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E-procurement Practices in the U.S. Construction Industry

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E-procurement has been a part of several industries for more than three decades now. Although the construction industry is commendable for its wonders, there are few studies about the current applications of E-procurement in construction. The main objective of this research is to survey the construction companies to collect the current practices of E-procurement in construction. A survey was developed and distributed to the construction industry in the U.S., and 409 responses were obtained. The researchers used the survey responses to document the current practices of the companies that use E-procurement. It is expected that documenting the current practices of E-procurement in construction could help enhance construction companies' use of E-procurement successfully to improve their business. Further, the companies that already use E-procurement may optimize their practices. E-procurement can positively impact the construction industry by saving time, money and resolving disputes with suppliers.

Key Words: E-procurement, Construction Technology, Supply Chain

Introduction

Due to the rapid competition between companies in the modern world, industries are adopting advanced and robust tools and technologies to enhance their efficacy to meet customers' versatile demands, which can also reduce cost (Fernandes et al., 2015). A successful procurement and supply chain model is deemed to be vital to the profitability of any business. Procurement is important to every kind of business, for example, manufacturing, retails, and services. One such case is the advent of E-procurement in the supply chain model, which has left indelible effects on the construction industry in modern times. E-procurement can be defined as the buying and selling of goods over the internet (Cherian et al., 2020). It is a digitized system that can support the sourcing of suppliers (requesting quotation) and managing the inventory in real-time. It is an evolutionary method of procurement rather than the conventional method of paper-based procurement, which is error-prone (Oh et al., 2014). The

use of E-procurement has brought simplicity, transparency, and efficiency to the overall supply chain management model. E-procurement adoption in the construction industry is not as broad. There has been minimal research into the current practices of E-procurement in construction. As a result, the purpose of this study is to address a knowledge gap by looking into the factors that influence the application of E-procurement using data from a questionnaire survey of 409 construction companies in the U.S.

Literature review

E-procurement in General

Many researchers investigate E-procurement applications in different industries. Makali (2015) described the implementation of internet procurement and its capabilities to increase performance in the retail market. This study was based on collecting data from the retail supermarkets to find how they achieved a competitive advantage using E-procurement. By creating a questionnaire, the author decided to target 40 supermarkets to measure the situation and concluded that the acceptance rate of E-procurement in Kenya is as low as 56%. According to Samoei and Ndede (2018), the main problem faced by the Ministry of Education, Science, and Technology in Kenya was poor information and communication technology integration, among others. The objective of E-procurement was to notice the improvements and effects in e-tendering, e-sourcing, e-ordering, and e-information within the ministry. The research findings showed that E-procurement has a significant effect on financial performance, and it helped the ministry connect efficiently with their stakeholders and previous buyers and all the purchases at one platform. Chirchir (2018) effectively investigated the effects of E-procurement on the supply chain and its benefit in Kenya. With the help of purposive and proportional sampling, he targeted the population of 4200 respondents from 12 different firms. The data was collected through different mediums like questionnaires and interviews through various levels of management. The overall outcome on the buying performance by adopting E-procurement was increased by 0.4. Therefore, he advised firms to adopt E-procurement and modify the supply chain for increased productivity and performance.

Baladhandayutham and Venkatesh (2012) focused on the factors that affect the effective implementation of E-procurement. The research results revealed that factors like workers' competency, management participation, and dedication had a positive impact on the E-procurement, but on the other hand, factors like cost had a negative impact. They concluded that retail markets should focus on their employees' performance and cost management to notice an increased positive rate in their profits and performance. Wankwe (2017) used a descriptive design to collect data. Methods like mean, median, mode, and percentages were used, which gave the effective performance relationship ratio between suppliers and management. The results reflected that between capacity and propensity to adopt, the researcher saw a strong positive relationship. Moreover, the author mentioned that there could be instances where the relationship could be affected due to supplier propensity and attitude to adopt E-procurement or not. Mwangi and Kagiri (2016) used a descriptive research method to collect random samples from the group of 112 members from various levels in the Sarova chain of hotels. Data was collected through questionnaires and analyzed with the help of SPSS (Statistical Package for the Social Sciences). The multivariate regression method was used to analyze each variable's importance, which concluded that the right quantities are present on shelves using e-tendering and e-sourcing. The study recommends using E-procurement to reduce cost and increase flexibility for the business in the hospitality sector.

