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THE IMPACT OF OPERATIONS MANUFACTURING MANAGEMENT SYSTEMS BY ENTERPRISE RESOURCE PLANNING (ERP) SOFTWARE APPLICATION

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Abstract:

Enterprise Resource Planning (ERP) is a concept that has evolved over the last six decades into all inclusive, companywide, management software system. Many companies have adapted this technology after weighing the benefits and challenges associates with its use. Those who have made the decision to deploy an ERP system, in a regimented and systematic manner have shown to make significant reductions in labor costs and errors, while increasing real time visibility to all internal processes. These reductions in labor have allowed companies to reallocate resources elsewhere to focus on becoming a more competitive company. In this paper ERP software are thoroughly explained and its history of evolution are reviewed. The benefits and challenges associated with ERP systems will be discussed to aid in determining an ERP system's feasibility. This has been done without referencing specific brands or specific software developers in order to provide a general understanding of technology and capabilities.

Keywords: - *ERP, MRP, SCM, HRM, CRM, FRM, Quality Management*

INTRODUCTION

Today's dynamic business the environment is experiencing unprecedented growth in complexity and aggressiveness. Businesses that once sustained themselves by offering a single product to local markets are now challenged with competing with broad product lines in vast global markets. This growth not only impacts the physical throughput of manufactured products but it complicates all other facets of a company's unseen business transactions as well. In today's aggressive business environment, it is crucial for companies to not only identify and address this challenge but to also find a means of gaining a competitive advantage over their competition.

Traditionally, companies have addressed this need through the use of experienced labor trained in the techniques and skills needed to perform the required tasks of their position. These individuals make up unique departments that focus on one specific VOL 2 ISSUE 2 February 2016 Paper 5 [39] function of an organization ranging from engineering and operations to finance and sales. Each of these departments is dependent upon the others and requires appropriate information and feedback from each of the others in order to function properly. With this said, each department must present or transmit their data systematically for it to be used effectively in the form of information by the other departments. As the demand upon these departments grows, companies have historically addressed the lack of needed labor in the form of new hires. As companies grow this task becomes daunting. Changes in advancing industries and global economies are requiring each department within a company to continuously tailor their information in order to keep up with the demands of their industries as well as ever growing regulations. This requirement of tailoring the information compounds the burdens placed upon the departments supporting the supply of information. As the burdens increase, so does the workload and stress. This inevitably leads to human error and decreased morale. For those companies fortunate enough to hire additional employees, this workload can be distributed evenly amongst others. Unfortunately, this is not always a viable option for those companies struggling to be competitive and maintain minimal labor costs.

Over the past two to three decades, many companies have begun using technology to streamline their back office processes. This is typically achieved through the use of electronic databases of information used by all departments within an organization. What was once physically documented on paper and stored in file cabinets is now conveyed through the use of electronic spreadsheets and documents that are stored in databases. Unfortunately for most companies, the rate of technology advancements and the accrual of information has occurred at such a rapid pace in recent history that it has lead to this information being used and stored in an unknowingly haphazard manner. As a result, these non regimented approaches lead to the need for multiple databases within a single organization, further complicating the task of maintaining and communicating information from department to department. This regression has lead to the need for a centralized system that transmits data from department to department providing crucial information as needed. As with any need comes a solution and in this case it was in the form of Software referred to as Enterprise Resource Planning (ERP) software. This software began to emerge in the early 1960's as a system of integrated applications used to manage a business and automate everyday business functions [4]. It has led to reductions in manual spreadsheet-based processes, IT costs and human error while increasing real time visibility to all information within the company. ERP has provided many competitive advantages for those companies who embraced its capabilities.

This review will fully define what Enterprise Resource Planning software is and how it used effectively in competitive organizations. In doing so, a thorough review of the history of its origins will be made. Furthermore, a clear examination will be made and articulated of the specific facets within an organization that can benefit from such software. Lastly, as with any powerful software package, there are major hurdles and common pitfalls found to be a major contributor failure or a lack of complete utilization. With this in mind, the issues will be discussed to aid in raising awareness to keep them from recurring.

What is Enterprise Resource Planning (ERP)?

