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The Study on Evaluation of Enterprise Resource Planning in Manufacturing Industry

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Abstract – Every operation in a modern organization relies heavily on timely and accurate information to survive in today's competitive market. This study seeks to analyze a techno-economic view of the ERP software implementation. The study will also examine the usefulness of the ERP system's functionality assessment, effective use of Enterprise Resource Planning for achieving cost effectiveness in all organizational processes, and for supporting the knowledge management functions from the Indian Multinational Companies' perspective. The main advantage of this approach is that the costs and benefits will be quantified and this makes it possible to use this information in combination with other quantitative evaluation models.

Key Words - Enterprise Resource Planning, Evaluation of ERP, Return on Management, Cost-Benefit, Critical Success Factor

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INTRODUCTION

Enterprise Resource Planning (ERP) technology has long been a staple for manufacturing organizations that wish to streamline operations and hasten inventory and warehouse management while improving customer service. However, with the advent of new technologies, ERP implementations are about to get dramatically better. These new technologies – including cloud computing, mobile solutions and real-time business intelligence/analytics – along with new advances in warehouse automation -- will empower manufacturing organizations like never before.

In fact, these new ERP innovations will allow manufacturers to completely jump-start their operations. For example, in the very near future, manufacturers will rely on mobile networked devices and on-demand software to increasingly enable the seamless integration, tracking and optimization of key tasks from inventory, shop floor and management all the way to capacity and materials planning and product quality control.

Manufacturers focused on growing their businesses must consider implementing these ERP advances in particular:

► **Mobile**

Mobile is emerging as a critical technology for manufacturers that wish to empower their remote workers while improving customer service and satisfaction. One leading manufacturer of insulated industrial outerwear relies on VAIs S2K Sales Force application so that the outside sales staff can use smart phones and tablets to directly view sales patterns, notes, previous sales, inventory levels and past appointments prior to visiting clients. They can also enter more notes or place orders in real-time – which are all immediately visible to the back office. This resulted in a major productivity boost for the manufacturer.

► **Business Intelligence and Analytics**

Most manufacturers are not leveraging their own internal data to their best competitive advantage. In fact, these organizations often have valuable data scattered throughout their enterprises without a proven mechanism to find, track and recover exact components of data in real-time – necessary for making more intelligent decisions on-the-fly as well as keeping abreast of competitors, sales forecasts, inventory changes and market trends. Next-generation ERP technology will get a boost from new advances in analytics and business intelligence solutions that will give manufacturers the ability to rapidly uncover the right data sets while providing intelligence on how to act on that data based on the situation at hand.

► **Warehouse Automation**

ERP solutions will be further bolstered by warehouse automation advances that offer such important capabilities as RFID tracking and integration with voice-pick solutions.

New advances in ERP will give manufacturers the ability to analyze large data sets to more effectively drive innovation, productivity and efficiencies. According to a recent study by the McKinsey Global Institute, a major retailer leveraged the power of Big Data to improve operating margins by more than 60%. And, McKinsey believes that the manufacturing industry can benefit in a similar fashion by leveraging data-driven strategies to innovate, compete and capture value from both deep and up-to-the-minute real-time information.

There are new technologies that can dramatically improve operations and inventory management for manufacturers of all sizes. These advances will transform the role of inventory management from a record keeping tactic to a more strategic business asset by driving major improvements in overall productivity while eliminating costly mistakes in the warehouse.

► **Understanding ERP**

There are two flows across supply chain, one is product flow, and the other is information flow. In the past, information system tended to be islands, depending on their functions within the company. For instance, when orders came from customers, they were processed and recorded by sales department, and then the sales transferred the information to manufacturing. After the production made the master schedule, the logistics knew the distribution requirements and then planned the delivery. Finally, the accounting was able to bill to customers. Under this business process, a lot of problems might occur, like delay, lost order, input errors and long lead time, which is illustrated by the following chart:

