IMPLEMENTATION ISSUES IN ERP

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ABSTRACT: *Enterprise Resource Planning (ERP) has carved a place in Information Technology frontier and grabbed the attention of business community worldwide. The process of implementing ERP solutions is ridden with risk and affects processes and the people. In this paper, the experience encountered by some companies and their approach to this difficult implementation process is discussed in some detail. The unique features of ERP project management were identified and compared with traditional IT project. The four primary issues, namely:- hardware, people and process, change management and managing the transition are considered in detail to provide pointers to evolve a new implementation template long overdue.*

Keywords: Enterprise Resource Planning ,Product Data Manager, Reengineering, Change Management.

INTRODUCTION

Enterprise Resource Planning (ERP) has taken the business community's opportunities to new heights. The holistic integrated transaction and business analysis afforded by the ERP paradigm has provided the synergy needed to keep the business process as dynamic as possible and cut down the reaction time to customer needs. There is no longer the need to subject a customer's query or order to be input into different databases which support different processes at considerable effort of non-value added work to seek answers and often the delays caused can turn way or frustrate the customers. In this space age everything is sought with extreme sense of urgency and there is no room for duplication of data inputs and serial processing.

ERP solutions however cannot replace some of the legacy system totally, as they are deemed unique to a core process. Thus there is need for coexistence of ERP solutions and well founded legacy applications. This predicament poses new challenges to ERP implementors. Added to this is the human resistance to change. Without change and reengineering various processes it is difficult to achieve implementation of ERP based software solutions. In this paper an appraisal of various implementation issues encountered and the manner by which those issues are resolved after researching into various implementations are presented. Notable organisations like Boeing Commercial Airplanes Group (BCAG), Seattle where this writer had worked for a period of 8 months, Ansett Australia, Amoco oil company and a number of organisations' experience are studied in this work.

CHARACTERISTICS OF ERP SYSTEM SOFTWARE

Typically, ERP system software are very expensive, take a long time to implement, has risk associated with implementation and affects the job profile of many employees. Thus it has three major dimensions namely cost, time and people involvement. In addition there is a need to reengineer business processes to match the dictates of the software. The home grown software implementation normally entails in tailoring the software to business needs whereas in the case of ERP systems software, the business processes need to change to conform to the " best practices modelled in the software" (Hughes,1999). Many implementing companies take this opportunity of reengineering their processes even beyond the ERP requirements. BCAG began Lean Manufacturing initiative almost about the same time they were introducing ERP based solutions in their company. BCAG did a benchmarking study of companies implementing lean manufacturing and found that typically, quality improves 50% a year, productivity increases two percent a month and lead time decreases by 90 percent, with successful implementation of lean manufacturing initiatives (URL www.boeing.com/initiatives/leanoverview). Such a perceived gain cannot be overlooked when a window of opportunity to reengineer the processes presents with ERP implementation. However, pursuing these two major initiatives at the same time adds to the project complexity.

Hardware, Networking and data migration are other major issues to pay attention. ERP systems are based on client server technology and being based on Object Oriented architecture are independent of operating platform. However a large number of servers may be involved and there are network issues to contend with. In the case of BCAG about 300 application servers are used and the challenges of networking these servers required a contract on its own with Hewlett-Packard company. Existing data need to be imported into the new system and it has to be planned well. Data in the existing format in the legacy systems may have to be reformatted to suit the new system. If these issues are anticipated during the implementation phase a considerable cost can be saved in data cleaning process by enforcing the new requirements even in the existing system where possible. This is best achieved by having in implementation team a core of end users who bring these subtle knowledge to bear. The outcome is a new instruction on how to input the problem data in the old system to mitigate the problem likely to be encountered in impending data migration to new system. In one of the instances of preparing a Manufacturing Requirement List document, the legacy system has no specific format of inputting drawing data in the drawing field. However in the case of ERP system, a defined format is required as it provides linkage to another module. Enforcing this rule now will save a considerable cost in the future. Strategies for downloading existing data when planned meticulously can help in a big measure in cutting down time and cost.

