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PROJECT CONTROL RISK MANAGEMENT AND PERFORMANCE OF SELECTED CONSTRUCTION PROJECTS IN KENYA

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ABSTRACT

The construction industry entails high levels of risk, but often this risk is not dealt with adequately, resulting in poor performance, which is reflected in frequent cost and time overruns, as well as poor quality of work. This may cause disputes which may lead to costly litigation and further time and cost overruns. Additionally, insurers traditionally avoid firms with high risk portfolios and subsequently will not offer insurance covers or may charge very high premiums to compensate for the increased risk. Previous studies have found an inconclusive relationship between adoption of risk management practices and enhanced construction Performance. As such, the general objective of this study was to determine how project control risk management Practices influence the performance of selected construction projects in Kenya. Performance was measured as a function of cost variance, time variance and quality control. This study used explanatory research design and the research philosophy was based on positivism. The population of the study was all construction projects carrying out construction and public works in selected firms in Kenya, registered by the Republic of Kenya as of July 2011 to June 2021, a total of 2,414 construction projects. The sample size was 97 respondents, and simple random sampling was used for identifying respondent firms. Data collection was done using a self-administered semi-structured questionnaire. Data analysis was done using both descriptive statistics and inferential statistics. The findings led to the conclusion project control risk management strategies had a significant influence on firm performance, implying that any effect on firm performance was not solely due to chance. The study recommended that, from a policy perspective, in order to further entrench risk management practices in the construction sector, construction firms in Kenya need to increasingly engage in capacity building activities in risk management and construction project management in general. The government should also encourage activities that encourage proper risk management and risk sharing cross the entire construction value chain.

Key Words: risk management practices, project control risk management, performance, construction projects

INTRODUCTION

The construction industry in the United Kingdom (UK), owing to the nature of its business that involves open air operations, has always been seen as vulnerable to weather extremes that impact adversely on financial performance. Wedawatta, Ingirige, Jones and Proverbs (2011) confirmed this in their findings that identified this sector as being one of the most exposed to the vagaries and extremes of climate change. Such adverse financial impacts are significant in light of the fact that construction sector firms constituted over 99 percent of Small and Medium Enterprises (SMEs) in the UK (Wedawatta et al., 2011), and dominated SME businesses.

The high-risk exposure to adverse weather in the construction sector was attributed to poor risk management Practices. These included negative individual attitudes and informal organizational culture, low levels of technical expertise, poor disaster risk management procedures, poor planning activities, low levels of capital formation to manage recovery efforts and poor linkages with national agencies and technical support institutions such as the universities. These were attributed as the reason for the poor cost, time and quality performance in the sector, within the UK (Wedawatta et al., 2011).

Depending on the country context, additional challenges were faced by construction projects. For instance, Hlaing, Singh, Tiong and Ehrlich (2008) argued that the turbulent economy in Singapore, coupled with continuous change in the corporate environment, exposed players in the construction industry to increased risk. This motivated a need among construction project managers to develop an integrated approach to construction project management, necessitating a strategic planning approach that covered the entire scope of construction projects, from inception to occupancy. This was as a consequence of significant changes within the sector, especially in the procurement function. This resulted in clients increasingly apportioning responsibility for risk management to contractors, making formal risk management a necessity among construction projects. Therefore, formulating effective risk management systems and Practices, in order to mitigate the impact of various risks, has become a critical issue that must be addressed by construction firm management (Hlaing et al.,2018).

In the developing country context, especially in Africa, risk management in the construction sector is an amorphous affair faced with higher levels of risk as compared to the developed countries. The level of adoption of formal risk management practices is not widely studied either. In Ghana for instance, Boadua, Fianko and Chileshe (2015) observed a limited level of adoption of formal risk management practices among construction-oriented firms, with low levels of procedural documentation.

One reason that was forwarded for this state of affairs was the low levels of awareness regarding appropriate tools and techniques to effectively manage construction risk. Consequently, the construction sector in Ghana faces many problems related to frequent cost and time overruns (Fugar & Agyakwah-Baah, 2016). Within the mass construction market in Ghana, Ahadzie, Proverbs and Olomolaiye (2016), observe that the most crucial project performance success criteria were overall project cost and quality.