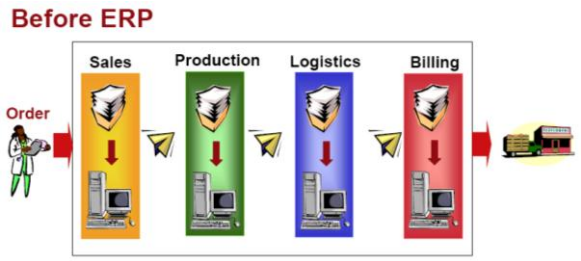

Figure 1. Order fulfillment before ERP [4]

Ideally, everyone should be access to the same real time data through some interface when they are needed to. This requires a single-point-of-contact system. That is one of the original ideas of ERP. Based on the identical system and database, the information flow and product flow can be processed efficiently. To guarantee the effectiveness of ERP implementation, we need to link all the functions of the chain seamlessly. As mention above, there are walls, barriers between departments. So what we need to do is to smash the walls, to get connected tightly via the system.

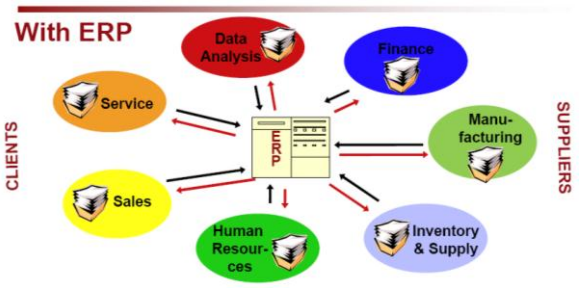

Figure 2. Order fulfillment after ERP

► **Core Components of ERP**

ERP totally changed the old computer systems from each separate department, and replaced them with a single unified software program that can be divided into software modules. The modules roughly approximate the old stand-alone systems. Since 1990s, ERP software has become flexible enough that you can install only some modules without buying the whole package. Many companies, for example, will install only part of ERP modules, like finance, HR, Material Management or Production Planning module and leave the rest of the functions for the future.

To enable the easy handling of the system the ERP has been divided into the following Core subsystems [5]:

- Sales and Marketing
- Master Scheduling
- Material Requirement Planning
- Capacity Requirement Planning
- Bill of Materials
- Purchasing
- Shop floor control
- Accounts Payable/Receivable
- Logistics
- Asset Management
- Financial Accounting

Evolution of ERP

The evolution of Enterprise Resource Planning (ERP) through the perspective of the historical

development of business integration concepts. Business integration concepts commonly connected to the development of ERP include Inventory Control (IC), Material Requirements Planning (MRP), Manufacturing Resource Planning (MRPII), and Computer Integrated Manufacturing (CIM). This review of the development of business integration concepts depicts the process that has led to the development of the modern ERP applications and thus, helps to better understand the nature of present-day ERP software.

The history of ERP can be traced back to the first inventory control (IC) and manufacturing management applications of 1960s These first applications for the manufacturing were generally limited to IC and purchasing, which was due to the origins of these applications in the accounting software The accounting, with its definition based around generally accepted standards, had been one of the first business functions to be computerized and the first applications for the manufacturing were created as by-products of accounting software driven by the desire of the accountants to know the value of the inventory .

During the 1970s, MRP packages were extended with further applications in order to offer complete support for the entire production planning and control cycle. This led to the next stage in the evolution of ERP, which was the introduction of the concept of Manufacturing Resource Planning (MRPII). The concept of MRPII emerged as a logical consequence of the development in earlier approaches to material control. MRPII seeks to improve the efficiency of manufacturing enterprises through integration of the application of information and manufacturing technologies MRPII approach was extended in the 1980s towards the more technical areas that cover the product development and production process, and that these functions were named with various CA- (Computer Aided) acronyms and included

The Gartner Group introduced the term Enterprise Resource Planning (ERP) in the early 1990s. The ERP evolution implies an extension of MRPII with enhanced and added functionality, encompassing functions that are not within the traditional focus of MRPII, such as, decision support, supply chain management, maintenance support, quality, regulatory control, and health and safety compliance. Today, ERP is the foundation of businesses domestically and globally. It is used as a management tool and gives organizations a great competitive advantage.

As e-business becomes business as usual, sharing accurate real-time information about orders and inventory is critical to success. Now, business needs to move that information across a supply chain. A new term to describe the enterprise systems for the 21st century: ERP II, has been introduced.

