

AN OVERVIEW OF ENTERPRISE RESOURCE PLANNING SYSTEM AND ITS USE IN HEALTHCARE SECTOR

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ABSTRACT: *This paper provides the brief overview of Enterprise Resource Planning Systems (ERPs) and its use in healthcare sector. In past years, the use of information technology in healthcare sector has been increased but a little direction is available in the literature about its evaluation of benefits. In this article a literature review was conducted relating to ERPs, evolution of ERPs, implementation of ERPs, ERPs use in healthcare and its benefits which revealed that use of ERPs in healthcare sector does not guarantee the success for system but it requires proper implementation. Well implemented ERPs in healthcare sector can have numerous benefits as it increases the quality of healthcare along with strategic and managerial benefits. This article will help the researchers for better understanding the concept of Enterprise Resource Planning Systems and provides the guide for future research relating to impact of Enterprise Resource Planning systems in healthcare sector.*

Keywords: Enterprise Resource Planning System, Evolution of ERPs, Benefits and use of ERPs in healthcare

ENTERPRISE RESOURCE PLANNING SYSTEM

The information system integration that supports the management of resources and maintains processes of a business in an organization is referred as Enterprise Resource Planning Systems (ERPs). This system has benefit of linking all business units together and have several modules. This system has the feature of customization as ERPs can be customized according to the industry and is a very complex in nature. So Enterprise Resource Planning Systems (ERPs) are “configurable information systems packages that integrate information and information-based processes within and across functional areas in an organization” [1].

EVOLUTION OF ENTERPRISE RESOURCE PLANNING SYSTEM

The name of “Enterprise Resource Planning” has been derived from “material requirement planning (MRP)” and “manufacturing resource planning (MRP II)” [2-3]. MRP was developed for more efficient calculation of material need. MRP evolved into “manufacturing resource planning” which included newer functions i.e. scheduling, capacity management and sales planning. Initially “manufacturing resource planning” MRP II was considered as logical for efficient planning in manufacturing sector. The companies realized that in addition to finance, human resource, manufacturing, sales and distribution there is a need of customer satisfaction and profitability. The next step was computer integrated manufacturing that included production process and product development in an integrated and comprehensive framework [4].

MRP was the first designed business application [5]. The software for MRP involved the material master data maintenance and creation and materials bill of in one or many plants. The typical parts of MRP covered demand and consumption based planning i.e. bill off material processing and forecasting algorithms. These were very early packages and process which have the ability to handle large data but the depth of data processing was limited [4].

MRP II started with the sales forecast in the long-term. The master production schedule can be derived from it. The requirements include input for the “manufacturing resource planning” and output for the master production schedule. Using demand and consumption based planning methods; the module of material management estimates the net and secondary requirements and take in account the stocks. After the material focused tasks the next step was capacity management that helps in integration of the machines available with the planning process. The schedule of production is combined the capacity demand which needs to be compared with resources available. By forward and backward scheduling an optimal production schedule is produced. For the capacity adjustment various approaches can be applied. Order release modules give rise to current production order and they are sent to production process along with the related documents. At the final stage, scheduling algorithm tackle the detailed work assignment to specific machines [4].

In 1980s, the MRP II was extended covering more technical areas that include production process and product development. These were named as computer aided quality assurance, computer aided design, computer aided manufacturing, computer aided engineering and computer aided planning. The complete framework for business administration integration and the technical functions was called as “computer integrated manufacturing” (CIM) [6]. This approach was manufacturer focused but it can be generalized i.e. “retailers integration model” [7]. In “computer integrated manufacturing” (CIM) process modeling techniques and data integration was improved. For the typical business process explanation, process chains were completely designed. So with the process models, integration and data models were also extended. From this research a methodological framework named “architecture of integration information system” (ARIS) evolved covering process views, data, organization and function [8].

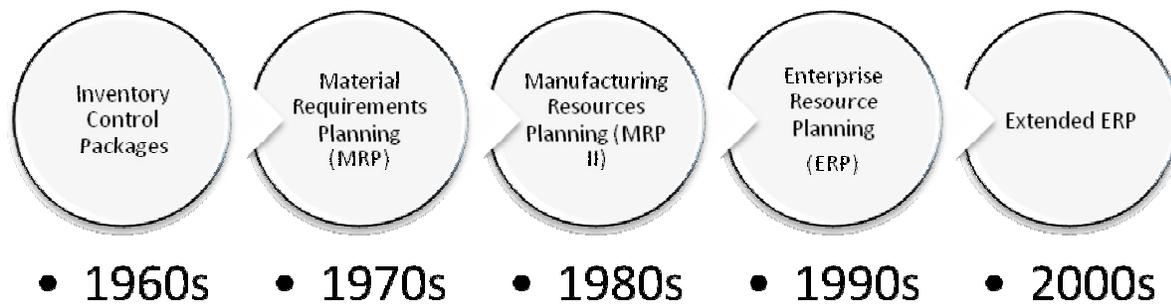


Figure 1 ERP Evolution [9].

