

# **EFFECT OF OPTIMIZATION PRACTICES ON OPERATIONAL PERFORMANCE OF CONSTRUCTION INDUSTRY IN UASIN GISHU COUNTY, KENYA**

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## **ABSTRACT**

Optimization practices encompass finding an alternative with the most cost effective or highest achievable performance under the given constraints, by maximizing desired factors and minimizing undesired ones. The objective of the study was to determine the effect of optimization practices on operational performance of construction industry in Uasin Gishu County, Kenya. The study was guided by lean theory. The research adopted the descriptive research design. The target population was the construction contractors in Kenya and the accessible population was the construction contractors in Uasin Gishu County, Kenya and licensed by the National Construction Authority of which as at 1st February, 2018 stood at 340 for building works and 298 for road works. The sample size was 34 building contractors and 30 road contractors. The study adopted a two stage sampling technique. Stratified sampling technique was applied in grouping companies into building works contractors and road works contractors. Simple random sampling applied where 1 director, 1 technical staff and 1 secretary were targeted in each of the 64 sampled companies. Therefore a sample size of 192 respondents was selected for the study. A pilot study was done where 20 respondents were selected randomly from the building and road works contractors in Uasin Gishu County, Kenya and the piloted respondents were not part of the study. The study

collected primary data using questionnaire and secondary data from journal articles. Data collected was analysed using both descriptive and inferential statistics. Descriptive statistics included mean, frequency, standard deviation, variance and percentages whereas inferential statistics included pearson product moment correlation coefficient and regression analysis. Data was presented using tables, charts and graphs. The study established that optimization practices increases operational performance of construction industry in Uasin Gishu County, Kenya ( $\rho=0.497$ ;  $p<0.05$ ). The study concluded that optimization practices have a significant influence relationship with operational performance of construction industry in Uasin Gishu County, Kenya. The study recommends that construction industry should be managed by qualified expertise and that the government should come up with sensitization programs pertaining benefits of excellent optimization. The study will add value to the knowledge base of scholars through new optimization practices that enhance operational performance. Management of construction industries will be aided by this study in their improved effectiveness and efficiency of running their operations. The Government through economic planners will gain insights of optimization practices in the pursuit of Kenya vision 2030 goals.

**Key Words:** *optimization, operational performance, construction industry*

## **INTRODUCTION**

Optimization practices is key to the success of any given business especially the construction industry based type of commercial business where demand, lead-time, issue size, re-ordering

and cost must be optimized in order to improve on the company's operational performance. Peacock's research (2013) found that effective application of inventory optimization models and practice is relevant to achieving quality and efficient operations. In addition, Adeyemi and Salami (2010) observed that the overall goal of optimization practices is to have what is needed, and to minimize the number of times manufacturing and services operations are interrupted by problems of stock outages. Bloomberg et al., (2012) further reported that effective management of inventory has enormous potentials for improving the efficiency of organizations, and firms that use scientific inventory control practices have a significant competitive advantage in the market. Agus and Noor (2010) points out that demand forecasting helps the organization to minimize operational costs, increased efficiency and on time delivery of goods and services.

Operational performance is defined as the actual outcome as measured against the intended results prescribed by the indicators of quality improvement, efficiency/effectiveness, cost reduction, client unwaveringness and on-time delivery of inventory to the firm (Iyer, 2011). Proficient and powerful operational execution is required to augment an organization's competitive edge through improvement of value, cost reduction quality, persistence, time to market, and item development, client lead times, stock levels, and conveyance time (Ngatia, 2013). Indicators of effective operational performance include: enhanced financial performance, lead time performance, enhanced responsiveness, client unwaveringness, advancement, quality items, and decrease in abundance stock levels and upgrades in item/prepare outline (Johnson, 2003).