The expansion process can be showed as following figure,

Interface of Modules

ERP-Interface module manages the import and export data for the higher-level systems. Interfaces to all popular ERP systems are available; e.g. SAP, Navision, infor, proALPHA, BAAN. The software package combines two individual modules, the communication module ERP-Export/Import and the ERP-Interface module.

All CROS modules [8] are related to each other, all users working simultaneously through the network, using the same data, according to their attributions and access rights.

- There are direct connections between different modules, without data's imports and exports and without data redundancy.
- The system brings together universally accepted models for all the organization processes, adapted and developed as a result of successful implementations in Romanian organizations
- The data flows within the informational system are faster and better organized with CROS, this representing an important support for organization management

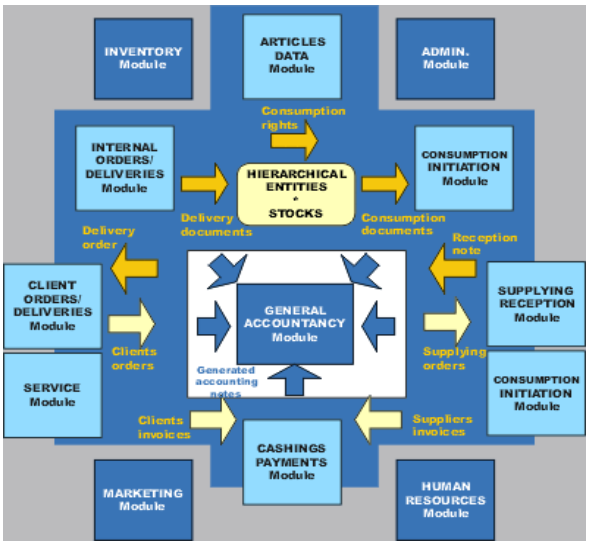

Figure 4: All CROS modules

ERP and Y2K

In the late nineties many organizations implemented ERP because of their need to get Y2K-compiant software, though implementing ERP just for Y2K readiness may be an overkill. The past few months also were post Y2K months; users and CIO's no longer look at Enterprise Systems, particularly ERP systems, to get over Y2K problem;

they look for business benefits. The feverish growth of ERP in the late nineties was fuelled by the CIO's wanting to put in place some systems that guarantee Y2K compliance. The integration benefits offered by ERP systems were overshadowed by their guaranteed Y2K compliance. Also some of the dominant ERP vendors such as SAP had by their stature, a hidden stamp of approval for the Y2K compliance; CIO's discovered that certification from less-known software houses was not that easy to "sell" to their CEO's. All these factors compounded stalled the growth of ERP in the past two years. Yet ERP is not "finished" by any standards – McKinsey Quarterly estimates almost $ 82 Billion for the year 2000!

The last six months of 1999 were tense moments for most CIO's. The supposedly imminent Y2K doom was writ large on their faces. Thanks to the fear of Y2K, the management attention it got and the media hype, Y2K came and practically went away without much noise. Call it better preparation to face the disaster or over-estimation of the possible impact of the Y2K disaster, Y2K was handled exceptionally well by MIS managers. Thanks to Y2K again, IT spending was very much controlled in the last six months of 1999. The worst to suffer was Enterprise Systems – ERP, SCM and the like. Most CIO's postponed their decision till the new millennium was born.

ERP and E Commerce

It is true that during 1996-98 ERP was the "talk of the town". Starting 1999, thanks to Dot.Com phenomenon the "flavor of the year" was clearly E Commerce. Companies were busy setting up store-fronts on the cyberspace, putting catalogues online, setting up websites with "bells and whistles", signing up web-hosting contracts, putting in place a Net strategy, hiring consultants to get a Net marketing in place to attract and retain "eyeballs", understanding payment systems, ensuring interactivity on their sites through mail, chat, discussion groups, opinion polls etc. But the December 1999 Christmas fiasco in USA clearly proved that without an Enterprise System (call it ERP or whatever) in place, one would not be able to manage all - customers, orders, inventories, suppliers and logistics - particularly in "physical" goods industries. The Dot.Com burst in the latter half of the year 2000 brought some sanity to the enterprise growth.

