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# LEAN PROJECT MANAGEMENT AND PERFORMANCE OF BUILDING CONSTRUCTION FIRMS IN NAIROBI CITY COUNTY, KENYA

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***ABSTRACT***

*This researcher sought to find out the inefficiencies that could be the cause of underperformance in order to fill the gap through applications of more efficient and cost effective methods. The researcher therefore sought to analyse the experiences of construction companies in terms of the problems of wastes, high costs, bottlenecks, inventory control and how performance has been impacted. The research was done in Nairobi City County because many of the construction operation were conducted in Nairobi. The finding showed a low application of methods in the construction process. The respondent indicted no policy known to the employees of the company that connected to the waste minimization programs. The researcher also noted that most of the firms did not visualise their process, so as to identify non-value adding processes in the stream or remove the bottlenecks within the construction stream. The few big companies that were in category 1-3 had value stream maps but the mapping of most of these companies lacked the input of the experts. Most companies however, indicated to have specific methods to regulate inventory, however the methods were not good enough to help in inventory related costs like stock out costs. Most of the firms had quality management methods of ensuring a continuous improvement in the firm. This was a good indicator that training and development for most of these firms was key to solving emerging issues within the construction industry. The researcher concluded that the major costs that the respondents indicated was as a result of non-application of better operational management methods in the building construction. The researcher therefore recommended the application of the lean project management to improve the performance.*

***Keywords:*** *Waste Minimization Programs, Value Stream Mapping, Building Construction*

## INTRODUCTION

A project is defined as a temporary group of activities meant to result to a unique product or service whereas project management is seen as the proper application of knowledge, skills as well as tools and techniques to project activities to meet the objectives of the project according to Project Management Institute of 2013. Performance in project is considered a success when it meets a certain measures and standards. These measures are generally acceptable and include; timely completion of the project, the project is completed within the budget, within the intended scope as well as satisfactorily meeting all the concerned stakeholders' needs in the project (Seddon, 2008).

It is until the 1950s that firms started application of systematic tools and techniques to the complex projects. Noteworthy projects such as the Manhattan project have greatly made a contribution in the advancement of practices into the modern project management. Very ambitious and historical projects such as the landing on the moon by man in 1960s further contributed to formation of tools to manage large scoped projects. In 1970s there was a great advancement in technology that made it possible to manufacture software for project management. This subsequently led to the start of use of computers for project management by smaller companies. In the years of 1990s, very notable tools for project management such as Project in Controlled Environment (PRINCE) and critical Chain Project Management (CCP) started. Later in the third millennium, it dawned the beginning of degrees offered by institutions for project management. Project management tools and techniques are in wide application in today's project management (Seymouret el., 2014).

A project is considered a success when it meets a certain performance measures and standards. These measures are generally acceptable and include; timely completion of the project, the project is completed within the budget, within the intended scope as well as satisfactorily meeting all the concerned stakeholder's needs in the project (Seddon, 2008). Despite the rich knowledge that has been acquired over the years in project management, the pattern in history shows underperformance (Thompson, 2012). Cost overrun and delays are evident in most of the projects according to (Ambituuni, 2011). Unfortunately, these challenges are more of rule as opposed to exception in areas of; construction, power generation, aerospace, product development and many other areas (Sterman, 2012).

Lean management is a philosophy that finds its root of derivation from the Japanese manufacturing industry, specifically, the Toyota Production System (TPS) ( Holweg, 2007).

The (TPS) system was originally presented by Japan after the 2nd world war when the country required manufacturing small batches of car away from the practice by Ford that for long applied the principle of same car with large production called the mass production. Toyota came to a conclusion that the principle of mass production lacked efficiency and desired effectiveness. This was especially at the time the sales collapse encounter that necessitated the laying off of some of their workers, therefore coming up with a new idea of TPS called Lean production. (Altekar, 2012).

TPS was introduced by the Toyota Company to; improve efficiency in production, produce high quality products, attain maximum value at minimal cost possible. The Lean approach is considered the newest method in project management in the various industries, construction being among of them. The approach is proven to be efficient especially on complex projects that are characterized with uncertainties. There exist quite a number of differences between the two approaches of lean construction and traditional construction.

These are some of these differences discussed in the literature (Sicat, 2012). The function of control in lean management is ensuring a reliable kind of workflow as opposed to traditional method which takes corrective measures to mitigate the aftermath variances. In summary lean is proactive in nature as opposed to the reactive nature of traditional construction management. The major aim of lean approach is the maximization of value by a continuous and deliberate improving of the whole process whereas in the traditional approach, the optimization is geared towards each activity independently. Lean is actually a pull-driven type of approach whereas for the traditional method it is a push-driven type of approach. Minimizing of variations at early stages is critical to lean thinking while in the traditional approach the variation is not considered.

