

Enterprise Resource Planning (ERP) Applications

Business Problems and Benefits

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Application Research Project: Enterprise Resource Planning (ERP)

Table of Contents

Introduction.....	3Error! Bookmark not defined.
Business Problems	4
Definition	6
Benefits of ERP.....	10
Case Study Service Sector– Elf Atochem.....	12
Vendor Matrix.....	13.
Challenges.....	17
Roles and Responsibilities	26
References.....	34

Enterprise Resource Planning (ERP)

Introduction

ERP Systems (Enterprise Resource Systems) are one of the most widely used and misunderstood IT systems that are available today. ERP is the concept of building applications which are fully integrated, that can be used to automate many of the routine functions of running the company (Bilbrey, 1999). Companies typically purchase these systems in an effort to consolidate their data and information flow into one system or database. In an environment that is currently not running ERP systems, the data is decentralized into many smaller subsets of system, servers and/or databases. By having everything separate, it limits the amount of integration and collaboration that can be done. IT functions such as disaster recover, data warehousing, backups and data updates must be done on each individual system, rather than on one ERP System. There are many examples of successful implementations of ERP Systems, but unfortunately, almost as many examples of unsuccessful ones. A tremendous amount of planning needs to be done prior to bringing this type of system in house, to ensure that it will really meet the business objectives of the company, while not forcing unwanted processes on departments that are not inclined to change the way they do business. In his article on ERP Systems, Davenport states, "If a company rushes to install an enterprise system without first having a clear understanding of the business implications, the dream of integration can quickly turn into a night-mare" (Davenport, 1997).

An important question that must be answered, is why are companies spending millions dollars on the purchase and deployment of these systems, and what problems are they trying to solve? Some will mention cost reduction, but that is not really an accurate description of why companies implement these systems. The primary reason companies look to deploy these systems is to gain better control of their data (Bilbrey, 1999). It gives companies the ability to consolidate and integrate their data into one single corporate type system.

Obviously, if implemented correctly, installation of the systems can result in savings over the long term, after the system has been in production for several years. Some of the savings can be through, lower warehousing costs, lower cost of materials due to the consolidation of purchasing and better management of assets. The basic concept of technical and business information architectures, relates to architecture and type of information systems. Technical corresponds to the technical part of information strategy, while business architecture relates to how information technology is used to improve business processes (Betz, 2003). This describes the purpose behind ERP systems. They are created solely for the purpose of improving business processes.

Business Problems

- Fragmentation of information/No single repository of data

Separate systems for multiple departments may give individual departments more control of their data, but do nothing to integrate the information. It also does not help the company accurately portray real data. Every system will have its own way of tracking the data and ultimately will have different data, irrespective of how careful the departments are in tracking their information. Lack of a single repository of data, hurt on several fronts. From an IT perspective, multiple backups will need to be made of each system. Disaster Recovery and Business Continuity planning of the independent systems will be that much harder to implement. From a business perspective, it can provide bad data to senior management that needs to make critical business decision to compete successfully. It also causes problems for finance department that need correct data to manage their environments.

- Too many processes and associated systems

Each department in an organization has their own methods of doing things. Along with these methods, come processes that are followed by these specific departments.

Having separate processes is one cause of having disparate data. All these processes hurt the ability of the company to come with real best practice guides to improve efficiency and productivity for the company. Each system will need to be maintained, and will require separate functional and technical administrators. Training of new staff and system upgrades are also an added expense.

- No real integration between Management Information Systems (MIS)

Lack of integration between MIS, hurts the ability of the company to provide timely and accurate information to its internal and external users. For example, order fulfillment systems that are integrated within an ERP system can provide much shorter turn-around times than disparate systems, where duplicate data entry may even need to be performed. Inventory systems that are not fully integrated within the order entry and invoicing system, will make inventory tracking that much more difficult.

- Poor decision-making: wrong information delivered

If a specific functional department only has access to their own system and that system is not as robust as other departmental systems, they may not be getting as accurate information as they could be getting. Even worse, internal departments may be providing external customers with incorrect data, which can really make the company look bad.

- Poor financial accounting providing inaccurate and untimely information

As the CEO tries to understand the overall performance of the Company, he may find many different versions of the truth. Finance will have their own set of revenue numbers, sales another and the different business units may each have their own version of how much they contributed to revenue. ERP creates a single version of the truth that cannot be questioned because everyone is using the same system.

- Limited forecasting tools

Companies that do not have ERP systems, do not have the sophisticated forecasting tools available within an ERP system. This hurts their ability to properly plan for the future and implement appropriate risk mitigation strategies.

- Constantly building new IT systems for disparate systems

Every system requires maintenance, which includes operating system patches, application patches and database maintenance. For companies that have disparate systems, IT will have a much larger burden in keeping the systems functioning. New requirements, may mean newer systems, which will cost money at all levels, including infrastructure, application and coding.

Definition

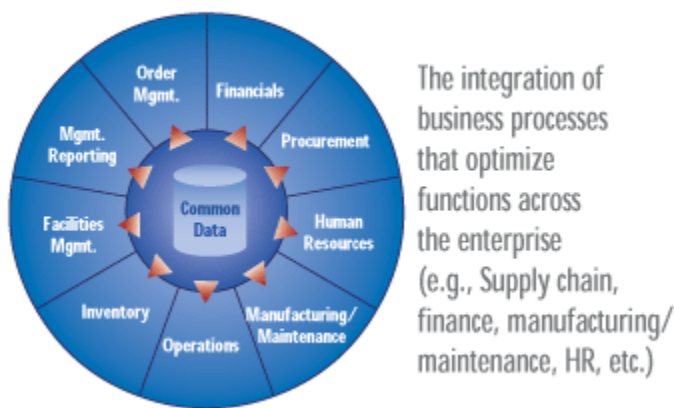
ERP - Enterprise Resource Planning.

