and with all the important data of their customer available to them they can try to research their way of enhancing their ERP software based on their customer's requirements.

IV. EFFECTIVE FORECASTING FOR IMPROVING SUPPLY CHAIN MANAGEMENT

Supply chain planning is usually reliant on demand forecasts at the stock keeping unit (SKU) level. Many factors influence the performance of a supply chain. One important factor is the accuracy of the forecasts used by different parties in making their planning decisions. The

accuracy achieved for these forecasts has consequences for companies at all levels of the supply chain, from the retailer to the raw materials supplier, and even for companies whose final product is 'make-to-order'. Errors at each stage of the chain are potentially amplified, resulting in poor service or excess inventory levels. For instance, most retailers do not know their demand with certainty; they have to make their inventory decisions based on demand forecasts. With inaccurate forecasts, the quantity of materials ordered does not match the demand. These errors in the retailer's forecasts are passed to the supplier in the form of distorted orders. The forecasting task is difficult due to the inter-related nature of the data series, the presence of outliers, level and trend shifts, and the impacts of the market and general economic environment. These data difficulties are compounded by the huge number of SKUs that often need to be forecast each period.

In order to plan and manage their supply chain, organizations typically set up a unit responsible for forecasting. Because of the size and complexity of the forecasting task, it is generally impossible for all SKUs to be given individual attention by demand planners. The most common approach to forecasting demand in support of supply chain planning involves the use of a statistical software system which incorporates a simple univariate forecasting method, such as exponential smoothing, to produce an initial forecast. For key products, these initial forecasts (hereafter called the 'system' forecasts) are reviewed, and may be adjusted by the company's demand planners to take into account exceptional circumstances expected over the planning horizon, or possibly to correct perceived inadequacies in the system forecast. This 'Sales and Operations Planning' process is usually carried out in a committee setting, where representatives from marketing, sales, production and logistics agree on the 'final forecast': a combination of a statistical forecast and managerial judgment. Other than this, over the last decade, companies have engaged in various forecast-sharing practices, including the commonly known Collaborative Planning, Forecasting and Replenishment (CPFR) initiative, which were launched to "create collaborative relationships between buyers and sellers through co-managed processes and shared information." Retailers such as Wal-mart and Best Buy, along with suppliers such as Procter & Gamble and Kimberly-Clark, have all reported substantial benefits from CPFR projects.

Despite these success stories, forecast sharing still suffers from two severe problems in practice. First, forecasts change and are continually updated as the buyer receives new information about the demand it faces. This problem, which we refer to as *forecast volatility*, raises the question of when the forecast

information provided by the buyer is sufficiently accurate to justify the supplier acting on it. A supplier that will act immediately on any given forecast will likely face significant future adjustment and rework costs. Second, forecasts provide information about what the buyer intends to do in a given future state of the world. These intentions, however, are not verifiable and cannot be enforced. This makes contracting based on shared forecasts extremely difficult. In the absence of a contractual obligation for the buyer to purchase what it has forecasted, the buyer has an incentive to inflate forecasts to assure sufficient supply (forecast inflation). Fearing inflated forecasts, the supplier might prefer to delay its actions to a point in time when the buyer is willing to commit to its forecast. This setup shares many similarities with the classical prisoner's dilemma, say for instance buyer forecast correctly but supplier waits till purchase order is submitted. Buyer may incur loss from delay. This scenario may be other way round in which the buyer inflates the forecasts and supplier trust on it leading to loss of cost of inventory from supplier side.

Forecast sharing has the potential to dramatically improve supply chain performance. Improved demand forecasting accuracy can lead to significant monetary savings, greater competitiveness, enhanced channel relationships, and customer satisfaction. Yet, as illustrated, a supply chain might not be able to achieve the potential performance improvements from forecast sharing. From the perspective of the supplier, the forces that prevent effective forecast sharing are forecast volatility and forecast inflation. As the buyer is exposed to additional information, it updates its forecasts to the supplier. While always sharing the latest information with the supply chain seems like a reasonable behavior for the buyer, frequent updates of information are perceived as disturbing from the perspective of the supplier. For accuracy in supply chain forecast these barriers are needed to be handled in latest ERP software's.

V. CONCLUSION

SCM relates to the co-ordination of products and information flows among suppliers, manufacturers, distributors, retailers and customers. An ERP system caters to the demand of SCM by integrating all aspects of business organization and thus is expected to yield many benefits, such as reduction of cycle time, faster transactions, better financial management, the laying of the groundwork for e-commerce, linking the entire organization together seamlessly, providing instantaneous information, and making tacit knowledge explicit. ERP can provide the digital nervous system and the backbone in an organization to respond swiftly to customers and suppliers. However implementing an

ERP system poses a big challenge before firms as tremendous amount of organizational changes are faced while implementing an ERP system. Apart from being expensive, large amount of data sharing needs to be done between the firm and ERP vendor which seems to be major obstacle. A firm requires strong infrastructural support backed by top and middle management. Another important factor which impacts SCM is forecasting. Forecasting Inflation and Volatility are two important parameters which may hamper SCM accuracy. Although many approaches have been applied in forecasting and many big firms have had their share of success's the impact of forecasting needs to be handled in latest ERP software's.

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