Enterprise Resource Planning (ERP) is a software concept or approach of using computer software to connect all facets of a manufacturing environment, including employees, suppliers, and even customers alike. According to Green Beacon Solutions [3], "ERP is available to work with many hardware configurations, including "on premises" (i.e. client/server) or hosted (i.e. "cloud-based" or Software as a Service)" (defining ERP benefits and solutions, para. 2). ERP is not a "coined" or copyrighted product name as it is sometimes misconstrued. ERP simply identifies a software architecture that is offered by many software developing companies. This software is used to facilitate the flow of information between business segments, both internal and external, in a consistently visible manner [8]). This flow of information is achieved through the use of a software package, or suite that is copied of many individual applications, or modules tailored for specific functions within an organization. Each of these individual modules pulls data in the form of information from a common database. This practice opposes the traditional point solution which require multiple and sometimes redundant databases. Point solutions are typically used by small to midsized businesses that require a great deal of support from IT resources (defining ERP benefits and solutions, para. 4). Although effective for small to midsized businesses, this becomes cumbersome and flawed when employed by large businesses. The purpose of ERP software is to eliminate theoretical walls and allow for unlimited, or selective, and immediate access of information to all those who can benefit from that information. As shown in figure 1 below, you will see that a central database is used to store data. This eliminates the need for segmented databases that are maintained by each group of individuals or departments requiring that information. When information is needed the ERP software pulls the data being requested from the database and provides it to the user in the form of useable information. This transparent transmission of data is dynamic and allows

for a way path for communication. This means that input by the customer will result in an output to other users such as the supplier and employee or vice versa.

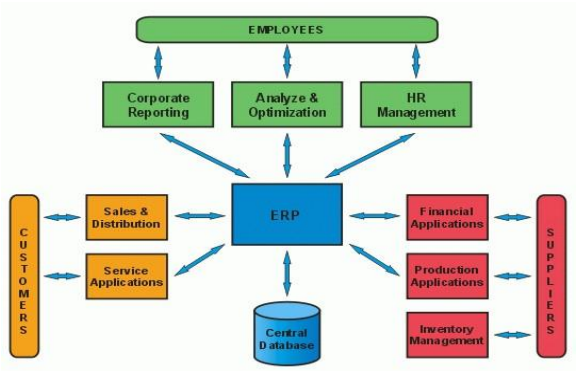

Figure 1. ERP Concept. This figure identifies the link between business modules through a common database.

Adapted from "How Does ERP Work" by http://erpsystems.wikispaces.com/ **History of ERP**
Enterprise Resource Planning (ERP) is a concept or approach that has evolved over the last 50 years. Beginning with it's roots of conception found in Inventory Control Packages (IC), ERP began with the popularity associated with the introduction and implementation of centralized computing systems [4]. IC software was built upon legacy programming languages and was focused on the management and control required for maintaining the appropriate level of stock in a warehouse. As technology advanced, resource planning evolved to include Material Requirements Planning (MRP). In the 1970's MRP gained interest as it was found to be effective for accurately planning the production of parts requirements based upon a master production schedule [4]. Although successful, this software was limited in that its focus was narrow and did not extend to other areas within the enterprise. In the 1980's this software platform was further developed with an emphasis on orchestrating the materials required for the production of parts. This software is often referred to as MRP II and includes additional areas of interaction such as engineering, finance, human resources and project management [4]. Beginning in the 1990's, Enterprise Resource Planning (ERP) software began to encompass an entire enterprise-wide integration as we are familiar with today [4]. The introduction of ERP integrated the fundamentals of IC, MRP and MRP II with the addition of the ability to provide accessibility through visibility and consistency across the entire enterprise. During the late 1990's and into the 2000's ERP began to become even more diverse and ERP programmers began to offer more modules are add-ons. These customizable ERP package coined the term Extended ERPs [4]. These add-ons continue to evolve with ever changing global business and include extensions such as ebusiness/e-commerce solutions, cloud compatibility, Customer Relationship Management (CRM), and Supply Chain Management (SCM) [4].

