

Benefits of Implementing Enterprise Resource Planning In The Construction Industry: A South Africa Study

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Abstract: Enterprise Resource Planning (ERP) has been branded as the panacea for the successful incorporation of a construction company wide-ranging information systems. ERP platforms brings together a construction firms daily processes ranging from finance, human resources, accounting, project execution and delivery, amongst others. Besides, ERP also link construction companies to the clients, subcontractors, material suppliers, other stakeholders connected to a project throughout a project life-cycle. Hence, this paper investigate from the perspective of construction professionals the benefits of implementing ERP in the South Africa construction industry. The assessment was undertaken through a quantitative questionnaire survey that was distributed amongst construction professionals working in both private and public construction firms in the Johannesburg- South Africa. Findings emanating from the study revealed that the construction professionals perceived the benefits of ERP to be: informed decision making, effective information management, effective project coordination, elimination of idling resources, improved project administration, improved information sharing and better project planning amongst others. The findings supports the argument that the implementation of ERP proves to be imperative in the elimination of redundant work processes in the construction industry in order to support improvement in construction project management and performance in the construction sector. Hence, the research contributes to the body of knowledge on the benefits that accrues from the implementation of ERP systems.

Keywords: Enterprise Resource Planning, supply and distribution, construction, enterprise

Introduction

Enterprise Resource Planning systems' origins date back to early 1970's (Radovilsky, 2004). Their first application according to Fitzgerald (1992) was on manufacturing and production planning systems incorporating the supply chain, inclusive of orders, sales, scheduling, supply and distribution. The initial scope positioned for the storage and allocation of production materials and ability to manage and plan inventories was later changed to the calculation of materials requirements including information needs for management and decision support about other production resources. As in every IT software, there were developments stages on the platform, with the inclusion of new and wider functionalities intended to fulfil and achieve the growing needs of the system. ERP systems comprises of a very successful software category that reached the \$10 billion dollar mark two decades ago (Davenport, 1998), with sales fueled by the 21st century bug phenomenon. Analyst had predicted they would soon vanish (Kumar and Hillsgersberg, 2000; Eduardo, 2009), but their expected worldwide sales (Kessinger, 2009) show enterprises today still considers it to be one of the most useful IT tools available for various industries. ERP is a computer program that provides a general working platform for all departments of an enterprise with their management functions being integrated into the program. ERP is a system for the seamless integration of all the information flowing through the company such as finances, accounting, human resources, supply chain, and customer information (Davenport, 1998). There has been claims suggesting that ERP systems facilitate efficiency of the processing of orders, the alignment of sales and production, integration of customer orders and delivery data.

Construction ERP allows construction companies to make optimum use of its assets resources in order to maximise the business profitability and keep it competitive in its market. The system offers a range of benefits to construction enterprises, which according to Davenport (2000), include coordinating processes and information, reducing carrying costs, decreasing cycle time, and improving responsiveness to customer needs. The common objective of

the ERP system is to optimize the usage of all the company resources in the company's operations by using as much information as possible across all company departments, limiting the inadequate conventional human approaches that are usually fragmented. Given that construction projects are transient in nature, span different lengths of time periods, and require different resources, it is usually very difficult to achieve a balance between the production capability and the actual workload on hand for a construction enterprise all the time (Shi & Halpin, 2003). The ERP in this regard, serves as an advanced planning tool, which helps construction firms decide on when and how company resources are to be allocated to specific projects, whether the company will need to complete for additional external resources from the market, and the strategy of how awarded projects are to be run and executed. Other benefits includes better planning of finances of projects and enterprise, management of projects within time and budget, enhanced decision-making capabilities, strengthened relationships with suppliers and subcontractors, elimination of data re-entry, and increased efficiency in management. The objective of this paper is to present construction professionals' perspective on the benefits of the implementation of an ERP system in the construction industry, thus boasting effective construction project management and improve resources procurement in the South African construction industry. The research method adopted for this research is a comprehensive combination of primary and secondary data of ERP in construction management. The first part of this paper comprises of a synopsis on ERP followed by a presentation of the research method adopted for the study before the presentation of the research findings and thereafter discussion of the results and its implications.