AMR Research Inc, a market research analyst, is predicting a Compound Annual Growth Rate of 36% in a 5 year span (1997-2002) from $15 Billion to $72 Billion in ERP Applications Revenue in all the industries (Hughes,1999). It is a cost to the organisations collectively and is the cost of software only. There is the attendant cost of implementation and hardware that may represent several billions. Therefore the significance of effective implementation cannot be overstated. In the remaining deliberations of this paper, an insight into the strategies adopted in various implementations of ERP system will be sought and hopefully provide some pointers to evolve an implementation model using some of the lessons learned

IMPLEMENTATION ISSUES

Based on the implementation experiences of a few companies like Cable Systems International (Appleton et al.1997), Amoco Corp (Jesitus,1997) McKesscn Corp(Wilder,1998), BCAG, Ansett Australia the issues that confront ERP implementation are People, Business Process Reengineering, Data migration, Hardware and Network topology and configuration issues , Enormity of the effect (ie interruptions to production processes) of go-live on production , integration of existing legacy systems to ERP and above all the massive cost associated with a ERP Project which may result in cost overruns. The overwhelming effect of some or all of these issues have resulted in abandoning the ERP software midstream by a number of companies (WM, 1999]. Therefore there is enormous risk associated with such bold initiative. As in all projects, risk management of ERP project will need extreme attention in project management strategy. A quick appraisal of Project Management strategies required for ERP implementation compared to traditional IT project is not out of place.

TRADITIONAL IT PROJECTS VERSUS ERP SOFTWARE PROJECTS

First and foremost difference is ERP projects are susceptible to and affected by the dynamics of an organisation. In Traditional Information technology projects, the emphasis is on Requirements Analysis and Specifications and once it is firmed and agreed to by the sponsor and the developers everything else in the project is evolved around it. User interface design, Preliminary and detailed design, coding, testing, integration and delivery and final installation all proceed to satisfy the Requirements Specification. There is incentive for avoiding changes at late stages (Cliffe, 1997). ERP implementation projects require greatest attention to its dynamic and evolutionary nature (Cliffe, 1997). Here we are bringing a well grown proven solution for adaptation to our organisational need. It will need a very flexible approach on our part as it has to be treated as a new venture (Cliffe,1997). It is not uncommon to see ourselves amending our charter of requirement. Risk in traditional IT project is, in relative terms, low. However ERP projects are highly vulnerable to risk and require a well thought out risk mitigation strategy. While it is possible to commit the funds in full in traditional projects, we require staged approach in ERP implementation. The key is Risk Sharing (Cliffe,1997) among stakeholders. Phased funding allows buy time. IT projects require mostly technical specialists in the project team whereas in ERP implementation we need a group of functional specialists who understand the business dynamics.

PEOPLE AND PROCESS

The sales pitch of ERP Vendors normally boast of large savings to be obtained in staff and wage cost. The rationale of single source of product data driving all elements of an enterprise means in lay man's terms avoidance of duplication and increase in accuracy. While this feature of accuracy is welcome, the people involved in the old legacy system inputting/processing product data could easily feel threatened and anticipate job loss. This is likely to have a profound impact on their morale. Unless implementing organisations can assure that job losses will be a minimum, there is going to be considerable resistance to ERP implementation. In large organisations like BCAG people factor are taken very seriously and no effort is spared to win the confidence of people. The positives are constantly projected in house bulletins like "The Boeing News", specially prepared video films and through ERP monthly update where the employees are invited to a Ice Cream party (arranged around lunch interval) and the Project leaders and Site Key Users share the progress made by the project and take questions from staff. They make sure that every employee is kept informed of how the project is progressing. In the process of reengineering, managers empower workers to make changes necessary but provide them with the boundaries and the end outcome. This approach makes people become a part of the new process. The ERP program summary was thoughtfully broken into four implementation phases namely, Preparation, Demonstration, Verification and Acceptance. In the preparation phase the Site Key Users are identified whose defined role is to become very familiar with "as is" business process , current state of the operation, and "to-be" concepts, policies and philosophy. Using a generic system implementation methodology (SIM) the factory is divided into several implementation areas and the four phase approach was used uniformly. SIM 1 is the Demonstration Phase. In this phase the Subject Matter Experts (SMEs) review the as-is products covering software, hardware, pre-converted data, documentation and job description and select the "to-be" products. The SMEs demonstrate the to-be processes to Site Key Users (SKUs) in a laboratory environment. SMEs come from two streams. The process SMEs have expertise in cross functional processes and they are normally designated as SIM2 leaders. The Data SME is an expert in data structures and has been trained well in data conversion process. SIM 3is the Verification Process. The Site Key Users verify that new business process and systems meet the business needs of their site. By walking through and verifying products the SKU's slowly begin to gain expertise in the new ERP software and visualise the transition plans required for implementation. SIM 4 is the acceptance phase which includes full data loading of conversion data, complete training and activating the production version of the system. End user focals (EUF) learn the new process first hand from SKU's and at this stage they are only learners. They get involved with the acceptance process at the implementation site and get to know the subtleties of man machine interface, processes, data, documentation and job roles. This approach was compared with a few other organisations researched in this work.