Effective cost optimization has become a critical issue for firms' productivity. Optimization practices are essential in the operation of any business that wishes to achieve efficiency in production. Construction project is the product of the construction industry and therefore, project performance which falls in one of the non-financial categories (product performance) defined by Gunday, Ulusoy, Kilic and Lutfihak (2011) is suggested as one of the suitable dimensions for the performance indicator for construction industry in determining the overall organizational performance.

## **STATEMENT OF THE PROBLEM**

Every construction industry is concerned with the maximization of its wealth through maximizing desired factors and minimizing undesired ones. This is achieved by finding an alternative with the most cost effective or highest achievable performance under the given constraints. However, management of construction companies is always in a dilemma on the optimal decision in order to attain the maximum outcome in regard to cost so as to achieve the required operational performance. Optimization practices still remain an academic debate among the other aspects that contribute to the success of any business. The reason of carrying optimization practices is to ensure that the organization achieves the significant cost reductions and substantial bottom-line savings that are the hallmarks of optimization. According to Peacock (2013), effective application of optimization models and practice is relevant to achieving quality and efficient operations. Effective optimization practice in construction industry is one of the key factors for success. The challenge in optimization

practice is to effectively balance the required and the unrequired constraints. If material is not managed properly, it will affect cost in construction projects (Lenin, Krishmaraj, Prasad & Kumar, 2016). Inefficiency in operational performance is likely to rise when material is not tracked properly in order to optimize on cost. Delays in project completion and poor performance in the construction industry has been experienced and has led to failure in achieving effective time and cost performance (Aftab, 2012). In Kenya, only 20.8 per cent of the projects were implemented on time and budget, while 79.2 per cent exhibited some form of failure (Nyika, 2012). The major causes of failures are insufficient implementing capacity, poor optimization practices, weak project design and political interference. Mwangi (2016) carried a study on factors influencing performance of contractors in the road construction sector in Kenya and found out that working capital, skilled manpower, organization structure and client contributed by 73.6 percent on the factors influencing performance of road contractors in Kenya. A study done by Seboru et al., (2016) on the acquisition of materials and performance of road construction projects in Kenya found out that the performance of roads in Kenya has not been adequate considering the presence of potholes on the majority of roads in the country. This has been caused by poor policies on establishment of quantities of materials required so as to enhance performance of road construction projects.

## **RESEARCH OBJECTIVE**

The research objective of the study was to determine the effect of optimization practices on operational performance of construction industry in Uasin Gishu County, Kenya.

## **RESEARCH HYPOTHESIS**

H<sub>01</sub>: Optimization practices do not significantly affect the operational performance of construction industry in Uasin Gishu County, Kenya.

## **THEORETICAL REVIEW**

The study was anchored on lean theory which was first introduced by Krafcik in 1988. The theory explains the essence of waste reduction through optimization practices. Toyota practiced the principles of lean management as early as the 1980s forming the basis of strategic management which today is envisaged as an essential core principle of almost any production system in all industries worldwide (Lysons, 2006). Wallian (2007) asserts that there are five key assumptions to lean thinking which include: identifying all steps across the value stream by eliminating non-value adding activities and processes leaving just a stream of value adding activities, making those activities that create the value flow by linking value-adding activities effectively to deliver total value to the customer, only making what is pulled by the customer just-in-time and striving for perfection by continually removing successive layers of waste.

Lean theory therefore focuses on optimization of costs in inventory systems thus the theory is applicable to the study. It is posited that through this theory, decisions on construction, manufacturing, warehousing, and general supply chain concerns can be expedited (Tempelmeier, 2011). Choice of lean theory for this study was informed by the need to

examine how optimization practices influences operational performance in the construction industry.

Eroglu and Hofer (2011) found that leanness positively affects profitability of a business firm. The theory elaborates on how manufacturers gain flexibility in their ordering decisions, reduce the stocks of inventory held on site and eliminate inventory carrying costs. At the aggregate level, the empirical strength of the lean explanation lies both in the timing and the magnitude of the adoption. However, in the theory, inventory constrains a firm's ability to respond to fluctuations in demand. Scholarly studies indicate that companies successfully optimize inventory through lean supply chain practices and systems to achieve higher levels of asset utilization and customer satisfaction leading to improved organizational growth, profitability and market share (Green & Inman, 2005).