Enterprise resource planning software is defined as integrated software that unites all data and processes of an organization into a single unified system. A typical ERP system will use multiple components of computer software and hardware to achieve the integration. A key ingredient of most ERP systems is the use of a single, unified database to store data for the various system modules. Though the actually term ERP (Enterprise Resource Planning) was coined in the early 1990's, its roots actually started developing in the early 1960s. It was established through a joint effort between J.I. Case, the manufacturer of tractors and other construction machinery, and their business partner IBM. The initial effort was Material Requirements Planning (MRP). This application software serves as the method for planning and scheduling materials for complex manufactured products. Initial MRP solutions were very cumbersome and required a large technical staff to support, largely because of the mainframe systems that they had to run under. In 1972, SAP became the first company to produce MRP software for integrated business solutions. In the mid-70s, MRP would become the fundamental concept used in production management and control. Baan and JD Edwards

also took form during the late 1970s. In 1980, MRP would evolve into MRP-II (Manufacturing Resources Planning) as a more accessible extension to shop floor and distribution management activities. During the late 80s and 90s, MRP-II was further extended to include areas like Finance, Human Resource, Engineering, Project Management etc. This gave birth to ERP (Enterprise Resource Planning) which covered the cross-functional coordination and integration in support of the production process. Basically ERP as compared to its ancestors included the entire range of a company's activities.

ERP systems include the ability to handle the following functions; manufacturing, logistics, distribution, inventory, shipping, invoicing, and accounting for a company. They can also aid in the control of many business activities, including; sales, marketing, delivery, billing, production, inventory management, quality management, and human resources management.

ERP: Enterprise Resource Planning System



As one can see from the illustration above, the common denominator in ERP systems is the data.

Prior to the advent of ERP systems, each department had its own system that was not integrated with any others. Data was kept separately and IT had to support each and every type of system. This was extremely difficult to manage and from a business process perspective, did not help the company become more efficient. ERP software, among other things, combined the data of formerly disparate applications. It standardized and reduced the number of software specialties required within larger

organizations. It enabled reporting that spanned multiple systems much easier. And it allowed for the development of higher level analysis functions enabling larger organizations to identify trends within the organization and make appropriate adjustments more quickly.

The modules that are used, breaks down further into more specifics:

- Manufacturing: Engineering, Bills of Material, Scheduling, Capacity, Workflow Management, Quality Control, Cost Management, Manufacturing Process, Manufacturing Projects, Manufacturing Flow
- Supply Chain Management: Inventory, Order Entry, Purchasing, Product Configuration, Supply Chain Planning, Supplier Scheduling
- Financials: General Ledger, Cash Management, Accounts Payable, Accounts Receivable, Fixed Assets
- Projects: Costing, Billing, Time and Expense, Activity Management
- Human Resources: Human Resources, Payroll, Training, Time & Attendance, Benefits
- CRM: Sales and Marketing, Commissions, Service, Customer Contact and Call Center support
- Data Warehouse and various Self-Service interfaces for Customers, Suppliers, and Employees

ERPs are cross-functional and enterprise wide. All functional departments that are involved in operations or production are integrated in one system. In addition to manufacturing, warehousing, logistics, and Information Technology, this would include accounting, human resources, marketing, and strategic management.

To help further understand what ERP exactly does, it helps to understand why a company would introduce it. There are five basic reasons for introducing ERP.

- Integrate financial information—;there are too many sets of financial data within a company, which can be maintained by Finance, sales and other business units. ERP creates a single version of the truth that cannot be questioned because everyone is using the same system.
- Integration of customer order information; By having all customer information in one software system, rather than scattered among disparate systems that cannot communicate with each other, companies can keep track of orders more easily, while at the same time, coordinate manufacturing, inventory and shipping among many different locations simultaneously.
- Standardize and speed up manufacturing processes; manufacturing companies will find multiple business units across the company that can actually make the same product, using different methods and computer systems. ERP systems come equipped with standard methods for automating the manufacturing process. Standardizing those processes by using a single, integrated computer system, saves time and increased productivity.
- Reduce inventory; ERP helps the manufacturing process flow more smoothly, and it improves visibility of the order fulfillment process inside the company. This in itself, can lead to reduced inventories of the materials used to make products (work-in-progress inventory), and it can help users better plan deliveries to customers, reducing the finished

good inventory at the warehouses and shipping docks. To dramatically improve the flow of the supply chain, one can also bring in supply chain software

- Standardize HR information; Especially in companies with multiple business units, HR may not have a unified, simple method for tracking employees' time and communicating with them about benefits and services. ERP fixes that and also integrates Payroll and HR processes and data.

ERP Benefits

- Improvement of order fulfillment processes

Without an integrated system, the process becomes very difficult to manage, as information is scattered among many different systems that can't communicate with each other. ERP systems can keep track of orders more easily. They can also coordinate manufacturing, inventory and shipping among many different locations simultaneously. The ERP system essentially becomes the place where a customer can now live from the beginning of the sales process until delivery and ultimately invoicing (Koch, 2006).

- Standardization of manufacturing processes

Manufacturing companies usually find out that multiple business units across the company, that might even make the same product, use all different types of methods and computer systems. Having consolidated systems with standard methods for automating tasks, will speed up the steps of the manufacturing process. In turn, this should save time, increase productivity and ultimately reduce the amount of staff necessary to maintain these systems (Koch, 2006).

- Reduction of inventory

With separate systems, inventories needed to make products and/or fill orders will be almost impossible to keep up-to-date. This can hurt corporate financials and impact the ability of the company to fulfill orders in a timely fashion. ERP systems, implemented successfully, can lead to reduced inventories of the materials used to make products (work-in-progress inventory), and should also help staff better plan deliveries to customers. This will have the impact of reducing the finished goods inventory at the warehouses and shipping docks (Koch, 2006).

- Standardizing of HR information

Without an integrated system departments within an organization will keep their own HR records. This can lead to all sorts of chaos, particularly in companies with multiple business units. There might not even be a simple method for tracking employees' time and communicating with them about benefits and services. An ERP system solves this problem (Koch, 2006).