Risk management among construction projects in Kenya has gained increased prominence owing to what Ngundo (2016) observes as an increase in infrastructure development in the country. The rise of many construction projects, most notable in real estate at the mass market level, has been faced with a lot of uncertainty, resulting in outcomes that fail to meet minimum standards benchmarked against best practice in the sector. Ngundo (2016) attributed the low levels of project success to failure to develop proper procedures, lack of sufficient training and capacity building programs, incompetence among project staff, low levels of formal quality management support and low levels of management commitment. As

a result, project risk management planning was characterised by poor risk identification, assessment, prioritization, mitigation and control. The overall outcomes were weak and inappropriate risk management measures that increased the vulnerability of the construction projects to risk.

In order to enhance the management of construction risks, the Republic of Kenya (RoK) enacted legislation such as the Engineers Act (2017) and the National Construction Authority Act (2011) for purpose of ensuring that legal compliance in the industry went a long way towards reducing the various risks associated with construction projects (RoK, 2017). Karimi (2004) further observed that key reforms proposed in the Kenya Vision 2030 that would have resulted in effective risk management of construction projects included the creation of the necessary institutional framework to improve policy implementation and enforcement of industry codes and standards among others. There was also recognition of the need to institute functional and comprehensive risk management practices in the industry, in order to achieve performance objectives.

Statement of the Problem

Projections by the KNBS estimate the population growth in Kenya at 4.2 percent per annum, with the actual population estimated to rise to 50 million by the year 2020 (KNBS, 2018). Based on these projections, the annual demand for housing units was pegged at 206,000 units, which, matched against a current annual supply of 50,000 units, created a deficit of 156,000 units per year (KNBS, 2018). The social pillar of the Vision 2030 had a target of matching the demand and supply of housing in the country by 2030by producing 200,000 housing units annually by 2012 under Public Private Partnerships (PPPs) and other initiatives such as the Kenya Vision 2030. However, according to the Ministry of Housing,Land and Urban Development (2011), 48 percent of construction projects in Nairobi County were incomplete, with about 10 percent completely stalled. For construction projects, these figures paint dim prospects with regard to Performance.

More specifically, the construction sector had a poor reputation for coping with construction risks, such as poor resource management, lack of competent personnel, poor project management controls, high exposure to litigation and a general aversion by insurers to underwrite construction projects (Charagu, 2016).Charagu (2016) further argues that the use of sub-standard or faulty construction techniques and a lack of adherence to the building code and best practice standards contributed further to increased construction risk. This was characterized by the tendency towards maximizing profitability through use of sub-standard construction techniques and materials, non-conformity with design and lack of quality supervision (Charagu, 2016).

The construction industry still continues to experience significant cost overruns, schedule delays and poor-quality output, resulting in poor time, cost and quality performance. This then made it necessary to understand the risk management practices that had been instituted by construction firm management in order to enhance Performance. Previous studies that have been conducted have attempted to bring various outstanding issues in the construction industry to light.

None of these studies dealt with the issue of risk management Practices in construction projects in relation to resource, personnel, project control, litigation and insurance risk management Practices, and how they affect the performance of construction projects. Also, given the changing political, economic, social, technological, economic and legal landscape in the country, various micro- and macro-economic variables that affect selected risk management Practices in the construction industry keep changing. The purpose of this study

was therefore to determine how risk management practices influence the performance of selected construction projects in Kenya.

Objectives of the Study

i. Assess the influence of project control risk management on performance of selected construction projects in Kenya;

LITERATURE REVIEW

Theoretical Literature Review

Theory of Constraints

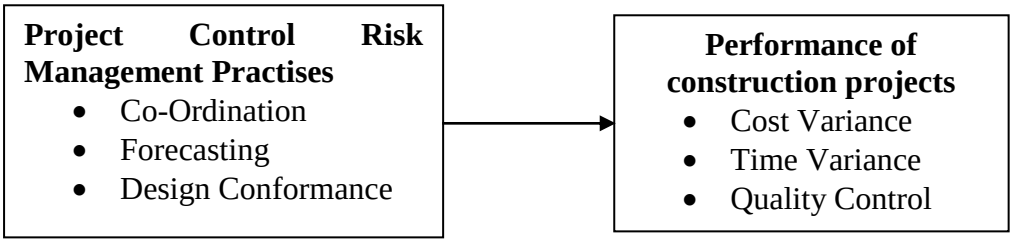
The primary theoretical anchorage of this study is the Theory of Constraints (TOC), a management paradigm that postulates that any manageable system faces a number of constraints that limit the achievement of its organizational goals (Goldratt, 1990). The TOC was the main theory for this study, as it interrogated the entire construction value chain, from start to finish. The TOC largely takes a process-based view of Performance and identifies the rate determining steps, that is, those that are most critical in affecting project performance, and by extension, Performance. When these are resolved, they have a net effect of enhancing the flow of work and effective allocation and distribution of firm resources.