Eroglu and Hofer (2011) found that leanness positively affects profit margins. According to Eroglu and Hofer (2011) firms that are leaner than the industry average generally sees positive returns to leanness. They used empirical leanness indicator as a measurement for optimization practices. Contrary to the present study, their study focused on assessing the relationship between optimization practices and overall firm performance. Lean thinking aids in making only what is pulled by the customer just in time leading to order fulfillment (Vollman, 2006). Similarly, lean thinking enables organizations to strive for perfection by continually removing successive layers of waste such as activities that add cost or consume resources, but are not operationally necessary and do not add value leading to efficient inventory control (Yugang, & Rene, 2012). In addition, lean thinking identifies all steps across the value stream with the aim of eliminating non-value adding activities and processes through employment of appropriate ICT application systems in the organization (Wadhwa, 2010). Therefore, the lean theory is of essence to the effectiveness of optimization practices which will result to increased profitability, responsiveness, flexibility, cost effectiveness and asset management. Criticism levelled against the theory is that it can only be applicable when there is a close and long-term collaboration and sharing of information between a firm and its trading partners.

## **EMPIRICAL REVIEW**

Nunez (2014) carried a study on the assessment of the assimilation of lean and supply chain management practices in the construction industry in the United States of America. The study applied the stratified sampling technique, data collection was done through survey method and later, data was analyzed using the SPSS version 22. The study found that lean practices did not show a significant correlation to overall performance measures. However, the study did not develop a theoretical review thus relying on the survey responses which could lead to less significance in the findings.

A study carried out by Kimondo, Mutuku and Winja (2016) on the dynamics of supply chain management on construction industry in the Kenyan. The research adopted cross-sectional survey research design with a population of 199 construction firms listed in the national irrigation board (NIB) register of contractors in 2013. The study found out that there exists a

positive relationship between financial flow integration and construction project performance. Also, the study established that there existed a positive relationship among physical flow integration, financial flow integration, information flow integration and trust and project performance in construction industry. The study had a narrow focus on the contractors working for NIB which represent a small sample size of respondents as compared to entire contractor's population in Kenya.

Mwangi (2016) studied on the factors influencing performance of contractors in the road construction sector in Kenya. The research adopted descriptive research design with a target population study of 156 road contractors. The findings of the study contended that there was an indication of 73.6 percent on the factors influencing performance of road contractors in Kenya due to working capital, skilled manpower, organization structure and client support at 95 percent confidence interval. Working capital had highest influence on performance of road contractors while client support had the least influence. The study skewed its study on road contractors only thus building and other form of contractors were left out.

Ayegba (2013) researched on material management on building construction sites in Niger. Data for the study was obtained through a structured questionnaire administered to respondents in ten different construction sites and head offices of the construction companies in charge of the sites in Minna metropolis Niger State. Findings revealed that, 31% of respondent organizations procure materials for sites by head office provisions without site requisition, 64% of respondent organizations procure materials for sites by head office provisions with site requisition and 5% of respondents in organization procure materials for sites through direct purchase by site manager or engineer. The study relied on the structured questionnaire thus leaving out the other perceptions of the respondents which could have been handled by un-structured part of the questionnaire. This will lead to low value on the significance of the feedbacks from the respondents.

Lenin, Krishmaraj, Prasad and Kumar (2014) carried out a study on improper material management affecting cost in construction projects in India. The study was exclusively assessed through questionnaire survey, interviews, field visits and discussion with the concerned authorities. Findings revealed that the top five major causes of cost overruns were: design issues, market condition, store issues, contractor issues, and external issues. Recommendations were given for reducing material mismanagement in the construction industry thus leaving behind the effects of material mismanagement.