Cable Systems International, perceived that the greatest challenge to their task in ERP software introduction was how to bring unison and homogeneity amongst personnel of "unlike" departments and make them think in common terms (Appleton et al, 1997). They decided that the only way it can be achieved is to form cross-lateral teams drawn from all affected departments. They saw value in this approach because when collective wisdom is applied to reengineer the process the problem areas are considered in detail for its cause-effect and remedied to meet the common goal. Communication and the appreciation of the difficulties was the key. This approach is somewhat different to BCAG. The reason why this was not a problem in BCAG was the ERP system was planned for introduction mainly surrounding manufacturing process. The Define, Configure and Control (DCAC) and Manufacturing Resource Management(MRM), the twin ERP implementation software were mostly affecting the Manufacturing division. This division in itself is so huge covering some 30,000 users and 250,000 part numbers (Hughes,1999) and in no way a cross departmental approach can be undertaken. Instead they followed a phased approach (URL www.boeing.com/commercial/initiatives/DCAC_summary) within the manufacturing Division. Each phase targeted a particular manufacturing activity and packaged a reengineered process. To site as an example, Release A1, Phase 1 targeted the parts fabrication plants (some 19 plants and about 412,000 parts and the process of preparing the Shallow Bill of Material (BOM) meaning not a full BOM, typically contributing to simple assembly details, was transferred to the Design Engineers who design these parts (URLwww.boeing.com/commercial/initiatives/DCAC_summary). Previously it was the responsibility of fabrication plant manufacturing engineers. And the assembly and installation manufacturing engineers assigned these parts to logistical companies. This function was also performed previously by parts fabrication plant manufacturing engineers. Through these reengineering, considerable workload was reduced for part manufacturing engineers who were previously merely acting as a no value adding interface agency. Phase 2, concentrated on different group of

employees and their processes. For example, the customer engineers, using a configurator translated a prospective customer's unique need by making use of reusable design data held in aircraft configuration library. The concept was to provide the customer the effect of his/her option, in real time, on the final product. This is a front-end activity but considerably dependent on back end data. This idea was borrowed from automobile industry where cars are manufactured per customer driven option but with a few alterations to a stable design.

PRODUCT DATA MANAGER (PDM)

