INFLUENCE OF ENVIRONMENTAL REGULATIONS IN THE PERFORMANCE OF CONSTRUCTION PROJECTS IN NAIROBI COUNTY, KENYA

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ABSTRACT

The performance of the construction projects in Kenya is poor as most projects experience time and cost overrun. About 70 percent Compliance with environmental regulations and bureaucracies involved influence the time and cost of completing projects. To improve the performance of construction projects, construction firms need to put into consideration environmental regulations from the planning phase of the project to the completion stage. This study investigated the influence of environmental regulations on the performance of construction projects in Nairobi County. The specific objectives of the study were to determine the influence of water regulations on the performance of construction projects in Nairobi County; establish the influence of waste management regulations on the performance of construction projects in Nairobi County; assess how noise and vibrations regulations influence the performance of construction projects in Nairobi County; and determine the influence of physical planning regulations on the performance of construction projects in Nairobi County. The study used correlational research design. The target population was 824 registered construction firms in Nairobi County who are overseeing construction projects in Nairobi. Slovin's Formula was used to determine the sample size. The study utilized a stratified random sampling to select a sample of 269 construction firm owners from the target population. Both secondary data and primary data were used in this study. Secondary data was obtained from national construction authority reports for the last five years. This study used semi-structured questionnaires in the collection of primary data. Quantitative data was analyzed by use of inferential statistics and descriptive statistics with the help of statistical software known as Statistical Package for Social Sciences. Frequency distribution, mean, percentages, and standard deviation are inclusive of descriptive statistics. Presentations of the results were in tables and figures. Correlation analysis was used to determine the relationship dependent and independent variable. The study found that water regulations have significant influence on performance of construction projects in Nairobi County. The study also found that waste management regulation has significant influence on performance of construction projects in Nairobi County. Moreover, the study found that noise and vibration regulations has little significance influence on performance of construction projects in Nairobi County. Further, the study established that physical planning regulation has insignificant influence on performance of construction projects in Nairobi County. The study recommends that construction firms should conduct environmental impact assessment for them to enhance accessibility of construction permit from relevant authorities. The study also the study recommends that the construction firms in Nairobi County should use recycling, open dumping and landfilling to improve on waste management among the construction firms. Moreover, the study recommends that construction firms should purchase equipment that minimize the level of vibration emission, use equipment that meet

ISO test code for vibration and employee competent assessment officers so as to enhance effectiveness of noise and vibration assessment among the construction firms. Further, the study recommends construction firm should employ competent physical planning advisors, allocate resources for planning and involve shareholders in planning process so as to improve on zoning of construction projects.

Key Words: *environmental regulations, performance, construction projects, Nairobi County, Kenya*

INTRODUCTION

Since civilization, human beings have looked for shelter in the ecosystem by building an artificial environment. Long time ago, people were building houses with the natural available construction material, but overtime they have improved on the type of construction material they use by designing more sophisticate buildings and construction materials (Christudason, 2012). However, despite their safety and comfort, modern construction materials significantly influence the ecosystem (Cunningham, 2014). For instance, the production of cement, a key component in building construction emits greenhouse gases which deplete the ozone layer and the effect is global warming (Beckrich, 2018). Additionally, construction projects lead to generation of solid waste and also lead to air pollution, water pollution and noise pollution. Further, the displacement and extraction of raw materials disrupts the ecosystem and leads to land degradation (Santin, 2009).

In response to the increasing environmental degradation, various countries around the world have developed legislations and policies to regulate construction activities and ensure that construction projects have minimum impact on the environment (Cunningham, 2014). In Singapore, Christudason (2012) indicates that the environmental issues have gained increased attention in the last two decades due to the increasing environmental degradation, which has led to the development of environmental policies like Environmental Protection Control Act (EPCA) and Singapore Green Plan. In the Europe, Ghanbari and Farshchi (2010) found that multilateral environmental legislations have been developed to regulate the construction industries so as to prevent and mitigate advanced negative impacts associated with environmental contamination. In Ghana, Ametepey and Ansah (2015) indicates that the government has developed environmental regulations that include Environmental Assessment Regulations Act, Environmental Sanitation Policy and building code.

As a result of the increasingly governmental legislation that are both international and national, and to respond to the concerns that are rising and being demonstrated by the general public on issues with the environment, most of the organizations in the construction industry are aware that there is a need to do an improvement on the issues with the environment in their business scope

(Christudason, 2012). In the United Kingdom, Pasquire (2010) found that the considering issues on the environment within a framework that is related to the construction process facilitate management responsibility allocation in the team used in construction. However, adherence to environmental regulations has been deferring from states, regions or and continental blocks. While construction firms in the United Kingdom and United States were adhering for environmental regulations, construction firms in Mexico. Santin (2009) asserts that despite of environmental regulations, majority of building construction firms have shifted prefabricated martials which are affordable and ecofriendly. In Ghana, Yalley et al. (2015) found that more than 50% of the construction firms in the building sector had never obtained an Environmental permit.

Despite the importance of environmental regulations in ensuring environmental sustainability globally, the regulations affect the performance of constructions projects negatively (Santin, 2009). In China, Wong, Chan and Lam (2012) show that negotiation uncertainties with government in terms of legislation compliance of the delayed the transaction costs of construction projects due to the delay in the approval processes.. In Pakistan, Cunningham (2014) found that raising the minimum standards of construction planning, safety, and protection of environmental leads to development of better projects even though it is costly. In addition, Pasquire (2010) indicates that governments' bureaucracy in obtaining of environmental approvals lead to an increase in the delivery time of a project. At times, obtaining environmental approvals takes longer than expected leading to stalling of construction projects.