Globally, infrastructure is an international business and this is evidenced by the kind of road construction activities as a primary infrastructural development in the developing countries and indeed all over the world. According to Mike et al., (2011) by the year 2020 construction will significantly account for about 13.2% of world GDP indicating an upward trend. There is evidence of infrastructural provisions in form of commercial and residential structures, road network construction and other forms of infrastructures like the railway networks. The industry also key to job creation as an economic development. The industry also accounts for at least 5% of Kenya's GDP and provides employment to millions of people especially the vibrant youth. This is a representation of annual wage bill of Ksh 3.2 billion according to the findings of the first quarter of KNBS of 2011.

There has been a positive trend in growth of construction activities in Kenya. The country continues to experience a fast and robust growth in construction sector and this remains a central component of Kenya's visionary short and indeed long-term growth and development plan. In 2014 the industries contributed a total of Ksh 259.6 billion up by 13% of the previous year 2013. This led to the industry being named as the best-performing industry for that year. This was attributed to the injections of funds for construction of major roads that are critical to Kenya's economy development, rehabilitation of some roads and railway constructions. Banks increased credit services to construction firms from 70.8 billion in 2013 to 80.4 billion in 2014 representing a 13.6%growth.

**Statement of the problem**

Performance of building construction sector is very critical to the economy of any country especially to a developing nation like Kenya. According to KNBS report of 2011 it counts for 5% of the country's GDP and employs youths with an annual wage bill of ksh.3.2 billion. Therefore, the sector's performance is of interest to various stakeholders. The key indicators for evaluation are critical in establishing the level of project performance (Wang and Huang, 2006). Good performance is achieved on time, within budget, within the scope, free from defects, efficiently, safely and profitable to the firm. This is the core purpose of Key performance indicators (KPIs). Despite the rich knowledge that has been acquired over the years in project management, the pattern in history shows project underperformance Thompson, (2012). According to the Lean Construction Institute report of 2014 about 57% of productive time waste emanates from the construction industries. These wastes have been linked to the inadequate application of project management tools in solving the challenges this industry faces. As a result, the industry is characterized by delays and often has suffered cost and time overruns (Sorooshian, 2014).

Gamal Swefie, (2013) discovered in his finding that there was a significant improvement in the total duration of the process after applying the proposed

lean construction framework on a case study. Musa, (2012) undertook a study to find out the effects of total quality management (TQM) on performance construction firms in Kenya a case study of Inter build Company Limited. His findings revealed that project management and resource management have a direct effect to the performance of the building company. Local studies have not focused on solving the challenges that the construction industry is facing. The researcher was motivated to fill knowledge gap on how lean project management tools can influence the performance of construction firms in Nairobi City County.

**Research Objectives**

The general objective of the study was to find out influence of lean project management to the performance of building construction firms in Nairobi City County, Kenya. The specific objectives were:-

- To determine the level of waste minimization programs applications and its influence on the performance of building construction firms in Nairobi City County, Kenya.
- To establish the role of value stream mapping in construction processes and its value on the performance of building construction firms in Nairobi City County, Kenya.

**LITERATURE REVIEW**

**Theoretical Review**

**Theory of Constraints**

The theory was first developed Elihayu Goldratt in 1984. This presents a methodology that identifies the most important limiting factor (i.e. constraint). The constraint has the characteristics that are impediment to achieving goals of the organisation. This theory takes the process of systematically improving that constraint to the extent that it's no longer a limiting factor. In manufacturing, the constraint is usually referred to as a bottleneck (Hyerle, 2009). The Theory of Constraints involves a scientific ways of approach that aims at improvement. It hypothesizes that all complex processes or systems, consists of several interlinked activities, one of which is constraint upon the entire system usually referred to as the weakest chain link (Demircioglu et.al., 2010). The theory is based on the following steps; First the Five Focusing Steps (a methodology for identifying and eliminating constraints), second, the thinking Processes (tools for analyzing and resolving problems), and third throughput Accounting (a method for measuring performance and guiding management decisions). This theory was useful to this study in that it inherently prioritizes improvement activities. The construction constraints in this study are wastes, non-value adding activities in construction and cost overruns. The activities suggested by the lean principles and technique principles are aimed to remove these constraints so as to improve the performance in terms of; cost minimization, timely completion of projects, high quality projects, high profitability performance, health and safety and working within budget by the building construction firms in Nairobi City County.