At the minimum, TOC holds that there is at least one constraint and proposes the use of a focusing process to identify the constraint and organize the rest of the processes around it. In identifying the constraint or constraints, TOC proposes measurement and control using three key parameters, namely, the throughput, operational expense and inventory. Inventory represents the financial costs of all items necessary in production; operational expense, on the other hand, is the cost of production (converting inventory into throughput); while throughput refers to the rate at which the system generates sales revenues.

According to TOC, if there were no constraints inhibiting an organization from achieving its throughput, its sales revenues would be infinite. This is however, impossible in a real-life system, and only by optimizing flow through the constraints, can overall throughput be maximized. Constraints can be internal, where the system fails to generate sufficient supply to match demand, conversely, external, where supply exceeds demand. In order to focus processes through the constraints, TOC proposes five key steps, namely, identification of the systems constraints, formulating practices on exploiting the identified constraints, prioritizing these Practices, increasing the constraints throughout capacity and monitoring and elevating with the necessary feedback loops. The five focusing steps are known as the Process of Ongoing Improvement (POOGI) and the centroid of their implementation is the identified system constraints (Goldratt, 1990).

In applying TOC to risk management of construction projects, there is recognition of the fact that existing and future constraints are liable to become project risks. In practice, in the initial definition of construction project risks, project management focuses on the identification of the most critical risks involved (Steyn, 2002). Risk events are thus prioritized according to their potential impact at any given stage in a project. This implies that, along the project life cycle, different risks tend to assume different levels of criticality as the project progresses. Using the feedback loop implied in the last focusing step of TOC approach ensures that risk events are effectively managed by continually reducing the most critical current risk, thereby ensuring that the overall risk is reduced gradually, continually and systematically. This ensures that scarce resources are directed at managing the risks that may impact adversely on the project at any given point, and that emergent risks obtain the required attention, in terms of resource allocation, at the right stage. Ultimately, this speed up project performance and has a multiplier effect on Performance.

Conceptual Framework



Empirical Literature Review

Meredith and Mantel (2016) define control systems as feedback loop's whole role is to inform management on variations between actual and desired performance. The feedback loop, according to Moselhi, Li and Alkass (2015), provides information that enables comparisons between planned and actual performance in terms of cost, time and quality. Project control systems are key to ensuring timely revision of project activities, to avoid deviations that mayimpact adversely on performance. An efficient control system is characterized by an accurate measurement system, given that the accuracy of information provided by the feedback loop determines the cost, time and quality performance of the project.

A review of the empirical literature has identified studies conducted in relation to control risk management and Performance. Ling and Ang (2013) conducted a study that involved identifying project control risk management practices that were crucial in determining effective project performance among Singapore based construction projects. Their research was a survey that deployed an online questionnaire and used electronic mail for data collection. They identified a total of sixteen project management control risk management practices that correlated significantly with project performance. The key control risk indicators identified included quality of techniques that enabled proper risk identification, adequacy of time float in the schedule, and relevance of information necessary for developing the time schedule.

Ling and Ang (2018) also piloted performance predictive models that were modelled along the identified control systems. These were used to attempt to predict schedule and quality outcomes of the construction projects. Time (or schedule) performance, was best predicted using the variables adequacy of time float and the relevance of the criteria that was used to select suppliers. Project quality outcomes were largely predicted by how competent project quality management was, rather by the actual processes used in the project. These findings help to point out the importance of control risk management Practices. However well planned a project may be, if the feedback mechanisms do not function properly, good project performance is not assured. Effective control systems help to concretize the monitoring and evaluation component in a project that in turn guides management towards revising the overall strategy to ensure the desired outcomes are attained.

In another study, Leonget al.(2014) conducted a survey to measure the effectiveness of Quality Management System (QMS) maintenance and Practices in the Malaysian construction industry. The methodology relied on a questionnaire survey based on QMS variables derived from past research and construction project performance indicators obtained from theories of project management. Data analysis relied on correlation and regression analysis. Seven indicators, including cost variance, cost performance index, time variance, non-conformance reports, client satisfaction, number of accidents and fatalities, were used as measures of quality performance.