- Server and Data Consolidation

An effective ERP system should dramatically reduce the overhead of maintaining many differently physical and logical systems. Each MIS system, typically requires its own infrastructure, which includes hardware and software. There are substantial maintenance costs required for upkeep of these systems. These includes IT personal required to take care of the systems, database administrators that must take care of the database and coders responsible for making changes to the systems. With a single ERP system, there is just one system and infrastructure to maintain.

- Integration of processes and people.

Productivity can be reduced dramatically through more efficient processes that can be structured with one system. Best practices can be implemented across the enterprise more easily with one application, then with disparate systems.

Because integrated systems requires more cooperation among departments, there could also be more resource sharing and teamwork across department and business units.

- Enhanced financial management and corporate governance

Disparate systems lead to inaccurate financial reporting. Single integrated systems will provide more accurate information to finance people and empower them to make better corporate decisions.

Corporate governance becomes easier to manage, as there is now a single system to work with.

Auditors can feel more at ease, knowing there are integrated systems that provide more detailed and accurate corporate information. Government regulations and systems such as Sarbanes Oxley require accurate information, which ERP systems can provide.

Case Study

An example of a company that did ERP correctly, is Elf Atochem (Davenport, 1997).. Elf Atochem is a 2 billion dollar chemical company, which is a subsidiary of ELF Atuitance, a French organization . Because of a series of mergers, the company found itself with fragmented IT systems across 12 business units. Ordering was not integrated with production systems, nor were forecast tied to budgeting systems. Because the data was different throughout the organization, management was not getting the right information they needed to make sound decisions. The Company recognized that the best way to integrate the various data flows would be through an ERP system. They decided to go with what was the industry standard, SAP. It was not just considered a technology initiative, but a corporative initiative that could help the company in all facets of the organization. They recognized quickly that the problems of the company were not so much that the systems were fragmented, but the organization was. To place a single order, a customer would have to make many different calls and deal with a variety of different business units. This was frustrating to the customer. Things were just as confusing with internal operations. It could take up to four days (and seven different departments) to process a single order.

Inventory was written off and sales were lost.

Management structured the ERP initiative to transform the method in which they provided service. They wanted to achieve tighter integration between its business and system processes.

They focused on materials management, production planning, order management and financial reporting. These were the areas that they struggled the most with and had the greatest impact on their ability to manage customer relationships. To further maintain their focus, they only installed modules that required them to support these four targeted systems. In addition to the systems changes, they made organization structural changes as well. For example the accounts receivable and credit department were merged into one (Davenport, 1997).. They also established a single service department to check orders and resolve customer issues. The company gained a major edge over their competitors, because the system automatically updated forecasts and schedules which enabled them to alter production to meet customer needs. At the time, only one of their competitors had this ability, which gave them an important edge over the competition. Overall the implementation was successful because they did not just install an application, but recognized all the business implications and aligned the business needs with the technology (Davenport, 1997).. This is the most important ingredient to a successful ERP implementation.

Vendor Matrix

The Vendor Matrix is posted as a separate spreadsheet. The companies that were selected were a broad mix that marketed to small, mid-range and enterprise organizations. They are Microsoft, Oracle, Sage and SAP. The products that were analyzed were Axapta, Oracle E-business Suite, Sage Pro ERP and MySAP, respectively. The document will analyze the ERP systems with a focus on the manufacturing point of view.

Microsoft Axapta

Axapta is Microsoft's flagship ERP package. They have several other packages, including Great Plains and Solomon's which are geared much more to smaller companies. The product itself has

been growing largely due to the association with the Microsoft brand. It also has strong manufacturing capabilities and is easily customizable. One of the strengths of the product is that it can function out-of-the box for industrial plant manufacturers. Independent Software Vendors (ISVs) address the business requirements by customizing the product itself. One must be careful to evaluate the strength of their business partners, as many of them are much smaller than the partners that the larger ERP companies deal with. They are also more geared to specific geographic regions. Gartner stresses that large companies with complex requirements think long and hard before purchasing the product. They do place the product in the Visionary class of their quadrant, because of the excellent growth opportunities, but caution customers who may be purchasing systems that may not be able to meet present user requirements.

The product itself has gained a reputation as being a very fast powerful system, in some studies even beating out SAP and PeopleSoft for customer satisfaction. The warehouse module allows customers to set-up multiple warehouses, which allows for a great deal of flexibility for wholesale and manufacturing companies. It has a specific focus on discrete and batch-processing manufacturing, e-business, wholesale and the services industry. It can run on either SQL Server or Oracle as a database, but requires Windows as an Operating System. Many large companies use Unix as their mid-range platform for Enterprise type systems and Microsoft does not support that platform, which is a negative. It is comparable with the functionalities of Tier 1 products such as Oracle and SAP. It was originally developed in Denmark and acquired by Microsoft in the summer of 2002.

Oracle E-business Suite

The Oracle E-Business Suite (EBS) is seen as a Niche Player in the Gartner Magic Quadrant, because of its uncertain future, with PeopleSoft having been purchased by Oracle. Prior to the acquisition, it was a strong player in the manufacturing of consumer goods, industrial manufacturing,

oil/gas and chemicals. It also has strong manufacturing functionality for high technology, industrial manufacturing, automotive and life sciences. It is currently being positioned as an upper midmarket and Tier 1 Solution. Gartner feels that Oracle will preserve the portfolio and sings its praises as a highly regarded product. However with new generation products coming, customers must consider the risk of having to migrate to a different product by 2013. The next generation product is called Project Fusion, which is supposed to leverage the best of OBS, PeopleSoft and JD Edwards into one product line.

Their market is primarily large enterprise organizations, though they also work with mid-sized companies as well. The business drivers for the product include; Total Cost of Ownership, performance, flexibility, reliability, security and strong technical support. The product itself runs on Unix based systems, which allow for more scalability in the Enterprise. It runs on Oracle and is also a J2EE system which is compatible with .Net and PHP. Oracle maintains a strong partner network which also resell the systems with databases and computer hardware.