**Theory of project**

Founded by Turner in 1993.The theory states that project management comprise of work management through decomposing activities into smaller tasks. The tasks are independent, and they comprise of the unit of analysis for project management processes, as for instance scope, time and cost management. In addition, the dependency relation between tasks is simple and sequential and to assure that activities meet schedule and budget objectives, the management and control is centralized. In this theory, the uncertainty of the tasks and requirements is considered low (Koskela and Howell, 2013). In this model, a project is

considered as the transformation of inputs into outputs and it is managed through different principles, which indicate that the total transformation of a project can be decomposed into sub transformation or smaller transformations, tasks. At the same time, these principles suggest that optimizing each task separately can optimize project results. Therefore, improving tasks can enhance project performance (Howell et al. 2013). According Koskella et al. (2013) they lay down the scope to which the theory of project tends to work on. They define this scope as follows: One, an adequate or sufficient amount of work is done two, unnecessary work is not done, and three achieves the set goals/objectives. This theory of project will be helpful in unit analysis of the independent application of lean management to the construction industry and the performance therein. The scope that is at the center of project theory as stated by Howell and Koskella, (2013) formed part of the objectives in measuring the influence of lean management to the performance of the construction firms.

**Empirical Review**

**Project performance**

Project management performance is considered a success when it meets certain performance measures and standards. These measures are generally acceptable and include; project completion within budget, within the intended scope as well as satisfactorily meeting all the concerned stakeholder's needs in the project. The reworks absence has too been qualified as project success (Ambituuni, 2012). According to Seymour and Hussein (2014) Project Management practices have existed as long as man has existed in the face of the earth, before the existence of any institute for project management or updated knowledge books and guides on how to manage projects, or before even the of Gantt charts existence. The past offers numerous of colossal projects that were successfully completed as examples. These include; The Pyramids of Giza, Great Wall of China, and Coliseum. There is evidence in history of very many challenging and successful projects that were completed despite the complexities and uncertainties that could have led to the projects' failure. Unfortunately, despite these numerous and monumental achieved projects, there is little documentation of the methods and techniques applied (Nahmens, 2009). Most of the literatures suggest that, project management processes are geared towards delivery of successful projects (Zulu, 2007). For instance, the Construction Industry Council of 2007 explained the aim of construction project management as a deliberate effort that aims to bring a significant value to the process of delivering a successful project through the prudent use of management principles suited for projects.

**Wastes in construction and project performance**

Over the years researchers have tried to find an all-inclusive and suitable definition for Wastes. On the process, different ways and classes of wastes have been presented and recognized. According to Senaratne and Wijesiri, (2008) delays, excess materials, defects and rework are some of those wastes more often mentioned by researchers. Hosseini, Nikakhtar, Wong, and Zavichi (2012) recommended considering a wider and broader definition of waste to include not only material waste, but also waste resulting in construction projects such as, transportation times, setup time and waiting times. This is a revelation that there are non-physical wastes within construction process, which is the basis of waste concept adopted by lean construction approach and by this research as well. There has been failure in trying to have a systematic attempt to identify waste in construction processes by project managers (flow wastes in lean thinking terms) up until the introduction of lean construction concept (Hosseini et al., 2012).

Construction industry struggles with major problems that are mostly practical in nature which essentially need a better understanding to be solved. This has consequently been characterized with delays in construction projects and often suffered cost and time overrun. According to Alsehaimi and Koskela, (2008) poor project management informed the common dominant reason for major delays in construction projects. Alsehaimi and Koskela, (2008) concluded that the problems particularly, in project management must be understood and efforts developed towards finding a lasting solution and a more effective operational method in construction.

**Construction Value flow and Project Performance**

Lean methods provide various tools that help identify different types of wastes in the process that are discussed here. The most outspoken and vast applied tool is the Value Stream Mapping (VSM), this technique creates a process flow map/diagram that indicates how materials and information flow in the area of application. According to Sacks and Partouche, (2010) VSM approach covers all the activities that are involved in the system flow to ensure that only those that are of value goes through the system. The non-value adding processes are excluded as a way of removing wastes. All the ineffectiveness in the system are identified and dealt with in creating a more effective map whose activities add value to the process. Yu and Tweed (2009) on a case study done on a standard wood platform-frame structure identified that a case of 400 constructions repetitive works. VSM approach is done in different Process steps. These steps depict each of the process steps in terms of value adding or non-value adding. They reveals process statistics, that include the following; number of operators, number of cycle time and quantity of inventory. VSM looks at the storage, quantity as well as the movement of inventory in the process. Information flow: VSM looks in length at the information that is required in the process, these includes schedules and specifications (Sayer and Williams, 2007).