Awadallah and Saad (2018) further researched the adoption of E-procurement in the hospitality sector. The research instrument for gathering primary data was a self-administered questionnaire with purchasing managers. Fifteen surveys were delivered to the fifteen hotels under investigation; 15 of the surveys were legitimate for analysis (100%); nevertheless, ten of the hotels undertook an E-procurement process. The researchers concluded that the advantages of E-procurement deployment include improved quality of goods and services, increased customer satisfaction, and time and cost savings for hotels. Aikins et al. (2014) also investigated the E-procurement practices and their benefits towards the better performance for the hotel sector in Kumasi. The research data was collected using questionnaires and was analyzed using SPSS software. Examining, categorizing, and tabulating the evidence to answer the study's objectives is what data analysis entails. The researchers concluded that a significant reduction in the cost of processing an order, shorter lead times, and faster delivery of products and services are just a few of the benefits of E-procurement in the hospitality sector. Hassan et al. (2014) examined E-procurement applications in the Information Technology (I.T.) sector in New Zealand. The researchers collected data from 151 senior managers in different I.T. companies. Their conclusions show that all the E-procurement features are in use, particularly those that rely on widely available technologies. Complex E-procurement systems, such as e-auctions, are, nonetheless rare.

Chang and Wong (2010) talked about speeding the acceptance of E-procurement and involvement in e-marketplaces. A two-stage investigation was used, which included both a qualitative and quantitative method. Following the distribution of a research questionnaire, data assessment and testing were performed. The results showed that firms that embraced E-procurement were more likely to participate in the e-marketplace, which improved the overall firm's performance. Bhadaoria and Karande (2020) did a study among big-scale enterprises in India. The investigation used a descriptive technique to determine the practices that influence the performance of E-procurement programs. A total of 38 responders were chosen from a list of 233 significant manufacturing companies. The information was gathered via distributing a questionnaire to the responders. Using SPSS (Statistical Package for the Social Sciences), the data was thoroughly examined and presented in tables. The study concluded that most of the large-scale manufacturers in India have welcomed E-procurement with various practices of e-procurement such as online advertising of tenders, online shortlisting of vendors, online tenders' submission among other items.

Nzuve (2013) used a semi-structured questionnaire to collect primary data from the health sector about E-procurement. Frequencies, mean, standard deviation, factor analysis, and multivariate linear regression were used as the primary analysis methods in SPSS. It was suggested that private hospitals look for ways to improve collaboration within the health sector and with medical suppliers to speed up the adoption of E-procurement. Pasiopoulos et al. (2013) did a cross-sectional study to determine how health providers felt about implementing E-procurement procedures in Greek public hospitals. The providers' attitudes were investigated using the Technology Acceptance Model (TAM). Two hundred eighty-three selected administrative workers of procurement units and head/deputy physicians from all Greek public hospitals participated in the study. 94.7% of the employees and physicians both thought E-procurement was helpful, according to the findings. Tai et al. (2010) conducted a questionnaire survey of 137 Taiwanese enterprises that have all engaged in E-procurement programs. The study proposed a supply chain orientation-based Web-based E-procurement impact model. The findings show that computerized execution of purchase processes enhances both operational efficiency and strategic effectiveness. Gupta and Narain (2012) conducted a survey to determine the current state of E-procurement and its adoption in India. The information was gathered from 36 big Indian organizations. According to the survey's findings, Indian companies are utilizing E-procurement to boost production flexibility and cost savings, improve customer happiness, improve delivery, improve inventory management, and offer a wider selection of products.

E-procurement in Construction

Ibem et al. (2016) researched the factors that influence E-procurement adoption using data from a questionnaire survey of 213 businesses in the construction industry in Nigeria. The data were analyzed using descriptive statistics, factor, and categorical regression analysis. The findings reveal that improving project delivery efficiency, eliminating geographic barriers, and better communication among project team members were the main barriers to E-procurement adoption. Tutu et al. (2019) assessed the important criteria for E-procurement implementation in Ghana. A poll of 60 procurement specialists was surveyed, and the mean score ranking test was then used to evaluate which criteria were important in E-procurement deployment. The findings demonstrated that internet availability, power stability, procurement officer capacity enhancement, and infrastructure availability were all essential critical variables in the deployment of E-procurement. Nawi et al. (2017) conducted a survey of 120 Malaysian construction enterprises, all of which have progressed beyond the fundamental phases of E-procurement. According to the findings, the usefulness of E-procurement is often restricted to operational and tactical gains. These empirical data provide helpful suggestions for construction companies looking to begin their E-procurement journey.