Benefits of enterprise resource planning implementation- a synopsis

Enterprise resource planning systems facilitates an organisations business in numerous ways. ERP system allows orders to be made efficiently, aligns sales with production, integrates requisition with delivery data, and provides efficient plant scheduling and production processes. Further benefits include better coordination and processing of information, reduction in carrying costs, decrease in process cycle time, and improvement in responsiveness to customer needs (Davenport, 2000). Since ERP systems integrate all divisions of an organisation seamlessly, it makes firm control over an organisation a possibility. Furthermore, the interconnectivity among the modules of ERP systems reduces the time to perform the different operational tasks – therefore, making better organisational efficiency a possibility (Kessinger, 2009). Lee at al. (2002) stated that an ERP system can shorten the procurement cycle by an approximate eighty percent, through the automation of repetitious transactions and reduction of manpower to perform particular tasks. Connor and Dodd (2000) summarised reasons why companies invest in ERP systems as follows:

- Integration of Financial Information: Different company divisions contribute differently to the total revenue the company generates. Each one has its own set sales, cost, revenue, and other financial
- Integration customer order information: Having information in a single integrated platform rather than scattered among many different systems that cannot communicate with one another, allowing organisations to keep track of requisitions more easily and coordinate all other departments which form part of the organisation simultaneously.
- Standardisation of processes: Standardizing company processes and using a single integrated system can save time, increase productivity, and reduce product cycle time
- Reduction of inventory: Improvement in the observation ability of ordering and processing within the company can lead to responsible and better planned fulfilment of all requisition by the users.
- Standardisation of HR division: ERP can help fix the HR problem of a company that may not have a unified, simple method for tracking employees' time and communicating with them about benefits and services, especially in the case of companies with multiple business units

The need to integrate organisational processes and exchange knowledge effectively and efficiently between all stakeholders necessitates on most businesses the implementation of ERP systems and technology. Ahmad (2009) states that an ERP systems is ideal for any company which seeks to enhance company competitiveness through effective use of all company assets. The general understanding surrounding the ERP systems is that they allow an organisations to explore knowledge about its business and related processes; essentially making the ERP system a vital tool for capturing, exploring, and transferring knowledge among its departments for better transparency and information flow. Furthermore, according to the Green Beacon Solution (2013), the objective of the ERP solution is to drive the flow of information between all internal business functions while managing connections to outside

stakeholders, which according to Negahban (2008), this act must promote an increase in efficiency of operation of an organisation and also increase additional profits generated from operations.

Methodology

The data used in this paper were derived from both primary and secondary sources. The primary data were obtained through the survey method, while the secondary data were derived from the review of literature and archival records. The primary data was obtained through the use of a questionnaire aimed at 200 construction professional working in both private and public construction firms in Johannesburg- South Africa to meet the research objectives. The questionnaire was considered vital for the survey in order to have a true reflection of the perceived benefits of ERP which are considered significant in the South Africa construction industry.

The professionals used for the survey were randomly selected amongst their peers. Survey participants included architects, quantity surveyors, civil engineers, construction and project managers. A list of construction professional that works within the greater Johannesburg Metropolitan Municipality was obtained from the respective professional council and the Council for the Built Environment- the watchdog of professionals in the country via the various professional councils. This approach concurs with the work of Swan & Khalfan (2007) who advise that the inclusion of all construction professionals in a study of this magnitude is essential for successful project delivery- which applies to the current study. Random sampling was used to select the professionals. According to Kombo and Tromp (2006) random sampling is the probability whereby people; place or things are randomly selected. From the list of construction professionals, 100 were randomly selected. This yardstick was considered vital for the survey in order to have a true assessment of the benefits of ERP for effective construction project management. Because all professionals as contained on the list had an equal chance to be drawn and participate in the survey. Out of the 200 questionnaires sent out, 167 were received back representing an 83.5% response rate. This was considered satisfactory for the analysis based on the assertion by Moser and Kalton (1971) that the result of a survey could be considered as biased and of little value if the return rate was lower than 30% to 40%. Because the sample size for this study was relatively small, all groups of respondents were lumped together in the analysis in order to obtain significant results. The data were analysed by calculating frequencies and the mean item score (MIS) of the rated variables. Although the empirical study is based on a relatively small sample of 167 construction professionals, the findings provided an insight into the general perceptions of the benefits of ERP to the South Africa construction industry. The calculation of the MIS is explained in the next section. The research was conducted between the months of July to October, 2016. The questionnaire was designed based on the information gathered during the literature review and does not form part of an existing survey instrument.