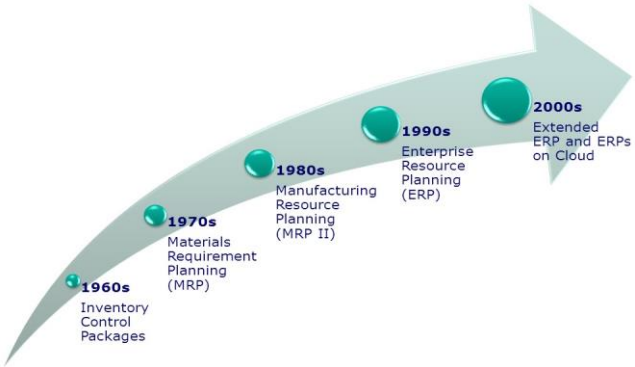

Figure 2. ERP Evolution. This figure shows the evolution of ERP systems over the past five decades.
Adapted from "ERP Evolution" by http://crackmba.com/erp-evolution

ERP Modules
As previously discussed, ERP software packages have evolved over time to incorporate a vast array of modules that automate the transactions between all functions within an organization. This design allows for companies to customize their own ERP system to what is feasible and economical to their business. The figure below identifies the commonly utilized modules offered by the most major ERP programmers. This section will provide a brief overview of the capabilities of the most commonly utilized modules.

Figure 3. ERP Modules. This figure shows the commonly available modules offered by the most ERP software developers.
Adapted from "Information Integration through ERP Systems" by http://fast.com.vn/he-thong-thong-tin-doanh-nghiep/giai-phap-erp/285 gioihieu-ve-erp.html

Manufacturing Resource Planning (MRP)
The most popular module that most companies employ is the MRP module. Seeing that MRP and MRP II are the foundation of ERP development, this does not come as a surprise. Since the initial development of early MRP Software, developers have made vast improvements upon production modules to include many new capabilities within the manufacturing production process. This module works by analyzing many inputs such as customer forecasts, current inventory levels, and planned productions. With this data the MRP module then provides recommendations allowing users to create production schedules and produce purchase orders to acquire the materials needed to support the planned production [10]. There are many other parts of this module which support the analytical computations required to provide accurate recommendation to level production flow. This includes the creation of bills of materials that are tied to cost associated items and valued labor. Beyond the ability to build the "recipe" required to manufacture the products this module can then track actual labor levels to monitor the efficiency of work in specific areas, trigger quality inspections and even identify the need for equipment maintenance [10].

Supply Chain Management (SCM)
Supply chain management modules are used to support the continuous flow of material in order to not cause any disturbances in the manufacturing controlled by MRP modules. Manufacturing facilities typically carry a large inventory of goods. These goods come in the form of raw materials, work in the process and even finished goods in the form of sub-assemblies. This module not only tracks and controls the real time location and status of all of these goods, but it is also capable of supporting electronic data interchange (EDI). EDI allows a company to communicate with their vendors to closely monitor the flow of materials even in external locations [10]. The types of data transferred can include nearly anything required to streamline material flow such as shipping date requirements, inventory needs and availability and real time information on shipment status. Using such software can even be further automated through the use of bar code systems that can input product data mid-stream and provide real time visibility throughout the manufacturing process from shipment of raw goods through a shipment of a finished product [10].

Finance Resource Management (FRM)
As the MRP module drives the manufacturing of the product and the SCM modules deliver the materials, the Finance Resource Management (FRM) module tracks all of the costs and revenues associated with each step. For instance, as a product is made, materials are consumed, and labor is utilized, a simple swipe of a barcode can apply a real time cost to these actions [10]. This action also triggers the receipt of materials allowing this module to automatically create accounts payable entries as well as process purchase orders to replenish materials when needed. Behind the scenes, this model can compare BOM's with actual material and labor usage to provide information of variance and adjust quantities as needed. Additional actions include monitoring of asset depreciation, automating payroll actions and generation of monthly and fiscal budgets based upon historical costs [10].

Customer Resource Management (CRM)
The Customer Resource Management module differs from the modules previously discussed as it deals with factors external to the business. This module manages specific customer data related to sales related efforts. Furthermore, this module manages the relationships built between internal employees with any external affiliates such as customers, business partners, or even vendors [1]). The purpose of CRM software is to aid in a meeting and exceeding customer expectations. This is accomplished by allowing business to share insights of multiple employees bridging potential pools of customers and related leads, using analytics to predict customer actions, and to even personalize customer service based upon the customer's past actions and personalized requests [1].