In Kenya various environmental legislations have been developed to ensure sustainable development and environmental protection by the real estate industries. These legislations include Waste Management Standards (Legal Notice 61), EMCA Regulations (2009), Physical Planning Act (1996), Water Act (2002) and Water Management Standards (Legal Notice 120) and Building Code 1968. The construction industry is a water intensive sector as a lot of water is required in the mixing of raw materials and in watering of newly constructed structures (Kimani & Musungu, 2010). The Water Management Standards (Legal Notice 120) indicates people should shun away from activities which lead to pollution of aquatic ecosystems. Even before the enactment of the water Act. In addition, regulations on water pollution influence where construction companies can obtain water for their construction sites. This in turn influences the cost of obtaining water and time taken to obtain that water. Houser and Pruess (2009) found that construction projects had a significant influence on water quality downstream and hence construction companies were banned from using tapped water in construction sites.

In addition, Section 87 of EMCA 1999 states that nobody should dump or discharge waste (in Kenya even persons from foreign countries) in a manner which cause ill health or contamination of the ecosystem. Further, Section 240(4) of the Building Code of 1987 states that the vacant left after the demolition of building should be tidy and the material derived from the demolished site should not be used for the construction of other buildings or structures. (Auma, 2014). The

removal of debris from construction sites may involve other costs such as cost of transportation and recycling costs.

Noise regulations also follow the same formulation as water, and waste management regulations. The precise standardization such as waste and water management regulations codified EMCA 1999 and EMCA .However, EMCA 1999, prohibits noise pollution above the set limits, designed by National Environmental Management Authority. The Act also provides for the duration of processing the noise and excessive vibration permit (Auma, 2014). In the year2009, Parliament felt the need to specifically implement noise and excessive vibration standards which the original EMCA prohibited. The bill was then passed by the parliament. The new regulations prohibited noise pollution on the environment. The first chapter of the regulation emphasize on prevention of noise pollution by setting standards to NEMA to issue noise or vibration licenses. The regulations provide guidelines for some of the sources of noise and vibration such as radio, television and industrial activities. The sources have specific causative agents hence the sound polluters have the right to apply for noise and excessive vibration permit from the National Environmental Management Authority.

Planning and building regulations requirements influence the performance of projects negatively. This is due to the bureaucracies involved in obtaining permits (Kimani & Musungu, 2010). The Physical Planning Act (1996) indicates that developers should comply with the by-laws.

STATEMENT OF THE PROBLEM

The construction sector plays a key role in the development of the Kenyan economy. The sector contributes immensely to the: Gross Domestic Production of the Kenya economy, Gross Domestic Capital formulation, employment creation and generate production capital (Ametepey & Ansah, 2015). However, the performance of construction projects in Kenya has been experiencing time and cost overrun. According to Auma (2014), construction projects in Kenya have been performing poorly with 70% of the projects experiencing time and cost overrun by approximately 50%. Construction activities considerably changes the surface of a land due to excavation and clearing of vegetation, which is communing in construction projects. These activities also lead to air pollution, soil pollution and water pollution, which implies that an increase in construction projects can lead to an increase in pollution. As a result, governments all over the world have developed environmental regulations in an effort to protect the environment. According to Njoroge (2013), compliance with environmental regulations and bureaucracies involved influence the time and cost of completing projects. To improve the performance of construction projects, construction firms need to put into consideration environmental regulations from the planning phase of the project to the completion stage. Various studies have been conducted on environmental regulations in construction industry in Kenya. For instance, Njoroge (2013) conducted a study on the effect of regulatory mechanism in construction firms on promotion of sustainable developments in Nairobi County and found that the framework

regulation in the construction companies in Kenyan were not holistic and dismally promoted sustainability.. However, the study was limited to the National Construction Authority and the dependent variable was sustainability of projects, which is different from performance of projects. In addition, Wambui (2014) conducted a study on evaluation of occupational safety and health in construction projects in Nairobi County and found that the enforcement of legal requirements in construction projects is done although there are numerous accidents which are experienced at the construction sites majorly on machinery accidents, slips and falls. Occupation occupational safety and health is only one of the regulations in the construction industry. Ndumia (2015) examined the influence of regulatory framework on performance of building construction projects in Nairobi County and found that Architects and Quantity Surveyors regulatory practices, County Government regulatory practices, National Environmental Management Authority regulatory practices and National Construction Authority regulatory practices influence performance building construction projects. However, this study did not show how various regulations influence projects' performance. This study therefore sought to investigate the influence of environmental regulations on the performance of construction projects in Nairobi County.

PURPOSE OF THE STUDY

The purpose of this study was to examine the influence of environmental regulations on the performance of construction projects in Nairobi County.

OBJECTIVE OF THE STUDY

1. To determine the influence of water regulations on the performance of construction projects in Nairobi County.
2. To establish the influence of waste management regulations on the performance of construction projects in Nairobi County.
3. To assess how noise and vibrations regulations influence the performance of construction projects in Nairobi County.
4. To determine the influence of physical planning regulations on the performance of construction projects in Nairobi County.
5. To determine the moderating influence of organizational resources on environmental regulations and performance of construction projects in Nairobi County.

