Assessment of Strategies for Practices of Quality Management in Construction Projects. A Review of the Knowledge for Practice

Patrick Kanini Ngata, Githae Wanyona, Anthony Kiplimo

Abstract- Strategic planning is a tool for organizing the present on the basis of the projections of the desired future. That is, a strategic plan is a road map to lead an organization from where it is now to where it would like to be in five or ten years in the future. In Kenya, there is failure in construction to achieve quality as seen in the frequent occurrence of building failure and collapsing (Mutoro, 2011). The aim of this study is to investigate the strategic factors that would enhance quality management implementation in the construction process. As the key to value creation, construction firms are deemed to treat quality as a strategic issue (Agbenyega, 2014). The main methods used in this journal is collection of data by survey, where questionnaires were distributed to 52 construction projects in progress within Kiambu County and then the data acquired was sorted using SPSS software. The writer approached the study using the positivist paradigm which enabled the researcher to make an objective analysis. This stance facilitated the researcher to use the quantitative research strategy and also questionnaire survey as the main data collection instrument for soliciting information from construction firms registered with the National Construction Authority and professionals registered with professional bodies recognised by the Kenyan government. The aim of the study was to describe strategic factors applied to quality management on construction projects.

Keywords: Quality, Strategies, Practices, Quality management.

I. INTRODUCTION

Quality and quality systems have become quite essential in the current push for globalization where contractors and investors are not limited to their regions. Consequently quality and quality systems are increasingly receiving worldwide attention (Chan, 1996a; Lowe and Seymour, 1990; Yates and Aniftos, 1997; Low, 1992; Docker, 1991; Walters, 1992) in (Chan and Tam, 2000). In every industry experts and players in the field are benchmarking standards that ensure and safeguard quality of the finished product. The building and construction industry is not exempt from this phenomenon, In fact given the industry's role in development and economic growth, quality management practices and strategies should second none.

Revised Version Manuscript Received on December 16, 2015.

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It is noteworthy that construction projects around the world are cost demanding hence increasing the risk of quality compromises. The current trend in the construction industry is now moving towards higher quality. Contractors are forced to upgrade the quality of their service (Hasegawa, 1988). This orientation towards quality has been brought about by the following reasons. First, clients are becoming increasingly more knowledgeable (Of ori, 1994). Some of the larger clients also have international assets and interests. With increased affluence and knowledge, clients are demanding better quality because in many construction projects, clients often find themselves paying high prices for defective works that do not satisfy their needs. Such situations often result in disputes that result in higher costs to the client at the end of the day. According to Juran and Gryna (1993), "quality is customer satisfaction". Hasegawa (1988) argues that contractors, who continue to neglect the sophisticated requirements of their clients, do so at their own perils. This is because in the quality perspective, profit is a result of continuous conformance to clients' requirements (Raynor, 1992). PMBOK (2008) identifies three elements that serve as factors that influence quality management; quality planning, quality control and quality assurance. Quality planning is a set of activities whose purpose is to define quality system policies, objectives, and requirements, and to explain how these policies will be applied, how these objectives will be achieved, and how these requirements will be met. (PMBOK, 2008).Quality Control (QC) in construction is the process of verifying that the project is built to plan, that the tolerances allowable by industry standard and engineering practices have been met or bettered.(Mc George & Zou, 2012). Quality Assurance is concerned with developing and planning the necessary technical and managerial competence to achieve desired results. These thematic tenets provide essential universal guidelines of quality management with reference to the construction sector. Hence, quality may be the main or only differentiating element in the eyes of the clients as it cannot be easily copied and duplicated (Siew, 1995). Certain synonimity exists universally on the quality standards that the final building product should meet. However, the approach towards meeting these standards heavily weighs in on the quality that the finished product meets. Strategies in quality management with reference to the construction industry has been modeled by a number of authors; Chinowsky and Meredith (2000), Dikmen and Birgonul (2003), Price et al. (2003) and Dansoh (2005) to name just but a few. Despite the universal description of a single strategy all the models stress on the ability of the strategies to conform to

pertinent environmental factors that include; technological, political, social and economic elements. Further the scholars on strategic quality management contend that strategies of quality management must be progressive hence they must always be under review to meet the ever changing environmental factors.. Hence, in construction projects the adherence of the construction process to the laid out quality management strategy determines the level of success.