In phase 3, The configuration control mechanism for the single source of product data was concentrated upon. This was achieved using a product data management (PDM) tool provided by Metaphase. A brief narration of PDM fits the context. The philosophy of PDM is pivoted round the concept of holding the master data relating to a component in what is termed as a 'vault' so that its integrity is assured by means of a very rigorous configuration control (URL www.pdmic.com/understnd.html). Copies of these data can be used by processes such as design but when the change is frozen, the revised version is returned to the vault with date stamp and all the valid audit trails. The revised version then stays in the vault along with the old version. That way the change that was made to the old data-set can always be traced with complete audit trail. It is a very important feature in aircraft industry for safety reasons. Typical PDM objects may include parts, picture sheets (BCAG calls Engineering Drawings as picture sheet), process specification plus the manufacturing resource objects. The other important element in PDM is "relationship" which links objects. A relationship is a unique connection between objects to accomplish a specific purpose. A relationship such as "uses" indicate that one object uses another as in the case of an "assembly" uses a "part". Another type of relationship is "described by". The Objects themselves will have what is called object attributes. These are global in the sense they never change. Examples are Part number, Description of the part, and Revision number. Many modules may make use of one part and this is characterised by "uses" relationship. In PDM all revisions are controlled by object data, so it can be said that PDM uses object-based version control. Therefore we can say that PDM enables part based revision control. Prior to introduction of PDM technology, BCAG used a system of "effectivity" which is nothing but a block of number or more correctly a customer identification number for a specific customer and all the drawings used for that customer's airplane carried that effectivity number as a configuration reference. This form of configuration control is local whereas PDM is more global and each airplane will be assigned a serial number and this number will be used to identify all the airplane's parts by part number. Part must be re-defined when its Form, Fit, Function or interchangeability are changed. PDM is a concurrent engineering process in that several people like designers, planning engineers and tool makers could be working on copies of the design but through check-in check out concept the integrity of the master design is preserved in the vault and the authority to change its state is vested with the designer. This free flow is facilitated by means of "state" of the design or any process for that matter. State describes the current level of completion of the process and this may be "Not approved", "components available to order", Pre approved", approved etc. and a change identifier (CI) is associated with each state. Through CI, changes to data are managed in PDM. This technology enabled BCAG to organise aircraft design and build data at single source and provides the capability to track all the changes that were made with information on who ,when and where. Prior to this, these data were spread in several legacy systems. The greatest advantage of this technology lies in the ability to obtain a complete and up to date report like parts list (Industry term Bill of Materials) for the complete airplane or a small assembly of the airplane like the wheel assembly. This report may provide reference to other documents that support and build process such as geometry of the part and requirement specification. Using different views of the product data, design engineers, manufacturing engineers and tool engineers author data in PDM appropriate to their job role.

CHANGE MANAGEMENT

The issues involved in BCAG are predominantly reengineering in nature in that there is radical shift in the way they make the aircraft ("as-is") to the way they need to make it in the future ("to-be"). These issues cover people and process. The success of this implementation largely depends on managing the change. Some similarities can be found in the implementation of ERP at AMOCO Corp, $33 Billion company headquartered at Chicago . In introducing ERP systems, AMOCO recognised very early stage of the project that the biggest challenge will come from change management (Jesitus, 1997). Using consultants from Anderson Consulting and Price Waterhouse and enlisting the co-operation of line -level personnel they chartered a meticulous plan for change management

(Jesitus,1997). The key was to view the business from a process perspective, much the way BCAG did, and respect the people issue as equally significant. In the words of Steve Grossman, SAP implementation manager at AMOCO Corp and as reported in (Jesitus,1997) quote " The life cycle we have experienced is: You go through about three month period where people are stunned. It is almost like shock; they can't even complain. Then they come out of shock and they are angry" unquote. This statement captures the initial reaction of people. But the amazing human ability to adjust to the reality and to gear themselves to survive the change is what AMOCO wanted to work on. They provided the employees with every opportunity to contribute to the reengineering process by enlisting the support of its own line-level personnel. The consultants were mixed with representatives from affected areas. Their philosophy is "It could not have been designed by people who did not perform the work" (Jesitus,1997). Interestingly, Department of Defence, in implementing a HR module based on ERP philosophy adopted focus groups as a means of obtaining data from stakeholders (DEFGRAM 253/97,1997). The task of the focus group is not only to provide information but validate the specifications arrived at by project working group. In the case of Ansett Australia who implemented a ERP solution to their Engineering Business Unit (EBU) they managed the people issue through a project named ASPIRE 2. Here too the emphasis was on the people bringing ideas to adopt the new systems. To achieve this ASPIRE2 project members tried hard to change the mindset of legacy system approach to an integrated approach. Underestimation of the significance of change management and training is quoted as a most common cause of ERP project failure (Bryan, 1998).

