INFLUENCE OF SUPPLY CHAIN MANAGEMENT PRACTICES ON PERFORMANCE OF CONSTRUCTION PROJECTS IN KENYA: A CASE OF CONSTRUCTION PROJECTS REGISTERED BY NATIONAL CONSTRUCTION AUTHORITY IN NAIROBI COUNTY

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ABSTRACT

Previous surveys have close to 40% of construction projects researched on a worldwide basis experience serious performance problems. Failing to plan the supply chain, involving supply chain members in the planning, and integrating the processes of planning the supply chains and the construction project can be one reason for the low numbers of successful SCM adoption in construction. With scarcity of studies focusing on SCM and performance of construction projects this study focuses on the influence of supply chain management practices on performance of construction projects in Kenya. Specifically, the study focused on inventory management, supplier selection, strategic purchasing and procurement planning on performance of construction projects in Kenya. A cross sectional survey research design was used for the study. The target population consisted of all the 621 registered construction projects by National Construction Authority of Kenya. The data collection instrument was a questionnaire and quantitative data was used. The study used correlation and regression to achieve the specific objectives. The study concluded that project managers that carry out evaluation on supplier quality control practices, supplier ability to deliver on time and supplier competency are likely to enhance the performance of their project. The study recommended that projects managers and head of supply chains departments should ensure that they have a minimal threshold for their inventory to ensure continuity of their projects. The study recommended the construction companies without automated system for inventory management should adopt such systems for efficient inventory management. The study recommended that County governments should include supplier competency and supplier consistency in supplier evaluation.

Key Words: SCM, Inventory Management, Supplier Selection, Strategic Purchasing, Procurement Planning
Introduction

A construction project is completed as a result of a combination of many events and interactions, planned or unplanned, over the life of a facility, with changing participants and processes in a constantly changing environment (Gudienė, Banaitis & Banaitienė, 2013). The level of success in carrying out construction project development activities will depend heavily on the quality of the managerial, financial, technical and organizational performance of the respective parties, while taking into consideration the associated risk management, the business environment, economic and political stability (Eriksson & Westerberg, 2011).

According to Meng (2012), a project is usually regarded as successful if it is completed on time, within budget and to the level of quality standard specified by the client at the beginning of the project. Balogun (2015) emphasized that the ultimate goal of any construction is to be delivered in the shortest possible time, at the lowest possible cost, with the highest quality while for many projects, this goal seems unachievable.

However, projects that are not managed effectively experience many cost overruns. In the past several decades, large construction projects have been known for their cost overruns and late completion times (Pickrell 2010; Flyvbjerg Holm & Buhl, 2013). Many factors are responsible for these cost overruns such as underestimation of costs caused by poor procurement planning, addition of scope during later stages of project planning and even during construction, changed conditions. One of the most important contributing factors to the magnitude of cost overrun in large transportation projects are project delays. Furthermore, the length of project development phase from planning to construction seems to be a major factor in the extent of cost overrun (Flyvbjerg, Holm & Buhl, 2014).

According to Thunberg and Persson, (2014) common on-site logistical problems such as late deliveries and faulty materials were a result of how the supply chains are managed. Inadequate management of supply chains affects costs, productivity, time, and quality of the end-product in the construction industry. This is also supported by more recent reports such as those of Bankvall et al. (2010) and BIS (2013) and both conclude that the current situation stems from an inadequate way of managing suppliers and subcontractors.

Dainty et al (2011) argue that subcontractors are involved too late in the planning of construction and supply chains. It is suggested that logistics and SCM are of importance for the construction industry in order to Developing a framework for supply chain planning in construction meet the demands of the construction clients, improve the communication, and increase the productivity.

Supply plans include material delivery schedules indicating when ordered materials will arrive. It can be argued that this integrative process for developing such as material delivery schedules is missing in construction today. Subcontractors and suppliers are not involved in developing material delivery schedules. Rooij (2017) stress that poor planning in general causes time and cost overruns in construction. To address costs, productivity, communication, and time overruns with SCM, it is also necessary to look at the planning part of SCM. Integrating the suppliers and subcontractors in the development of material delivery schedules is crucial for the success of the construction project. Attention should therefore be given to seeing
how SCP can be a facilitator for improving the industry, which is missing today (Forcada, Gangoilells, Casals & Macarulla, 2017).

**Statement of the Problem**

Project performance challenges are not unique to a particular industry but cuts across all industries although the magnitude of the effects of these problems may vary from one industry to another (Mansfield et al., 2014). Performance of construction projects is an issue that has raised questions ever since (Tserng et al. 2011). A survey in 1987 for instance investigated cost overruns in construction projects across the world and established that budget overruns typically vary from 30% to as high as 250%. Meanwhile, reported under runs were minimal. Another survey states that close to 40% of construction projects researched on a worldwide basis experienced serious performance problems ($985 million average cost) (Mishra & Soota, 2011). European Investment Bank (2010) further argues that globally, 9 out of 10 construction projects experience overruns.

Issues of poor supply chain management practices have been established in construction projects. Josephson and Saukkoriipi (2015) indicated that on average craftsmen in construction projects in Sweden spent more than 80% of their working day on waiting, material handling, and indirect work. While this is the case, Thunberg (2016) argues that supply chain management (SCM) has been stressed as a remedy to many of the underlying issues in the construction industry.

However, the positive examples where SCM has been successfully utilized and diminished the lingering issues in construction is scarce. Failing to plan the supply chain, involving supply chain members in the planning, and integrating the processes of planning the supply chains and the construction project can be one reason for the low numbers of successful SCM adoption in construction (Thunberg, 2016). The supplier–contractor perspective has received little attention (Bygballe et al, 2010, Vidalakis et al, 2011). There was therefore a need to focus on the influence of supply chain management practices on performance of construction projects in Kenya.