## **RESEARCH METHODOLOGY**

### **Research Design**

A research design outlines how the research will be conducted. Generally, this is a guide to the research process. Research design is a plan and structure of investigation so conceived as to obtain answers to the research questions (Cooper, 2008). Descriptive research design was used in this study. This design granted the researcher with fairly a lot of information from a huge sample of individuals. The design accurately describes an association between variables minimizing bias and maximizing the reliability of the data (Kothari, 2008). This design was

intended to provide solutions to the hypotheses. According to Mbuvi et al., (2016) descriptive research design utilizes both quantitative and qualitative data, which enables the researcher to have an in-depth examination of the key indicators under investigation. Basically, descriptive research design is appropriate since it describes the elements of the study variables.

### **Population of the Study**

A population refers to all individuals, units or elements that meet the selection criteria for a group to be studied, and from which a representative sample is taken for detailed examination. According to Borg and Gall (2009) target population is a universal set of research of all members of actual or imaginary set of people, events or objects to which an investigator wishes to generalize the result. The target population of the study was the construction contractors in Kenya and licensed by the National Construction Authority. Accessible population is the final group of participants from which data is collected by surveying either all its members or a sample drawn from it (Asiamah et al., 2017). Accessible population for the study was 340 building works and 298 road works contractors licensed by the National Construction Authority as at 1st February, 2018 and their operations centred at Uasin Gishu County, Kenya.

### **Sampling Technique and Sample Size**

This is a way of gathering information whereby information will be collected from a study population representation. Cooper and Schindler (2011) state that stratified sampling is best suited in research because it minimizes biasness. The study adopted a two stage sampling technique method. Stratified sampling technique was applied in the first stage where companies were grouped as building works contractors and road works contractors. There are 340 building works contractors and 298 road works contractors. In a descriptive research, a sample size of 10-50% is accepted (Mugenda & Mugenda, 2003). Thus, the researcher took 10% of the accessible population to be used on the study hence 34 building works and 30 road works companies were targeted. The total population of 64 companies in Uasin Gishu County, Kenya was divided into two strata; that is 34 building works contractors and 30 road works contractors. The second stage applied the simple random technique to identify 1 director, 1 technical staff and 1 secretary in each of the 64 selected companies. Therefore, a total of 192 respondents were sought for the study.

### **Data Collection Technique**

Primary data was collected through semi-structured questionnaire. Questionnaire contained both open and close-ended questions so as to be able to capture more information from the respondents. This method was adopted because questionnaires provide an efficient and convenient way of gathering the data within the resources and time constraints (Gitau, 2016). The structure of the questionnaire provided the flexibility for specific and unique responses to some of the questions (Wangari & Kagiri, 2015). Secondary data was obtained from the journal articles on the operational performance of construction industry.

### **Pre-testing of Research Instruments**

A pilot study was done before commencing on the actual study. The aim of the pilot study was to test the reliability and validity of the research instrument (Wire, 2015). Mugenda and Mugenda (2003) suggest that the piloting sample ought to represent 10% of the population size based on the study sample size. The accuracy and validity of the data instrument of the study was thus tested by administering it to 20 respondents randomly selected from the building and road works contractors from Uasin Gishu County, Kenya. The instrument of the study was modified according to the pilot test responses. Piloting helps in revealing questions that could be vague which facilitates their examination until they communicate the same sense to all the subjects (Mugenda & Mugenda, 2003).

### **Data Processing and Analysis**

After collecting all the relevant data, the questionnaires were edited, coded and classified for completeness and accuracy. The data collected was analysed using descriptive statistics and inferential statistics. Descriptive statistics included mean, frequency, standard deviation, variance and percentages. Inferential statistics included Pearson product moment correlation coefficient and regression analysis. Regression analysis is a research method used when the study involves modeling and analyzing several variables, where the relationship includes a dependent variable and one or more independent variables to provide meaningful and accurate conclusions of the phenomenon under study (David, 2005). Information was displayed by use of bar charts, graphs, pie charts and tables to search for any correlation between the variables. The study adopted the linear regression model as shown in Equation 1.

$$\hat{Y} = \beta_0 + \beta_1 X_1 + \varepsilon \dots\dots\dots \text{Equation 1}$$

Where:  $\hat{Y}$  represents the operational performance,  $\beta_0$  is a constant, that is the y-intercept for the regression model,  $\beta_1$  is the beta coefficient of optimization practices,  $X_1$  represents optimization practices and  $\varepsilon$  is an error term.