Garrett and Lee (2011), in applying lean strategies of VSM analyze the submission and review concluded that incomplete documentation were a major problem during the process of construction. In their application, lean tools reduced non-value adding activates. A significant achievement in terms of reduction of the whole process as well as lead time was achieved. Lapinski and Horman, (2006) expressed Toyota's successful application of VSM to minimize costs and improving construction. Yu and Tweed, (2009) in another study discovered that poorly managed process flow was the cause of a significant wastage in the construction. After this realization, they then applied VSM in order to restructure the flow process and as a result realized a significant reduction of waste. However, in this finding the research demonstrated the ability of VSM in outlining the process flow as well as identifying the wastes; it fails to analyze the environmental impact in trying to improve the construction process prior to the construction itself.

**Conceptual framework**

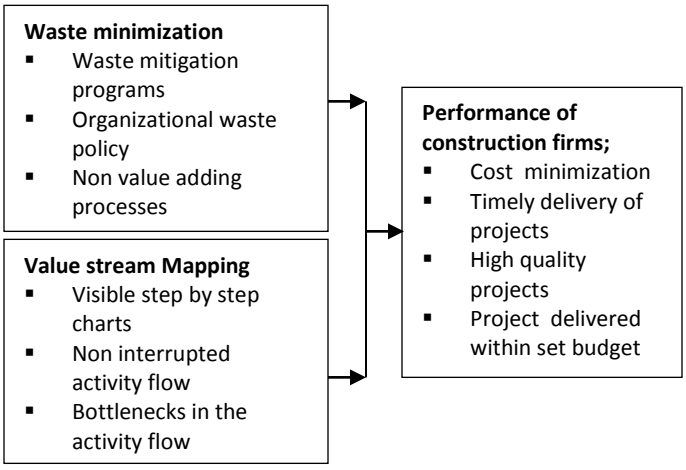


**Figure 1: Conceptual Framework**

Source: Own Survey, (2017)

## METHODOLOGY

The researcher adopted a descriptive research design. This is because the design is suitable in describing the state of affairs and facts as they are, (Mugenda and Mugenda, 2003). The target population for this study consisted of the registered construction companies under class of building works. Data collection was done using questionnaires. The results of the questionnaires was quantified by the researcher using the SPSS software package since the responses from the questionnaire are highly structured and easily coded as opposed to the use of an interview schedule.

## FINDINGS AND DISCUSSIONS

### Waste minimization and performance

The research first sought to identify if wastes was a major challenge in the firms and that it had major operational costs in building construction.

**Table 1: Descriptive Statistics on wastes**

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Waste is a major challenge in construction | 165 | 4.72 | .453 |
| Major operational Cost occurrence is from wastes | 165 | 4.24 | .664 |
| Available policy statement on waste minimization | 165 | 1.64 | .789 |
| Statement known to all employees | 165 | 1.72 | .770 |
| The firm has put in place proper waste mitigation programs | 165 | 2.02 | .873 |
| Valid N (listwise) | 165 | | |

**Source: survey data, (2017)**

The researcher sought to determine if the management of the building construction firms, in their policy statement, had statement that was related to mitigation of wastes and if the statement was well known to the employees of the firms. Further the researcher sought to know if the policy was translated into programs of waste mitigation. The data showed that the firm's management had not taken deliberate steps to have policies in place to minimize wastes in the construction process. A Mean of 1.6 was obtained, showing that the firms disagreed that there was any of statement on waste policy with a standard deviation of 0.79. Further the project managers indicated that they disagreed that any policy statement on wastes were known to the employees of the firm at a mean of 1.72 and standard deviation of 0.77 Finally on any proper waste mitigation program, a mean of 2.02 was obtained showing that, no programs were in place to mitigate the waste occurrences in the construction process. In the research conducted by Aduk (2013), all the 22 contractors interviewed agreed that lean construction among other benefits highlighted could deliver product with minimum waste.