Leong et al's. (2014) findings indicated that construction projects implement quality control as a risk management practices to improve the cost, time and quality performance of their projects. Additionally, in regression analysis, Leong et al. (2014) observed that two key project performance indicators, namely client satisfaction and time variance, demonstrated a statistically significant positive association with indicators of quality control risk management's Practices. Soetanto and Proverbs (2004) argue that this provides an explanation as to the reason why time is a critical determinant of client satisfaction in many studies done on construction project performance.

Ali and Rahmat (2010) agree with these findings with the observation that they concur with the findings of an ISO 9000 study in the Malaysian construction industry, where client satisfaction as a QMS project management control risk management practices emerged as one of the most important criteria used to measure construction project performance. However, Leong et al. (2014) indicated that overall project performance cannot be indicated by cost, time and quality alone, but other indicators needed to be factored for a more holistic assessment. One limitation of Leong et al. study was that the findings varied in different countries due to differences in the business environment. There is thus a need to replicate the findings of this study in different countries to improve generalizability.

In a different study, Ali and Kamaruzzaman (2016) conducted a questionnaire survey to identify factors that contribute to cost overruns and potential mitigating measures in Malaysia. The methodology relied on questionnaires which were administered to 30 respondents in the Klang Valley. The findings demonstrated that inaccurate or poor estimation of original costs, a planning parameter, was the most serious causes of cost overruns. Effective risk practices measures suggested to control construction costs included proper project costing and financing and analyzing and forecasting cost and schedule performance. This presented an opportunity for further research into the effectiveness of proper project costing in reducing cost overruns. Gido and Clements (2018) also observed the need for proper cost estimation at project inception and continuous cost assessment and control throughout the project life cycle to ensure conformity to budget, as an effective cost risk management practices in construction projects. Effective project cost management also factors in the needs of all project stakeholders as these will also be affected.

Zou, Zhang and Wang (2007) carried out a study where they used a holistic and systematic approach to identify construction project risks, their likelihood of occurrence, impact of the risks and mitigating factors. Their study, rather than focusing on the traditional elements of cost, time and quality took a stakeholder and project life cycle approach and focused on a broader set of quantitative and qualitative variables, among these, those that affected project cost performance. The research methodology used for this risk management project comprised of a comprehensive literature review, a postal questionnaire to the construction industry practitioners and a statistical analysis of the survey data. Twenty major risk factors were identified based on their probability of occurrence and impact on the project goals.

Among those that adversely affected project costs included tight project schedules, design variations, excessive approval procedures in administrative government departments, unsuitable construction program planning and variations of construction program. Zouet al.(2017) proposed holistic risk management practices where clients, designers and government bodies work cooperatively from the feasibility phase onwards to address potential cost and time risks. Zouet al.(2017) also proposed that contractors and subcontractors with robust construction and management knowledge be employed early to make sound preparation for carrying out safe, efficient and quality construction activities.

RESEARCH METHODOLOGY

This study used an explanatory research design. For the purpose of this study the unit of analysis was construction projects. A study population is the people or individuals that meet the researcher's operational definition of the target population. In this study, the study population was 2,414 construction projects; The desired sample size of the study was 384. Based on the theoretical assumption that the distribution is assumed to be normally distributed with a sample size of a above 30 objects, the sample size was determined using Bell, Brymann and Harley (2018) sampling frame for large population number, that is more than 1000 objects,

The study collected both the secondary and primary data. The secondary data was collected from the journals, books and published academic references. Questionnaires were used for primary data collection. Data entry was done in a designed SPSS version 20 template through variable definition files generated from the questionnaires. Qualitative and quantitative data was analyzed using descriptive and inferential statistics. Qualitative data was analyzed by the use of content analysis. This study used both descriptive and inferential statistics to analyses the quantitative data. Bivariate regression models were fitted to determine the relationship between each independent variable and dependent variable.

RESEARCH FINDINGS AND DISCUSSION

The research sample composed of 384 respondents, out of which 365 questionnaires were received back, with nineteen (19) being either not filled or not returned at all. This translated to 95.1% response rate which was acceptable for data analysis.