### **RESEARCH FINDINGS**

The study sought to find out the effect of optimization practices on operational performance of construction industry in Uasin Gishu County, Kenya through the respondent's views. From the findings, the respondents agreed that the company avails to the customers the required inventory with the required quantity at a minimal cost (mean=1.901; std dev=0.691) and that, the company avails the required inventory at an appropriate time, neither earlier nor late (mean=2.120; std dev=0.807). Further, the respondents agreed that the company is always with the right issue size of inventory in the store when required (mean=2.359; std dev=0.899) and that, the company accurately replenish inventory (mean=2.214; std dev=0.910). Lastly, the respondents agreed that the company meets the required quantity of inventory at every given time (mean=2.255; std dev=0.983). These findings concur with the study carried out by Kimondo, Mutuku and Winja (2016) which recommended that there exists a positive relationship between financial flow integration and construction project management. This is



also in corroboration with Mwangi (2016) which noted that working capital had the highest influence on the performance of road contractors. The finding results imply that the respondents are in agreement that the optimization practices variable has a positive statistical significance in operational performance of construction industry in Uasin Gishu County, Kenya.

### **Effect of Optimization Practices on Operational Performance of Construction Industry in Uasin Gishu County, Kenya**

The study revealed that the respondents were in agreement that the company avails to the customers the required inventory with the required quantity at a minimal cost and that it avails the required inventory at an appropriate time, neither earlier nor late. Further, the respondents were in agreement that the company is always with the right issue size of inventory in the store when required, the company accurately replenish inventory and that it meets the required quantity of inventory at every given time. Optimization practices indicated a statistically positive significant relationship with operational performance of construction industry in Uasin Gishu County, Kenya. It was noted that the findings on the effect of optimization practices in Uasin Gishu County, Kenya tied with the assertion of the lean theory that, optimization practices would be achieved through waste reduction.

### **Operational Performance of Construction Industry in Uasin Gishu County, Kenya**

It was noted that the respondents were in agreement that optimization practices have contributed to the quality improvement on the company's products and also it has contributed to the efficiency and effectiveness of the company's operations. Further, the respondents were in agreement that optimization practices have contributed to the cost reduction policies of the company and also it has contributed to client unwaveringness in the company. Lastly, the respondents were in agreement that optimization practices have contributed to on-time delivery of the company's inventory.

## **INFERENTIAL ANALYSIS**

The study carried a correlation analysis between optimization practices and operational performance of construction industry in Uasin Gishu County, Kenya. Result findings are shown in Table 1.

**Table 1: Optimization Practices Correlation Analysis**

		Operational Performance
Optimization Practices	Pearson Correlation	0.528**
	Sig. (2-tailed)	0.000
	N	192

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Optimization practices indicate a statistically positive significant relationship with operational performance of construction industry in Uasin Gishu County, Kenya ( $r=0.528$ ;

p<0.01). This implies that implementation of optimization practices in the construction industry of Uasin Gishu County, Kenya would yield a positive growth on its operational performance.

From the linear regression analysis, it was noted that there exists a strong positive relationship between the study variable. This is shown by the correlation coefficient (R=0.528). Also, R<sup>2</sup>=0.278 meaning 27.8% variation in the operational performance of construction industry in Uasin Gishu County, Kenya is explained by the predictor variable in the model. However, 72.2% variation in the operational performance of construction industry in Uasin Gishu County, Kenya is due to other predictor variables not in the regression model. The summary for the linear regression model is shown in Table 2.