Human Resource Management (HRM)

Similarly to how MRP modules observe a product's performance, the Human Resource Management (HRM) module observes people's performance. This software is quite important as people are commonly deemed a business's most valuable asset. Through the use of performance reviews and discipline tracking, the HRM module allows business to mold employees and make them better [10]. HRM allows business to captivate and motivate their employees, generating new ideas and sparking creativity. Just like other modules, HRM automates many tedious, but absolutely imperative tasks. Some examples include coordinating work and time off scheduling, attendance tracking, maintaining health and safety programs and administering training and skill management programs [10].

Other Modules

As previously explained, today's ERP software systems are advanced and have the ability in incorporate nearly any aspect of today's complex business environments. Quality is a concept that is difficult to justify financially as it adds no value to a business's product even that it is a necessity. As Plex states, "When you consider the value of things like customer retention or a competitive advantage, it becomes clear that the real cost of quality is the absence of it" [10]). ERP provides a cost effective solution through an optional Quality Management System (QMS) module. This module automates many tedious tasks related to quality such as calibration, random auditing and required inspections. Furthermore, data retention can be entered electronically rather than manually [10]. This allows for real time access by linking quality to production and inventory records. This allows for quick and accurate review in times of recall or containment of suspect material due to quality concerns. This module can even be used by startup companies to assist in the process of earning and maintaining ISO or other quality related accreditations [10].

As you can now see, each of these modules is dependent upon the other. Each provides information for the others to analyze and provide valuable information for the user to act upon. Furthermore, when all modules work in unison they are able to automate many everyday transactions as well as perform proactive tasks. As companies continue to downsize and place more responsibilities on each employee, their ability to act progressively is diminished. By using an ERP system based upon modules explained, it allows businesses to continue working towards excellence by filling processing gaps in turn minimizing errors and increasing efficiencies. Essentially, any process within a business, that retains or utilizes documented information can benefit from the assistance of an ERP software program. If the process can be simplified by being input, automated, calculated, or analyzed it will benefit from the use of such a system. This can include anything from project management to preventative maintenance. As one can assume the automation of these processes will both reduce labor and human error. Although it seems as though the implementation is an obvious necessity, businesses must weigh the benefits to the downfalls, both of which will now be reviewed.

ERP Benefits

By this point, it is easy for any business savvy individual to see the potential benefits of using an ERP system in lieu of manually documenting, retaining, sharing, monitoring, and utilizing information. The first benefit of an ERP program is that it is customizable and can be scaled for any sized company from a privately owned start-up venture of a fortune five hundred corporation. As discussed, the modules can be selected based upon the nature or need of the business [7]. This modular design can also allow for staged implementation which is very important for a company to keep in mind. As with anything, change is difficult. If a regimented and incremental implementation plan is embraced it will allow for users, as well as those responsible for the implementation, to adjust rather that become overwhelmed. The initial stages can allow for the database to be built. This is a crucial step as the database is the foundation of the software. From there, businesses can release the modules for use in a predetermined order starting with the modules that will provide the highest and quickest rate or return on their investment. Alternately, this modularity allows for a business to cease implementation early if the anticipated results are not being achieved, or if funding is no longer available. In this case, it must be understood that the full benefits cannot be achieved if the entire enterprise is not embracing software; however, it does give the client flexibility in unforeseen or unique circumstances.

The second benefit is the ability of the software to automate everyday transactions. This can reduce workload while also minimizing human errors. Without the use of a software system with a common database, employees must repeat entries of information into multiple databases. Not only is this is both redundant and prone to error, but it also allows to variances in the way data is entered. One user may enter the number 1 while another might write out the word one. This simple oversight or difference has now created a potential problem in that it the information may not be able to be retrieved using a search method that was set up for the other. In addition, Global Shop Solutions [9]) has found that some companies have experienced labor reductions of up to 25% after implementing ERP systems (Shop the cost reduction tipping point, para. 1). Ideally, this would allow employers to reduce or eliminate overtime, and reduce direct labor costs.