The network is called the Oracle Partner Network, which includes consultants, education providers, network integrators and system integrators. The systems is based on open architecture and a single data model, which allows applications to either be deployed as individual modules or as an entire integrated suite. Another strong feature is that OBS customers have the option of having Oracle experts manage their Oracle software, so that their IT staff can focus on either activity. It also provides hundreds of canned reports, though Oracle Daily Business Intelligence, which can be done without using a Data Warehouse. Integration of their suite with their database is a strong selling point for customers who want a single vendor to deal with.

Sage

Sage PRO ERP is the smallest of the ERP packages that were reviewed. Though they do count fortune 500 companies as their customers, they primarily deal with small and mid-sized

businesses. Manufacturing and Distribution are the primary industries that they serve. Secondly, they focus on service industries. Sage Pro integrates manufacturing with purchasing, sales, receivables and accounting. Similar to OBS, one can select only the modules that they require. Each one are like mini-applications which can be added to the system at a later date. Production entry provides bills of materials, sales kits and supports up to 99 bill of material levels. The product itself is sold through a Value Added Reseller (VAR) channel. Their web-site has a link to over 400 developers that create and market applications specific to industries.

Though most customers run the product on Windows Servers, SUSE Linux is now also supported. The databases must be FoxPro or Microsoft SQL. The company is not shy about advertising their freely available source code, which allow for modifications at the client site. It also allows their system to be highly customizable. Because it is a smaller system, the product can be up and running at a client site in usually under 6 months.

Their new version (7.3), came out with over 200 features and enhancements, including national accounts functionality in the AR Module and enhanced data management and manufacturing modules. The London based company itself supports over 2 million small and mid-sized businesses and caters to companies that have revenues between 25 million up to one billion.

SAP

SAP is the oldest and most well-known of all ERP Systems. It is also the most expensive and is used predominantly by Enterprise companies. Not surprisingly, it is listed as a Leader on the Gartner Magic Quadrant. This is because of its growth rate, industry focus, global reach and fixed price implementation. SAP is a German based company, which focuses on enterprise type markets. Their business driver, is that they combine a scalable complete solution built on an open technology platform which can integrate with systems even outside its own box. Their pricing model starts from 250,000 and up. They also provide fixed price implementations, which are important to their smaller

customers. Each partner re-markets and implements offerings which uses a combination of SAP templates and their own, to configure turnkey solutions for the customer with a fixed scope and price. In 2004, SAP announced a roadmap which strengthened their commitment to their architecture, through the release of the NetWeaver platform. SAP NetWeaver is an application builder platform for SAP, which is used to integrate business processes through different systems and sources. It is the foundation for all products since the introduction of their suite. The release of Netweaver was seen as an important strategic move by the company to help drive enterprise to run their business on a single scalable platform.

Technically, all these products work well, some are just tailored for different markets. It is essential for companies to look at everything they are trying to do prior to signing off on any package. The price of the package itself is also oftentimes misleading, as much of the costs involving an ERP implementation are based on services.

One must also remember that without thought as to how the company needs to align their business to the ERP package, the system just becomes another piece of software. A company cannot just spend several million dollars on SAP and expect the product to work miracles. It is the people that must ensure that they are using the technology accordingly and implement the systems to take full advantage of what they can provide.

Challenges

Now that we have made a case to bring in an ERP application to integrate various business, functional and IT systems across the company, we'll focus on the challenges to a successful deployment. Oftentimes, companies do not realize the sheer size and complexity of ERP implementations and the difficulty in managing them. While an ERP system itself is developed through technology, it is the people that will deploy and have to manage it. The package can impact the entire organization and in some instances, may affect nearly every employee. It is essential that at the initiating stages of the project, an ERP manager know exactly who will be affected by this implementation. Even on the technology side, it can be a challenge to get a clear vision of the technological portion of the implementation because of the vast combination of hardware and

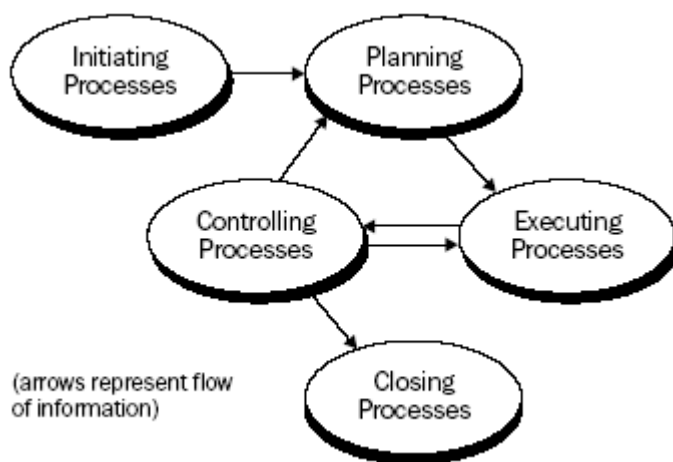
software that is involved. The project manager who will lead this project, must cope with thousands of moving parts. Regardless of how many modules are being implemented, consistency and full integration across the various subprojects is critical, which is an enormous effort. There are many different challenges that relate to the successful deployment of such an application. They include:

- Successful Project Management methodologies
- Strong Project Manager with authority
- Unclear business objectives/strategies
- Alignment of technology with business strategy and objectives
- Integration/interoperability with other systems
- Vendor Management
- Escalating Costs and Expanding schedules
- Managing Change

Successful Project Management methodologies

Perhaps no area is as critical for the implementation as a successful project management methodology. The Project Management Body of Knowledge (PMBOK) methodology is an example of a strong industry standard method.