ERP is inward focused– it looks at the enterprise. E-Commerce is outward focused – it looks at the customers. To deliver value and succeed in business, you need both ERP & E-Commerce. Dell Computers had initially put a stop to SAP because Dell found ERP was too rigid; today Dell E-Commerce solution works with ALL ERP software! Since Dell sells to UniLever, GM and Boeing, Dell's E-Commerce solution should co-work with all the ERP systems of Dell's customers. Dell primarily assembles PC's and Servers; naturally their processes are far simpler. But for companies like Boeing and GM with complex operations, ERP is far more important. But everyone needs both E-Commerce and ERP. Their relative importance will vary with the nature of a specific company's operations. While E-Commerce may be more important for a company like Dell that sells computers directly to millions of end customers globally, ERP may be more important for a company like Boeing that sells far complex equipment to just dozens of Airlines.

LIMITATIONS OF THE STUDY

The present study is limited to Enterprise solution and its impacts. Most of them are organized retailers having a market chain of network with wide variety of brands across the country.

EVALUATION METHODS USED

When it comes to the methods used for evaluating the proposed investment, there are a number of available alternatives including both the traditional financial calculation models, such as the return on investment (ROI) and cost benefit analysis (C/B), but also models that try to evaluate the proposed investment using alternative approaches.

► **Return on Investment**

The most commonly used approach for evaluating investments today is the return on investment (ROI). The ROI approach includes a number of techniques that try to estimate what financial return an investment will generate, i.e. the cash flow of the company, including the initial investment cost. This approach tends to be used by companies with tight financial disciplines (Farbey et al., 1999)16. ROI is based on the idea that all costs and benefits can be transformed into measures, i.e. the costs and benefits are quantified in monetary terms, which makes it easier to comprehend for the people involved in the decision making process.

However, this approach will encounter problems if the value of the ROI is zero or negative, if the costs and benefits are not easily translated into monetary terms, or if there is no casual connection between the ERP-system investment and the accomplishment of the decided business goals.

The main benefit from using one of the ROI models is that by using this technique it will be easy to rank the different investment alternatives, but at the same time it is difficult to identify the qualitative benefits (which might be a part of an ERP-system investment) and hence the evaluation of the investment alternatives might not be correct. ROI evaluation models are preferably used when making rationalisation investments where the costs and benefits derived from the investment are direct and quantifiable, i.e. when the investment is

expected to produce direct savings or benefits. At the same time these estimates can be supported by accurate calculations and there is a low level of uncertainty concerning the result of the investment.

It may also be favourable to use one of the ROI models if there are a number of investment alternatives, and there is a need to compare these in a standardized financial order. On the other hand, the weaknesses of the ROI models are revealed when the benefits can not easily be transformed into financial measures, if there is a high level of uncertainty concerning the calculations, or if the intangible benefits are not taken into account due to the fact that they are difficult to translate into monetary terms.

Considering these strengths and weaknesses of the ROI methods, this approach to evaluating investment alternatives is preferably used when the investment can be identified as cost reducing. There should also be a high level of certainty concerning the result of the investment, all effects of the investment can be translated into financial measures, that the same time-scale is used for comparing all the alternatives, and that the investment should be on a tactical or operational level.

It is also of importance that the company's environment, both internal and external, is relatively stable and that the management has a strong focus on the financial measures provided by the ROI and at the same time has confidence in standardised methods of evaluation. As ROI methods have problems with quantifying intangible costs and benefits, which may be very substantial when investing in IT, the usage of a sensitivity analysis can increase the correctness of the result of a ROI evaluation. Based on the issues identified above, it can be said that by only using a ROI method, more strategic investments are likely not to be approved unless the ROI is complemented with some other method. (Farbey et al., 1999)17

► Return on Management (ROM)

