Identification of Critical Issues and Solutions during ERP Software Development Life Cycle

Sushil Kumar Choudhary, Member, IAENG, R.S Jadoun, Niraj Gupta

Abstract-**Information technology is revolutionizing the way the business intelligence is being done. For any organization to succeed, all business unit or departments should work in harmony towards a common goal. ERP is a very powerful tool, which provides perfect information system to maintain the various functional business modules of an enterprise. Most organization is turning to available ERP software package for solution to their information management problem. ERP package if chosen correctly, implemented sensibly and used capably will enhance the output and profit of the any association considerably. ERP software package is at the cutting frame of information system technology. ERP software package help to manage institute and firm extensive business processes, using a common database and shared management reporting tool. ERP software supports the well-organized operation of business actions, including sales, marketing, manufacturing, accounting and staffing. The aim of this study is to provide a contribution to the research field of the ERP software development life cycle (SDLC), critical success factors, issues for ERP package development and implementation with various kinds of organization and discuss about the Essential factor for ERP Selection and ERP Benefits etc.**

Keywords: **Enterprise resource planning (ERP), ERP Implementation, Supply chain management (SCM), ERP critical success factor, software development life cycle**

I. INTRODUCTION

ERP software package is intended to give enterprise broad solution for all business actions with single application and single data storehouse, but today ERP is headed towards another way. The change, which Enterprise resource planning software seems to implement in near future, is the Cloud Enterprise resource planning. ERP solutions like Human resource management (HRM), Customer relationship management (CRM), supply chain management (SCM), financial management (FM) etc with complete and very easy integration facilities and the future form of ERP is cloud. ERP solutions inclined and equipped with more and more ecommerce facilities and tools.

Er. Sushil Kumar Choudhary is a PhD. Scholar in the Department of Industrial & Production Engineering, College of Technology, G.B Pant University of Agriculture & Technology, Pantnagar-263145 Uttarakhand, India (+91-8081879262, Email-sushil_think@rediffmail.com, ct44065d@gbpuat.ac.in)

Dr. R.S Jadoun is working as a Head and Professor in the Department of Industrial and Production Engineering G.B Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India (+91-9456470344, Email: rsjadoun@gmail.com, rsjfpe@gbpuat-tech.ac.in)

Dr. Niraj Gupta working as a Head and Professor in the Department of Mechanical Engineering at SRMU, Lucknow, India (+91-9451021185 Email:drniraj.me@srmu.ac.in)

The availability of this ERP has opened up gates for the large corporation to the worldwide markets and in order to attract more and more user's future. ERP cloud computing, on demand and Software as a service (SaaS) were all introduced in order to capture mid size and small division firms by providing inexpensive and easy to use solutions.

Figure:1 Enterprise resource planning (ERP)

A-Manufacturing resource planning (MRP-II)

Manufacturing resource planning (MRP II) is defined as a method for the efficient planning of all resources of a manufacturing company. Manufacturing resource planning of any Manufacturing organization depends on the various aspects such as: Master production schedule (MPS), Bill of materials (BOM), Capacity requirement planning (CRP), Shop floor control (SFC), Purchasing management (PM), finance , inventory control , forecasting etc.

Figure:2 Material requirement planning (MRP)

B-Human resource management (HRM)

Human resource management is a purpose in organizations designed to maximize member of staff performance of an employer's planned objectives. Human resource is first concerned with the management of people within organizations, focusing on policy and systems. Human resource management mainly responsible for recruitment selection and introductions, human resource planning, labor relationship, Succession and carrier planning, talent management, performance and reward management, training and development, Personnel administration etc.