Finally the researcher sought an opinion on how else the respondent viewed waste minimization in relation to the influence it has to performance. The finding showed that majority of the respondent believed that waste minimization contributed to high profits followed by those who believed that it had an impact on the quality. Public image followed last from a distance. The finding showed that project managers were alive to the fact that lean project management applied in construction had a potential of bringing the anticipated high profits. This finding was similar to that of Chena, (2010) that the service industries as well as the manufacturing ones have increased their levels significantly in terms of production, profitability as well as quality by having waste mitigation programs in their firms.

**Value stream mapping and performance**

The researcher sought to identify the application of visual technique of value stream mapping by the building construction firms in the construction process. The researcher further sought to understand if the standards of the value stream were followed by charts being displayed at the construction site and finally if the person who drafted the maps was qualified. By use of Likert responses of 1-5 strength, the following were the findings in table 2.

**Table 2: Descriptive Statistics on Value Stream Mapping**

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Have value stream maps | 165 | 1.64 | .796 |
| Value Stream identifies non adding value activities | 165 | 4.36 | .663 |
| Value stream mapping reduce reworks and overruns | 165 | 4.10 | .751 |
| Standard charts clearly displayed and understood | 165 | 1.64 | .789 |
| Value stream maps influence performance | 165 | 4.18 | .637 |
| Value stream mapping is done by experts | 165 | 1.77 | .778 |
| Valid N (listwise) | 165 | | |

**Source: (survey data 2017)**

The responses indicated that most of the firms do not have the value stream maps that guide in the construction process. The mean for the Likert scale was 1.6 and 0.79 standard deviation showing a disagreement by the project managers on whether they had value stream maps. Consequently, the project managers indicated that there were no charts showing flow of construction displayed on site that guide in the construction process. Similar results were obtained from the data on who does value stream mapping, at a mean of 1.77 showing a disagreement that any value stream maps were done by experts. Sacks and Partouche, (2010) stated that VSM approach covers all the activities that were involved in the system flow to ensure that only those that were of value goes through the system. However, despite the lack of the value stream mapping practice in most of the firms, the project managers were optimistic that the practice had a positive contribution to performance. A mean of 4.1 of respondents agreed that the practice reduce reworks and overruns and hence the contribution to performance which stood at mean of 4.18. Lack of this could be the recipe for higher costs from wastes that firms indicated to suffer from. Yu and Tweed, (2009) in a study discovered that poorly managed process flow was the cause of a significant wastage in the construction by small and medium firms. After this realization, they then applied VSM in order to restructure the flow process and as a result realized a significant reduction of waste. Having a huge number of construction firms in Nairobi not following the standard streams in the construction process, is a recipe of poor performance. According to Sacks and Partouche, (2010) VSM approach covers all the activities that are involved in the system flow to ensure that only those that are of value goes through the system. The researcher further sought to seek opinion on what project managers felt was the impact of value stream mapping in terms of performance. The finding indicated that most of project managers felt that value stream mapping led to timely completion of projects followed by those who felt that it had a direct performance in terms of increment in profits.

**Performance**

The researcher sought to determine the opinion of the project managers on the state of project performance in relation the indicators of: to cost minimizations, timely delivery of project, quality

delivery of project and delivery within budget. The response was based on scale of 1-5 where 1 was very low and 5 very high. For the state of performance and Likert of 1 strongly disagree and 5 strongly agree for statements on indicators of performance. The findings were as follows in table 3.

**Table 3: Descriptive Statistics performance Indicators**

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Delivered construction projects at minimal cost | 165 | 1.70 | .844 |
| We have delivered projects on time | 165 | 2.14 | 1.131 |
| We have achieved Quality projects | 165 | 2.19 | 1.158 |
| we deliver projects within budget | 165 | 2.18 | 1.196 |
| State of performance in the firm | 165 | 1.78 | .564 |

**Source: survey data, (2017**)

The data showed that the firms were not satisfied with their performance, that their potential was not fully capitalized. This explained the earlier finding where firms indicated they experienced costs that related to operational inefficiencies, inventory costs and wastes. Most of the firms indicated that they had not delivered construction projects on minimal costs at a mean of 1.7.the performance in terms of quality was better at a mean of 2.19 and a wider standard deviation of 1.158, meaning that quite a number of big firms were better in terms of quality. However the mean was still at Likert scale of disagree. This was summarised but the last question on the state of performance where firms indicated low performance state at 1.78 and narrower standard deviation of 0.56. The findings agreed with a survey done in 2008 by IBM on change management projects, just 40% of projects met performance indicators of; budget, quality and set schedule. Standish Group, (2013) established that 43% of projects had challenges of finishing late, over budget with less than the required features. The finding also agrees with that of Thompson, (2012) that despite the rich knowledge that has been acquired over the years in project management, the pattern in history shows underperformance. Cost overrun and delays are evident in most of the projects according to (Ambituuni, 2011).