Descriptive Analysis

Project Control Risk Management Practices

Table 1 presented the findings with regard to project control Risk Management Practices and their perceived influence on Performance. The percentage scores indicated a clustering around the column for 'agree'. The first three mean values all had values greater than 3.50 and rounded off to a mean of 4.00 (which corresponded to 'agree' on the monadic-type measurement scale). This implied that the respondents agreed on the perceived influence of how the first four personnel risk management indicators influence Performance, and these had the highest ranking. Those with mean values of less than 3.50 indicated a clustering around the mean value of 3.00, or 'disagree' on the measurement scale used. Indicators with low standard deviations had less dispersion about the means than those with high standard deviations.

Table 1 Project Control Risk Management Practices and Performance (Percent)

Statement	Neutral	Strongly disagree	Disagree	Agree	Strongly agree	Mean	Standard Deviation
Monitoring the quality non-conformance report ensured minimal variation from quality specification	12.7	6.3	.0	67.1	13.9	3.63	1.189
Adherence to technical specifications improved firm performance	20.3	.0	2.5	55.7	21.5	3.58	1.383
Objectively measuring work progress assisted	29.1	2.5	2.5	50.6	15.2	3.20	1.514
Effective coordination of project activities	30.4	.0	.0	60.8	8.9	3.18	1.474

Developing a time phased budget for each work task	34.2	.0	3.8	49.4	12.7	3.06	1.547
Continual cost revisions reduced risk of cost overruns	17.7	3.8	.0	64.6	13.9	3.00	1.609
Continual schedule revisions reduced the risk of time overruns	36.7	2.5	.0	45.6	15.2	3.00	1.609
Reduced design variations improved	31.2	6.5	2.6	53.2	6.5	2.97	1.460
Forecasting cost/schedule	43.0	.0	5.1	43.0	8.9	2.75	1.573
Overall						**3.15**	**1.484**

Monitoring the quality non-conformance report against an agreed quality standard ensured minimal variation from quality specification. This was in tandem with what Meredith and Mantel (2016) observed as the need to benchmark in order to ensure compliance with widely agreed upon industrial standards. Ali and Kamaruzzaman (2018) study regarding the need for forecasting cost and schedule performance in Malaysia appeared inapplicable in the context of this study, given the lowest mean value for this aspect.

Performance

This section presented findings in relation to how the different Risk Management Practices influenced Performance as measured by cost variance, time variance and quality control.

Table 2 Influence of Risk Management Practices on Cost Variance (Percent)

Cost	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Mean	Standard Deviation
Risk management strategies reduces price escalation	5.1	11.4	26.6	44.3	12.7	3.48	1.02
Risk management strategies reduces inaccurate costing	5.1	10.1	58.2	16.5	10.1	3.16	0.93
Risk management strategies reduces supplier/ contractors defaults	0.0	31.6	26.6	19.0	22.8	3.33	1.15
Risk management strategies improves costs estimation	0.0	13.9	27.8	22.8	35.4	3.15	1.06
Overall						**3.28**	**1.04**

Table 3 presented the findings with respect to cost variance; these indicated that most respondents disagreed or strongly disagreed with the statement that risk Management Practices reduced inaccurate costing and supplier/contractors defaults. The respondents further strongly disagreed that Risk Management Practices improved cost estimation. The observed scores reflected increasing disagreement with the corresponding statements. This was demonstrated by the mean values for the impact of Risk Management Practices on cost variance, which clustered around a mean of 3.00.

Table 4 Influence of Risk Management Practices on Time Variance (Percent)

Time	Neither agree nor disagree	Strongly disagree	Disagree	Agree	Strongly agree	Mean	Standard Deviation
Risk management strategies reduces information delay	0.0	1.3	17.7	48.1	32.9	4.13	0.74
Risk management strategies reduces funding problems	0.0	8.9	25.3	31.6	34.2	3.91	0.98
Risk management Strategies improves project management	0.0	12.7	16.5	38.0	32.9	3.04	1.03
Risk management strategies reduces Disputes	1.3	29.1	12.7	16.5	40.5	3.32	1.31
Overall						**3.60**	**1.015**

Table 5 indicated that most respondents agreed with the statement that 'Risk Management Practices reduce information delay and Risk Management Practices improved project management'. The respondents also strongly agreed that Risk Management Practices reduced funding problems and disputes. This was observed in the mean scores reflecting disagreement and agreement with the corresponding statements. Table 4.8 indicated that most respondents agreed with the statements regarding the influence of Risk Management Practices on the various aspects of quality control as expressed in the different statements. All the mean values indicated that most responses clustered at the disagree-agree continuum. In accordance with the fuzzy set theory, construction firm management should then focus on enhancing quality control through focusing on resource risk management. Interpreting these