**Objectives of the study**

i. To establish the influence of inventory management on performance of construction projects in Kenya.

ii. To determine the influence of supplier selection on performance of construction projects in in Kenya.

iii. To find out how strategic purchasing influences the performance of construction projects in in Kenya.

iv. To determine the influence of procurement planning on performance of construction projects in in Kenya.

**Literature Review**

**Theoretical Review**

**Deterministic Inventory Theory**

Baker and Urban (1988) developed the deterministic inventory theory to determine the level of inventory when demand is mostly largely obscure. According to Croom and Jones (2010) deterministic inventory theory is one of the fundamental techniques used by firms to develop inventory reserve estimates. Deterministic models of inventory control are used to determine the optimal inventory of a single item when
demand is mostly largely obscure. Inventory is built up at a constant rate to meet a
determined or accepted demand.

Dai and Kauffman (2001) argue that a deterministic circumstance is one in which the
system parameters can be ascertained precisely. This is also known as a situation of
sureness since it is realized that whatever is ascertained, things are sure to occur the
same way. The model provides techniques that can be used to manage inventory and
avoid stock outs by developing inventory reserve estimates when operating where
demand is mostly largely obscure. The theory applies to management of inventory in
the construction sector where due to fluctuations, the demand for most of the raw
materials is obscure and can hence provide techniques to manage inventory.

**Grey System Theory**

Grey system theory was first introduced in early 1980s by Deng (1982). According to
Grey System Theory, in a practical business environment, in most instances, supplier
selection takes place in an environment with less than perfect information. As such,
there is some level of uncertainty in the decisions related to supplier selection. In such
an environment, it is important to develop certain indicators or criteria; qualitative or
quantitative that the supplier can be subjected to before selection. From this theory,
the grey correlation analysis model with seven progressive steps was developed (Zou,
2008).

These steps include; grey generation aimed at gathering information on grey aspects,
grey modeling done to establish a set of grey variation equations and grey differential
equations, grey prediction aimed at achieving a qualitative prediction, grey decision,
grey relational analysis and grey control (Tsai, 2003).

The theory of Grey System considers the following factors in deciding on the best
supplier; Existence of key factors important to the buyer, the numbers of factors are
limited and countable and can be directly attributed to potential suppliers, in
dependability of factors and factor expandability. The theory applies the principle of
series comparability to generate a grey relation. An evaluation matrix may be
developed to facilitate this process. The best supplier is selected by choosing a goal
and weighting the values of all evaluation factors based on the characteristics of
materials to be sourced based on demand patterns (Zou, 2008). In a supplier selection
environment, this theory can be applied during evaluation of critical performance
areas by the procuring entities.

This theory has relevance to the study as it surrounds the process of supplier selection
as it mainly provides a criteria and procedure for supplier selection. The theory has a
practical and positive benefit of improving effectiveness in the selection process
because it provides criteria for selecting the factors to look for in a supplier and when
a good supplier is selected, this positively affects performance.

**The Kraljic Purchasing Portfolio Model.**

The theory was introduced by Kraljic (1983). It is about classifying purchases
according to urgency and need which allows for differentiated supplier strategies
based upon the position of a product and that reduce transaction cost. Kraljic (1983)
developed a convenient portfolio approach for the determination of a comprehensive
strategy for supply. Kraljic’s (1983) approach includes the construction of a portfolio
matrix that classifies purchased products and services on the basis of two dimensions:
profit impact and supply risk (“low” and “high”). The result is a 2 X 2 matrix and a
classification into four categories; bottleneck, noncritical, leverage and strategic items
where each of the four categories requires a distinctive approach toward supplier management.

Leverage items allow the buying company to exploit its full purchasing power, for instance through tendering, target pricing and product substitution. Routine items are of low value, are ordered frequently and therefore cause high transaction costs. Therefore, strategies are aimed at reducing transaction costs through category management in e-procurement solutions. Bottleneck items cause significant problems and risks that should be handled by volume insurance, vendor supplier control, and safety stock and backup plans. In some cases, a search for alternative suppliers or products is needed. Strategic items require a more collaborative strategy between both the buyer and the seller. The general idea of Kraljic’s model is to minimize supply risk and make the most of buying power.

The theory is relevant to this study as it helps link strategic purchasing to performance. The theory indicates that for a firm to cut costs, it should be able to divide its purchases into three main groups ranging from routine items which are of low value and ordered frequently and therefore cause high transaction costs; bottleneck items which cause significant problems and risks that should be handled by volume insurance, vendor supplier control, and safety stock and backup plans and strategic items which require a more collaborative strategy between both the buyer and the seller. To manage these purchases, a balance should be arrived at in order to manage unnecessary costs.

The SCOR Model

The SCOR model was previously endorsed by the Supply chain council (SCC) but is now endorsed by APICS (APICS, 2015). The SCOR model consists of three parts: business process re-engineering, benchmarking, and best practice analysis. The business process re-engineering part consists of predefined process specifications in a hierarchical structure in three different levels. These processes can be used to map the current state of the supply chain to identify problematic areas and to map the future state of the supply chain. Moreover, the benchmarking part is standardized and consists of predefined metrics also hierarchically structured (APICS, 2015). These can be used to measure the supply chain in terms of how well the supply chain performs in terms of reliability, responsiveness, agility, cost, and assets. The SCOR model also incorporates a number of best practices that can be used in order to identify ideas for how to resolve common supply chain issues (APICS, 2015).