COMPUTER BASED TRAINING

Computer Based Training (CBT) was another strategy that was resorted to impart online learning on the new system. These CBT materials were edited by in house managers. Several iterations of training were required to reinforce the subtleties of the ERP. In BCAG a web based interactive training module was put on the Intranet and different employee groups were given different packages of modules applicable to their job. Minimum score is 80%. If the trainee failed to obtain the required score he or she has to repeat that module again. The successful completion of each module is registered against the employees' name and on successful completion of all the modules a result statement is provided which the employees hang on their work partition with pride. In addition, class room training lasting for 3 days at a stretch on specific topics like Shallow BOM are held. The successful completion of these training is acknowledged through certificate of completion.

RESISTANCE TO CHANGE!

In Amoco's experience the greatest resistance to ERP process came from middle managers! (Jesitus,1997). It appears that the problem was largely due to the top level management's neglect of this band of managers. While the doers get the attention and the top management have a commitment of implementing the system to meet, the middle managers are busy fighting the consequences of lost hours due to training and they can perceive the new initiatives as a distraction. Moreover, most of the middle management staff are experts in the legacy system and they see the new ERP system as a threat to their own authoritative role. It is not uncommon to hear the whispers and moaning about how the corporate dollar is being squandered in a project that is likely not to succeed!. Amoco solved this problem by vigorously interfacing the middle managers with providing an index card note book which outlined the job impact analysis pertinent to the processes undertaken in their area and made them review it with their team to get involved (Jesitus,1997). While it is reported to have worked, the non involvement of middle managers is a serious impediment. In another work (Scheraga, 1999) it was reported that profound business changes that ERP implementation brings often provokes internal resistance from management reluctant to give up its old ways, particularly the middle management group who have developed a "certain methodologies" for doing specific tasks and ERP software may have a different approach.

HARDWARE

ERP systems use more than one platform and would endeavour to leverage their strengths. They will need Graphic User Interface (GUI) front end and are architectured around client server technology. They will require the ability to access and share data across applications in all platforms. This ability will require interoperability features which will free implementers and users from managing the complexity of connections, handling communications, reporting

error, translating data and disconnecting from remote databases (URLwww.businessservers.hp.com/solutions/3_10/3_10). In general, Open Database Connectivity (ODBC) is one of the means by which interoperability is achieved. If ODBC is not sufficient to achieve the full extent of interoperability a middleware may be required which helps in assembling data from dissimilar data together in as seamless manner and provides the glue for the assemblage(URLwww.businessservers.hp.com/solutions/3_10/3_10).

But most organisations have a host of machines that run on other operating systems that have hitherto supported the legacy systems. They may have a LAN which is their backbone for shared network operating on an operating system quite different to the one needed for ERP solutions. Most importantly some of these legacy systems will still be used even after the introduction of ERP systems into the company. The client server technology needed for ERP will require SQL servers in addition to some special purpose enterprise servers. These equipment have to be custom built as in the case of Telstra (TELSTRA,1999) and there may be a long lead time associated with their procurement. The communication protocols like TCP/IP and HTML are commonly used in ERP system networking and topology. So it is not a case of picking off the shelf a few boxes of hardware (TELSTRA,1999). Leading organisations have placed their reliance on consultants in advising them the hardware arrangement, although they have enormous IT staff as resource. The primary reason for this arrangement is due to the respect they attach to the hardware issues which are unique to ERP systems. In BCAG, Infrastructure and networking was entrusted to Hewlett-Packard Company as they had extensive experience in the ERP implementation. The fact sheet relating to DCAC/MRM implementation on hardware is testimony to the complexity of the IT topology required for ER. About six vendors namely, HP(who provided 300 application servers) , Linkage Solutions from CIMLINC, Metaphase from Structural Dynamics research Corporation , SalesBuilder from Triology and Orbix from INOA Technologies (for integration) and Oracle were involved in overall implementation.

Telecom chose SAP as a solution provider for their ERP to replace some 22 existing legacy systems (SAP/R3,1996). SAP is running on three application servers and one database server located in Auckland. All four servers are IBM RS/6000 R30 SMPs, held together with an FDDI local area network (SAP/R3,1996). System has ability to support 700 users concurrently with about 1000 users provided access to the system. Telecom had to upgrade the workstations to a prescribed minimum standard required for running SAP. Both IBM and Apple computers are used.