Table 5 Influence of Risk Management Practices on Quality Control (Percent)

Quality	Neither agree nor disagree	Strongly disagree	Disagree	Agree	Strongly agree	Mean	Standard Deviation
Risk management strategies improved fitness for purpose of the construction end product fitness for purpose	12.7	.0	.0	70.9	16.5	3.78	1.129
Risk management strategies increased construction safety	16.5	3.8	5.1	57.0	17.7	3.56	1.298
Risk management strategies reduced	20.3	2.5	6.3	59.5	11.4	3.39	1.325

design variation							
Risk management strategies increased stakeholders satisfaction with the construction end product	21.5	2.5	7.6	60.8	7.6	3.30	1.314
Overall						**3.51**	**1.267**

Findings in light of TOC also led to the conclusion that those resource risk Management Practices with high mean values were crucial for effective project completion. These also represented those Risk Management Practices that acted as effective buffers in eliminating quality control constraints. Quality controls revolved largely around the quality of labour and raw materials. Project control risk management parameters entailed proper-budgeting and cost revisions that minimized cost variance, proper scheduling that minimized time variance and quality assurance that optimized quality controls.

Inferential Analysis

Table 6 Coefficients of the Regression Model

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	2.919	.287		10.160	.000
Project control risk Management Practices	.226	.075	.480	3.003	.004

Table 6 presented the results of the regression analysis involved. In explaining the influence on firm performance, resource risk Management Practices, personnel Risk Management Practices, project control Risk Management Practices were statistically significant at the 5 percent level of significance. The beta coefficients provided information on each predictor variable necessary to predict Performance from the Risk Management Practices. From Table 4.9, after plugging in the unstandardized coefficients, the final form of the regression equation with the moderating variable was presented as:

Performance = 2.919 + .226 CPCR

The interpretation of the above model was that when all other independent variables were held constant, increasing each independent variable by one unit, caused a corresponding increase or decrease in Performance by the amount (and sign) of the beta coefficient associated with each independent variable. The beta coefficients provided information on each predictor variable necessary to predict Performance from the Risk Management Practices. The constant value of 2.919 was the intercept, and corresponded to the model-predicted value of Performance when the value of every predictor was equal to zero.

The findings further indicated that project control Risk Management Practices and Government policy and regulation of the construction sector, were statistically significant at the 5 percent level of significance. The values of the standardized coefficients were useful in determining the relative importance of the significant predictors.

When ranking contribution to explaining variation in Performance, it is the absolute value of the coefficient that was used, since the sign of the coefficient merely indicated the direction of the relationship, while the value of the coefficient was a measure of the strength of the

relationship. Project control Risk Management Practices contributed most in explaining the variation in Performance, with standardized coefficients of .226,

Conclusion

Resource risk management, personnel risk management and project control Risk Management Practices, had a statistically significant effect on performance of construction projects in Kenya. This implied that the influence of these three Risk Management Practices on Performance, was not due to chance alone, but could be explained as a having an impact that enhanced construction firm operations and subsequent performance.

Recommendations

In relation to the study objectives, these findings point out the need to deepen the application and implementation of the given Risk Management Practices in the sector. This may be achieved through increased engagement in capacity building activities in risk management and construction project management in general. This would help equip project management with the requisite managerial tools and techniques to effectively run construction projects.

There should also be a higher level of involvement of construction sector professionals charged with offering expert advice and assistance on implementation of Risk Management Practices. Awareness creation among clients was another front that was encouraged in order to optimize the benefits of risk management practice implementation, through increased uptake and compliance.

Suggestions for Further Research

This study examined only a limited number of risk management parameters and their influence on Performance. This study examined the use of risk management practices in construction projects only. This makes the study Kenya-specific and therefore, difficult to apply directly to other contexts. Further research could examine the state of risk management using comparative case studies and could expand the sampling base. These studies could also expand the range of possible independent variables and dependent variable. The findings indicate that these Risk Management Practices explain only a partial level of variability observed in Performance. This implies the existence of other variables, both internal and external to the firm, which would need to be scrutinized in order to further elucidate the relationship between the dependent variable and independent variables. This may include, but not limited to corporate governance (internal) and trade unions (external), that impact on the firm's micro- and macro-environment.

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