Figure: 4 SCM goals

Figure:3 Human resource management (HRM)

C- Supply chain management (SCM)

Supply Chain Management is the management of the flow of commodities and services. It includes the movement and storage of raw materials (RM), work-in-process (WIP) inventory, semi finish and finished goods from location of Orison to location of consumption. In the supply chain management (SCM) flow of material supplier to customer and flow of money customer or consumer to supplier. Main goals of the supply chain management are listed in the given below:

1. The Right Product
2. To The Right Customer
3. At The Right Place
4. At The Right Time
5. In The Right Condition
6. In The Right Quantity
7. At Right Cost

Figure: 5 Supply chain management

Figure:6 Customer relation management

D-Customer relation management (CRM)

Customer relationship management is an approach to managing a firm's interactions with recent and future clients. It frequently involves using technology to order, computerize and organize with the sales, marketing, social media, customer service, strategy and technical support.
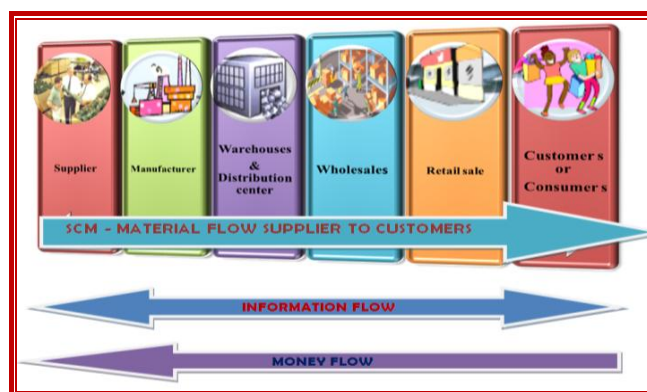
E-Finance resources management (FRM)

Financial resource management (FRM) involves organizing; planning, controlling and monitoring economic resources in arrange to achieve managerial objectives. Excellent financial management (FM) will facilitate your association to:

- Make successful and resourceful use of resources
- achieve objectives and complete commitments to stakeholders
- Become more accountable to contributor and other stakeholders
- Increase the respect and confidence of funding agencies, beneficiary and partners
- Prepare for long-term financial sustainability

F- Evaluation of ERP System

Table-1 Evaluations of ERP

Year wise	Evaluation steps of ERP
Year 1960	System to handle inventory management and control (IMC)
Year 1970	Shifting to Material requirement planning (MRP)
Year 1980	Shifting to manufacturing resources planning (MRP-II)
Year 1990	Manufacturing Resources Planning (MRP-II) Extension
Year 2000	Extended Enterprise Resources planning and ERPs on Cloud Computing technology
Year 2014	Growth of Enterprise Resources planning in supply Chain Management (SCM), finance resources management (FRM), Customer relationship Management (CRM) and Material requirement planning (MRP)

G-Essential factor for ERP Selection

1. Company aim and objectives
2. Functional software necessities
3. Depends on the company size, application area, number of branches & users
4. Underlying technology and expectations scalability
5. Reliability/stability
6. Enterprise resource planning software package cost
7. Financial plan and resources availability
8. Easiness of customization
9. Ease of implementation
10. Vendor standing

H-Benefits of Enterprise Resource Planning

1. Standardized the business process in the organization
2. Upgrading technology infrastructure
3. Achieve better efficiency of operations
4. Provide immediate access to enterprise information
5. Improve data Precisions
6. Reduced error and data duplicate
7. Enhanced Productivity
8. ERP Replaces the systems that separate your data
9. Centralized the related data
10. Improved security of data because login by only authorized person

II. SOFTWARE DEVELOPMENT LIFE CYCLE

A structure that describes the activity performed at each state of software development assignment is given in Fig.7 In this assignment waterfall model is used. Waterfall strengths mainly are easy to used and understand, give structure in experience staff, target are well understood, Sets requirement stability, better management control, necessities are very well identified, product definition is very well.

A. Feasibility study

A feasibility study is carried out to decide on the best system that meets presentation requirements. The most important seek of the feasibility learning activity is to find out whether it would be economically and exactly feasible to develop the result. The feasibility study activity engage the analysis of the difficulty and set of all relevant information

relating to the product such as the dissimilar records items which would be participation to the system, the processing required to be carried out on these data, the output data necessary to be created by the system as well as different constraints on the performance of the system.