A systematic questionnaire was created by Cherian et al. (2020) to investigate the elements that influence material E-procurement in the cement sector. The researchers collect data from 126 employees of five cement businesses. The researchers used descriptive research and factor analysis to determine the most important factors in E-procurement. Aguiar et al. (2015) used Building Information Modeling (BIM) as a novel approach to help construction companies apply E-procurement. This paper presents an innovative approach to E-procurement in construction, which uses building information models (BIM) to support the construction procurement process. The result is an integrated and electronic instrument connected to a rich knowledge base capable of advanced operations and able to strengthen transaction relationships and collaboration throughout the supply chain. Vasudevan et al. (2021) studied the adoption, implementation barriers, and implementation strategy for BIM and E-procurement systems in the Malaysian construction industry. The responses of 100 people were analyzed, and the information was discussed and tabulated. The findings reveal that most respondents are aware of BIM and E-procurement systems and their benefits and challenges in Malaysia. The study concluded that both BIM and E-procurement are still in the early stages of application in the Malaysian building industry. Only a little research has been found on the E-procurement application in construction. This paper aims to bridge this gap by looking into the current practices of E-procurement in the U.S. construction industry. The following section will discuss the survey process and results.

Current Practices Survey

The survey targeted people from various age groups, different experiences, and different job titles. Survey Monkey has been used to generate and distribute the survey. The first set of questions was demographic (4 questions). The second set of questions was technical and targeted current practices used in the construction industry (11 questions). The survey was distributed to the construction industry in the U.S., and 409 responses were collected. The survey results are shared below.

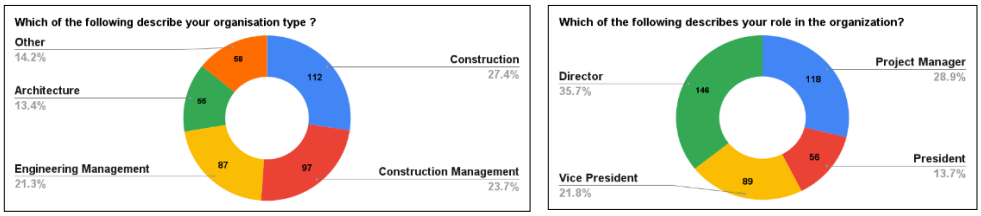

Figure 1.A (left) & 1.B (right). Respondents' organization types and organizational role

Figure 1.A illustrates responders from different companies answered the survey questions. Responders from construction companies represent 51.1% of the respondents' population, followed by 21.3% from engineering companies. Figure 1.B shows that the organization's Director represents 35.7% of the respondents, while 28.9% have a project manager role.

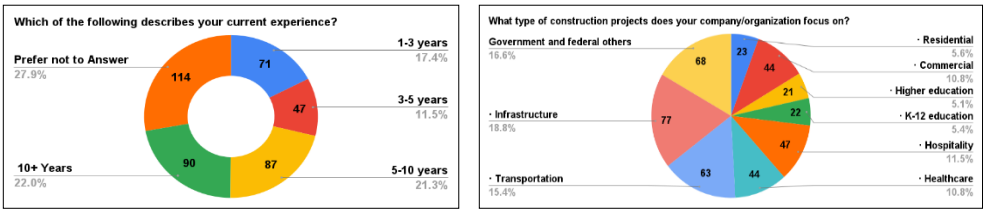

Figure 2.A (Left) & 2.B (right). Respondents' experience and construction project types

Figure 2.A shows that 22% of the respondents have 10+ years of experience, followed by 21.3% who have 5-10 years of experience. Figure 2.B shows that 18.8% of the participants work in heavy infrastructure construction companies, followed by 16.6% who work for the government.