LITERATURE REVIEW

Performance of Construction Projects

There are several studies that have been done on project performance. However, there has been no consensus among various authors on the correct definition and the standard measures of

project performance. According to Bateta and Wagoki (2015), project success is one of the subjects in project management that has been discussed among authors without reaching to an agreement and as a result the definition of project performance remains vague and differs from one author to another. In addition, the variations in the definition of project performance also lead to variations in the measures of project performance among different authors. In addition, the users' perception of project performance may differ from that of the contractors and donors. Nevertheless, there is a general agreement among others that the performance of a project involves both effectiveness and efficiency.

Performance of projects can be measures in terms of schedule, safety, quality, and cost and user satisfaction. However, Afaq (2013) asserts that the performance of a project is considered good if it meets its technical specifications and if satisfaction is achieved among stakeholders such as end users, project team members, parent organization managers and donors or financiers. According to Abok (2013), the performance of a project is considered good if its completion is within schedule, within budget, achieves the set goals and ensures user satisfaction.

Traditionally, the performance of a project was measured in terms of schedule, within budget (cost) and specified quality. Nevertheless, even though projects completion is done on time, within budget and are perceived to be of good quality, they can still be considered as failures while projects that have exceeded the set time and exceeded the budget can be considered successful. Therefore, even if the traditional performance measures such as quality, cost and budget are important in measuring performance; other measures have also to be used. These measures include user satisfaction, client satisfaction and environmental impact. Nguyen and Watanabe, (2017) argues that the measures of project performance should include completion time, completion within budget, efficiency, effectiveness, meeting stakeholder's expectations, minimum conflicts and disputes and safety.

As highlighted above, different authors use different measures of project performance. For instance, measurement of the performance of construction project moreover, Elshakour, Al-Sulaihi and Al-Gahtani (2013) studied on the factors which are used to measure the construction industries performance in Saudi Arabia Kingdom. The collection of the study data was carried out by administering questionnaires from the findings, the traditional financial measures cannot be the only determinants of a firm success. External satisfaction of the customers, business efficiency, safety, planning effectiveness are other indicators of performance which are increasingly becoming important. Further, Roshana, Akintola and Kelly (2015) did an analysis of performance measurement of construction projects in Malaysia. Data was collected using descriptive statistics. From the findings, the commonly used performance measures included contractor performance, measuring project quality, project manager's performance, project viability and feasibility and consultant's performance.

In Kenya, Ogutu and Muturi (2017) conducted a study on the determinants of successful completion of construction projects in Mombasa County. The results indicated that 50 per cent of the construction projects in Kenya experience time overrun and cost overrun. However, most of the projects were completed less or more to specification. The main measures of performance of construction projects included budget (cost), schedule, quality and scope. In addition, Kaniaru (2014) conducted a study on the determinants of the performance of construction projects in Mombasa County. The results indicated that the measures of project performance include time taken to complete the projects, cost of the construction project, quality of the project and achievement of the set objectives.

Water Regulations and Performance of Construction Projects

Water is a key resource in the performance of a construction project and it plays a great role in ensuring that the project performs as required. However, during construction activities, water tends to be misused. Inadequacy in water, in construction projects, leads to an increase in the cost of the projects as more resources are used in getting water over long distances. In addition, inadequacy in water implies that more time is spent in obtaining water, thus increasing project implementation and completion time. The scarcity of water therefore leads to it being regulated and this reduces misuse. It is therefore important that the available water is utilized well thus ensuring that there is enough to be used during the project life cycle thus enhancing the performance of the project (Ametepey &Ansah, (2015).

Construction of projects leads to water pollution. Water pollution on building sites are inclusive of: construction debris, paint, diesel and oil; leaners, solvents and other chemicals that are harmful. Soil erosion is caused by clearing land thus leading to silt-bearing run-off and sediment pollution (Cunningham, 2014). Construction and land clearing in most cases puts sediment in rivers and water bodies.

Other pollutants are carried by surface water runoff. These pollutants include diesel, oil and other toxic chemicals. When pollutants on construction sites soak in underground water, it causes water pollution. It is very difficult to treat contaminated ground water compared to surface water treatment. Water that is polluted leads to several problems. These problems include destruction of natural beauty, suffocation of aquatic creatures, water bodies' contamination, diseases and effect on industrial units (Pasquire, 2010). Adnan (2016) researched on factors which affect sustainability of construction in project life cycle. Questionnaires were used during the study for data collection. From the findings, the most common elements that hindered sustainable performance of construction projects include recyclability, service provision, consumption of energy, the cost of water, and assessment of the level of water pollution.

In Sri Lanka, Anuradha and Waidyasekara (2016) found that efficient water practices were greatly influenced the prevailing condition within the project operation of a project. However,

improvement measurement beyond the project level, industrially supported and policy intervention are important for successful measurement of these levels. This study is based on soft measures posed to hard measures such as technological based measurements of water efficiency, water cost; source and employees' attitude were identified as significant factors which influence efficient usage of water on construction site. Stakeholders' commitment and experience were also influential factors in efficient use of water. The management gave water efficiency less priority compared to others which were considered more important managerial functions. Sanitation, construction activities and cabins of site were considered to consume the highest percentage of water and resulted to water shortage. Construction activities consume over two third of water used in construction sites. Hence, the construction industries indirectly misuse portable water which could be used for other beneficial gains.

In India, Bardhan (2015) indicates that water regulation policies which were adopted did not efficiently manage to curb the misuse of water in construction sites and more effective mechanisms need to be adopted since a large volume of water consumed were not documented. Since water usage vary with the type of activities carried in construction industries. Off-site activities such steel and glass industries have different consumption rate of water due to material variation materials while on-site water usage plays a significant role-in cast reinforcement of cement concrete. Thus, water efficiency need to be taken into consideration during production stage of these industries.