II. REVIEW OF THE LITERATURE

A. *Strategic Quality Management*

The construction process should be revamped by emphasing quality management practices in its delivery. In order to achieve vision 2030 in economic, social and political strategic development goals in Kenya, the focus for construction management need to be given a new approach. Strategic quality management (SQM) is the process of establishing long-range quality goals and defining the approach to meeting those goals (Juran and Gryna, 1993). As its name suggests, it merges corporate strategy with total quality management (TQM) wherein incremental quality plans are replaced by bold initiatives such as cycle-time reduction and business process re-engineering.

B. *Overview Of Construction Process*

Construction industry is joining the world of business in competition and therefore demand of quality is treated as an aspect of construction planning. The last decade has witnessed a considerable research surveying manufacturing quality practices in several countries and regions. Documenting quality practices and total quality management (TQM) implementation in the USA (Benson et al., 1991; Richardson, 1993; Roethlein et al., 2002), India (Motwani et al., 1994; Jain and Tabak, 2002; Mahadevappa and Kotreshwar, 2004), China (Tuan and Ng, 1997; Yu et al., 1998; Li et al., 2003; Lau et al., 2004), Australia (Sohal et al., 1991; Mandal et al., 1999; Terziovski et al., 1999), Singapore (Ghosh and Hua, 1996; Yong and Wilkinson, 2001), Malaysia (Eng and Yusof, 2003); Scotland (Masson and Raeside, 1999), Germany (Zink and Schildknecht, 1990), Turkey (Ozgur *et al.*, 2002), and Spain (Martinez-Lorente *et al.*, 1998), represents some efforts in this direction. Effective training to the implementation of such a system is equally important to ensure a building is constructed right first time with zero defects. Training is the single most important factor in improving quality, once there has been a commitment to do so (Oakland 1993). For training to be effective, however, it must be planned in a systematic and objective manner.

In the United States of America, quality management started in 50s and 60s. (Rumane, 2011) Razzak Rumane (2011) emphasized that quality of construction is even more difficult to define as compared to manufacturing. First of all, the product is usually not a repetitive unit but a unique piece of work with specific characteristics. Secondly, the needs to be satisfied include not only those of the client but also the expectations of the community into which the completed building will integrate. The construction cost and time of delivery are also important environmental characteristics of quality. Based on the foregoing argument, the quality of construction projects can be defined as the fulfillment of the owner's needs per defined scope of works within a budget and specified schedule to satisfy the owner's/user's requirements (Rumane, 2011).

Quality was further interrogated in USA under quality management practices in construction where construction functions are seriously in tandem with the standards. According to ISO 9000 (or BS 5750), quality assurance is "those planned and systematic actions necessary to provide adequate confidence that product or service will satisfy given requirements for quality." ISO 8402-1994 defines quality assurance as "all the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfill requirements for quality."The third era of quality management saw the development of quality systems and their application principally to the manufacturing sector. This was due to the impact of the following external environment upon the development take-up of quality systems at this time: Growing, and more significantly, maturing populations

C. *Historical Perspective*

The world over has seen the dawn and practice of different quality management systems ranging from; Investors in People (IIP), ISO9000, Total Quality Management (TQM) among other systems that include custom design systems that are usually based on each country's quality policies (Adams & Bradt, 2002). Therefore, an effective management system has to manage the quality of all the procedural tenets. In order to ensure tangible qualitative standards the construction industry has coined quality management practices or rather policies to pick the form of quality manuals. With specific, reference to the Kenya BOOM which serves as the quality manual for construction projects, the document only allocated the professionals to various departments in the government of Kenya, leaving quality management practices in public construction projects not addressed. Although the departments are headed by well trained and experienced professionals in building and construction industry, the issues of quality planning, quality assurance and quality control does not feature in any public construction project. Despite the existence of this raft of measures, the industry in the country has faced various serious challenges that provide feasible questions on the parameters of the policy. Scenarios like the collapse of buildings and construction of substandard buildings under international parameters provide clear examples of significant failures in quality management practices in Kenya.