The researcher sought to get an opinion from the project manager on his advice to management in terms of adopting the lean technology. About 57.6% of the respondent suggested that lean technology should be applied in firms and 32.12% suggested that management needs to consider to have lean management in construction where as 10% could advice management to study more. Essentially, 90% of respondent were positive on lean technology and could wish its applicability be considered. This explained why Gamal Swefie, (2013) discovered in his finding that there was a significant improvement in the total duration of the process after applying the proposed lean construction framework on a case study. This necessitated the final question where the researcher tested the optimism of the respondent on their take on the future of lean. The finding showed that most respondents were optimistic that the future for lean was bright. This explains why Seymour et al., (2014) predicted from his findings that lean management awaited a lot in the future of project management.

## CONCLUSIONS AND RECOMMENDATIONS

On waste minimization programs and performance, the study showed clearly that waste was a major issue that affected the performance in the construction firms; firms however were prone to this challenge because most of them had in place no managerial policies to mitigate the wastes. No

operational methods for waste reduction were found in most firms that could bring efficiency and effectiveness in the construction processes. The fewer big companies had put in place few policies to mitigate the waste challenge. The firms that had indicated to have the waste mitigation programs had their performances better and with low costs of operations.

On value stream mapping and performance, value stream, a visualization technique, was dismally known to many of the firms contacted. This meant that the firms could incur overrun costs and rework costs due to the fact that unnecessary flows in construction were done when they ought to have not. Some bigger firms of NCA 1-3 had the method in place but it was incomplete in that most lacked experts to visualize the stream and make necessary changes that will make the construction process efficient and effective.

**Conclusions**

The findings showed a limited application of waste minimization method. The researcher concludes that the waste minimization programs are not well conversed to many of building construction firms in Nairobi city county. The management, which is at discretion to have these methods in the firms, have limited policy statements to have the employee understand the need of having waste minimization program in place. The researcher therefore conclude that there is need for the method of waste mitigation critical and that the costs that the firms experienced were as a result of non-application of waste minimization programs which in extension affected their performance.

The visualization of the construction process was not well managed by the firms. No experts were involved in overseeing some unnecessary construction process in most of the firms. These was the reason why as per the findings, most firms suffered overrun and reworks costs. The researcher therefore concluded that the firms need to have in place a visual mapping process in the construction process to identify unnecessary process that are repeated so as to minimize the costs therein, bring efficiency and effectiveness in the process.

**Recommendations**

The researcher's conclusions presented a strong need for the construction firms to begin having waste minimization programs in their internal trainings, seminars and workshops. These mitigation methods should form organisational statements and policies. The policies to be well known and applied by all the employees of the firm. For the smaller firms that may not be enjoying the economies of scale, a lot of training and working exchanges should be given priority. The management should take deliberate effort to have a competitive advantage so that the firms can begin having some of the methods applied.

The firms need to consider the flow streams of the construction process. This should be done by mapping the process and identifying processes that do not add value to the construction, or including the process that are critical but left out. This essentially should be done by experts or if the firms are not able to hire experts, then trainings to be in place for the employees of the firm to know how visual mapping is done. By having the stream maps, a lot of value will be added in the construction process that brings efficiency in the process and making it cost effective.

**Suggestions for further study**

Further research to be conducted outside the scope of Nairobi City County to consider the state of lean project management. It will be interesting to know the benefits in terms of profits the firms that have received by applying lean methods; therefore, a quantitative research for similar research is highly

suggested. From the research, the researcher found a rather wanting construction practices of small construction firms, their adoption rate was low, the researcher therefore suggest further study on small firms factors for non-adoption of lean techniques.

**REFERENCES**


Adenuga, O. A. (2013). *Factors Affecting Quality in the Delivery of Public Housing Projects in Lagos State*.International Journal of Engineering and Technology.Vol.3 No. 3 ISSN 2019-3444.

Alsehaimi, A., Koskela, L.(2008). *Critical evaluation of previous delay studies in construction,* Proceedings of the 8th International Postgraduate Conference, Prague.

Alsehaimi,A., Koskela.(2008*). What can be learned from studies on delay in construction*, Proceedings of the 16th IGLC Conference, Manchester, UK.

Ambituuni, A. (2011). *Causes of Project Delay and Cost Overrun, and approach.*Abardeen, U.K.Robert Gordon University.