PMBOK



This chart helps us understand the proper way of managing a project, from the initial stages of a project, through its conclusion. The most important starting points of a project are the development of a project charter (including roles and responsibilities) and a preliminary scope statement. The project charter defines the scope, objectives, and overall approach for the work to be completed. It is a critical element for initiating, planning, executing, controlling, and assessing the project. It should be the single point of reference on the project for project goals and objectives, scope, organization, estimates, work plan, and budget. In addition, it serves as a contract between the Project Team and the Project Sponsors, stating what will be delivered according to the budget, time constraints, risks, resources, and standards agreed upon for the project. When a project does not have a formal project charter, it can lead to much confusion, as people really did not understand the fundamental objectives to the project, nor the principles on how it would be managed. The document itself should also consist of appropriately defined scope and responsibilities. The purpose of defining roles and responsibilities is to provide the project team members with a clear definition of expectations for their participation and the participation of their teammates. The goal is to provide well defined and communicated roles and responsibilities and provide a clear and comprehensive roadmap where specific roles are assigned accountability for leading, participating and/or reviewing the work products produced as part of the development lifecycle. Using PMBOK methodologies, after the Charter has been signed off by the Project team, a scope statement is then developed, from which all future changes in the project are managed. The Scope Statement provides a documented basis for making future project decisions and for confirming or developing a common understanding of the project scope among the stakeholders. As the project progresses, the scope statement may need to be revised or refined to reflect approved changes to the scope of the project. The scope document is a dynamic document and is perhaps the most important document of the entire project, as it outlines all project objectives, which are then to be signed off by the entire project team. Only after these two documents have been completed, then a project plan can be put together and developed.

Too often, the first document produced in an ERP Project, is the project plan itself. There is a lot of pressure from others to produce a project plan as the initial document, though a project is bound to be haunted with problems without an official charter and scope.

Strong Project Manager with authority

The Project Manager has the most important role of all within the project. The methodologies used may be impeccable but if the PM is weak or the structure of his role is weak, the Project will not be

as successful. A project manager must be flexible enough to deal with change as the project progresses, and also not lose it when unpleasant surprises come up during an ERP implementations. This person must be able to work with nearly every individual in the organization, from the most technical IT person, to the business people, to the functional types that do the actual work. They must possess the ability to learn extremely fast, because they will need to understand business issues in areas of the organization with which they may not be familiar with. An ERP project manager must also be very disciplined. This person must be able to envision the project end game, and then hold the entire organization towards that end. This means bringing other team members back on track when problems develop and also making tough decisions understanding that those decisions will upset some and please others. More than any other trait, they need a thick skin.

According to Gartner, the following characteristics are essential in for an ERP PM.

A successful ERP project manager...

- is flexible
- is disciplined
- is a quick learner
- is a good decision maker
- has ERP experience
- has business experience
- has political clout
- has a good formal education
- is well liked

- motivates staff

Source: Gartner Institute.

There are also various degrees in which a project of this size can be defined in terms of its overall structure. There are three ways in which a project can be structured. They are:

- Functional
- Matrix
- Projectized

A functional project is defined as a classic hierarchy in which each employee has a single superior, and then employees are organized by specialty and work accomplished is specific to that specialty. This is the most difficult assignment for a project manager, as they lack the authority to assign resources and must acquire people from other functional managers. When this occurs, the priority can be viewed lower than operations by the function manager. In these types of organizations, the project manager must often appeal to senior management to resolve issues at all levels.

A matrix project is defined as a blended organizational structure. Although a functional hierarchy is still in place, the project manager is recognized as a valuable position with greater authority to manage the process and resources. Within this structure, one can have a weak, balanced or strong matrix. In a weak matrix, the PM reports to a functional manager that also manages the day-to-day work. In a strong matrix, more power is given to the PM, as he usually reports to a Project Management Office (PMO).

A projectized organization is one where there is no defined hierarchy. Resources are brought together specifically for the purposes of the project. People assigned to the project work only for the PM for the duration of the project. This is the preferred method of an ERP structure for any PM, though as a practical matter, he should probably hope for a strong matrix implementation. A Project org chart is also a key element in this process and helps illustrate at a high level the nature of the project organization.

Unclear business scope/objectives/

In a project of this magnitude, it is essential that the business objectives are clear. Those objectives should be defined in the Project Charter and Scope. They must be enforced so as to prevent the "never ending project" syndrome. This occurs when constant scope changes are made, which cause confusion among project team members. The primary focus of scope management is on defining and

controlling what is the project. The project manager needs to work with the other departments and the sponsors of the project to clearly define the project scope. If it is not clear, then required work can be missing which can jeopardize the project success. It can also hurt the budget, as scope changes always affect the budget in an ERP implementation. To prevent scope creep, the project charter and scope statement must be clear. All project requirements must be clearly defined, documented and signed by the users and senior management. Clearly define change control procedures and hold everyone to them. Tight change control procedures may end up causing tension between the project team and those who do not get changes they want. Ultimately, though, the project can't be successful if the project team is trying to hit a constantly moving target.

Alignment of technology with business strategy and objectives

Business objectives must be properly aligned with the objectives of IT and executive management. Before aligning those objectives, they first must be described. Objectives can be defined as follows:

Executive Management Objectives

- Support the strategic goals of the organization (I.E. Mergers), eBusiness and other operation initiatives
- Maximize the Total Cost of Ownership (TCO)
- Facilitate the exploitation of new revenue that can be derived from the new systems

Business Objectives

- Support the integration of business units and their various processes and systems
- Improve system availability and functionality for end-users

IT Objectives

- Support the development, testing and production environments

- Ensure reliability, availability scalability and security of systems

The objectives should take into account the needs of the user communities and prioritize them based on the overall goals of the organization. Milestones and benchmarks related to the objectives are also recommended. Successful criteria for ERP projects are frequently inadequate. Success criteria should be clearly defined, in the procedures, which should be a that are part of a high quality project control system. Standards and techniques for measuring the quality of performance expected from the new system should be defined early, and redefined over the project life-cycle.

Integration/interoperability with other systems

The ERP system is never going to replace every other system in the company, no matter how large the expectation. This is particularly true during the implementation of the project, where only certain modules are deployed. Because of the gaps in the functionality of the software and/or time constraints and/or political issues, there are usually many interfaces to other systems.