**Table 2: Summary Model for the Linear Regression**

<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>Std. Error of the Estimate</b>
0.528 <sup>a</sup>	0.278	0.275	0.48932

a. Predictors: (Constant), Optimization Practices

From F-Test analysis, the linear regression model is statistically significant (F=73.311; p=0.000) thus making the model good fit for the data. The significance value (p-value) is 0.000 which is less than 0.005 thus making the model statistically significant in predicting how the independent variable affects the dependent variable of the study. The ANOVA results are shown in Table 3.

**Table 3: ANOVA Analysis Results**

<b>Model</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Regression	17.553	1	17.553	73.311	0.000 <sup>a</sup>
Residual	45.492	190	0.239		
Total	63.045	191			

a. Dependent Variable: Operational Performance

From T-Test analysis, results show a positive significance of the predictor variable. Optimization practices is a significant predictor on operational performance of construction industry in Uasin Gishu County, Kenya (t=8.562; sig.=0.000). Hence, the research hypothesis that optimization practices does not significantly affect the operational performance of construction industry in Uasin Gishu County, Kenya was rejected at significance level of 5. The results of analysis are shown in Table 4.

**Table 4: Linear Regression Model Significant Test Results**

<b>Model</b>	<b>Unstandardized Coefficients</b>		<b>Standardized Coefficients</b>		<b>t</b>	<b>Sig.</b>
	<b>B</b>	<b>Std. Error</b>	<b>Beta</b>			
Constant	0.935	0.131			7.150	0.000
Optimization Practices	0.497	0.058	0.528		8.562	0.000

Based on the findings of the t-test results, the independent variable was proved to be significant at significance level of 5%. Its p-value was less than 0.05 significance level. Therefore, the study variable result in the regression equation as shown in Equation 2.

$$\hat{Y} = 0.935 + 0.497X_1 \dots\dots\dots \text{Equation 2}$$

Equation 4.1 depicts that if the construction industry in Uasin Gishu County, Kenya does not implement the optimization practices, operational performance would be constant at 0.935 unit. A unit increase in optimization practices will lead to 0.497 increase in operational performance of construction industry in Uasin Gishu County, Kenya.

## **CONCLUSIONS**

The study concluded that there is a statistically positive significant relationship between optimization practices and operational performance of construction industry in Uasin Gishu County, Kenya. The use of optimization practices would lead to enhanced operational performance of construction industry in Uasin Gishu County, Kenya. Based on research findings, the study concluded that optimization practices had a statistically positive significant relationship with operational performance of construction industry in Uasin Gishu County, Kenya. Hence, the construction industry is advised to embrace optimization practices in order to enhance operational performance.

## **RECOMMENDATIONS**

The study revealed that optimization practices are key on the outcome of operational performance of construction industry in Uasin Gishu County, Kenya. Optimization practices is significantly relevant and therefore the study recommends that the management of the construction industry should employ qualified expertise that are capable of handling well the management accounting concepts which leads to the company's day to day decisions pertaining expenditures. Also, the study recommends that the government should come up with sensitization programs pertaining benefits of excellent optimization practices. This will act as a motivational gear since all construction industry partners are after better returns on their investments. Lastly, the study recommends that the government should come up with measures that will curb the high political interferences when it comes to the selection of the best contractor in awarding tenders. The effect of these interferences is that contractors will look for short-cuts when delivering the project in hand due to the lost resources in getting the tender award or due to the advantage of the political will being enjoyed by the company. This will lead to omission of relevant optimization practices.

Based on the lean theory which explains the essence of waste reduction through optimization practices, the study recommends the application of this theory in that, by optimizing cost, lead-time, issue size, re-ordering and demand, operational performance will improve significantly.