There are several benefits of using the SCOR model. Cohen and Roussel (2005) point out the SCOR model’s ability to generate benefits in the three modeling levels. In level 1, where the outline of the whole supply chain can be modeled, benefits are usually found as synergies between business units and in an agreement on performance priorities. Benefits in the form of supply chain simplification and a shared vision of supply chain processes are found in the second level. The third level with the processes well defined, holds benefits in the form of best practices and predefined metrics.

Bolstroff and Rosenbaum (2007) report the financial benefits of using the SCOR model in more than 60 real projects. They claim the results to be consistent across all projects and in summary, the projects improved the operating income by 3%, reduced information technology operating expenses, and showed an ongoing profit
improvement of between 0.5 to 1% per year. Xia (2006) points out better communication and planning collaboration with suppliers as two other benefits of using the SCOR model. However, it has been identified that the SCOR model needs to be adapted to different environmental settings in order to reap the benefit (Legnani, 2011).

The theory can be of relevance in linking procurement planning to performance of construction projects. The model highlights the benefits of adopting and modeling best procurement practices along with other supply chain practices. According to the model, when supply chain processes are well defined as well as when best supply chain practices such as procurement planning are implemented, its benefits can be realized at the third level in the form of reduced costs, increased reliability, responsiveness and agility thus increasing the chances of better performance of building projects.

Conceptual framework

![Conceptual Framework](http://www.ijsse.org)

**Independent Variables**

- **Inventory Management**
  - Determination of adequate storage space
  - Minimal stock level
  - Up to date information on site stock

- **Supplier Selection**
  - Supplier Quality control practices
  - Supplier ability to deliver on time
  - Supplier Competency

- **Strategic purchasing**
  - Supplier integration
  - Buyer-supplier coordination
  - Supplier tiering

- **Procurement planning**
  - Need identification
  - Identification of the scope of goods required
  - Cost estimation

**Dependent Variable**

- **Performance of construction projects**
  - Completion time
  - Cost of completion
  - Number of projects completed within specified standards

Figure 1: Conceptual Framework

**Inventory Management**

Materials inventory management is important as materials constitute a large amount in construction costs (Lu et al., 2011). Better inventory management practices lead to better
performance of projects. Kasim, Liwan, Shamsuddin, Zainal and Che Kamaruddin (2012) argue that poor inventory management affects costs, time and project schedule delays. For large construction projects, the good management and control over inventory is important. It is to ensure that the right quantity and quality of materials and equipment to be easily specified in a timely manner, obtained at reasonable cost and are available when needed (Kasim, Liwan, Shamsuddin, Zainal et al., 2012).

Inventory management in construction project could be affected by several factors such as; inadequate storage space (Sardroud, 2012), over ordering and double handling (Donyavi & Flanagan, 2011); and incomplete and lack of up-to-date information regarding on-site stock (Navon & Berkovich, 2016). The lack and incomplete of up-to-date information regarding on-site stock is caused by the poor tracking and locating of materials in construction sites. Thus, there is a need for a proper inventory management in order for the materials to be tracked and located easily; and without employing additional costs.

Tracking of materials and components in construction project is not an easy task. Navon and Berkovich (2013) agreed that materials tracking still remain as a big problem in construction jobsites. The difficulty in tracking over materials and components is contributed by the large amounts of materials and components involved in the development process.

In an uncontrolled environment especially in construction projects where inventory management and tracking of materials becomes everyone concerned, it is almost compulsory to apply information and communication technology (ICT) on those processes. ICT implementation could expedite the process of data transfer (Kasim, 2008) and facilitate the effective and efficient control over materials on-site. Molnar et al. (2006) also agreed that ICT plays an important role in construction, which is to make the sector more efficient and customer oriented. ICT has brought new evolution in construction industry where previous construction practices used traditional methods of construction which is labour intensive, time consuming and error prone (Navon & Berkovich, 2006). With the implementation of ICT, the dependence on traditional manual methods could be reduced. Construction projects also could be managed effectively and efficiently, reduces labour and materials costs, and at the same time reduce time consuming processes. One of the possible areas for ICT application in construction processes is in the materials tracking field.

Supplier Selection

Supplier selection is a management activity whose primary aim is acquiring information to analyze and to manage supplier relationships and supply situations (Li et al., 2010). The process entails the simultaneous consideration of a number of critical supplier performance features that include price, delivery lead-times, and quality. The importance of supplier evaluation is evident from its impact on firm performance and more specifically on final product attributes such as cost, design, manufacturability, quality, and so forth (Sarkis & Talluri, 2012).

Organizations have different policies and criteria that they put in place during suppliers selection. Policies are generally adopted by the Board or senior governance body within an organization whereas procedures or protocols would be developed and adopted by senior executive officers. Organization policies can assist in both subjective and objective decision making process. According to Matook et al. (2009) the operational success of organizations policies will often depend on the development of a network of reliable and trustworthy suppliers and consequently,
making the right supplier selection decisions are important. Sabiti, Basheka and Muhumuza (2011) the key to accountability is the capacity to select the best contractors within the public sector. The internal contractor selection process of government, procurement and personnel have long received sustained attention as the centerpiece of reforms to promote accountability.

Supplier Evaluation and Management is a very strong concept in manufacturing industry, but has to come a long way in the construction Projects. For instance, in projects, especially in India, it is considered as a part of the unorganized sector. Its importance is not only in aspects of logistics in projects but also holds an important position in growth and survival of project organization itself. There are three general types of supplier evaluation systems which are Categorical method, Cost-Ration method and linear averaging method. The guiding factor in deciding which system is best is the Ease of implementation and Overall reliability of system (KarimiAzari, Mousavi, Mousavi & Hosseini, 2011).