Pushplata (2013) conducted a study on the relationship between building regulations focusing on environmental protection in hill towns in India. The results indicated that in an effort to mitigate the effect of construction on the maintenance of quality environment, the government came up with various regulations. However, despite the implementation of these regulations environmental degradation was still evident.

Houser and Pruess (2017) indicates that sedimentation and construction activities were the major causes of water contamination and these activities need to consider the best management practices so as to retain water quality. Jinlong (2015) indicates that China enacted water and environmental laws so as to protect their ecosystem. Different multilateral environmental laws and standards are used to develop of more effective laws within countries.

The government of Kenya enacted laws and regulations to ensure sustainability and protection of riparian ecosystems. Water Quality Regulation 2006, Environmental Management and Coordination Act of 2015 and Waste Regulation of 2006 are some of the examples. Industries are required to annually apply for effluent discharge licenses from NEMA for disposing of water used in their production activities as indicated under section 12 of the EMCA (Water Quality) Regulations, 2006. Penalty of Ksh 500,000 is normally charged to non-compliance parties. The specification of discharge limits are also provided by the regulation. Under Part III section 12 and 14 of the regulations, NEMA licensed proponents are responsible for monitoring the quantity

and quality of the effluent discharged in the affected water ways. Part III section 16(d) of the EMCA Regulations 2009 states that it is important to prevent siltation of water ways. Furthermore the license required by the Water Quality Regulations, the Water Act 2002 regulates the usage of water in construction activities. It also mandates WRMA to determine the validity of the applied water consumption and monitor its usage to ensure conformity with the provide license. Construction activities utilize too much water and can lead to pollution of water. Additionally, no empirical studies have been conducted to determine the influence of regulation of water on construction projects performance in Kenya.

Waste Management Regulations and Performance of Construction Projects

Waste management practices have emerged due to environment degradation and are adopted mainly to reduce negative impacts on environment. It is important to have waste management in order to ensure the profitability of an organization (Dania, Kehinde & Bala, 2013). Where a company's waste is well managed reduction in waste leads to reduced cost. Controlling cost is important in performance management. This leads to establishment of regulations that ensure that there is performance of project. Various studies have therefore been done in relation to management of waste and its performance. For instance, Osuga (2015) researched on the influence of management of waste on performance of the environment in timber production firm in the County of Nakuru. He found that waste management has positively influenced the performance of construction projects.

In Hong Kong, Lu and Tam (2013) elaborated on the negative impacts of waste generated from construction activities. In the past, different waste management policies were introduced by the government but they were not very effective hence the government introduced new policies based on recent philosophies of waste management. Such as triple R principles (recycle, reuse and reduce) and polluter pays principle form a chain of effective regulatory framework for management of construction waste in Hong Kong. However, there is still room for establishment or implement more effective policies such as that of the year 2006. The findings of Wong and Yip (2014) indicated that CWDCS demonstrated its ability to minimize disposal of construction waste on landfills through provision of economic incentive to sustainable development activities. Hong Kong government should constantly monitor and evaluate waste disposal charge for CWDCS so as to adapt with the changing circumstances of economic in construction industries.

In Malaysia, Mohd and Nurul (2014) examined the performance of waste management strategies in healthcare organizations and concluded that waste management strategies which are effective led to an improvement in the performance of organizations (internal business process performance, financial performance, learning Innovation and growth performance, and customer performance). Further, Rudolph and Seetharaman (2013) researched on the waste management performance in the construction industry and established that there are many ways that can be used in waste management such as properly disposing waste, reusing or recycling waste that has

a residual value and minimizing waste that is generated by companies. Construction waste can therefore be managed by the contractor ensuring the availability of waste streams, should focus on avoiding waste, the personnel used in the construction should be educated on how to manage waste and the contractor should be qualified so as to give quality services on waste management. The project manager should also monitor and evaluate the project so as to ensure that waste is well managed (Wong & Yip, 2014).

Ng, Tan and Seow (2017) found that Solid waste reduction through triple R principle is fundamental for National Solid Waste Management Policy in the country of Malaysia. However, the practice is mandatory to project contactors unlike in management of construction waste in Penang. Therefore, implementation of triple R principles results to sustainable utilization of resource and expands the lifespan of the landfills.

In Nigeria, Dania, Kehinde and Bala (2013) reported that the government had not implemented regulation on waste management in construction industries hence the contractors were more focused on other objectives of their projects such as time, cost, quality of project rather than the associated environmental impacts from construction industries. Most of the employees in construction industries lack waste management skills since the companies did not have policies for management of waste.

In Kenya, the law demands that a construction site must be kept in good order and the workplace should always be clean. The corporation and coordination between people involved such as contractors, clients, suppliers and construction trades helps on determining the safety and efficiency of material storage (Kioko, 2017). There should be a discussion and an agreement between the project client and the project manager on material storage (Njoroge, 2013). In Kenya, EMCA (Waste Management) Regulations, 2006 is the key policy which governs the management of waste. Construction projects generated considerable amount of waste granules which is normally on the surrounding leased by the contractors. However, this regulation has a few provisions which pertain to project construction activities. According to Section 6(1) it is mandatory for waste facilities owners to adopt clean production mechanisms through energy and material conservation and emission reduction. The seventh section of the regulation requires that all waste transportation vehicles should be issued with waste transportation license by NEMA within a period of twenty one working days from the date of application. This means that granular waste generated from the construction activities should be transported to waste management facilities by the use of NEMA licensed vehicles. Section 18 also emphasizes on the need of approval from NEMA before disposal of granulate waste from the construction sites (Chepkole, 2014). Despite of large amount of waste generated from construction industries, there is no clear evidence on the impact of waste management policies or regulations on the construction projects performance. However, in a study on the assessment of solid waste management policies in Mombasa and Nairobi Haregu (2015) found that solid management policies were evolving in terms of functions, scope and focus. Nevertheless, they highlighted that

there was weak institutional capacity and structures and weak enforcement of the policies already in place. Nonetheless, when following all the policies in solid management, construction companies are required to clear are the debris in the construction sites, which increase cost of the project and time taken to complete the project.