Mean Item Score (MIS)

A five point Likert scale was used to determine the benefits of implementing BIM, ERP and their integration for effective project management in the South Africa construction industry with regards to the identified factors from the extant review of literature. The adopted scale was as follows: (1) = Strongly disagree; (2) = Disagree; (3) = Neutral; (4) = Agree; and (5) = Strongly agree. The five-point Likert scale scores were transformed to mean item score (MIS) for each of the roles of BIM and ERP, and the effects of integrating BIM+ERP as scored by the respondents. The indices were then used to determine the rank of each item. These rankings made it possible to cross compare the relative importance of the items as perceived by the respondents. The computation of the MIS was calculated from the total of all weighted responses and then relating it to the total responses on a particular aspect. This was based on the principle that respondents' scores on all the selected criteria, considered together, are the empirically determined indices of relative importance. The index of MIS of a particular factor is the sum of the respondents' actual scores (on the 5-point scale) given by all the respondents' as a proportion of the sum of all maximum possible scores on the 5-point scale that all the respondents could give to that criterion. Weighting were assigned to each responses ranging from one to five for the responses of 'strongly disagree' to 'strongly agree'. This is expressed mathematically below in Equation 1.0. The relative index for each item was calculated for each item as follows, after Lim and Alum (1995):

$$\text{MIS} = \frac{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}{\sum N} \quad \text{Equation 1.0}$$

Where; n1 = number of respondents for strongly disagree; n2 = number of respondents for disagree; n3 = number of respondents for neutral; n4 = number of respondents for agree; n5 = number of respondents for strongly agree; N = total number of respondents. Following the mathematical computations, the criteria were then ranked in descending

order of their relative importance index (from the highest to the lowest). The next section of the article presents the findings of the survey and some discussion.

Results and discussion

Demographical specifics

Findings from the sixty-five usable questionnaires revealed that 22.0% of the respondents were in the age group of 20-25 years old, 26.0% in the age group of 26-30 years old, 22.0% were in the age group 31-35 years old, 12.0% were in the age group 36-40 years old, 2.0% of the respondents were in the age group 41-45 years old, 4.0% were in the age group 46-50 years old, 3.4% of the respondents were in the age group 51-55 years old and 4.0% of the respondents were above 55 years old. Further, results showed that 30.0% of the respondents were African, 58.0% were White, 8.0% were either Indian or Asian and 4% of the respondents were coloured. It was also found that the respondents are currently handling construction projects ranging from residential, road construction, and civil engineering related projects. Findings relating to respondent's professional qualification showed that all respondents were construction professionals. Furthermore, results reflected that 40.0% of the respondents had experience ranging from 1-5 years, 26.0% had experience in the range of 6-10 years, 18.0% had experience that ranged between 11-15 years, 4.8.0% had experience that ranged from 16-20 years, and 12.0% had more than 20 years' experience in the construction industry. Further, 42.0% of the respondents had bachelor's degrees, 18.0% had diplomas, and 12.0% of the respondents had master's degrees, whilst 28.0% of the respondents had honours degrees. These finding thus reveals that the respondents have a working knowledge of the construction industry/ projects and activities in Johannesburg; hence their opinions on the study objective will be deemed credible. The next sections present the result of the survey findings on the benefits of ERP for effective construction project management in the South Africa construction industry.

Benefits of implementing ERP systems in construction firms

Table 1.0 indicated the benefits of implementing ERP systems in the South Africa construction industry. The results from the collected data indicated that 'informed decision making' and 'effective information management' were both ranked first with a mean score of 4.42 and a standard deviation of 0.706 and 0.697; 'effective project coordination' and 'elimination of unnecessary processes' were both ranked second with a mean score of 4.36 and a standard deviation 0.651; 'elimination of idling resources' and 'improved project administration' were both ranked third with a mean score of 4.34 and a standard deviation of 0.628 and 0.636 respectively; 'improved information sharing' was ranked fourth, with a mean of 4.30 and a standard deviation of 0.616; and 'better project planning' was ranked fifth, with a mean of 4.22 and a standard deviation of 0.704 as the benefits of ERP implementation in the South Africa construction industry.