Since the goal is never to cause layoffs as a result of becoming more efficient, this reduction in labor allows employers to reallocate valuable resources to areas of need. This can allow business the resources needed to begin to focus on and improve upon quality, customer responsiveness, innovation, safety or even focus on analyzing the data being gathered. These are all areas that are typically the first to suffer as a result of a lack of available resources (Shop the cost reduction tipping point, para. 4-9). In addition to labor cost reductions, ERP systems have proven the ability for businesses to reduce inventory levels. Traditional methods of maintaining inventory are not conducive to inventory reductions due to the constant level of attention required to maintain business functions while keeping less raw materials on hand. ERP programs automate inventory levels based upon historical needs. This allows for a minimal amount to be kept on hand.

Furthermore, since ERP systems can communicate externally, with suppliers, it allows for the coordination of higher occurrences of lower quantity shipments to occur [7].
Lastly, all actions within and ERP system can be monitored and traced in real time. This allows a business to monitor the work of their employees to place accountability [7].
This does not always mean that employees must be watched for mistakes and reprimanded accordingly. An effective approach is to create metrics based upon average levels of work over a given period of time. This data can then be used to compare employees' performance to a baseline as well as provide goals for future durations of time. At times the ability to trace an action is imperative and does require an individual to be reprimanded. If a severe mistake has been made, it may be necessary to identify the responsible employee if it has been identified that it was done with negative intent. In addition to the ability to monitor specific actions, ERP allows business leaders to review order tracking, inventory levels as well as sales forecasting and other related financial planning information.

ERP Challenges

Although there are many apparent advantages for a company to employ an ERP system, there are many disadvantages that may keep them from doing so. The main reason that most companies forgo an ERP system is due to the costs associated with a start-up. These costs extend beyond the actual cost of the software and include implementation costs as well as the costs of additional hardware and software add-ons. For example, most ERP software developers charge a fee for each user or license of the software. This price can vary based upon the type of business and complexity of software but "out of the box" ERP licenses typically cost between $2,000 and $4,000 each [6]. These prices can increase drastically if heavily customized software is required. Furthermore, if additional components are required, such as bar code readers or other peripherals, Kaupp identifies that a business can expect additional costs of 10% to 35% of the overall software cost [6]. Lastly, implementation costs must be accounted for. This accounts for labor required to convert data, train users and install the actual software. These costs are typically accounted for in ratios of the cost of actual software and add-ons. It is commonly expected for these costs to be 1:1, but can reach as high as 1:2.5 in highly complex situations that require the exorbitant amount of labor and support [6]. In all, an average sized company can expect to pay between $150,000 and $750,000 to implement an ERP software system [6].

The other main drawback to ERP systems is related to the overall effort and duration required for implementation. The majority of the effort is typically tied to the migration of existing data. Companies implementing ERP systems typically transition from a point solution, which uses multiple databases, maintained by multiple parties. This leads to non standardized data with varying formats. Because of this, the migration cannot be automated easily and requires a significant amount of effort to do so [7]. Once the information is migrated, the implementation is not yet completed. The physical implementation of software and hardware begins. Since the software is meant to be enterprise wide, it can be a monumental task to install the required tools at all user's work stations. The users will then require a significant amount of training. Most ERP software is complex and the learning curve is drastic [7]. Companies must assure that all users have a proper understanding of use and fundamental functions of software [7]. If employees are not using the software correctly it will not yield the correct information. In this case it would deem the entire efforts and accrued costs useless. In all, implementation plans need to be well thought out and given enough time to allow for unforeseen issues. Typically, companies that deploy an ERP system spend 1-3 years launching the program from start to finish [7].

Conclusion

In conclusion, Enterprise Resource Planning software packages have evolved into sophisticated software packages they can automate a daily transaction across an entire business. This automation can provide businesses with a competitive advantage however, businesses must be aware of all of the benefits as well as the disadvantages associated with the software prior to deploying an ERP implementation plan. In doing so, businesses must evaluate their needs and choose the correct modules that will yield the efficiencies needed. Lastly, a detailed implementation plan is critical to assure that the execution is seamless and the software is utilized to its full potential.

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