Noise and Vibrations Regulations and Performance of Construction Projects

A lot of noise is produced in the construction sites can lead to hearing problem, hypertension, severe stress and sleepless night According to research, increased noise leads to disturbance of the natural cycles of animals and can as well reduce their usable habitats (Mandeep, 2015). The construction noise regulations tend to lack specificity of the general noise regulations. Worker mobility and large proposition of small businesses characterize the construction industry and they make the implementation of hearing conservation measures to become difficult (Pasquire, 2010).

Some of the activities done in a construction site are noisy. Using improved work practices, the noisy activities can be controlled (Veggeberg, 2011). Treasonable measures should therefore be taken by builders in order to reduce noise and minimize noisy activities (Ametepey &Ansah, (2015). Noise and vibration affects project performance since they hinder proper communications thus failure of the project. This thus leads to formation of regulations that is essential in improving on performance.

In the United Kingdom, Pinsents and Masons (2016) reported the use of Section 60 of Noise Pollution Act of the year1974 by authorities had increased significantly to curb noise pollutants emanating from construction of buildings and the local authorities willingness to mitigate and control the associated negative impacts of noise pollution Abatement notice under enforceability options of the EPA 1990 was also used to curb noise pollution.

In Canada, Manvell and Stollery (2014) argued that new infrastructure construction causes significant noise pollution the surrounding environment especially mega infrastructural projects. For instance, Diamond project in West Toronto in the state of Canada which resulted to noise pollution when they were constructing a massive underpass to separate commuter railway line from freight rails, which was at the center the community. However, the project failed to address stakeholders' outcry and this forced the transport regulatory authority to intervene by specifying alternative and advanced technological policies that could be used in the feature to impose operation limits and reporting of cost increase requirement that could extended the project completion by three more years. If public participation was effectively utilized prior to the commencement of the project, the challenges which emerged from public outcry such as project delay and overrun cost could have been avoided.

A Noise and Vibration Management Plan (NVMP) is necessary in the formulation of regulations. This plan is used to identify activities which could potentially cause noise pollution in noise

sensitive environment and for development of mitigation strategies which is later implemented for the safety of the community. This process basically involves stakeholders in decision making so that their views can be considered during establishment of the project. It also entails noise management adherence part of CMP. The level of details expected on this plan is dependent on duration, scale, type of work and hours of work used in a project (Bayless et al., 2016). Not all the activities in a construction site meet the set regulations and this is dependent on the work involved in the site and the location of noise sensitive use. Acoustic consultant inputs demonstrate these limitations so as to achieve equilibrium approach. When works proposed are outside standard working hours, further assessment could be conducted by the consultant to determine the allowable work schedule which positively affects the community.

In the United States, Veggeberg (2011) highlight that construction projects often lead to noise pollution complain from community more so in highly developed urban areas. The acoustic requirements and system analyzation can be intensive and more stringent. Noise originating from construction facilities could cause collapse of surrounding buildings and discomfort to human beings. This study implements monitoring of noise pollutant stations by acquisition of noise and vibration detectors such as microphones which are wireless, accelerometer geophone, supervision centre, and a data post processing database designed to enhance monitoring efficiency and performance. The monitoring stations are autonomous with respect to the central servers which allow critical tasks such as alarming system to be locally conducted in case of network disruption.

In Kenya, the noise and vibrations regulations are stipulated in EMCA (2009). The aim of these regulations is to ensure tranquillity, healthy ecosystem and psychological wellbeing of noise pollution regulation (Mandeep, 2015). The Regulations also elevate living standards by prescribing acceptable levels of noise for various activities and facilities. These Regulations prohibit production of unreasonable, unnecessary or unusual, disturbing noise. Involvement of persons in activities that emit excessive or vibrations must obtain a license from the relevant authority (Muriuki, 2008).). Despite the fact that construction projects involve noise and vibrations, there are no studies showing the effect of noise and vibration regulations on construction project performance in Kenya.

Physical Planning Regulations and Performance of Construction Projects

The extent to which workforce, timetables, equipment, milestones, and budget are specified or estimating the time, effort, and cost as well as staff resources needed to execute the project can be described as physical planning of a project. The aim of planning is to ensure that a project is placed back on its track in case a deviation had occurred from the plan and it can also be used to control a project and also establish a baseline so as to gauge progress. Lack of planning leads to lack of control (Njoroge, 2013). The overall challenge in physical planning is how to provide

sustainable growth guidelines. This guidelines form a basis in which project performance is regulated.

In Ethiopia, Tekalign (2014) examined the role of project planning on project performance in Ethiopia. The study used descriptive statistics to collect data. The findings of the research indicated that the main planning input factors that affect the performance of planning processes are: management, human, organizational and technical factors. Further, the findings indicated that the major areas that faces problem in the planning processes are risk, quality human resource, scope and integration knowledge areas were inadequately/poorly/ performed in the studied project. In the development of a project plan, it is necessary for advice to be given due to elements such as concerns in the community, demolition periods and the noise regulation mechanisms in the workdays or weekend, night works, sensitivity to project sites and noise balancing needs or any work which result to noise pollution.