These process and data models are nowadays used as reference models and have an application in document of “Enterprise Resource Planning” software and supporting software for enterprise data, process modeling and are extensively used in implementation of “Enterprise Resource Planning” projects. So ERPs are the integrated systems which are the combination of best information and business practices. Extended Enterprise Resource Planning is the extension of functionalities of Enterprise Resource Planning in supply chain management, advanced planning and scheduling, human resources, Internet-enabled integrated e-commerce, business intelligence, distribution, sales-force automation, manufacturing and finances. For example the application of Enterprise Resource Planning in small and medium enterprises and Enterprise Resource Planning implementation in the health care sector [9].

IMPLEMENTATION OF ENTERPRISE RESOURCE PLANNING SYSTEM

The implementation of ERPs in an organization supports the operations in a company and provides numerous benefits [10]. ERPs is a major tool in technology and management which needs multidisciplinary approach related to behavior of the organization, finance, human resource, information system, and operations management [11]. The introduction of the information technology into an organization do not itself increase the productivity and its efficiency is dependent on the usage of this technology by people [12]. The transformation occurring in current work nature due to ERPs cannot be studied without the consideration of institutional context and change in technology [13]. The satisfaction of user is very important for system success as involvement of user, integrity of system and understanding of system effect the satisfaction related to usage of ERPs [14] (Wu et al. 2002). Due to globalization, ERPs is a requirement of organization in present era so that the organization can cope up with competitors and gains a competitive advantage. The adoption of ERPs by an organization is dependent on tangible and intangible factors [15].

During the last decade the adoption of ERPs has increased. In 2004 the sale of ERPs was \$ 23.6 billion which has increased to \$ 24.5 billion in 2009 [16]. ERPs implementation offers several benefits like lowering of the operational cost, integration of the data and high speed

application deployment [17]. ERPs implementation in an organization has a motive of providing competitive advantage. The implementation of ERPs in certain organization did not yield positive benefits as expected. In Indonesian organizations the implementation of Enterprise Resource Planning system in both private and public sector has met with 60% failure [18]. Similarly some bigger companies in the world like Dell Computers have failed in achieving ERPs implementation benefits despite of spending a lot of funds for its implementation [19]. A pharmaceutical company named “Fox Meyer” has met with a failure in implementation of ERPs and declared itself bankrupt [15]. The success rate of ERPs implementation in China is only 10% [20]. The ERPs needs to be maintained properly and up gradation of the system is also necessary for successful implementation [12]. A study on ERPs maintenance has been carried by Celeste See Pui Ng [21] and concluded that a better maintenance of ERPs will result in its enhancement and better functioning.

Failure and success of ERPs implementation is dependent on several external and internal factors in an organization. The success of ERPs is linked with various factors. In the implementation of “Enterprise Resource Planning” there exists an issue of choice of a proper “Enterprise Resource planning system” [22-23]. In addition to technology change, implementation of ERPs involves change process. Generally the implementation of ERPs involves three steps: pre implementation stage, implementation stage and post implementation stage [24]. For the choice of the most suitable ERPs implementation is dependent on the company characteristics and involves the company size [25]. The industrial sector and size of the industry has been compared by [26] for studying the difference in ERPs implementation.

The life cycle of implementation of ERPs includes five steps i.e. preparation of the project, selection of the technology, formulation of the project, development or implementation and deployment of system [27]. The first step, preparation of the project involves defining the objectives and goals, estimation of the time and budget, identification of maturity level of an organization, reengineering of the processes in business, analyzing the existing information technology and investigation of further investment required [27]. The second step, selection of the technology covers selection of the

“Enterprise Resource Planning” software, hardware and database needed for “Enterprise Resource Planning system” support, determination of the team for project, selection of the consultant for “Enterprise Resource Planning” and choice of methodology and strategy required for “Enterprise Resource Planning” implementation [27]. The third step, formulation of the project includes blueprint of the business that is needed for development or implementation like the plan for the development and buildup of the functional requirement. The fourth step, development or implementation involves customization of the system and ensuring the running of the system in working environment. The fifth step, deployment covers eliminating the bugs in the system, system stabilization, system maintenance, user support, system up gradation and normal system operation [15]. The standard processes for the Enterprise Resource Planning needs to be aligned with the processes in the company business for the adequate implementation of ERPs [12].