## REFERENCES

- Adeyemi, S. L. & Salami, L. O. (2010). Inventory Management: A Tool of Optimizing Resources in a Manufacturing Industry. *Journal of Social Science*, 23(2), 135-142.
- Aftab, H. M., Ismail, A. R. & Ade, A. A. A. (2012). Time and Cost Performance in Construction Projects in Southern and Central Regions of Peninsular Malaysia. *International Journal of Advances in Applied Sciences*, 1(1), 45-52.
- Agus, A. & Noor, Z. (2010). *Supply Chain Management and Performance: An Empirical Study*, University of Malaysia, Singapore.
- Ahmed B. Abdel-Maksoud (2011). Management Accounting Practices and Managerial Techniques and Practices in Manufacturing Firms: Egyptian Evidence. *Int. J. Managerial and Financial Accounting*, 3(3), 237-246.
- Asiamah, N., Mensah, H. K. & Oteng, E. F. (2017). General, Target, and Accessible Population: Demystifying the Concepts for Effective Sampling, *The Qualitative Report*, 22(6). 45-58
- Ayegba, C. (2013). An Assessment of Material Management on Building Construction Sites. *Civil and Environmental Research, Niger State*, 3(5).
- Bertelsen, S. (2004). Lean Construction: Where are we and how to Proceed, *Lean Construction Journal*, 1(1), 46-69.
- Bloomberg, D., Lemay, S. & Hanna, J. (2012). *Logistics, Supper Saddle River*: New York: Prentice Hall.
- Borg, W. & Gall, M. D. (2009). *Educational research: An introduction*, (5th ed.). New York: Longman.
- Chapman, S., Ettkin, L. P. & Helms, M. M. (2000). Businesses Need Supply Chain Management, *Institute of Industrial Engineers Solutions Publication, New York*, 32(8), 31 - 35.
- Cooper, D. (2008). *Business Research Methods*. London: McGraw Hill Publishers.
- Cooper, D. & Schindler, P. (2011). *Business Research Methods*. 11th Edition, McGraw Hill, Boston.
- David, B. (2005). *Regression Analysis Application: Repression Sensitization as a Dimension of Personality*. New York: Free Press.
- Eroglu, C. & Hofer, C. (2011). Lean, Leaner, too Lean? The Inventory-Performance Link Revisited. *Journal of Operations Management*, 29(2), 356–369.
- Esther, O. M. (2015). The Effect of Inventory Management Practices on Service Delivery at St. Martin's Hospital, Agroyesum, Amansie-West. *Corporate Management, Governance, and Ethics Best Practices*, 5(6), 121-191.
- Gitau, N. N. (2016). Inventory Management Practices and Organizational Productivity in Parastatals in Kenya. *IOSR Journal of Business and Management*, 7(1), 11-56.
- Green, K. W. & Inman, R. A. (2005), Using a Just-in-Time Selling Strategy to Strengthen Supply Chain Linkages, *International Journal of Production Research*, 43(16). 3437-3453.