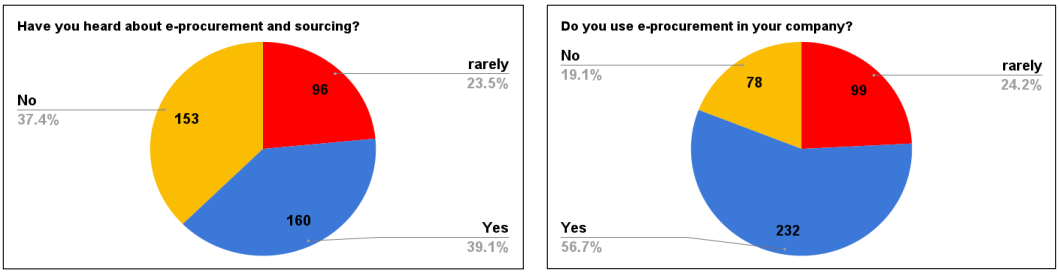

Figure 3.A (left) & 3.B (right). Respondents' familiarity of E-Procurement

Figure 3.A depicts that 39.1% of the respondents have heard about E-procurement, although some of them responded negatively while others preferred not to say about it. Figure 3.B illustrates that 56.7% of the respondents already use E-procurement, however, some of the companies still use the traditional method of procurement.

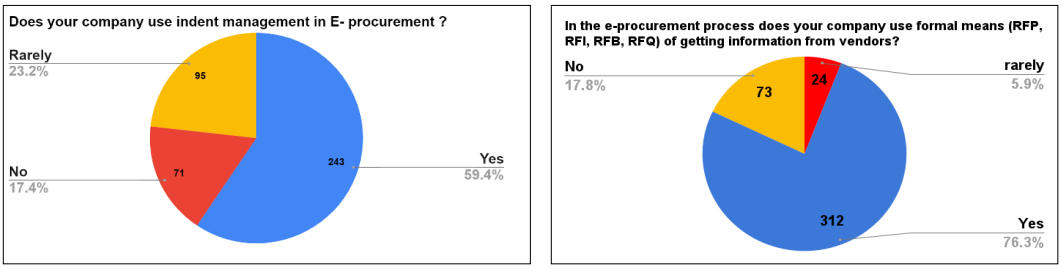

Figure 4.A (left) & 4.B (right). Respondents' familiarity with indent management and formal means of E-procurement

Figure 4.A shows that 59.4% of companies use indent management in E-procurement, only 17.4% percent of responders answered that they don't use indent management. Figure 4.B shows that 76.3% of the companies use E-procurement formal means (i.e., RFP, RFI, RFB, RFQ).

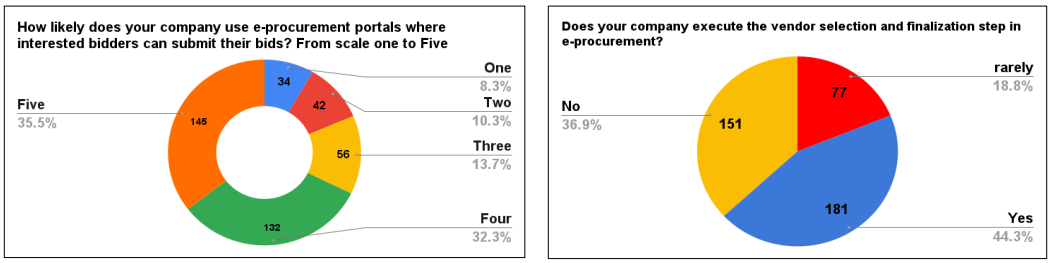

Figure 5.A (left) & 5.B (right). The likelihood of using portals and vendor selection using E-procurement.

Figure 5.A illustrates that 32.3% of the responders state that their companies are likely to use portal platforms for E-procurement, while 35.5% say that their companies are very likely to use the portals. Figure 5.B shows that 44.3% of the companies use E-procurement to finalize vendor selection. However, some of the companies still use a traditional methodology of selecting a vendor.