There are certain key success factors in the implementation of ERP that involves both technical and non-technical factors but technical factors have more influence as compared to non-technical factors. The key success factors covers different aspects i.e. people, process, organization and technology. The first aspect people involves support from the top management [28-29], team work [30-31], involvement of the users [32]. In the phase of implementation the factors related to humans are critical. For development of positive response towards the implementation of ERPs, the involvement of people in pre-implementation stage is necessary [33]. Several studies have also showed the cultural aspects that are important during the implementation of ERPs. National culture is a serious factor in a multi-national setting for the implementation of ERPs [34]. Similar cultural amenities and sharing of the knowledge is an important factor during the ERPs implementation [35]. The project actors and the team members trust building on each other is a major issue during the ERPs implementation phase [36]. The better system acceptance through shared beliefs made the implementation easier [37]. The cultural aspects of company are also an important dimension during this stage of ERPs implementation [38]. The second aspect is process and organization which covers clear objectives and goals, budget of the project, time required for project [39], maturity level of an organization [18], readiness of the culture [30], strategy for implementation of ERPs [40], methodology for “Enterprise Resource Planning” [41], management of project [42], change management [43], risk management [44], reengineering of business process, communication and training [28]. The preliminary step in ERPs implementation is process mining as studied by [45] while capturing of the entire environment of the business during the reengineering of business process with information technology aid was mentioned by [46]. Business process reuse and requirements of data is a main concern during ERPs implementation [47]. The third aspect of technology includes infrastructure for the technology, analysis of data and migration [48] and strong product of ERPs [39].

ENTERPRISE RESOURCE PLANNING SYSTEM USE IN HEALTHCARE

Information technology in healthcare sector provides effective delivery and control over the information for decisions makers. In healthcare, information technology is

emerging i.e. the introduction of decision support system, access to the clinical knowledge for outpatient and inpatient support to the healthcare professionals [49]. The use of modern information technology produces opportunities for clinical error reduction, increase care efficiency, improvement in patient care quality and healthcare professional support [50]. As the welfare of people is on priority there has been a need of management of large scale patient information so the “Enterprise Resource Planning System” has been employed as a solution to this problem [51]. Originally the ERPs were developed for manufacturing industries for the complex manufacturing data and “supply chain management” [52]. Information technology has certain hazards associated with it in health care. For example it is very costly and 4.6% of healthcare organization budget is spent on it and its failure can cause negative impact on healthcare professionals and patients [53]. Health care is different from other sector because it is human centered. So there exist complexities in healthcare sector and is due to the fact that healthcare service can induce persistent and comprehensive change in the patient well-being either physically or mentally [51]. Many countries have implemented “Enterprise Resource Planning systems” for the management of information related to health [54].

Health care informatics can have impact at individual, group and organizational level. In individual level impact, re-engineering of the business and the design of the system are the same thing [55]. The management of the information of patient reflect that how the patient will be treated throughout the treatment process in healthcare [56]. This is related to the patient expectation from the provider of healthcare. Technologist, scientists and engineers are responsible for the creation of technology [57]. The provision of health care services is a national service so the addition of any technology to healthcare sector can have indirect or direct societal impact.

Health care information systems are powerful tools based on ICT to make efficient and effective healthcare delivery [58]. Health care information systems are a combination of three disciplines information management, organization management and health care management [59]. Management information system application to healthcare sector is known as Health care information systems [60].

The health care sector has intensive information [58] for service planning and monitoring timely where as reliable information is very important at international [60], national [61], regional [62] and organizational level [63]. The need of “Information and Communication Technologies” (ICTs) has increased in healthcare sector due to the fact that the healthcare sector is a decade behind other industrial sectors for example airline, manufacturing and banking industry [64]. The “Information and Communication Technologies” (ICTs) adoption by healthcare sector involves series of phases evolved since 1960 [65]. The adoption of health informatics has started from payroll, financial systems, organization’s billing and accounting system. In 1970s clinical departments have launched initiative for healthcare internal activities like pharmacy, laboratory and radiology [66]. In 1980s financial system became prominent by making investments in “materials management systems” and cost accounting [67]. In 1990s the attention was diverted towards computerized “Electronic Medical Record” (EMR),

clinical data repositories and enterprise-wide clinical systems [68]. The healthcare sector has adopted “Information and Communication Technologies” under the technologically-pushing forces pressure [66, 69] but limited attention has been paid on effectiveness improvement and consequences of “Information and Communication Technologies” adoption [70]. These factors have caused Non-homogeneous Health Care Information Systems (HCISs) development [71]. Nowadays healthcare sector is facing pressure and competition for improvement in healthcare effectiveness and quality [72]. New IS Modelling Techniques help “Information and Communication Technologies” for the improvement of managerial process, healthcare quality and reduction in cost [73].