Categorical method involves categorizing each supplier’s performance in specific area defined by a list of relevant performance variables. The buyer develops a list of performance factors for each supplier and keeps track of each area by assigning a ‘grade’ in simple terms, such as ‘good, neutral, unsatisfactory’. In the meetings with the supplier the buyer informs him of his performance (KarimiAzari et al., 2011).

Cost-Ration evaluates supplier performance using standard cost analysis. The total cost of each purchase of material is calculated as its selling price plus the buyer’s internal organizational cost associated with the quality, delivery and service elements of purchase (KarimiAzari et al., 2011).

Linear averaging is the most commonly used evaluation method. Specific quantitative performance factors are used to evaluate supplier performance. The most commonly used factors are quality, service (delivery) and price, although any one factor may be give more weight than others. The assignment of these weights is a matter of judgment of top management preferences. These weights are subsequently used as multipliers for the individual ratings on each of the three performance factors. After the weights have been assigned the individual performance ratings are determined. This is done by summing the scores for each factor. Then each performance ratings are multiplied by its respective weights as percentage. Finally, the results of three factors are added to give a numerical rating for each supplier (KarimiAzari et al., 2011).

Strategic Purchasing

According to Van Weele (2015) purchasing is the management of the company’s external resources in such a way that the supply of all goods, services, capabilities and knowledge which are necessary for running, maintaining and managing the company’s primary and support activities is secured at the most favourable conditions.

Purchasing has been viewed as an essential component of a firm's strategic planning process (Castaldi et al, 2011). As recognized by Carr and Peterson (2012), strategic purchasing is an upstream component of supply chain management (SCM). This dimension involves strategically selecting the suppliers. The construct of strategic purchasing is operationalized in terms of dimensions such as whether purchasing is aligned with the firm's strategic orientation, whether purchasing is carried out while keeping the long-term issues of the firm in mind, and whether the suppliers have
adequate knowledge of the firm’s strategic goals (Chen & Paulraj, 2014). Purchasing is often linked to an organization's achieving competitive advantage.

Historically, purchasing had been considered to have a passive role in the business organization. In the 1980s, purchasing was seen to be involved in the corporate strategic planning process. By the 1990s, both academics and managers were giving much more attention to strategic purchasing (Coban 2012). The conceptual re-description of purchasing as the integration of internal and external exchange functions is affiliated with many neo-classical tasks of industrial purchasing such as measuring internal customer’s perception of purchasing service quality (Corina and Sitar, 2011), making entrepreneurial ventures through innovation, risk-taking, pro-activeness and establishing cooperative supplier relationships to match a firm’s competitive stance. The perspective of strategic purchasing is also consistent with general strategy literature.

The ability of purchasing to influence strategic planning has also increased due to the rapidly changing competitive environment (Coban, 2012). A number of studies have addressed the imperative role of strategic purchasing in SCM (Coban, 2012). Increasing evidence reveals that purchasing is increasingly assuming a strategic role in SCM. For example, more purchasing professionals are now trained in cross-functional areas and strategic elements of the competitive strategy where purchasing selects the right type of relationship with its suppliers; supplier relationships are strategically managed and purchasing performance is being measured in terms of contributions to the firm’s success (Chen & Paulaj, 2004).

**Procurement Planning**

Planning is a systematic devise to develop, on a continuing basis, specific courses of action towards a desired objective or goal in the most effective, efficient and economic manner (Eigege, 2012). In this light, planning has four goals in any proposed task (Krishnamurthy & Ravindra, 2010): to offset uncertainty and change, to focus attention on objectives, to make economic operations possible, and to assist managers to control. There are two main levels of planning associated with construction projects: strategic and operational (Bamisile, 2012; Harris & McCaffer, 2015). The interrelationship between activities, resources and times in most projects, especially building, is such that unless they are carefully planned, resources can become overloaded during operation (Baily et al, 2013).

Onyango (2012) argues that procurement planning entails the identification of what needs to be procured, how the organizations needs can best be met, the scope of the goods, works or services required, what procurement strategies or methods to be deployed, setting the time frames, and the accountability for the full procurement process.

The object of planning construction project therefore, is to pre-determine how the project objectives will be achieved (Chitkara, 2012). The contractor use planning as a tool for: achieving efficient and effective resource management by facilitating scope management, decision making, resource organization and coordination, monitoring and control, and sound financial management (cash flow forecasting) (Inuwa, Wanyona & Diang’a 2015). To achieve success in project planning (Bennett, 2003): there must be a clear understanding of the project’s objectives, purposes, scope and nature by both the client/owner and organization responsible for carrying out the work and; a relationship between the client/owner and the project delivery organization
must be established, with clearly defined roles and responsibilities. It is paramount to note that any effort from the client or the consultant short of the above will negatively affect the contractor's project planning.

Ocharo (2013) argues that planning is the process of choosing the most appropriate contractor to deliver a specified project so that the achievement of best value for money. Procurement methods are one of the critical steps in planning and bid evaluation methods are the key procedures through which a contractor is selected. Ocharo (2013) posits that planning is one of the main decisions made by the clients. In order to ensure that the project can be completed successfully, the client must select the most appropriate contractor. He identifies procurement methods as the procedures used by the procuring entity to acquire goods, services and works.

**Performance of Construction Projects**

Project performance is defined as the total quality of a project in terms of whether it has impacted the beneficiaries and whether the interventions are sustainable (Chandes et al., 2010). Project performance is different from Industrial or manufacturing sector performance owing to the unique structural nature of the projects. However, like the operations of other sectors, project construction performance can be achieved through evaluation against suitable criteria, monitoring and evaluation or benchmarking against set standards or previous performance of similar projects (Warmode, 2002). Key criteria against which the project performance can be evaluated against includes; whether it is relevant, efficient, effective, whether it has impacted the beneficiaries and whether the interventions are sustainable (Hill, 2005).