The benefits which the respondents regarded to be the most unlikely to be gained if ERP systems are implemented in construction firms include proactive material supply, effective project progress monitoring, improved quality of work, improved client and lastly reduction of disputes.

The findings from the study fundamentally supports the study conducted by Bhirud and Revatkar (2016) where they communicate that through the implementation of ERP systems organisations can benefit cost optimization, incorporate design changes, consistent quality conformance, information reliability, faster and on-time material delivery, incorporates value engineering. The study is also in agreement with Oracle (2016)'s white paper on project portfolio management through an ERP system; the organisation states that these systems can simplify project planning and efficiently manage project resources. Furthermore, the study is in agreement with Oracle (2016) white paper on Contract Management, the organisation states that ERP systems facilitate the management of all critical information and complete visibility, which is in agreement with this study. According to Kruger and Rampal (2009), the benefits that can also be gained through the implementation of an ERP system is that the facilitate orders to be made efficiently, aligns sales with production, integrates requisition with delivery data, and provides efficient plant scheduling and production processes. Further benefits include better coordination and processing of information, reduction in carrying costs, and decrease in process cycle time (Davenport, 2000; Elarbi, 2001; Chung et al., 2008).

Table 1.0: Benefits of implementing ERP systems in the construction industry

Benefits of implementing ERP systems in construction firms	\bar{x}	σX	R
Informed decision making	4.42	0.706	1
Effective information management	4.42	0.697	1
Effective project coordination	4.36	0.651	2
Elimination of unnecessary processes	4.36	0.651	2
Elimination of idling resources	4.34	0.628	3
Improved project administration	4.34	0.636	3
Improved information sharing	4.30	0.616	4
Better project planning	4.22	0.704	5
Efficient material and plant coordination	4.20	0.688	6
Optimised utilisation of production resources	4.19	0.682	7
Effective subcontractor coordination	4.19	0.702	7
Reduction of project duration	4.16	0.720	8
Reduction in order errors	4.14	0.760	9
Improved transparency of management responsibilities	4.10	0.733	10
Improved project control	4.09	0.727	11
Better project control	4.09	0.732	11
Reduction in reworks	4.07	0.725	12
Reduction in order cycle-time	4.07	0.738	12
Maximised project profitability	4.03	0.832	13
Proactive material supply	4.01	0.821	14
Effective project progress monitoring	3.99	0.814	15
Improved quality of work	3.95	0.820	16
Improved client satisfaction	3.93	0.830	17
Reduction in dispute/ conflict	3.90	0.830	18

\bar{x} = Mean item score; σX = Standard deviation; R = Rank

Conclusion

On the basis of the reviewed literature and the empirical findings (questionnaire survey), it can be concluded that South Africa construction professional perceived the benefits of ERP to the construction industry as informed decision making, effective information management, effective project coordination, elimination of unnecessary processes, elimination of idling resources and improved project administration as the benefits of ERP implementation in the South Africa construction industry. The findings shows that ERP systems could benefit their organizations by providing better integration of working environment, more automation and more flexibility in operations and information access. The implementation of an ERP system is oftentimes an investment move which is categorised as strategic in nature; therefore the perception of benefits which can potentially be gained through the implementation of ERP systems can be very influential in terms of an organisation's commitment to the idea of adopting the system. The findings indicate that construction professionals in the Gauteng province expect informed decision making, effective information management, effective project coordination, elimination of idling resources and unnecessary processes to be among the top benefits to be gained from the implementation of an ERP system solution. This implies that, with the prospective end-user being of the view that ERP systems possess the ability to facilitate the gaining of various influential benefits; the perceive usefulness of the system by end-user can result in rapid improvement in terms of efficiency within the organisation as perceived usefulness will results in the actual usage of the ERP system. The findings imply that the actual usage of the ERP system will result in more informed decision making, effective information management, and so forth, due to the perceived usefulness and the intentions of use of the prospective end-user. Hence, it is recommended that the implementation of ERP systems in the construction industry should be encouraged in order to solve current problems that are currently inherent in the South Africa construction industry.

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