B. Requirement analysis phase

In this stage, we study on the subject of the software requirement specification (SRS) and study Requirement Analysis is the method of understanding the customer and client and expectations from a projected system or appliance and is well-defined phase in the software development process. Basic requirement such as user and top management, software requirement, hardware requirement, technology requirement, required management module, required report and master data, etc.

C. Designing & documentation

In this phase, we study about the software design and description. Designing is the most crucial steps of software development life cycle (SDLC). It requires a careful planning and thinking on the part of the system designer. Designing software Package means to map how the different parts of the software are going to complete the most wanted goal. In this, stage development of data flow diagram (DFD), Entity relationship (E-R) Diagram and design of database etc.

D. Coding and implementation

In this steps, Using coding performance and high-quality programming practices to generate high quality code plays an essential role in software excellence and presentation. The system design requires to be implemented to make it an effective system. This demands the coding of design into PC or laptop logical language, i.e., programming language (visual basic, C, C++, and C≠ etc).

E. Testing phase

During the software testing phase representatives from every one of customer groups, need to be concerned for purposeful or functionality & usability testing. The goal of testing process is to recognize all defects in a software package or product. Testing is any activities aimed at assess the software for quality results it generate and the quality of results it can held. Testing is an operation to identify the differences between the projected (required) result and the real outcome. Software testing mainly classified in the following categories such as performance testing, usability testing, inter operability, functional testing and code review etc.

F. Delivery phase

Most of the Software Development methodologies look as if to stop once development has completed. However the acceptance testing and operation process are fundamental to the success of the plan as an entire. What's more, very few organizations have the necessary expertise internal to make of these both processes and achievement.

G. Maintenance phase

In this phase is necessary to eliminate errors in the system during its working life and to adjust the system to at all variations in its working situation. It has been seen that there are always several errors found in the systems that must be prominent and corrected. It also means the analysis of the system from time to time.

H. Retirement phase

In this phase, last steps of software development life cycle (SDLC). The major aim of this phase is the removal of a system free from process work, and occasionally even the complete system itself, a movement also well known as system decommissioning or system setting. Retirement of structure is a serious issue faced by several organizations these days as legacy systems are removed and change by new systems.
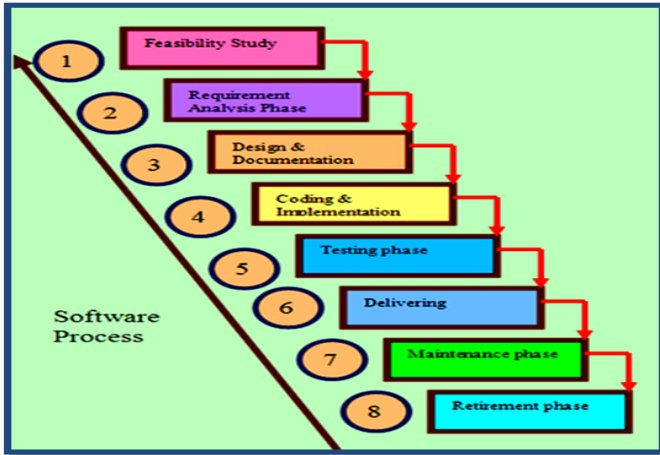

Figure: 7 Software development cycle

III. CRITICAL FACTOR DURING THE DEVELOPMENT OF ERP SOFTWARE PACKAGE

A. Pre- Evaluation screening
- Look for the perfect software package.
- Eliminate those software packages that are not at all right for the big business process.
- This restrictions the number of packages that are to be evaluated by the team member.
- This screening is done based on the product literature of the external consultants and related vendors etc.
- One time you decide on a few software packages after the screening, you can begin the detailed evaluation process.