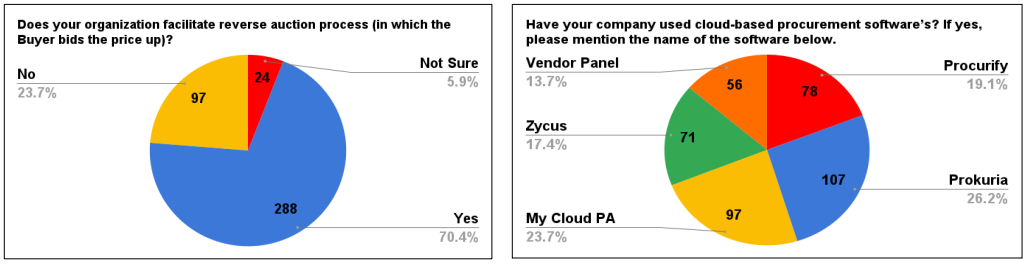

Figure 6.A (left) & 6.B (right). The likelihood of using reverse auction and cloud-based E-procurement.

Figure 6.A depicts that about 70.4% of the companies are involved in the reverse auction process while 23.7% don't use a reverse auction. Figure 6.B shows that 100% of the respondents use cloud-based E-procurement tools and the most common tools are Prokuria, My Cloud PA, and Procurify.

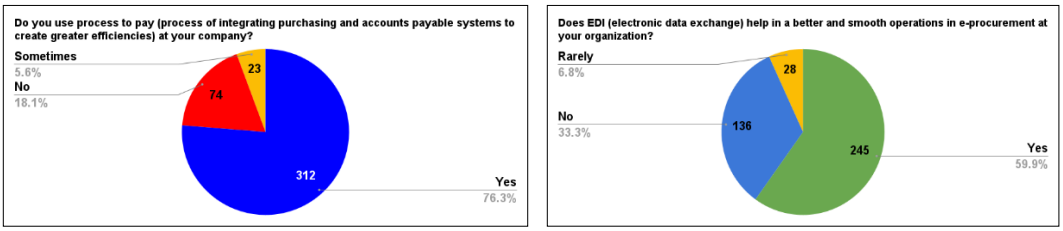

Figure 7.A (left) & 7.B (right). The integration of E-procurement with Account Payable/Purchasing for Electronic Data Exchange

Figure 7.A illustrates that 76.3% of the companies that use E-procurement integrated their E-procurement system with their Account Payable/Purchasing systems. Figure 7.B shows for the majority of companies, Electronic Data Exchange (EDI) has been helpful when it comes to operations in E-procurement.

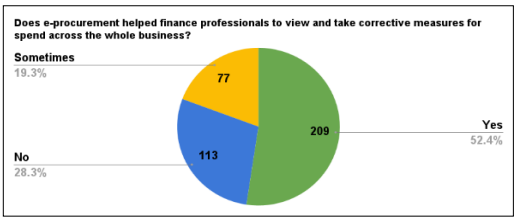

Figure 8. utilization of E-procurement for cost controls

Figure 8 shows that 52.4% of the participants stated that E-procurement had been used effectively to help finance professionals take corrective actions to control spending in the organizations.

Conclusion

This study has provided construction companies with an in-depth analysis of the current practices in E-procurement. The study results carry more weight because the responses given by the people have first-hand experience, and many fall in the role of top management in construction, such as Project Managers, Directors, and Vice Presidents. Further, most of the responders have more than ten years of experience in the construction industry. E-procurement is a relatively novel platform for doing business, and its usage has been increased over time. E-procurement is more than just a system for making purchases online. The system has been implemented to achieve significant benefits such as product delivery, getting different business requests for proposals, and quotations from vendors. Similarly, many companies found indent management useful, implying that they can order, track, and monitor their resources in real-time. Survey responses show that most companies have adopted E-procurement for their selection of vendors. Also, from the survey, it can be inferred that many companies allow reverse auctions in their supply chain model to save costs and ensure greater transparency. Also, responders stated that E-procurement helped them control cost and has enabled finance professionals to do the financial transactions with greater transparency. One of the reasons the use of E-procurement has been increased is because of its easiness and flexibility. Not only is it ideal for large corporations, but small and medium enterprises can also easily adapt to E-procurement. In a nutshell, the study shows that the use of E-procurement in construction is indispensable, and its scope will be widened with the passage of time.

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