In another report on implementation (Eskow,1997) a company whose name is not provided, faced with a problem of multitude of systems to be resolved in the implementation process with a tight budget of $200,000 for the year of implementation. Their accounting and finance system operating on IBM370 architecture mainframes, an MRP system on a high end VAX and some logistics system on AS400. The workstation range from networked windows operating systems to dumb terminals. The local area network which links the plant wide computers run on Novell 3.11 and the new SAP components will be on NT servers. After wrestling with this problem for a while, the company identified there are basically three issues. These are: the choice of operating system for workstation , given that majority of employees are used to mainframe architecture and the constraint imposed by applications. Then the issue of reengineering the processes to match new capabilities and finally the issue of managing the transition. This company has legacy systems coded mostly in COBOL. Some judicious choice has to be made about the right type COBOL porting tools that integrate well with PC-based development tools like Visual Basic(VB). These are technical issues requiring technical input.

In summary, it can be said that leaders in general have employed a specialist consultancy group to provide advise on hardware issues in the implementation of ERP solutions. The unique hardware needs of ERP and the continued use of some of the legacy applications hosted on different platforms require a careful consideration.

MANAGEMENT OF THE TRANSITION

The biggest challenge in ERP implementation, next to change management is management of the transition from old system to new ERP system. Since ERP system is an integrated system a cut over has to occur at a time which results in minimum disruption to the normal business. Unlike traditional IT software project where we continue to use the old software along with new one as a fall back process, in ERP system it is not feasible as it is transaction based in

character and affects all the integrated system in real time. The process of testing and acceptance, Production support readiness, migration of data , and setting up of security of users has to be appropriately planned to achieve one stop switch over to new ERP system. In this section each of the above issues are considered in detail through consideration of some of the implementation.

Testing and acceptance of the ERP solutions will require a design of testing methodology. The emphasis here is to ensure whether the new system behaves the way it was anticipated in the conceptual design. Normally during the pre implementation phase, all the application coding and the interfaces would have been tried out in development databases which are saved in a separate server called development servers. So in reality the final testing is a process where we migrate from development server to production system. Aerojet(Works,1998) in their test and acceptance program included the elements like testing conversion procedures and programs, testing interface programs, conducting volume and stress testing and conducting final user acceptance testing. In Department of Defence where we are in the process of implementing a HR module(named PMKEYS, based on PeopleSoft ERP solution) a user acceptance activity is included in every phase without which roll out to production system cannot happen. The migration of data has been considered as a high risk area (DEFGRAM, 1998) in PMKEYS implementation. In migrating data from existing systems it is necessary to resort to some form of automatic transfer process from old tables or systems through a process of extracting data, cleaning data where necessary and loading data in the ERP modules. Some additional data may be needed as a result of the new data flow design adopted in ERP modules to achieve integration. Once the data transfer occurred into production system it would need acceptance by the production areas. The post implementation strategy may include the project focals returning to work areas and providing help desk kind of service to end users.

CONCLUSION

The process of implementation of ERP solutions requires a different tack as compared to traditional IT software projects. This is largely due to the character of ERP solutions which require business process reengineering as a precursor to its introduction because ERP systems are centered round world best practice business rules. The reengineering process affects the people and process in a profound way and to enlist the co-operation of employees at all levels of the organisation a strategic approach to change management is necessary. Leaders in the ERP implementation race like BCAG, Department of Defence, AMOCO have involved the people from functional areas in contributing to the success of their projects. While ERP vendors have provided assistance with the technical aspects of implementing the software (through Procedure Model and Accelerated SAP in the case of SAP) there is no framework available to handle the change management and human side of the implementation process. As significant cost is associated with the implementation process, a proven framework to address the key issues concerning people and process is overdue. This gap need addressing at the very early stage as otherwise the cost of implementation may become a major deterrent in seeking ERP based solutions particularly in companies with small budget. Not withstanding this gap, leading companies like BCAG, AMOCO, Ansett Australia, Telcom Australia have invested considerable time and money in change management process. The results are rewarding as ERP systems bring big savings to these companies and render them more competitive.

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