B. Package Evaluation
- This is one of the important phases of the ERP Implementation because the ERP software package that one chooses will decide the success or the failure of the desire project.
- Implementation of ERP system involves a vast investment, so once a software package is buy it is not an easy task to switch to another one. So it is a do-it right the first time suggestion
- The objective is to find ERP package that is flexible enough to meet the company's requirements, that is it may be not a just right fit but a good fit.
- Once the ERP packages to be evaluated are identified, the company needs to develop selection condition that will permit the evaluation of the entire available ERP package on the similar scale.
- It is constantly better to form a selection committee member for the evaluation of the packages.
- The committee should comprise of people from the various departments like the functional expert.

C. Project planning Phase
- In this step, the ERP implementation process is designed and the details of how to go regarding the implementation are decided.

- Deciding the time schedule and deadline of the project.
- The implementation team members are selected and the task allocations are done.
- This phase decides when to start on the project, how to do it, and when it should be completed.

D. Requirement Analysis
In this phase study about the software requirement specification (SRS) & analysis. Requirement Analysis is the process of understanding the users and Clint and expectations from a projected system and is well-clear-cut point in the software development. Essential requirement such as users, top management, software, hardware, Technology, specifying management module, required report, master data, etc In this steps various kinds of critical aspect involve all over the analysis of requirement listed in the given below:

- Users do not know about present technology
- Technical personnel and end users may have different terminology. as a result, they may incorrectly consider they are in ideal agreement until the finished product is supplied.
- Developer and Engineers may attempt to construct the requirements fit an existing model or system, rather than develop a system exact to the requirements of the customer or client.
- Engineers or programmers, rather than personnel with the public skills and the field knowledge to understand a client's needs correctly may often carry out analysis.
- Communication with users is slow
- Users or customers are technically unknown
- Users or customer do not understand the development process
- Users will not entrust to a position of written necessities
- Users maintain on latest requirements after the fixed cost and scheduling

E. Design & Documentations
A very essential part of the design document in enterprise resource planning software development is the Database Design Document. It contains theoretical, logical, and physical Design Elements. The Database Design Document includes the proper information that the public who interact with the database want. The purpose of preparing it is to generate a general source to be used by every player within the view. The possible users are database developer, database designer, database administrator, Application designer and Application developer. In this phase, various design characteristics included such as: minimum complexity, Ease of maintenance, loose coupling, Extensibility, Reusability, Portability, compactness and Stratification etc.

F. Implementation Team Training
- For the corporation to be self-satisfactory in working in the Enterprise resource planning system, it should have a good in-house team member that can handle the various solutions.
- Heavy investment in training or teaching and re-skilling of developers in ERP software package designing. .
- In this phase, Company must be selecting the right staff with good manner

G. Software testing

The goal of the software testing process is to identify all defects in a software package or product. Software testing is at all activity aimed at evaluating the software package or product for quality outcome it produces and the quality of results it can handle. Software testing is an operation to detect the differences between the required outcome and the actual outcome.

- Complete testing is impossible
- Needs are poorly written when requirement are unclear, incomplete so crate problem during testing.
- New features added after development
- Miscommunication between customers and developers create confusion about the customer requirements
- Test groups control under multiple missions, often conflicting, hardly ever expressed
- Lack of tool compatibility and interoperability
- Testing cannot promise the accuracy of software but can be effectively used to discover error
- Lack of skilled testing capability
- Changing customer requirements
- Lack of resources tool & training

H. Going Live

- In this phase, the entire data conversion necessities have been done, and databases are up and running; and the prototype is fully arrange and tested.
- This is the phase where the entire technicalities are complete and officially ready for operation.
- The ERP implementation team must have software tested and run the system successfully for a few time.
- In this stage remove the old system and the new system is used for doing business process

I. End-User Training

- This is the phase where the real users of the ERP system will be trained on how to use the ERP system.
- The employees who are going to use the innovative ERP system are identified and their skills are well known based on their technological skills levels are separated into groups.
- Then every group is given instruction on the new ERP system.
- These types of training are especially useful as the success of the ERP system is in the hands of end-users.
- Member of staff must be trained on the innovative system in order to use it to continue day-to day operations