Relevance relates to whether the project activities are in line with the priorities of the target group, recipient and donor or sponsor. Key questions that are asked in assessing relevance are whether the goals of the project respond to the needs of the recipients and whether the activities and outputs of the project are in line with those goals. Effectiveness measures whether a certain project is able to realize its goals. Impact examines positive and negative changes as a result of the project. Efficiency assesses inputs against outputs to find out whether the project uses optimum resources possible to achieve the desired results. Sustainability assesses the ability of the project benefits to continue when the project closes (Chandes et al., 2010).

Project performance is behavior that can be evaluated with regard to whether it adds value or it makes the organization more effective (Onukwube, Iyabga & Fajana, 2010). Illriegel, Jackson and Slocum (2009) approaches performance as each person’s work achievement after through exerting effort. From the above definitions, project performance touches on how the ability of workers to finish the jobs they are responsible for and how those jobs help in achieving the goals of the organization.

**Research Methodology**

The study employed a descriptive research design. According to Flick (2011), a descriptive design is a process of collecting data in order to test hypothesis or answer questions concerning the status of the subjects in the study. The target population consisted of all the registered construction projects in Nairobi. The target respondents were project managers since they have knowledge and participate in project panning since inception to finish. The study adopted the Fisher (1982) formula to determine the sample size, \( n = \frac{Z^2 pq}{d^2} \) Where: \( n = \) sample size, \( p = \) the proportion in the target population estimated to have characteristics being measured, \( q = (1-p) \), \( d = \) The level of statistical significance set (0.05), \( Z = \) The standard normal variant at the
required confidence level (95% level of confidence) to arrive at sample size of 138 respondents. The study made use of primary data collected by a structured questionnaire. Quantitative data was analyzed using descriptive statistics involving percentages and mean scores. In addition, regression analysis was used to determine relationship between the study’s quantifiable variables. Pearson’s Correlation, Analysis of variance (ANOVA) and Multiple Regression Analysis was used to establish the relationships among the study variables. Equation below shows the linear regression model of the independent variables against the dependent variable. The multiples regression equation below was adopted to show the effect of the independent variables on the dependent variable.

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \]

Where: \( Y \) is the dependent variable (performance of construction projects), \( X_1 \) is Inventory management, \( X_2 \) is Supplier selection, \( X_3 \) is Strategic Purchasing, \( X_4 \) is Procurement planning, \( \beta_0 \) is the regression constant, \( \{\beta_i; i=1,2,3,4,5\} \) = the coefficients for the various independent variables and \( \varepsilon \) is the error term.

Results

The study administered a total of 138 questionnaires to project managers of registered construction projects in Nairobi County. A total of 120 questionnaires were duly filled and returned which represented a response rate of 86.9%.

Table 1 Demographic Characteristics

<table>
<thead>
<tr>
<th>Demographic Characteristic</th>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents level of education</td>
<td>University</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td>college</td>
<td>25%</td>
</tr>
<tr>
<td>Respondents work experience</td>
<td>Less than 1 year</td>
<td>8.3%</td>
</tr>
<tr>
<td></td>
<td>2 to 5 years</td>
<td>20.8%</td>
</tr>
<tr>
<td></td>
<td>6 to 10 years</td>
<td>43.3%</td>
</tr>
<tr>
<td></td>
<td>Over 10 years</td>
<td>27.5%</td>
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Descriptive Results

Inventory Management

The results indicated that respondents reviewed on site stock half weekly (30%), implying that project managers in Nairobi County frequently reviewed their on-site stock. The findings of the study revealed that respondents agreed that there was effective determination of adequate space before purchasing (mean= 3.65). The results of the study also showed that respondents indicated that minimal stock level was determined below which the stock cannot go (mean= 3.46) and also the respondents indicated that there is always updating of stock information to have up to date information on site stock (mean= 3.85). The findings of the study further revealed that respondents indicated that there is a consistent inventory stock taking system in the organization (mean= 3.57) while majority of the study respondents indicated that inventory management automation has been adopted in the organization (mean= 3.49). Results of the study also showed that respondents indicated that Proper inventory forecasting is being done in the organization (mean =3.62). The results further showed that respondents indicated that there is a well-developed and functioning practice of development of succession registers (mean= 3.56).

The results implied that majority of the companies that had projects in Nairobi County had proper supply chain management practices in place ranging from stock purchase to monitoring.
Table 2 Inventory Management

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is effective determination of adequate space before purchasing</td>
<td>12.5%</td>
<td>10.0%</td>
<td>11.7%</td>
<td>31.7%</td>
<td>34.2%</td>
<td>3.65</td>
<td>1.37</td>
</tr>
<tr>
<td>Minimal stock level has been determined below which the stock can’t go</td>
<td>13.3%</td>
<td>8.3%</td>
<td>23.3%</td>
<td>29.2%</td>
<td>25.8%</td>
<td>3.46</td>
<td>1.32</td>
</tr>
<tr>
<td>There is always updating of stock information to have up to date information on site stock</td>
<td>7.5%</td>
<td>5.8%</td>
<td>21.7%</td>
<td>24.2%</td>
<td>40.8%</td>
<td>3.85</td>
<td>1.23</td>
</tr>
<tr>
<td>There is a consistent inventory stock taking system in the organization</td>
<td>10.8%</td>
<td>6.7%</td>
<td>23.3%</td>
<td>33.3%</td>
<td>25.8%</td>
<td>3.57</td>
<td>1.25</td>
</tr>
<tr>
<td>Inventory management automation has been adopted in the organization</td>
<td>15.0%</td>
<td>8.3%</td>
<td>16.7%</td>
<td>32.5%</td>
<td>27.5%</td>
<td>3.49</td>
<td>1.37</td>
</tr>
<tr>
<td>Proper inventory forecasting is being done in the organization</td>
<td>10.0%</td>
<td>11.7%</td>
<td>15.0%</td>
<td>33.3%</td>
<td>30.0%</td>
<td>3.62</td>
<td>1.30</td>
</tr>
<tr>
<td>There is a well-developed and functioning practice of development of succession registers</td>
<td>10.8%</td>
<td>10.8%</td>
<td>20.0%</td>
<td>28.3%</td>
<td>30.0%</td>
<td>3.56</td>
<td>1.31</td>
</tr>
<tr>
<td>The organization makes use of enterprise resource planning to manage inventories</td>
<td>10.8%</td>
<td>4.2%</td>
<td>21.7%</td>
<td>31.7%</td>
<td>31.7%</td>
<td>3.69</td>
<td>1.26</td>
</tr>
</tbody>
</table>