In Nigeria, Usman, Kamau and Mireri (2014) indicate the procedures to be adhered to for successful achieving of project outputs. However, most of stakeholders did not comply with the guidelines of the NBC. Despite of the existing construction regulatory frameworks in the city of Abuja, the compliance rate is significantly low. The NBS stipulates other procedures such as building plans, fee for mobilization, provision of occupational health and safety were given minimal consideration.

In Rwanda, Gitau (2015) found that most projects had very competent architectures and engineers. The study also indicated that ninety two percent of risk management practices were informal and not effective risk mitigation measures were implemented. Further, the results revealed that projects managers came up with different strategies of risk management at the planning stage by involving skilled professionals in decision making. Furthermore, study established found that project stakeholders were involved in decision making process at project implementation stage.

Planning in Kenya operates within a legal framework in terms with Section 66 of the Constitution. By careful analysing of issues in project design, the following legislations are key in providing further guidance towards better development of project: Physical Planning (Subdivision) Regulations, 1998; and the Local Government (Adoptive By-Laws) (Building) Order 1968 (The Building Code) (New Edition 1997 contain objective and guideline requirements (Gitau, 2015). These polices enhance the provision of ecofriendly and sustainable developments within the community. The government of Kenya encourages proponents to consider the use of suitable design professionals such as architects and engineers it is therefore advisable that registered professionals with valid practicing certificates are involved, failure to which submission certificate are not issued. Even though there are various policies that directly influence construction projects in Kenya, there is little empirical evidence showing the influence of physical planning regulations on performance of projects.

In addition, Maina (2012) assessed the level of land use competency skill among staff working in Nairobi County, Kenya. The researcher used descriptive research design. The study found that there units were characterized by staff incompetence. In addition, the study found that communication delay was one of the main challenges that were facing local authority planners when involving various government agencies. This was followed by bureaucracy, role conflicts and technical capacity. These challenges lead to an increase in the approval time and hence increases project delivery time.

Organization Resources and Performance of Construction Projects

Organizational resources are human, physical and financial, technical resources that affect performance of construction projects (Crivelli & Gupta, 2013). Financial resources are funding that are required for purchasing of machinery or equipment that are needed in undertaking road construction projects and cater for expenses such as wages and salaries (Frimpong et al., 2013). Hermawati and Rosaira (2017) researched on the effect of technical resources on implementation of renewable energy in Indonesia. The researchers used descriptive- survey research technique. The studies found that availability of technical resources have significant effect on implementation of projects. Moreover, the study established that availability of competency technical staff have significant effect on implementation of renewable energy projects.

Kharazmi and Teymouri (2013) assessed the effect of financial resources on implementation of organizational activities in Iran. The researchers used descriptive research technique. The study established that financial resources have significant effect on implementation of organizational activities. Ochenge and Ngugi (2018) assessed the organization resources on implementation of road construction projects in Kenya. The study adopted descriptive research design. The study found that financial resources, human capital and technical equipment have significant effect on implementation of construction projects.

Rugiri and Njangiru (2018) researched on the effect of organizational resource on implementation of water projects in Nyeri County, Kenya. The researcher employed descriptive research technique. The study found that physical, financial and human resources have significant effect on implementation of water projects. Bartocho (2016) researched on the effect physical resources on implementation of courier-firm projects in Kenya. The study adopted descriptive survey design. The study found that physical resources significantly affect implementation of courier-firm projects. The study also established that the availability of information communication technology, vehicles and office stationaries enhanced implementation of projects.

Otuoma (2018) researched on the effect of financial resources on implementation of photovoltaic projects in Homabay County, Kenya. Descriptive study was adopted during the research. The study found that financial resources have significant effect on implementation of photovoltaic

projects. Kiara (2013) assessed the effect of technological resources on implementation of renewable energy projects at KenGen. Descriptive research method was adopted during the research the study found that technological resources have significant effect on implementation of renewable energy projects at KenGen. The results also revealed that KenGen allocated intensive technological resources as a way of improving innovative edge of renewable energy projects.

THEORETICAL FRAMEWORK

A theory is a set of facts that are accepted, assumptions or propositions, that attempts to provide a rational and plausible explanation on the relations on cause and effect among a set of elements of an observed phenomenon. This study adopted the public interest theory of regulation. This theory is used to describe the regulations that seek to protect and benefit the public. In majority of the societies, there exists a basic assumption whereby people should carry on their businesses in their own interests. As they carry their businesses, they meet other people who influence them or they are influenced by their activities. When the government and other regulations are put in place to influence the business interests, citizens tend to benefit from their activities. Becker (1986) conducted a study on Public Interest Theory. Results of the empirical studies gave various results.

The first results added support to the Peltzman regulation theory. Most variables used conquer with the hypothesis of this theory. Secondly, the results supported the conclusion drawn from the Peltzman theory as it describes the regulatory capture. However, it is not always decisive. This theory is and can be maintained in many countries. The final conclusion drawn indicated the concerns on protecting the public interests. We can explain why the public interest is considered even if it conflict with the interests of project developers. To the contrary, it is the legislator personal interests' protection mechanism which bring about the outputs, particularly when the public's awareness and democratic voting turnout of the stakeholders are high (Becker, 1986).This theory is essential in the regulation of construction projects in order to meet the public' demands and thus ensuring customer satisfaction. It also ensures that the construction projects are done in the right manner and their results are of high quality and t the right time.