Bertelsen, S.,Sacks, R. (2007). *Towards a New Understanding of the Construction Industry and the Nature of its Production*. IGLC 15, Lansing, Michigan

Bjornfot, A., Jongeling, R. (2007). *Application of Line-of-Balance and 4D CAD for Lean Planning. Construction Innovation* 7 (2), pp 200-211.Carlifornia: Sage.

Charagu, E. (2013). *Thesis on Collapsing Building Structures in Kenya*. Nairobi: JKUAT

Chena, J. C., Lib, Y., Shadyc, B. D. (2010*). From value stream mapping toward a lean/sigma continuous improvement process*: an industrial case study. International Journal of Production Research.Vol. 48, No. 4.

Creswell, J. W. (2013). *Qualitative, quantitative, and mixed methods approaches (4th ed.).* Carlifornia: Sage.

Demircioğlu E.N., Demircioğlu M. and Küçüksavaş N. (2010*). The Relationship of The Theory of Constraints with Other Accounting and Management Techniques*. Journal of Çukurova University, 14(1), 42-55.

Egberi, K.,(2011*). Competitive Iintelligence and Markrting Effectiveness of Corporate Business in Nigeria*. International journal of Economic Development research and investment, vol 2 No.2

El-Ghazali, Y., Lafebvre, E., &Lafebvre, L. A. (2011).*Enabled Materials Management in the Industrial Construction Supply Chain*. Proc. of the 5th International Conference on Communications and Information Technology, pp. 79-84.

Ergen, E. &Akinci, B. (2007).*An Overview of Approaches for Utilizing RFID in Construction Industry*.IEEE Xplore Digital Library.

G.O.K. (2011).*National Construction Authority Act 2011.*Nairobi: Government Press.

Garrett, D. and J. Lee (2011).*"Lean Construction Submittal Process." Quality Engineering*, Taylor & Francis 23(1): 84-93.

Garson,D (2008). D*ata imputation for missing values*.

Gwaya, A., Wanyona, G., &Masu, S. M. (2014, January). *The Need for a Change in the Practice*

Hosseini, S., Nikakhtar, A., Wong, K., and Zavichi, A. (2012)."*Implementing Lean Construction Theory into Construction Processes' Waste Management.*"International Conference on Sustainable Design and Construction.

Holweg, M 2007).*The geneology of lean production*. Journal of Operations Management,25(2), 420-437.

Howell,G., Koskella L., (2013).*The theory of project Managemen*t:Gramando Brazil.

Hyerle, (2009).*Visual tools for transforming information into knowledge*, 2nd edition., Corwin Press 2009, p.58

IBM., (2008). *Making Change Work.*New York: IBM Infrastructure Group. Middle East & North Africa, International Incorporated.

Kenya National Bureau of Statistics, (2011) *state of Construction in Kenya*. 1st quarter Report.

Kenya Urban RuralAuthoruty, (2013). 2nd quarter report.

Koskella,L.,(2007).*Lean production in construction.Lean construction*, 1-9.

Kothari, C., (2008). Research Methodology:Methods and Techniques, 3rd Edition , New Delhi,New Age International (P) Ltd.

Lapinski, A., M. Horman, (2006). *"Lean Processes for Sustainable Project Delivery*." *Journal of Construction Engineering and Management* 132(10): 1083-1091.

Lu, W., Huang, G. Q., & Li, H. (2011).*Scenarios for Applying RFID Technology in Construction Project Management. Journal of Automation in Construction,* 20, pp. 101-106.

Maxwell, J. A. (2012). *Qualitative Research Design: An interactive approach (3rd ed.).*
*Method is challenged*

Mike A.,Howell, G., & Ballard, G. (2011*). Implementing lean construction: reducing inflow variation.* Lean construction.Journal of Future State of Construction pp 200-203.

Minja, *(2009).Handbook of Human Performance Technology, San Francisco.*

Mogere, K.M.,Oloko, M.,&Okibo, W.,(2013).*Effects of Inventory Control System on Operational Performance of Tea Processing Firms*. The international Journal of Business and Management.Jomo Kenyatta University of Agriculture and Technology.ISSN 2321-8916

Molnar, M., Andersson, R., &Ekholm, A. (2007).*Benefits of ICT in the Construction Industry - Characterization of the Present Situation in House-Building Processes*.Proceedings of the W78 Conference, Maribor.

Mugenda, O. M. and Mugenda, A. G. (2013).*Research Methods: Quantitative*
*and Qualitative Approaches.* Nairobi: Acts Press.