Interfacing with legacy data may involve connections to mainframes, midrange Unix/Linux system and/or PC Servers. The interfaces must have the ability to handle complex data sources and legacy data types. Nationally other in-house client/server systems must also exchange data with the ERP system. The ERP software might also interface with external business partners through electronic data interchange (EDI). With e-commerce, ERP systems must also be able to send and receive data over the web. Another example of an interface that may have to be build, would be integrating with data-warehouses. Managing the discovery, analysis, design, and implementation of interfaces can be an enormous undertaking. The data translation and movement requirements alone can cost a tremendous amount of money. This is where scope management again comes into play. The PM. can prioritize interfaces so that mission critical systems engaged in daily processing can exchange data when the ERP software is implemented. Interfaces to systems that do periodic processing-monthly or year-end-can be completed after the initial implementation. It is essential that work be properly prioritized, and ERP team members must focus on immediate needs.

Vendor Performance and Management

Another problem faced by ERP project managers is the need to integrate consultants with corporate staff during the project implementation. Due diligence must be done with consultants/vendors before they are hired. This includes checking references, evaluating hands-one experience and there levels

of expertise. It is critical that the control of the project must be in the hands of the internal PM and not the vendor. The vendor should report the internal PM. The Statement of Work (SOW) must be clearly documented so that all project expectations and deliverables are clear before any work can begin. Performance must be continually monitored with agreed-to measurable results and provide real-time feedback. Any issues should be addressed immediately and an issues list should be kept. Knowledge transfer is also a key facet here as the consultants will eventually leave. The consultants and corporate staff should work together side by side throughout the implementation. This helps ensure a nearly constant flow information from consultants to corporate staff, and prevents important knowledge from leaving when the consultants leave the project.

Escalating Costs and Expanding schedules

Project costs must be constantly monitored throughout the life-cycle of the project. The PM must be effective at keeping track of the budget, how much has been spent and how much is left. A project cannot be deemed a success if everything ends up working well, and the CFO determines that you spent 10 million more than you were supposed to. That is the easiest way to lose your job. There are many tools that one can use to help you manage your money. Excel is an important tool that you'll need to use and Microsoft Project also has financial links that can monitor resources and spending dollars. Regarding Scheduling, managing the project schedules will also be a very difficult task. There are always conflicting political and organizational issues. It's extremely important to consider all of the issues and develop a clear, concise, and thorough project plan before starting the implementation. An expert project manager creates a plan that addresses the major issues, and is flexible enough to change as the project hits the inevitable bumps in the road. One of the major problems with scheduling large projects is accounting for time issues with people assigned to the project. These must be identified in the schedule. The proper dependencies and human resources should be requested prior to creating and dating activities in the schedule. It's also important to account for vacations, sick days, and other leave that frequently takes people away from the project unexpectedly. A critical path analysis should also be performed on the project schedule, to determine any potential "show stoppers". A critical path analysis determines which resources absolutely must be present at certain times in the project for it to succeed.

Managing Change

Increasingly, the future of IT is as an enabler of change. The measure of IT, then, is its ability to align its efforts with those of the business processes that are defined in a change effort. (Gartner).

Working to get everyone in the same boat rowing in the same direction is essential, as is continually making the business case (benefits outweigh the costs). Education and training is also a key factor that helps people in their ability to manage change. Garnering stakeholder buy-in is another important method to ensure executive support who share the vision. These must be executives who are willing to mandate the change throughout the organization and also willingly fund the project and prioritize it accordingly. The sponsors must ensure end-use buy-in and continually manage stakeholder expectations accurately. Developing both a Change Management and Cope Management Plan is also a critical element in managing change throughout the project lifecycle. Further, the development of change champions who can clearly articulate the advantages to stakeholders at the grass roots level, is a critical element.

Case Study/National Organics --- SAP ERP implementation

When the company kicked off its installation of an SAP R/3 ERP system on March 6, 2000, members of its business teams (finance, sales, marketing) all started looking for additional reports and functions beyond what was originally intended. Even the CEO started changing the scope when he wanted a call-reporting system to track the activity of the company's sales representatives. Scope creep/change was one of the top problems identified in this case study. Because the tracking system wasn't part of the original contract for the project, the company had to issue a change order for the new system, which was one factor producing scope creep on the project. The total ERP package, including hardware, software, and consulting, cost the company \$3 million.

Another big issues for the company was dealing with all the people involved in the project, as well as outside systems integrators. The CFO, Philip E. Theiss, stated the people aspect of things were a greater challenge than actually averting technology issues. Even when they went live on the system in November 1, 2000, people were still getting used to its functionality and kinks. The response within the company to the new system had been diverse, with some people still attached to the legacy systems and some intrigued about the future.

Vendor Management was another area that proved extremely important. Theiss said that, "it's the people" employed by the outside systems integrator that need the most scrutiny. Integrators, for instance, "can alienate the user community and, all of a sudden, the project can come to a halt because of the personality" of the contractors. Regarding criteria to be used when selecting an integrator, it wasn't just how bright they were, but the experience with the specific technology (SAP) and the culture of the client company. They chose a company that worked in their same town, which

helped them with the culture and established trust. Finding a company that also worked with business similar to there's was also a priority and they were happy that they did.

Integrating their systems was another huge challenge. In installing the system, the company replaced its legacy system, which amounted to "a scattering of in-house systems and other vendor software," including filePro and Microsoft FoxPro products, the CFO said. After many years of use, the existing systems were "highly fine-tuned" and "rigid." They even had to integrate systems that they thought that SAP could provide, but found out later that it could not. The SAP system was able to integrate together the company's financial reporting, planning, procurement, production, inventory-control, and bill-paying functions. Unfortunately, it was not able to do the same for the order-management and order-checking function, including the auditing of invoices. The company had to use other software, supplied by Epic Data International. SAP couldn't handle the intelligence needed for that type of distribution function. They needed to integrate the other software with SAP, which they were able to do, but at a cost.

Ultimately they were very pleased with the system and the choices that were made. Pain is a part of the ERP process and regardless of what promises a vendor will make, one must be prepared to deal with the pain and see the end-game.