Supplier Selection

The results of the study showed that the study respondents indicated that there was always evaluation of supplier quality control practices to ensure quality products are delivered (mean=3.64). The results of the study further revealed that the study respondents indicated that there was always evaluation of supplier ability to deliver on time to ensure lead time is under control (mean=3.66). The results of the study also revealed that the respondents agreed that there was always evaluation of supplier competency to ensure quality products are delivered (mean=3.39). The results of the study further revealed that the study respondents indicated that there was always evaluation of supplier financial status to ensure continuous supply (mean=3.63). The results of the study also revealed that the respondents agreed that there was always evaluation of supplier production capacity to ensure quality products are delivered (mean=3.58). The results of the study finally showed that respondents agreed that there was always evaluation of supplier consistency to ensure consistency in supply (mean=3.46). The findings implied that the County government of Nairobi conducted supplier evaluation on their ability to deliver quality and cost effective project in good time.

Table 3 Supplier Selection

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
</table>

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There is always evaluation of supplier quality control practices to ensure quality products are delivered

<table>
<thead>
<tr>
<th>Percentage Distribution</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.8% 8.3% 19.2% 29.2% 32.5% 3.64 1.31</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There is always evaluation of supplier ability to deliver on time to ensure lead time is under control

<table>
<thead>
<tr>
<th>Percentage Distribution</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5% 13.3% 18.3% 27.5% 33.3% 3.66 1.27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There is always evaluation of supplier competency to ensure quality products are delivered

<table>
<thead>
<tr>
<th>Percentage Distribution</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.8% 14.2% 20.8% 33.3% 20.8% 3.39 1.27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There is always evaluation of supplier financial status to ensure continuous supply

<table>
<thead>
<tr>
<th>Percentage Distribution</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.3% 10.0% 20.8% 32.5% 28.3% 3.63 1.23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There is always evaluation of supplier production capacity to ensure quality products are delivered

<table>
<thead>
<tr>
<th>Percentage Distribution</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.8% 10.0% 18.3% 31.7% 29.2% 3.58 1.30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There is always evaluation of supplier consistency to ensure consistency in supply

<table>
<thead>
<tr>
<th>Percentage Distribution</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5% 10.0% 18.3% 37.5% 21.7% 3.46 1.28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Strategic Purchasing**

The results of the study showed that the study respondents indicated that there was supplier integration in the projects so that they can understand the requirements (mean=3.65). The results of the study also showed that the study respondents indicated that there was bulk buying to manage costs involved (mean=3.36). The results of the study further showed that the study respondents indicated that buyer-supplier coordination has been enhanced during the period of the project constructions (mean=3.58). The results of the study showed that the study respondents indicated that supplier tiering was used to enhance continuous supply from the suppliers (mean=3.54). The results of the study also showed that the study respondents indicated that there was double sourcing to enhance continuous supply (mean=3.52). The results of the study finally showed that the study respondents indicated that respondents agreed that there was an updated communication system for exchange of information (mean=3.55). The findings implied that most of the respondents agreed with the statements on strategic purchasing and further confirmed that project managers practiced strategic purchasing to enhance the performance of their projects.

**Table 4 Strategic Purchasing**

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is supplier integration so that they can understand the requirements</td>
<td>11.7% 8.3% 15.0% 33.3% 31.7%</td>
<td>3.65</td>
<td>1.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is bulk buying to manage costs involved</td>
<td>12.5% 10.8% 25.8% 30.0% 20.8%</td>
<td>3.36</td>
<td>1.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.0% 12.5% 17.5% 30.0% 30.0%</td>
<td>3.58</td>
<td>1.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Buyer-supplier coordination has been enhanced

There is supplier tiering to enhance continuous supply

| 10.0% | 11.7% | 20.0% | 30.8% | 27.5% | 3.54 | 1.28 |

There is double sourcing to enhance continuous supply

| 11.7% | 9.2% | 20.8% | 32.5% | 25.8% | 3.52 | 1.29 |

There is an updated communication system for exchange of information

| 10.0% | 10.8% | 20.8% | 30.8% | 27.5% | 3.55 | 1.28 |

**Procurement Planning**

The results of the study showed that the study respondents indicated that there was proper needs analysis before making purchases (mean=3.63). Results of the study also showed that the study respondents indicated that there is proper needs identification before making purchases (mean=3.54). The results of the study also showed that the study respondents indicated that the scope of the goods and services required was always identified before being procured (mean=3.58). The results of the study further showed that the study respondents indicated that sufficient budgetary allocations are done before procuring (mean=3.53). The results of the study also showed that the study respondents indicated that there is determination of the best procurement strategies to be deployed before procurement began (mean=3.70). Further, the results of the study showed that the study respondents indicated that timeframes are set before procurement process began (mean=3.69) and procedures to ensure accountability of the procurement process are set before procurement process began (mean=3.50). These findings implied majority of the project managers revealed that procurement planning was seriously undertaken before actual procurement.