ERPs have several applications that fulfill the healthcare organization needs like data management of administrative and clinical processes. The data can be utilized for various processes by number of systems [66]. The data needs to be integrated for its effectiveness [74], the data related to patients must have security and be confidential [75]. The research on the health care information system has increased due to increased investment in this sector, [76], having the capability to increase in healthcare quality [77], its ability to rationalize cost and increased pervasiveness in health care sector [78].

ERPs are diverse systems in terms of patients who are the final customers, nurses, doctors and administrators who are involved in healthcare delivery process, regulators who have interest and stakeholders in this sector [73]. ERPs are specific because any information mismatch effects the quality of healthcare and any error in monitoring can effect continuity of care [73]. The information handled by healthcare information system involve risk which can be perceived and actual like the information can be leaked out into wrong hands and any information leak can also effect privacy. For the patient data management the health care sector has to follow regulatory policies so there is a pressure created from health care regulators for information management [76].

The hierarchical structure of the health care sector and the professional driven nature are the barriers in exploiting the healthcare information system potential. The use of healthcare information by organization due to its multidisciplinary nature can help in overcoming the barriers [79]. ERPs deals with the three healthcare levels.

- Central at regional and national level which comprises of resource management, financial performance control, central planning capability, safety and quality monitoring. The organization of this level varies depending upon the national health care system model.
- Primary services related to healthcare and covers all system that deal with health care service delivery to the public through regional and national territory and include local practices and practitioners.
- Secondary healthcare services that deal with systems and support the processes related to health care among the providers of health care.

National healthcare system in Italy is entirely public and is responsible for providing services related to healthcare to all public as their constitutional right. The health care information system in Italy is based on specific pillars for

example information flow digitization at regional and national level, regional infrastructure development for online support service to public, interconnections development in between primary care (general practitioners) and secondary care (health care providers), regional and national security card development, service-delivery processes digitization in health care providers and regional Electronic Health Record (EHR) creation at national level [80]. Healthcare information system can further be implemented in evidence based medicine, health care analytics and health care social media.

BENEFITS OF ENTERPRISE RESOURCE PLANNING SYSTEM USE IN HEALTHCARE

Health care information system helps in improvement in quality of care and management of cost [81] in addition to their benefits in diagnostic and clinical equipment [82]. Health care information system are unique for capturing, storing, processing and communicating information to decision makers for better healthcare coordination [73]. The use of ERPs helps in cutting of the operational cost and increase in outputs. ERPs helps in streamlining the processes and it provides benefits to organization by enhancing volumes of operation, substituting labor and speeding up the business process [83-84]. “Enterprise Resource Planning systems” enable change in processes, business process atomization and offer benefits such as customer service, cycle time, productivity and improvement in costs. ERPs offers benefits to the senior managers [85]. “Enterprise Resource Planning systems” have capability of built-in data analysis and a database that is centralized so they provide benefits related to information to the senior managers. This type of benefits related to information help the company in better planning and decision making, improvement in performance and improved resource management. There are three strategies where ERPs helps in achievement of competitive advantage in business i.e. focus, differentiation and cost leadership. ERPs helps in customizing services and products and delivers chance for competitive differentiation [86]. “Enterprise Resource Planning systems” have integrated application and provides an infrastructure which support reduced information technology cost, flexibility in business and new application implementation in an economic way [87].

CONCLUSION

In this study the articles related to “Enterprise Resource Planning Systems” are reviewed and this paper is a slight step toward a huge task: the use and impact of ERPs in healthcare services. The review reveal that being the integrated information system, the use of “Enterprise Resource Planning Systems” impacts the process and performance of the organization and its impact is not only limited to the manufacturing organizations but also to the services sector. The performance of the organization due to ERPs use can only be increased if the ERPs are properly implemented. Customization is the main feature of the ERPs as ERPs can be customized as per the requirements of the organization. Due to the complexity of the healthcare organization and the risk involvement the development, implementation and maintenance of ERPs are really challenging for system developer as it involves human lives and a little error can cause a loss in human life. In healthcare

sector the flow of information and quality of system installed are very important and directly related to the healthcare service quality. So the use of ERPs provides the integration for healthcare organizations which results in better operation and ultimately better services.

This paper has some future implications. Firstly, the future research should have direction to study the impact of ERPs in healthcare sector qualitatively. Secondly, the future research should propose an impact measurement framework on the basis of individual impact, organizational impact, work group impact and technological impact. Finally there should be a follow up research to check the validity of the proposed impact measurement framework.

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