Roles and Responsibilities.

The purpose of defining roles and responsibilities is to provide the project team members with a clear definition of expectations for their participation and the participation of their teammates. Well defined and communicated roles and responsibilities provide a clear and comprehensive roadmap where specific roles are assigned accountability for leading, participating and/or reviewing the work products produced as part of the development lifecycle. It can also substantially improve team productivity. The roles required to successfully deliver the ERP solution are divided into functional categories below.

The following tables define the specific roles and responsibilities for the business initiative.

Business & External Management

Role	Responsibilities	Team
Business End Users	<ul style="list-style-type: none"> • Provides information on existing business practices and assist in the development and confirmation of future process • Represents their area of expertise on project • Assists in all phases of the testing cycles including development of test cases • Supports all decision support activities 	
Executive Sponsor	<ul style="list-style-type: none"> • Contract-level signature and funding authority based on company policies • Approves strategic business and/or technology recommendations • Supports initiative requirements with executive leadership • Champions the initiative • Communicates decisions in the context of the new world • Acts as project main change advocates • Provides overall direction for the project • Endorses and supports new business practices to ensure benefits are realized • Ensures that all risk is mitigated and cost or impact issues are resolved 	
Initiative Owner	<ul style="list-style-type: none"> • Defines the overall organizational structure for the initiative • Authorizes the initiation of any projects for the initiative and monitors progress • Defines client communication model • Reviews appropriate project deliverables to ensure consistency and quality • Ensures appropriate financial standards are defined. • Ensures appropriate initiative standards are defined. • Communicates status to executive-level stakeholders • Assesses and manages risk factors throughout the initiative • Monitors and approves high-impact scope/changes for the initiative • Works with the leadership teams to allocate appropriate resources 	

IT Leadership

Role	Responsibilities	Team
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Role	Responsibilities	Team
IT Manager	<ul style="list-style-type: none"> • Solicits input from IT to understand needs and priorities • Represents IT as project decisions are made • Is responsible for managing the installation & configuration of new technology • Communicates project vision and outcome to IT associated project team • Oversees all data conversions, interfaces and modifications and ensures accuracy and completeness • Understands the "Big Picture" in order to push the resolution of all technical issues. • Assists the team to identify and resolves any gaps to business processes. Assists the business to reengineer the business processes supported by the system to maintain as vanilla an implementation as possible. • Comprehends, with guidance from business and technical consultant's as well internal business personnel, the changes that will be required to the existing business and technical processes with the introduction of the new system applications. • Leads the knowledge transfer process to ensure that the technical team is fully capable of independently supporting the system prior to moving to the Production environment. • Takes ownership of the technical processes, environments and system. • Manages and coordinates technical analysts and developers • Manages additional leads as necessary for modifications, interface, conversions and reports depending on the complexity of project • Ensures timely resolution of open issues 	
Project Manager	<ul style="list-style-type: none"> • Responsible for managing the overall scope, issues, change management and status reporting, version control and signoff • Provides a weekly update of the status of technical components of the project to the initiative owner, including but not limited to milestone/task progression, issues, major risks, any potential delay factors and staff performance • Coordinates weekly status meetings with appropriate IT leads • Coordinates monthly meetings with the steering committee to report status, actuals vs. budget, issues list, risks and mitigation actions. • Controls on a weekly basis, the actuals of the project vs. the original budget. • Monitors all project activities to ensure they occur as planned. • Set-up and maintain detailed project plan and high level planning documents. • Ensures that all project standards are followed • Works directly with the client counterpart and other partners • Coordinates client participation and sign-off of all project deliverables • Assesses and provides alternatives to mitigate risks to the project schedule • Monitors and controls scope/changes throughout the projects • Develops a full understanding of the project's requirements 	

Development, Technology, & Operations

Role	Responsibilities	Team
Analyst	<ul style="list-style-type: none"> • Understands both the new system and the legacy systems and their data models in place today and understands the objectives behind the new system implementation • Determines the overall integration requirements between systems and into / out of the new system • Participates in the general integration activities for interfaces and conversions, reports, modifications and form development, testing and implementation. • Accepts the knowledge being transferred from the new system technical team • Documents detailed design documents. • Takes ownership of the new system's technical processes with regards to interfaces, conversions, reports or form development, testing and implementation. • Provide on-site/remote support during project 	
Change Management Lead	<ul style="list-style-type: none"> • Ensure change requests are processed. • Ensure notification via change management meetings & meeting notes. Supports change management process as required • Act as change agent(s) • Is receptive to knowledge transfer from consultant change management specialist(s) • Develops and executes communication and change management plan • Raises any issues (actual or potential) to the project manager that may put the project at risk, or that may adversely affect the success of the pilot and go-live • Ensures timely resolution of open issues • Provides weekly updates to the project manager as to the status of deliverables being performed 	
Data Security Technician	<ul style="list-style-type: none"> • Grants appropriate access for system users • Confirms data security policies are met • Ensures system meets Operational Readiness requirements for Data Security • Performs scheduled audits/reviews of systems 	