RESEARCH METHODOLOGY

Research Design

The current research used correlational research technique. Correlational research design is normally used in the assessment of the relationship between two variables (Creswell, 2006). Mainly, it shows the existence and direction of an association between variables in a study. This study sought to assess the relationship between environmental regulations (water regulations,

waste management regulations, noise and vibrations regulations and physical planning regulations) in the performance of construction projects.

Target Population

Target population refers to items or individuals that are considered in any field of inquiry and has common attributes (Cooper & Schindler, 2006). The target population was all the registered construction firms in Nairobi County. The unit of analysis was the construction firms and the unit of observation was project managers. According to the National Construction Authority (2016), there are 824 registered construction firms based in Nairobi County.

Sample Size and Sampling Techniques

A sample size must be large enough in order to represent the universe population (Kothari, 2004). Creswell (2006) indicates that information gathered from the sample size should be enough and can be analyzed easily. Slovin's Formula determined the sample size. The formula enabled the researcher to effectively select the sample size of the current research.

$$n = \frac{N}{1 + NE^2}$$

Where: n = number of samples; N = total targeted audience; E = error margin (0.05)

$$n = \frac{824}{1+(824*0.05^2)}$$ n = 269

The research utilized a stratified random-sampling technique in the selection of 269 construction firm owners from the target population. The strata of the current research comprised of various categories of construction companies: Electrical Engineering Services, Building Works, Water Works and Mechanical Engineering Services. This was followed by use of a random sampling method to select respondents in each of the categories. The researcher used the technique since it discourages biasness when selecting study's samples. The technique ensured fair representation of population under investigation. The following formulae was used in selecting the study's strata;

$$n_h = \frac{N_h}{N} * n$$

Where: n_h represents the sample size for stratum *h*; N_h represents the stratum *h* population size; N represents total population size; and n represents total sample size.

Research Instruments

Primary and secondary data were used in the current study. The researcher derived secondary data from national construction authority reports for the last five years. A document analysis

guide was used to collect information such as estimated cost, completion cost, estimated time (months) and completion time (months). This study used structured questionnaires in the collection of primary data. Questionnaires are often used in collecting data since it is cost effective and save on time. This method of collecting data is convenient as it can reach many people so long as the people can read and write independently. Greener (2008) indicated that questionnaires can be used to define the study specific objectives and the statement of the problem. In addition, data collected is quantitative and can be analyzed. Resources and time are minimized with the use of questions. The questionnaire is categorized into six distinct sections (A to F). Section A focuses on respondents' biographic details, Section B to F contains questions relating to independent variables while section F contains details on dependent variable.

Data Collection Procedure

Before collection of data, the researcher obtained department's clearance permit of extra mural studies upon successful project defense. The researcher applied for research permit from NACOSTI. A letter to the individual respondents was written by the researcher for seek for permission of data collection from the participants. The researcher met with the participants to schedule on data collection date. Researcher assistants aided in administration of questionnaires among the participants. The researcher assistants were well education on the aim of the study before they were engaged in data collection process. Hand delivery and emailing of the questionnaires were used to administer questionnaire among the respondents thus increasing the rate of responses. To monitor the respondents' progress in filling the questionnaires, follow up was conducted on daily basis.

Data Analysis Techniques

Packaging data collected, placing it in order and major elements structuring in a manner that the results may be communicated easily and efficiently is known as data analysis process (Kothari, 2004). Inferential statistics and descriptive statistics were used to analyze data that is quantitative and the SPSS version 22 was used. To precede the analysis a code book for quantitative variables that are different was prepared on the base of questionnaire numbering structure. After data collected has been confirmed to be accurate, descriptive statistics analyze the quantitative data. Frequency distribution, mean, percentages, and standard deviation are inclusive of descriptive statistics. Presentation of the results was in tables and figures. Distribution measurements are explained by the researcher using descriptive statistics and it also explains, organizes and reviews data (Bryman, 2003). Further, to determine the relationship between the variable which is dependent and the independent variables, correlation analysis was conducted. A significance level of 0.05 is indicated in the study which applied 95% confidence level. In order for the independent variable to have an effect that is significant on dependent variable, the p-value should be less than the significance level (0.05).

RESEARCH RESULTS

Water Regulations

The study found that water regulations have significant influence on performance of construction projects in Nairobi County (r=.377, p=.0005). The study established that that requirement for permit influence performance of construction projects (M = 3.798). Moreover, the study also found that unauthorized construction and use of works influence performance of construction projects (M = 3.687). In addition, the study found that regulation on usage of water influence performance of construction projects (M = 3.699). Besides that, the study established that procedure for obtaining permit influence performance of construction projects (M = 3.489). The results revealed that charges for water use influence performance of construction projects (M = 2.794). Further, the study found that availability of water regulation influence performance of construction projects (M= 2.493).Furthermore, the study found out that cancellation of permits has influence on performance of construction projects (M = 1.399).

Waste Management Regulations

The study found that waste management regulation has significant influence on performance of construction projects in Nairobi County (r=.363, p=.0005). The study also found that requirement for environmental impact assessment influence performance of construction projects (M= 3.411). Moreover, the results revealed that site clearing regulations influence performance of construction projects (M= 3.214). In addition, the study found that waste managing regulation influence performance of construction projects (M = 3.094). Besides that, the study established that environmental audit and monitoring of the environment influence performance of construction projects (M = 2.818). The results also revealed that waste disposal regulation influence performance of construction projects (M = 2.798). Further, the study established that dumping regulations influence performance of construction projects (M = 2.790). Furthermore, the study found that segregation and destruction of waste influence performance of construction projects (M= 2.403).