**Table 5 Procurement Planning**

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is proper needs analysis before making purchases</td>
<td>12.5%</td>
<td>6.7%</td>
<td>14.2%</td>
<td>39.2%</td>
<td>27.5%</td>
<td>3.63</td>
<td>1.30</td>
</tr>
<tr>
<td>There is proper needs identification before making purchases</td>
<td>10.8%</td>
<td>10.0%</td>
<td>22.5%</td>
<td>27.5%</td>
<td>29.2%</td>
<td>3.54</td>
<td>1.30</td>
</tr>
<tr>
<td>The scope of the goods required is always identified before being procured</td>
<td>10.8%</td>
<td>9.2%</td>
<td>22.5%</td>
<td>25.8%</td>
<td>31.7%</td>
<td>3.58</td>
<td>1.31</td>
</tr>
<tr>
<td>The scope of the services required is always identified before being procured</td>
<td>8.3%</td>
<td>10.0%</td>
<td>20.0%</td>
<td>27.5%</td>
<td>34.2%</td>
<td>3.69</td>
<td>1.27</td>
</tr>
<tr>
<td>Proper costs estimation is done before procuring</td>
<td>9.2%</td>
<td>9.2%</td>
<td>25.0%</td>
<td>23.3%</td>
<td>33.3%</td>
<td>3.63</td>
<td>1.28</td>
</tr>
<tr>
<td>Sufficient budgetary allocations are done before procuring</td>
<td>11.7%</td>
<td>9.2%</td>
<td>20.0%</td>
<td>32.5%</td>
<td>26.7%</td>
<td>3.53</td>
<td>1.30</td>
</tr>
<tr>
<td>There is determination of the</td>
<td>9.2%</td>
<td>7.5%</td>
<td>16.7%</td>
<td>37.5%</td>
<td>29.2%</td>
<td>3.70</td>
<td>1.23</td>
</tr>
</tbody>
</table>
best procurement strategies to be deployed before procurement begins

Timeframes are set before procurement process begins  8.3%  7.5%  25.0%  25.0%  34.2%  3.69  1.25

Procedures to ensure accountability of the procurement process are set before procurement process begins  13.3%  13.3%  15.0%  26.7%  31.7%  3.50  1.40

Project Performance

The results of the study showed that the study respondents indicated the percentage of cost overrun of the construction projects in Nairobi County was above 20% (mean=4). The results of the study also showed that the study respondents indicated the percentage of time overrun for their projects was also above 20% (mean=3). The results implied almost 100% of the project had either time overrun or cost overrun or both cost and time overrun.

Table 6 Performance Indicators

<table>
<thead>
<tr>
<th>Performance indicator</th>
<th>0 to 5%</th>
<th>6 to 10%</th>
<th>11 to 15%</th>
<th>16 to 20%</th>
<th>Above 20%</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost overrun</td>
<td>9.2%</td>
<td>12.5%</td>
<td>7.5%</td>
<td>35.0%</td>
<td>35.8%</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Time overrun</td>
<td>17.5%</td>
<td>14.2%</td>
<td>22.5%</td>
<td>20.0%</td>
<td>25.8%</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

The results of the study showed that the study respondents indicated that construction projects are completed on time (mean=3.57). The results of the study also showed that the study respondents indicated that construction projects are completed within the specified budgetary allocations (mean=3.71). The results of the study further showed that the study respondents indicated that the construction projects finalized are of high quality and standards (mean=3.57). The results of the study also showed that the study respondents agreed that construction projects are completed within the specified scope definitions (mean=3.69). The results implied that some construction projects in Nairobi County performed better compared to others.

Table 7 Performance

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction projects are completed on time</td>
<td>8.3%</td>
<td>15.8%</td>
<td>16.7%</td>
<td>29.2%</td>
<td>30.0%</td>
<td>3.57</td>
<td>1.29</td>
</tr>
<tr>
<td>Construction projects are completed within the specified budgetary allocations</td>
<td>5.8%</td>
<td>14.2%</td>
<td>20.0%</td>
<td>23.3%</td>
<td>36.7%</td>
<td>3.71</td>
<td>1.26</td>
</tr>
<tr>
<td>Construction projects</td>
<td>12.5%</td>
<td>9.2%</td>
<td>19.2%</td>
<td>27.5%</td>
<td>31.7%</td>
<td>3.57</td>
<td>1.35</td>
</tr>
</tbody>
</table>
finalized are of high quality and standard

Construction projects are completed within the specified scope definitions 11.7% 6.7% 20.0% 24.2% 37.5% 3.69 1.35

Correlation Results

Results of the study showed that the correlation between inventory management and project performance of construction projects in Nairobi County was .554 with a corresponding p value of .000. The correlation coefficient was therefore significant and positive implying that increase in inventory management would result to an increase in the project performance of construction projects. The results further revealed that the correlation between Supplier Selection and project performance of construction projects in Nairobi County was .526 with a corresponding p value of .000. The correlation coefficient was significant and positive implying that increase in supplier selection would results to an increase in the project performance of construction projects. The results also revealed that the correlation between strategic purchasing and project performance of construction projects in Nairobi County was .594 with a corresponding p value of .000. The correlation coefficient was significant and positive implying that increase in strategic purchasing would results to an increase in the project performance of construction projects. Finally the study established a positive and strong correlation between procurement planning and performance of construction projects in Nairobi County as shown by a Pearson correlation of .580 and significance value of .000.