J. Post – Implementation (Maintenance Mode)

- This phase is the core of life cycle model. During this phase, the managerial processes are redesigned to work with the ERP system.
- This is the extremely critical phase when the ERP implementation stage is over.
- There have to be sufficient employees who are trained to handle the difficulty that may occur when the system is running.
- There should be technical groups in the company who have the ability to enhance the ERP system when required.
- Projects for implementing the ERP systems get a lot of resources and attention.

IV. Conclusions

This paper has provided a brief overview of Enterprise Resources Planning (ERP), critical success factors during the development of ERP Software package and various steps of ERP Implementation process. In This paper mostly, Tan critical success factors during the development of ERP Software Package and implementation process have been identified. It may be Pre- Evaluation screening, Package Evaluation, Project planning, Requirement analysis, Design and documentation, Implementation team training, Software testing, Going live, End user training, Post Implementation (Maintenance Mode) etc. Other essential critical factors include National environmental, Organizational / Internal issue, Worked with functionality, Project team, maintained scope, management support, consultants, Internal readiness, Training, Planning, Development, Budgeting, Deal with organizational diversity. This valuable knowledge very helpful for ERP software package development cycle and actually ERP implementation of different kinds of organizations.

Table-2 some important Critical issue during the ERP implementation

Types of issue	Descriptions of the Critical issue of ERP Implementation
1.National Environmental	- Infrastructure, economic and financial growth Regional, government and manufacturing (MRP, MPS, WIP, BOM, QM and Cost management etc.)
2.Organizational / Internal issue	- IT Maturity, computer culture, business size, management commitment
3.Worked with functionality	- Doing business process reengineering and aligning the business processes with software - Doing minimal customization to the software
4.Maintained scope	- Proper maintain the initial scope - Choosing the best way of implementation method

5.Project team	• Enterprise resource planning team should be cross functional, mix of consultants & in-house staff • Team should have both business (familiar with business functions and products) and technical knowledge. • The project team should be dedicated to ERP implementation • ERP team should be given reward and incentives
6.Management support	• Highly support and approval from the top management is necessary during Enterprise resources planning implementation process • Top senior management must be committed with its own involvement and allocating valuable resources • New organizational structure should be established and communicated to each employees
7.Consultants	• Consultants should have in-deeply knowledge of software designing & applications • consultant should have multiple skills covering functional, technical, and interpersonal area • Should be involved in different stage of the Enterprise resources planning Implementation process
8.Internal readiness	• Organization and people should be prepared for revolutionize • User should be involved in designed and ERP implementation of small and large-size organization process. • Education should be a priority from the start of the project, and funds and time should be spending on various forms of education and training.
9.Training	• Heavy investment in training or teaching and re-skilling of developers in ERP software package designing. • Member of staff must be trained on the innovative system in order to use it to continue day-to day operations
10.Planning	• A understandable business map and vision to guide the direction of the plan • Business plan should be tactical and real profits, resources, risk costs and timeline
11.Development	• Edge point for marketable software applications or tradition system may need to be developed.
12.Budgeting & Deal with organizational diversity	• The project assignment budget is an in depth estimate of entire the costs required to complete project tasks. • Keep the project as much as possible within budget. • Reengineering in both people and operational level in different business unit.

REFERENCES

[1] P. Bingi, M.K. Sharma, J.K. Godla "Critical issues affecting an ERP implementation" Information Systems Management , vol.16, no.3 pp.7–14, 1999.

[2] Zakaria N.H., Haron A., Sahibuddin S. & Harun M. "Requirement Engineering Critical Issues in Public Sector Software Project Success Factor", International Journal of Information and Electronics Engineering, vol.1, no.3, pp.200-209, 2011.