- Gunday, G., Ulusoy, G., Kilic, L. & Alpkan, L. (2011). Effects of Innovation Types on Firm Performance. *International Journal of Production Economics*, 133(2), 662-676.
- Iyer, K. (2011). Demand chain collaboration and operational performance: Role of IT analytic capability and environmental uncertainty. *Journal of Business and Industrial Marketing*, 26(2), 81-91.
- Johnson, R. (2003). E-service: Enhancing Internal Customer Service through E-Procurement, *International Journal of Service Industry Management*, 14(5), 539-55.
- Kimondo, J. M., Mutuku, R. N. & Winja, M. (2016). *Dynamics of Supply Chain Management in the Kenyan Construction Industry*. A Case Study of National Irrigation Board, Master of Science, Jomo Kenyatta University of Agriculture and Technology.
- Koskela, L. (2000). *An Exploration towards a Production Theory and its Application to Construction*. VTT Publications: Technical Research Centre of Finland.
- Kothari, C. (2004). *Research Methodology: Methods and Techniques*, 2nd edition. New age International Publishers, New Delhi, India.
- Kothari, C. R. (2008). *An Introduction to Operational Research*, New Delhi: Vikas Publishers.
- Lenin, P., Krishmaraj, L., Prasad, D. N. & Kumar, V. R. P. (2016). Analysis of Improper Material Management Affecting Cost in Construction Projects. *International Journal for Research in Applied Science and Engineering Technology*, 2(5), 486-492.
- Lysons, K. & Farrington, B. (2006). *Purchasing and supply chain management*, (7<sup>th</sup> ed.). Harlow, United Kingdom: Pearson Education Publishers.
- Mbui, L., Namusonge, G. & Arani, W. (2016). Factors Affecting Automation of Inventory Management in Micro, Small and Medium Enterprises: A Case Study of Kitui County. *International Journal of Academic Research in Business and Social Sciences*, 6(1), 2222-6990.
- Mugenda, O. M. & Mugenda, A. G. (2003). *Research Methods*, Laba Graphic Services: Nairobi.
- Mwangi, M. J. (2016). Factors Influencing Performance of Contractors in the Road Construction Sector. *Construction Contractors*, 15(3), 6-17.
- Ngatia, C. W. (2013). Supply Chain Management Practices and Performance of Kenya Tea Development Authority Managed Factories. *Journal of Supply Chain Management*, 4(8), 22-63.
- Nunez, Helen S. (2014). An Assessment of the Assimilation of Lean and Supply Chain Management Practices in the Construction Industry. *Journal of Supply Chain Management*, 6(5), 141-631.
- Nyika, D. (2012). *An Analysis of the Causes of Failures in the Implementation of Projects in Kenya*. Repository, University of Nairobi.
- Oballah, D., Waiganjo E. & Wachiuri E. W. (2015). *Effect of Inventory Management Practices on Organizational Performance in Public Health Institutions in Kenya: A Case Study of Kenyatta National Hospital*. *International Journal of Education and Research*. 3(3), 703-711.

- Peacock, R. (2013). *Victimology in South Africa* (10<sup>th</sup> ed.), Van Schaik Publishers: Hema Hargovan, South Africa.
- Radosavljevic, M. & Bennett, J. (2012). *Construction Management Strategies: A Theory of Construction Management*. London: Wiley-Blackwell Publisher.
- Rajeev, N. P. (2010). Inventory Management Performance in Machine Tools SMEs: What Factors Do Influence them? *International Journal of Industrial Engineering and Management*, 3(3), 542-560.
- Seboru, M. A., Mulwa, A. S., Kyalo, D. N. & Rambo, C., M. (2016). Acquisition of Materials and Performance of Road Construction Projects in Kenya: A Case of Nairobi County, *European Scientific Journal*, 12(32), 1857-7881.
- Tempelmeier, H. (2011). *Inventory Management in Supply Networks* (3<sup>rd</sup> ed.), Norderstedt Publishers: University of Cologne, Germany.
- Vollman, M. (2006). *Manufacturing Planning and Control Systems*. London: McGraw Hill.
- Wadhwa, N. (2010). Effects of Information Transparency and Cooperation on Supply Chain Performance. A Simulation Study. *International Journal of Production Research*, 48(1), 145-166.
- Wallian, N. (2007). *Inventory Ownership and Placement Decisions for an Externally Sourced Item within a Buyer-Supplier in Inventory Management*. London: Prentice Hall.
- Wangari, K. L. & Kagiri, A. W. (2015). Influence of Inventory Management Practices on Organizational Competitiveness: A Case of Safaricom Kenya Ltd. *International Academic Journal of Procurement and Supply Chain Management*, 1(5), 72-98.
- Wire, W. C. (2015). Influence of Working Capital Management Practices on Financial Performance of Small and Medium Manufacturing Enterprises in Nairobi County, Kenya. *African Journal of Business Management*, 45(98), 125-151.
- Yugang, Y. & Rene, B. M. (2012). On the Sub-Optimality of Full Turnover-Based Storage. *International Journal of Production Research*, 51(6), 1635-1647.