Table 8 Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>Inventory Management</th>
<th>Supplier Selection</th>
<th>Strategic Purchasing</th>
<th>Procurement Planning</th>
<th>Project Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory Management</td>
<td>Pearson Correlation</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplier Selection</td>
<td>Pearson Correlation</td>
<td>.458</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Purchasing</td>
<td>Pearson Correlation</td>
<td>.395</td>
<td>.473</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Multiple Regression Analysis

The findings revealed a relationship $R = 0.721$, indicating a strong positive association between procurement planning, supplier selection, inventory management, strategic purchasing and project performance of construction project in Nairobi County. $R$-squared= 0.520 indicated that 52.0% of variation in the project performance can be explained by procurement planning, supplier selection, inventory management, strategic purchasing.

Table 9 Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.721</td>
<td>0.520</td>
<td>0.503</td>
<td>0.62598</td>
</tr>
</tbody>
</table>

Predictors: (Constant), Procurement Planning, Supplier Selection, Inventory Management, Strategic Purchasing

The results of ANOVA test indicated an $F$ value of 31.137 with a significance of $p$ value = 0.000 meaning that there is a significant relationship between all the independent variables and project performance of construction project in Nairobi County. These finding implied that supply chain management practices significantly influenced the project performance. The findings are also confirmed by comparison of a calculated $F$ value of 31.137 against $f$ critical value (4, 115) of 2.451. The $f$ calculated value of 31.137 was greater than $f$ critical value of 2.451 further confirming model significance.

Table 10 ANOVA Results

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>48.804</td>
<td>4</td>
<td>12.201</td>
<td>31.137</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual</td>
<td>45.063</td>
<td>115</td>
<td>0.392</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>93.867</td>
<td>119</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dependent Variable: Project Performance

Predictors: (Constant), Procurement Planning, Supplier Selection, Inventory Management, Strategic Purchasing

The study further presented the regression coefficient results to examine the effect of each study variable on the organization performance. The results of the study are as presented in table11 below
Table 11 Regression Coefficients Results

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Beta</th>
<th>Std. Error</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>0.044</td>
<td>0.337</td>
<td>0.130</td>
<td>0.897</td>
</tr>
<tr>
<td>Inventory Management</td>
<td>0.305</td>
<td>0.089</td>
<td>3.414</td>
<td>0.001</td>
</tr>
<tr>
<td>Supplier Selection</td>
<td>0.184</td>
<td>0.083</td>
<td>2.220</td>
<td>0.028</td>
</tr>
<tr>
<td>Strategic Purchasing</td>
<td>0.335</td>
<td>0.096</td>
<td>3.500</td>
<td>0.001</td>
</tr>
<tr>
<td>Procurement Planning</td>
<td>0.221</td>
<td>0.11</td>
<td>2.014</td>
<td>0.046</td>
</tr>
</tbody>
</table>

Dependent Variable: Project Performance

The optimal multivariate Regression Model for the study therefore is as shown below

Project Performance = 0.044 + 0.305 (Inventory Management) + 0.184 (Supplier Selection) + 0.335 (Strategic Purchasing) + 0.221 (Procurement Planning)

The model coefficients results as presented in Table 11 above showed a statistically positive and significant relationship between inventory management and project performance ($\beta=0.305, p=0.001, <0.05$). The results implied that a unit increase in inventory management would result to an increase of 0.305 units in project performance. The model coefficients results further showed a statistically positive and significant association between supplier selection and project performance ($\beta=0.184, p=0.028, <0.05$). The results implied that a unit increase in supplier selection would result to an increase of 0.184 units in project performance. The coefficient of strategic purchasing was ($\beta=0.335, p=0.001, <0.05$) shows a statistically significant and positive relationship between strategic purchasing and project performance. The results implied that a unit increase in strategic purchasing would result to an increase of 0.184 units in project performance. The results finally revealed a coefficient of procurement planning was ($\beta=0.221, p=0.046, <0.05$) shows a statistically significant and positive relationship between procurement planning and project performance. The results implied that a unit increase in procurement planning would result to an increase of 0.221 units in project performance.

Conclusion

The study concluded that inventory management is a key aspect of project performance. The study concluded updating of stock information to have up to date information on site stock, effective determination of adequate space before purchasing, adopting a consistent inventory stock taking system, proper inventory forecasting and the use of enterprise resource planning to manage inventories are among key inventory management practices that enhance the project performance. The study also concluded that project managers that carry out evaluation on supplier quality control practices, supplier ability to deliver on time and supplier competency are likely to enhance the performance of their project. The study also concluded that project managers practiced strategic purchasing and proper procurement planning enhanced the performance of their projects.

Recommendations for the Study

The study recommended that projects managers and head of supply chains departments should ensure that they have a minimal threshold for their inventory to ensure continuity of their projects. The study also established that not all the...
companies had adopted inventory management automation for inventory management. The study therefore recommended the construction companies without automated system for inventory management should adopt such systems for efficient inventory management.

The study further recommended that County governments should include supplier competency and supplier consistency in supplier evaluation. The study also recommended that contractors should embrace bulk buying of the stock for various reasons which include to benefits from discounts and avoids the impacts on inflation on stock. The study also recommended that supply chains department should prepare goals, objectives and procurement programs in advance to assist in procurement budgeting and planning. The study finally recommended that procurement planning should be carried out in consultations with quotations provided by pre-qualified suppliers.

**Acknowledgement**

I wish to acknowledge the invaluable support of my family who endured many days of my absence as I tried to complete this project. I also have a special mention for my supervisor, Dr. George Ochiri for his continuous advice. I am greatly indebted to him for his guidance, support and the timely comments to this proposal. To JKUAT, my colleagues and lecturers, I acknowledge you.

**References**


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