III. RESEARCH METHODOLOGY

A pilot survey was first conducted with 30 construction project under construction. The necessary revision was made before conducting the questionnaire survey. Only professional assigned to an on-going projects working locally for construction firms in Kenya, Kiambu County were included in the sampling for their knowledge of strategic quality issues on building sites. They were identified through the authors' contacts in the industry as well as

identified from further referrals by the respondents themselves. Out of 30 self-administered questionnaires, ALL usable questionnaires were finally received. This represents a response rate of 100 per cent. The construction firms where these project professionals work for range in size from those with less than five staff members to those with over 30 staff members. Each questionnaire was self-administered by the second author to the construction professionals who were experienced in quality management practices.

IV. FACTORS AFFECTING STRATEGIC QUALITY IN BUILDING CONSTRUCTION PROJECT

11. Factors that have deterred Increase/Enhancement of Quality in this Project

Statistics					
		Related to project	**Project location**	**Site access**	**Period of Project**
N	Valid	52	52	52	52
	Missing	2	2	2	2
Skewness		-.921	-1.141	-.993	-.958
Std. Error of Skewness		.330	.330	.330	.330

The response rate to this question was 96.3% as there were missing answers from two interviewees. With a skewness of -0.9 to -1.1 it means the sample data in the distribution is approximately symmetrical which implies that the four factors (scope of the project, project location, site access and period of project) influence quality in building and construction projects. Therefore, strategic management planning focuses on these quality strategic factors.

Frequency Table

Scope of project					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Strongly disagree	1	1.9	1.9	1.9
	disagree	3	5.6	5.8	7.7
	neither/ nor	9	16.7	17.3	25.0
	Agree	24	44.4	46.2	71.2
	strongly agree	15	27.8	28.8	100.0
	Total	52	96.3	100.0	
Missing	System	2	3.7		
Total		54	100.0		

27.8% of the respondents were of the opinion that the scope (nature and type of the project) has helped to increase/enhance quality in the project as they strongly agreed with this question. The cumulative percentage of the respondents who were in agreement with this factor was 72.2 leading to a conclusion that the scope of the project is actually significant in enhancing or manipulating quality of the building construction project.

Project location

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Strongly disagree	2	3.7	3.8	3.8
	Disagree	1	1.9	1.9	5.8
	Neither/Nor	10	18.5	19.2	25.0
	Agree	25	46.3	48.1	73.1
	Strongly agree	14	25.9	26.9	100.0
	Total	52	96.3	100.0	
Missing	System	2	3.7		
Total		54	100.0		

Project location is also a key factor in enhancing quality of the building construction project as 72.2% of the respondents were of the opinion (25.9 strongly agree + 46.3 who agreed). 9.3% of the respondents could not agree nor disagree as inclusive of that figure are those who disagreed but their number is insignificant not to make project location a factor in enhancing quality of the project

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	strongly disagree	1	1.9	1.9	1.9

	disagree	3	5.6	5.8	7.7
	Neither/ Nor	8	14.8	15.4	23.1
	Agree	25	46.3	48.1	71.2
	Strongly agree	15	27.8	28.8	100.0
	Total	52	96.3	100.0	
Missing	System	2	3.7		
Total		54	100.0		

Site access as alluded to by the respondents is also a factor in enhancing quality of building construction projects in Kiambu County as 27.8% strongly agreed with this issue. factor rendering the contrary opinions insignificant hence we have enough evidence to conclude that site access enhances project quality.

Correlations

		Related to project	Project location	Site access	Period of project
Related to project	Pearson Correlation	1	.680**	.696**	.402**
	Sig. (2-tailed)		.000	.000	.003
	Sum of Squares and Cross-products	44.827	30.769	30.885	19.538
	Covariance	.879	.603	.606	.383
	N	52	52	52	52
Projectlocation	Pearson Correlation	.680**	1	.756**	.334*
	Sig. (2-tailed)	.000		.000	.016
	Sum of Squares and Cross-products	30.769	45.692	33.846	16.385
	Covariance	.603	.896	.664	.321
	N	52	52	52	52
Siteaccess	Pearson Correlation	.696**	.756**	1	.305*
	Sig. (2-tailed)	.000	.000		.028
	Sum of Squares and Cross-products	30.885	33.846	43.923	14.692
	Covariance	.606	.664	.861	.288
	N	52	52	52	52
Periodofproject	Pearson Correlation	.402**	.334*	.305*	1
	Sig. (2-tailed)	.003	.016	.028	
	Sum of Squares and Cross-products	19.538	16.385	14.692	52.769
	Covariance	.383	.321	.288	1.035
	N	52	52	52	52