Noise and Vibration Regulations

The study found that noise and vibration regulations have insignificant influence on performance of construction projects in Nairobi County (r=.063, p=.328). The study also established that NEMA noise regulations influence performance of construction projects (M= 2.794). Moreover, the study found that NEMA noise and vibrations licensing influence performance of construction projects (M = 2.790). In addition, the result revealed that acceptable noise levels influence performance of construction projects (M= 2.690). Besides that, the study found that background noise assessments regulations influence performance of construction projects (M = 2.497). The study established that measurement procedures for noise and vibrations influence performance of

construction projects (M = 2.493). Further, the study found that vibration assessments regulations influence performance of construction projects (M = 2.304). Furthermore, the results revealed that prohibition of generation of noise by place and time does not influence performance of construction projects (M = 1.995).

Physical Planning Regulations

The study found that physical planning regulation has insignificant influence on performance of construction projects in Nairobi County (r=.036, p=.575). The study also established that infrastructure availability influence performance of construction projects (M= 3.308). In addition, the study found that public utilities (electricity, water and sewer) influence performance of construction projects (M = 3.185). Besides that, the results revealed that approval of development application influence performance of construction projects (M = 3.086). The study established that approval of development application influence performance of construction projects (M= 3.086). The study found out that development control influence performance of road construction projects (M= 2.897). Further, the study found that environmental impact assessment influence performance of construction projects (M = 2.399). The study found out that land use controls influence performance of construction (M = 2.304). Furthermore, the study established that zoning influence performance of construction projects (M= 2.300).

Organization Resources

The study found that organization resources have insignificant influence on performance of construction project in Nairobi County (r=.014, p=.832). The study also established that construction firms use modern machinery and equipment to develop property (M = 3.094). Moreover, the study found that adequate financial resources influence development of construction projects (M = 3.000). Besides that the study found out that there were adequate mechanical engineering staff in construction firms (M = 2.901). The results revealed that the construction firms have skilled and adequate staff (M = 2.802). In addition, the study established that construct firms own their construction equipment (M= 2.703). The study found out that construction workers were paid salaries that match the industry (M = 2.609). Further, the study established that construction firms have adequate finance to maintain construction machinery (M = 2.596). However, the study found that staff in construction projects were not recruited based on their competency skills (M= 2.107).

CONCLUSIONS

The study concluded that water regulations have significant influence on performance of construction projects in Nairobi County. The study established that that requirement for permit influence performance of construction projects. Moreover, the study also found that unauthorized construction and work force influence performance of construction project. The study established

that regulation on usage, procedure for obtaining permit, charges for water use influence performance of construction projects.

The study concludes that waste management regulation has significant influence on performance of construction projects in Nairobi County. The study also found that requirement for environmental impact assessment, site clearing regulations, waste managing regulation influence performance of construction projects. Moreover, the study established that environmental audit and monitoring, waste disposal regulation and dumping regulations influence performance of construction projects. Furthermore, the study found that segregation and destruction of waste influence performance of construction projects.

The study concludes that noise and vibration regulations have significant influence on performance of construction projects in Nairobi County. The study also established that NEMA noise regulations influence performance of construction project. Besides that, the study found that background noise and vibration assessments regulations influence performance of construction projects. The study established that measurement procedures for noise and vibrations influence performance of construction project. Further, the study found that vibration assessments regulations influence performance of construction projects. Furthermore, the results revealed that prohibition of generation of noise in a particular place and time does not influence performance of construction projects.

The study concludes that physical planning regulation has insignificant influence on performance of construction projects in Nairobi County. The study also established that infrastructure availability, public utilities, approval of development application, development and land use controls influence performance of construction. Furthermore, the study established that zoning influence performance of construction projects.

Further, the study concludes that organization resources have significant influence on performance of construction project in Nairobi County. The study also established that construction firms use modern machinery and equipment to develop property. Moreover, the study found that adequate financial resources, staffing and construction equipment influence performance of construing projects. The study found out that construction workers were paid salaries that match the industry. Further, the study established that construction firms have adequate finance to maintain construction machinery.

RECOMMENDATIONS

1. The study found that requirement for permit influence performance of construction projects. Therefore, the study recommends that construction firms should have company registration certificate, land ownership validation document and conduct environmental impact assessment for them to enhance accessibility of construction permit from relevant authorities.

2. The study found that waste management of waste influence performance of construction projects. Henceforth, the study recommends that the construction firms in Nairobi County should use recycling, open dumping and landfilling to improve on waste management among the construction firms.
3. Further, the study found that vibration assessments regulations influence performance of construction projects. The study recommends that construction firms should purchase equipment that minimize the level of vibration emission, use equipment that meet ISO test code for vibration and employee competent assessment officers so as to enhance effectiveness of noise and vibration assessment among the construction firms.
4. The study established that zoning influence performance of construction projects. Therefore, the study recommends that construction firm should employee competent physical planning advisors, allocate resources for planning and involve shareholders in planning process so as to improve on zoning of construction projects.
5. Furthermore, the study found that adequate financial resources influence performance of construction projects in Nairobi County. Hence, the study recommends that construction firms should ensure timely release of funds, effective fund utilization and borrow funds to ensure there is adequate funding of construction projects.

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