Return on management (ROM) focuses on measuring the productivity of a company's management. The calculation of the ROM uses the additional financial value that can be directly linked to the management of the company after an investment has been carried out as a base on judging the investment. The financial value of the management is the value after all costs of the investment have been paid, and this is then divided by the cost of management. By estimating these costs and benefits of an investment, it is possible to use this as an ex-ante evaluation method, but due to the difficulties in making these estimations, this method is preferably an approach to be used for expost evaluation. However, given a large database of such ex-post computations, it is possible to classify projects in order to associate type of application with ROM and thus help in defining, on an ex-ante basis, which type of application appears to have the best chance of achieving a high ROM. (Farbey et al., 1999)

The purpose of ROM is to supplement the ROI method as a technique to evaluate IT-investments. One of the advantages with this method is that it focuses on the management of the company, and at the same time it is relatively inexpensive to perform. On the other hand, a disadvantage is that the value, that is seen as a financial benefit produced by the management, cannot always be related to this part of the company, and hence there might be changes in the ROM that are not a result of good management (Projekt Janus, 1999a). ROM is a method to be used for establishing working relations between the ITdepartment and the company's management. At the strategy formulation phase, changes in ROM must be based on an estimate of revenue after the change is implemented and estimates of changes to resource costs and contributions. (Farbey et al., 1999)

► Cost-Benefit Analysis

The decision to implement an ERP software is a business investment decision, hence, the ERP investment decision must create measurable business benefits thet justify the acquisition costs and costs of implementation (Mary Sumner, 2009)19. The main goal of the Cost Benefit (C/B) analysis is to put a financial value on every effect derived from an investment, e.g. if the goal with an ERP-system investment is to improve the working environment for the employees of the company, then the goal can be put in terms of lowered recruitment and education costs, which are derived from what is presumed to be a lowered staff turn-over. This means that all costs and benefits will get a certain value, which can be used in one of the ROI models.

The costs and benefits, which have no obvious market value or price, will be assigned a monetary value based on some notion of valuation. Due to the connection to the ROI methods, C/B analysis also requires a stable business environment. The C/B analysis is especially useful when a number of effects of the investment are intangible, but all the people involved in the investment process agree on the actions taken to measure and evaluate these costs and benefits.

The main advantage of this approach is that the costs and benefits will be quantified and this makes it possible to use this information in combination with other quantitative evaluation models. One weakness with this approach is that some of the values given to certain costs and benefits will be

seen as 'constructed' and thus the reliability of the evaluation might decrease.

A second problem with the C/B analysis is that it might take a long time to get the results and it requires good analysts. This technique might also overlook the problems related to risks with the investment, and it does not consider costs and benefits that are too difficult to quantify and due to this the C/B analysis might encourage companies to make low risk investments.

Based on this, it can be said that the C/B analysis is best suited as an investment evaluation tool when the company is able to quantify the results of the investment and has plenty of time to conduct the evaluation. Due to the lack of consideration of risks and the necessity of good analysts, the C/B analysis is best suited for the process of determining what the company generally needs rather than at the time of specification, which means that this method is well suited for strategic investment evaluation.

► **Critical Success Factors**

Using critical success factors (CSF) is well-known strategic approach to evaluating investments, based on the idea that top management discuss which are the CSF of the company or an investment. By focusing on these factors, the management will be involved with and devoted to the investment and hence they will support an investment that will help the company strengthen these factors. (Farbey et. al.,1999)20. An advantage with this approach is that by using CSF, the company focuses on the questions that are seen as most important.

During a further evaluation of the investment alternatives, it is possible to see how an investment in an ERP-system can support management in dealing with these factors. A negative aspect of this method is that it is not possible to use CSF to deal with future strategic opportunities, nor can it be used to identify information that supports or creates advantages compared to the competitors. CSF is a method that can be used when it is important to study involvement management in the implementation process.

CONCLUSION

The term Enterprise Resource Planning has evolved from Manufacturing Resource Planning (MRP II) that followed Material Requirements Planning (MRP I). Enterprise Resource Planning software are cross-functional and organization wide i.e Enterprise Resource Planning (ERP) software integrates all functional areas of business such as sales, logistics, billing, production, inventory management, quality management, and human resources management etc into one organization wide system. The magnificent performance of Enterprise Resource Planning systems established them as one of the most important development in the application of information technology in the Business world.

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