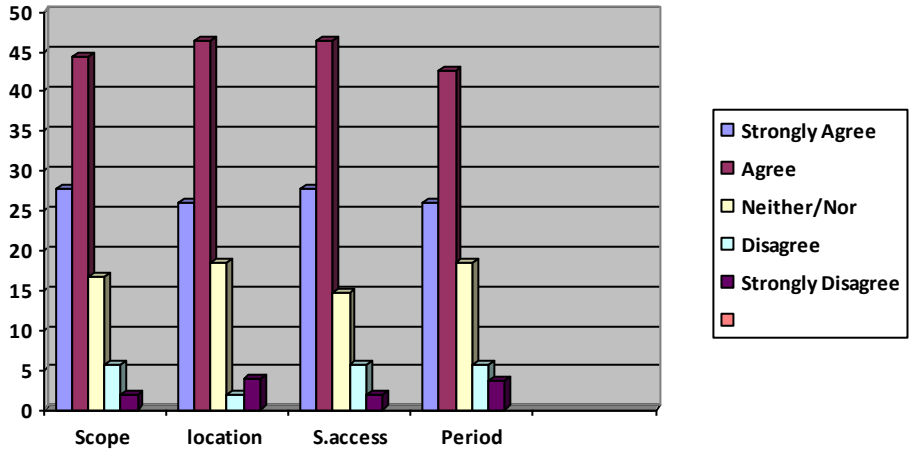
Generally 74.1% of the respondents agreed to it being a

Period of project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	stronly disagree	2	3.7	3.8	3.8
	disagree	3	5.6	5.8	9.6
	neither/nor	10	18.5	19.2	28.8
	agree	23	42.6	44.2	73.1
	strongly agree	14	25.9	26.9	100.0
	Total	52	96.3	100.0	
Missing	System	2	3.7		
Total		54	100.0		

27.8% of the respondents were not of the opinion that period of the project is a factor in improving project quality as 3.7% strongly disagreed, 5.6% disagreed as 18.5% were not sure of their opinion. This however is not significant evidence to assert that period of project is not a factor of enhancing quality of project since 68.9%, the majority said it was a factor.

The graph below summarizes the findings:



The correlations table above shows the association among the factors that enhance quality of a project in building and construction. The is enough evidence to conclude there exists a strong positive correlation among the first three factor; for instance scope of the project and project location have a correlation of 0.680 which shows a strong association between the two. Project location and site access exhibit a strong association as well of 0.756. This means that the three factors significantly enhance the quality of projects in Kiambu County and in so doing depend on one another. Only period of project exhibited a weak association with the other factors meaning in enhancing quality of the project it is an independent variable. This will form the basis for strategically addressing the factors for the benefit of the owner to give client satisfaction and organise the activities to be minimal for the periods of increment weather conditions.

V. FACTORS RELATED TO DESIGN

Statistics

		Related to design	Drawings prep	Conformance to code	Adherence to codes	BQ detailed
N	Valid	52	52	51	52	52
	Missing	2	2	3	2	2
Std. Error of Mean		.110	.114	.101	.120	.126
Mode		4	5	4	4	4[a]
Skewness		-.740	-.989	-.316	-.571	-.570
Std. Error of Skewness		.330	.330	.333	.330	.330

52 respondents gave their opinion on this question giving a 100% response rate but for conformance to codes and standards where the response rate was 98.09%. On the completeness and consistency of design documents the mode is 4 meaning that majority of the respondents are in agreement with the factor. This applies to all the other factors with the mode of 4 apart from the fact that drawings are prepared in full details where majority of the respondents strongly agree with a modal response of 5.

Frequency Table

Completeness and consistency					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	2	3.7	3.8	3.8
	Neither/Nor	7	13.0	13.5	17.3
	agree	25	46.3	48.1	65.4
	Strongly agree	18	33.3	34.6	100.0
	Total	52	96.3	100.0	
Missing	System	2	3.7		
Total		54	100.0		

46.3% of the respondents were of the opinion that completeness and consistency of design documents as related to design is a factor in enhancing project quality. 33.3% of the respondents strongly agreed to the issue of it being related to design giving a cumulative 79.6% of those who agreed. 16.7% were of the contrary opinion, however their numbers do not provide sufficient evidence to adopt their opinion. This is because only 3.7% agreed which is insignificant as 13.0% of the respondents could not give their opinion.