[3] P. Singh & A. K. Tripathi, "Issues in testing of software with NFR", International Journal of Software Engineering & Applications, vol. 3, no. 4, pp.61-76, (2012).

[4] Purohit G.N. , Jaiswal M.P., Pandey S, "Challenges Involved in Implementation of ERP on Demand Solution: Cloud Computing", IJCSI International Journal of Computer Science Issues, vol.9, no.4, pp.481-489, 2012.

[5] Kalbasi, H., "Assessing ERP Implementation Critical success factors", Master Thesis, Tarbiat Modares University (2007).

[6] Law, H.C. & Nagi, T.W., "ERP Systems Adoption and Exploratory Study Of The organizational Factors and Impacts of ERP Success", Journal of Information and Management, vol.44, pp.418-432, 2007.

[7] Mahajan, M., "Industrial Engineering & production management", Dhanpat Rai & Company (p) LTD, New Delhi (2005).

[8] Otieno, O.J., "Enterprise Resources Planning (ERP) Systems Implementation Challenge: A Kenyan Case Study", Journal of Business Process Management, vol.7, pp.339-409, 2008.

[9] Rahul V. Altekar, "Enterprise Resources Planning", PHI Private Ltd. New Delhi (2005).

[10] Chumney, M.W., Wyeth, M. & Sullivan, J.J., "Developing a Practical Framework for ERP Project Implementation: A Proposed Research Design", Journal of International Federation for Information Systems, vol. 9, no.1, pp.341-351, 2006.

[11] Gargeya, V.B. & Brady, C., "Success and failure factor of adopting SAP in ERP system Implementation", Business Process Management journal, vol.11, no.9, pp.175-197, 2005.

[12] Kumar, V., Maheshwari, B., & Kumar, U., "ERP systems implementation: Best practices in Canadian government organizations", Government Information Quarterly, vol.19, pp.147–172, 2002.

[13] Law, C. C. H., & Ngai, E. W. T. "ERP systems adoption: An exploratory study of the organizational factors and impacts of ERP success", Information & Management, vol.44, pp.418–432, 2007.

[14] Ngai, E. W. T., Law, C. C. H., & Wat, F. K. T. "Examining the critical success factors in the adoption of enterprise resource planning", Computers in Industry, vol.59, pp.548–564, 2008.

[15] Al-Mashari, M., Zairi, M, "Supply chain re-engineering using enterprise resource planning (ERP) systems: An analysis of a SAP R/3 implementation case ", International Journal of Physical Distribution and Logistics Management, vol.30, no.3, pp.296–313, 2000.

[16] Nah, F.F.-H., Lau, J.L.-S., Kuang, J.,"Critical factors for successful implementation of enterprise systems", Business process Management Journal, vol.7, no.3, pp.285–296, 2001.

[17] S.K. Choudhary and R.S Jadoun, "Role of Cloud Computing Technology in Agriculture Fields", Computer Engineering and Intelligent Systems, vol.7, no.3, pp.1-7, 2016.

[18] Sushil Kumar Choudhary & Niraj Gupta, "ERP Implementation Process for Manufacturing Industry, LAP LAMBERT Academic Publishing is a trademark of: Omni Scriptum GmbH & Co. KG, Saarbrücken, Germany (2015), ISBN: 978-3-659-67148-7.

[19] S.K Choudhary and N. Gupta, "Developed the Inventory Management System for ERP Implementing in Manufacturing Industry, IOSR Journal of Mechanical & Civil Engineering, vol.11, no.6, Ver.vi, pp.19-29, 2014.

[20] Choudhary, S. K., Suman, R., Gupta, N., "Designing the Process of Stores Management for Implementing ERP in Manufacturing Organization: Case Study," Industrial Engineering Letters, Vol.4, no.3 pp.49-66, 2014.

[21] K.K. Hong, Y.G. Kim "The critical success factors for ERP Implementation: an organizational fit perspective", Information & Management, vol.40, pp.25–40, 2002.