Musa N.,(2012). *Effects of Total Quality Mangaement in Construction Companies in Keny*a. Case study:Inter build company Ltd

Nahmens, I. (2009). "*From lean to green construction: A natural extension*." Construction Research Congress :*Building a Sustainable Future*, ASCE, Reston, VA, 1058–1067.

Nasir, H. (2008). *A Model for Automated Construction Materials Tracking*. University of Waterloo: Master Thesis.

Navon, R. &Berkovich, O. (2006).*An Automated Model for Materials Management and Contro*l. Journal of Construction Management and Economics, 24, pp. 635-646.

Obeidat, M. S., Al-Aomar, R., & Pei, Z. J. (2014).*Lean Manufacturing Implementation in the Sewing Industry*. Journal of Enterprise Transformation, 4(2), 151-171.

Odek,S.(2013). *An assessment of applicability of lean construction in Kenya and its contribution to performance of construction projects in Kenya*: A perspective of contractors, research project submitted to Nairobi University, Kenya

Project Management Institute. (2013). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*. (5th Edition ed.). Newtiwb Square, Pennsylvania:

Rumane, A. R. (2011). *Quality management in construction projects*. New York: CRC Press, Taylor & Francis Group.

Sacks, R., &Partouche, R. (2010). Empire State Building Project: Archetype of "Mass Construction". Journal of construction Engineering and Management, 136(6), 702-710

Salem, O., Solomon. J..Genaidy, A. and Minkarah. I. (2006).*Lean construction: from theory to implementation*, *Journal of Management in Engineering*. Vol. 22 No. 4, pp. 168-75. 5 4

Sayer, N. and B. Williams (2007).*Lean For Dummies*. New Jersey, Wiley Publisher, Inc.

Seddon, J. (2008). *Systems Thinking in the Public Sector:* The Failure of the Reform regime and a manifesto for better way. Station Yard, United Kingdom: Triarchy Press

Senaratne, S., and Wijesiri, D. (2008). *Lean construction as a strategic option: testing its suitability and acceptability in Sri Lanka*. Lean Construction Journal, 34-48. Sloan School Students, 3rd Ed, Pearson Education Limited, England

Seymour, T., Hussein, S.,(2014). *The History Of Project Management*. International Journal of Management & Information Systems (IJMIS), p. 233-240.

Sicat,S. (2012).Lean construction Management. Available from htpp://www.fgould.com/lean approach/American Journal.

Sorooshian, S., (2014).*Assessment of environmental risk in construction project*.University of Malasia.Malasia.

Strenman J. D. (2012). *System dynamics modelling for project Management* .The Earth Institute of Colombia. (2012). *Thika Highway Improvement Project; The Social Community Component of Analysis.* Nairobi

The Standish Group.(2013). *Chaos Manifesto 2013; Think Big, Act Small.*The Standish Group

Thompson, J. L. (2012). *Why Are Projects Late? Everything, but the Project Management*.Journal of Construction Engineering and Management

Thyssen, Mikael H. (2010): *Facilitating Value Creation and Delivery in Construction.* PhD Thesis, DTU Management, Technical University of Denmark

Vandevoorde, S., &Vanhoucke, M. (2006).*A comparison of different project duration forecasting methods using earned value metrics*. International journal of project management, 24(4), 289-302

Walliman, N., (2011).*Your Research Project: a step-by-step guide for the first-time researcher.* SAGE Publications, London, Thousand Oaks, New Delhi

Wang, G., Huang, S. H., (2006). Product driven supply chain selection using intergrateddecission making. International Journal of production economics,pp 1-15.

Weil, D. (2005). *The contemporary industrial relations system in World Bank*, Infrastructure Assessment, Finance, Private Sector

Yu, H., T. Tweed, (2009). *Development of Lean Model for House Construction Using Value Stream Mapping*. Journal of Construction Engineering and Management 135(8): 782-790.

Zahir, E., Love, P.,& David, E. (2007). *Learning to reduce rework in projects: analysis of firm's organizational learning and quality practices, Project Management.* Journal 1 (September) (2007) 13–25.

Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2010). *Business research methods* (8th ed.).Mason, HO: Cengage Learning.

Zulu, S. (2007*). Impact of project management on project performance: a structural equation modelling approach*. In: Boyd, D (Ed) Procs 23rd Annual ARCOM Conference, 3-5 September 2007, Belfast, UK, Association of Researchers in Construction Management, 651-660

http://www.nca.go.ke/index.php/contractors-center/search-registered-contractors