Role	Responsibilities	Team
Database Administrator (DBA)	<ul style="list-style-type: none"> • Provides coordination in developing database components to ensure that they comply with standards • Minimize data redundancy and maximize data sharing and compatibility • Approve all changes to data definitions • Monitors database performance statistics and recommends improvements • Setups and maintains required database environments • Set-ups and maintains database security • Assists with installation of new software • Observes and understands the construction of the new system Oracle databases for development, production and support purposes • Works with the business and technical leads and the Network and UNIX administrators and the technical architect to ensure the metrics provided for sizing purposes are accurate • Creates and supports development, conversion, testing and production environments as well as supports pilot, go-live and post go-live activities • Raises any issues (actual or potential) to the infrastructure lead that may put the project at risk, or that may adversely affect the success of the pilot and go-live • Ensures timely resolution of open issues • Be able to apply new system patches as needed to support development, go live and post go live • Monitors and advises of new system database performance • Performs all project administrative activities in a timely manner 	
Database Architect	<ul style="list-style-type: none"> • Defines database standards for the project • Reviews application designs to ensure efficient use of database resources • Defines tables, indexes, views, constraints, triggers, stored procedures, and other constructs necessary to facilitate storage of persistent data 	
Development Systems Lead	<ul style="list-style-type: none"> • Works with the application development team to define requirements for the development environment • Monitors and approves high-impact scope/changes for the initiative • Responsible for ensuring the development environment is appropriately maintained and that all required tools/software are acquired, installed, configured and supported • Troubleshoots problems with the environment and coordinates assistance required to resolve any issues quickly • Ensures that the source code configuration management standards are followed for the development environment 	
Network Engineer	<ul style="list-style-type: none"> • Translates technology and business requirements into specific connectivity solutions • Network engineering solutions include LAN/WAN/Internet Service designs, security models, network monitoring/management, capacity/scalability plans, firewalls and routers • Ensure Network Operational readiness questions are answered 	

Role	Responsibilities	Team
Operations Analyst	<ul style="list-style-type: none"> • Supports Operational websites for Operations, Production Control and Change Management • Gathers documentation needed by Operators to support the Data Center • Represents Operations in project meetings and is Operations liaison with the rest of IT • Assist in designing and monitoring metrics to measure improvements achieved. • Manage and prioritize tasks and projects to meet all deadlines. Work with the Operations Manager and Operations Director to mitigate issues/obstacles and ensure tasks/projects stay prioritized as appropriate. 	
Operations Hardware Technician	<ul style="list-style-type: none"> • Coordinates shipping and delivery of hardware • Coordinates AADC Physical Plant physical planning • Ensures AADC Physical Plant Operational Readiness requirements are met and the product is ready for production 	
Operations Team Lead	<ul style="list-style-type: none"> • Determines operational requirements of the project including effort. • Assists with development of overall operations plan for the project. • Ensures completion and approval of the Operations support manual. • Installs and tests batch schedule • Be able to support batch scheduling post go live. 	
Production Control Technician	<ul style="list-style-type: none"> • Complete requests for job changes and new jobs. • Ensure Operational Readiness requirements are met for Production Control. • Schedules production jobs via AutoSys. • Setups initial batch schedule and adjust as required for optimal performance • Supports batch scheduling post go live • Monitors system performance 	
Programmer - Modifications	<ul style="list-style-type: none"> • Develops and unit tests modifications based on technical specifications provided • Provides appropriate technical documentation of modifications. • Advises the technical team lead of statuses and issues as required. • Ensures timely resolution of open issues • Provide on-site/remote support during project as required 	

Role	Responsibilities	Team
Technical Architects	<ul style="list-style-type: none"> • Observes and understands the construction of the new system's databases for development, production and support purposes • Comprehends new system's batch processing to optimize performance for large store counts, partitioning in order to cater for growth and performance, and the use of fine grained security • Understands ongoing requirements to prepare for operational support, technical Unix environment configuration, optimization and ongoing maintenance. • Be familiar with supporting large Oracle databases with high data volume • Ensures with the new system technical architect that an adequate technical infrastructure is designed, tested and implemented to support the new applications • Ensures an adequate technical infrastructure is designed, tested and implemented to support the new applications • Works with the business and technical leads to ensure the metrics provided for sizing purposes are accurate • Performs and supports development, conversion, testing and production environments as well as pilot, go-live and post go-live activities • Be able to apply new system patches as needed to support post go live. 	
Test Lead	<ul style="list-style-type: none"> • Develops or leads the team in the development of the Test plan • Guides the testing process through the various stages of testing ensuring the proper standards and tools are in place to ensure best practices are done • Defines, implements and monitors appropriate quality assurance • Act as liaison between business and IT during testing phase 	
Tester	<ul style="list-style-type: none"> • Develops and executes the test plan and test cases for assigned components • Submits defect reports daily to Test Lead • Submit daily testing metrics to Test Lead 	

Governance

Role	Responsibilities	Team
Quality Analyst	<ul style="list-style-type: none"> • Document methods and standards • Perform formal and informal quality reviews • Mentor Test Leads on the use of testing procedures, testing tools and the creation of test deliverables • Review test deliverables for compliance to standards • Perform defect analysis and trending • Reviews functional and technical documentation for accuracy, completeness, and adherence to documented standards from an independent point of view. • May participates in review sessions 	
Steering Committee	<ul style="list-style-type: none"> • Oversees the project with regard to scope, benefits and risks • Meets weekly, bi weekly or monthly to review issues brought forward by PMO • Makes decisions on escalated issues, risk mitigation and change requests • Identifies, authorizes and provides resource availability (financial, human, technical, etc) to carry out the project • Ensures any issue relating to company strategy is resolved • Monitors the project benefits – ROI • Communicates project progress and directions to stakeholders – manage expectations • Incorporate “new world” within business strategy • Change advocates 	

References

Betz, F. (2003). *Managing Technological Innovation*, (2nd edition.). New York: J Wiley & Sons

This author summarize what ERP brings to the table and how best to implement the system. By identifying the successful ingredients, it more clearly defines the best way to deploy ERP applications.

Bilbrey, D. (1999). *PeopleSoft Administrators Guide*. California: Sybex Inc.

This author discusses important variables which are necessary as part of an ERP implementation. Though tailored to PeopleSoft, he brings important concepts to the table and how best to implement the system.

Davenport, T.H. (1997). *Putting the Enterprise into the Enterprise System*. Harvard Business School Press.

This author discusses at length important concepts as they relate to ERP planning and implementation. He brings forth a case study which is discussed in this paper, to show how successful ERP implementations should be deployed.

Koch, C 2006. The ABCs of ERP. Retrieved July 9th, 2006 from <http://www.cio.com/research/erp/edit/erpbasics.html>

This author brings forth examples of the benefits of ERP applications. He defines what they do for an organization and summarizes important concepts as they related to process and implementation methodologies.