Drawings preparation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	2	3.7	3.8	3.8
	Neither/Nor	6	11.1	11.5	15.4
	Agree	20	37.0	38.5	53.8
	Strongly Agree	24	44.4	46.2	100.0
	Total	52	96.3	100.0	
Missing	System	2	3.7		
Total		54	100.0		

As to whether drawings being prepared in full details were a factor related to design in enhancing quality of the project, 44.4% were of the opinion that it is. Another 37.0% agreed to it being a factor, therefore there is sufficient evidence to assert that drawings being prepared in full details is a factor related to design and has an effect in quality of building and construction projects. Only 3.7% of the respondents were of the negative opinion.

Conformance to code

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neither / Nor	9	16.7	17.6	17.6
	Agree	23	42.6	45.1	62.7
	strongly agree	19	35.2	37.3	100.0
	Total	51	94.4	100.0	
Missing	System	3	5.6		
Total		54	100.0		

Conformance to codes and standards from the opinion of respondents as a factor related to design affects quality of projects in building and construction in Kiambu County. Evidence from the tabulated analysis indicates that 35.2% of the respondents strongly agreed to this as a blanket 77.8% had a similar opinion. Only 16.7% of the respondents were not sure as to whether conformance to codes and standards affects the quality of building and construction projects.

Adherence to codes

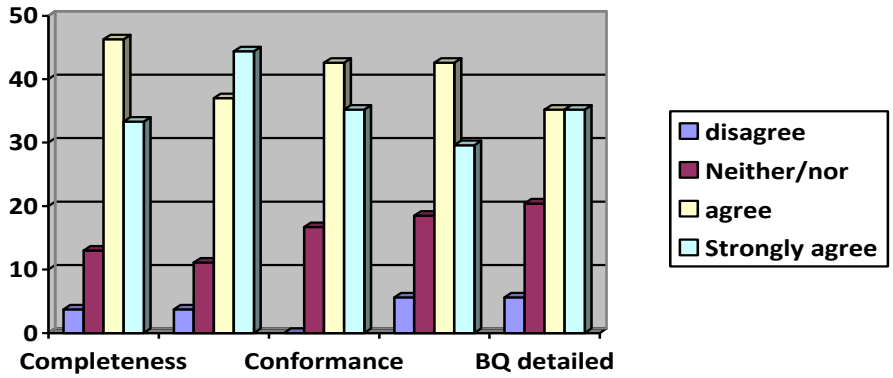
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	3	5.6	5.8	5.8
	Neither / Nor	10	18.5	19.2	25.0
	Agree	23	42.6	44.2	69.2
	Strongly agree	16	29.6	30.8	100.0
	Total	52	96.3	100.0	
Missing	System	2	3.7		
Total		54	100.0		

Adherence to specifications as shown in the table is also a factor related to design that affects quality in building and construction projects. 29.6% of the respondents were of the idea as the strongly agreed, 42.6% as well did agree to it being a factor as opposed to the 3 respondents who were of the contrary opinion however the latter wasn't enough to influence the conclusion.

BQ detailed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	5.6	5.8	5.8
	Neither / nor	11	20.4	21.2	26.9
	Agree	19	35.2	36.5	63.5
	Strongly agree	19	35.2	36.5	100.0
	Total	52	96.3	100.0	
Missing	System	2	3.7		
Total		54	100.0		

Bill of quantity being detailed and accurate according to 70.4% of the respondents is a factor related to project design hence, therefore affects quality of building and construction projects. 35.2% strongly agreed to bill of quantity being after while a similar percentage of respondents agreed. Hence it is evident that the mentioned factors related to design affect the quality of a building and construction project. These factors can be represented graphically as follows:



The table below shows the association of the variable related to design that affect quality of the building and construction project:

Correlations						
Control Variables			**Drawings prep**	**Conformance to code**	**Adherence to codes**	**BQ detailed**
Related to design	Drawings preparation	Correlation	1.000	.241	.258	.001
		Significance (2-tailed)	.	.092	.070	.993
		df	0	48	48	48
	Conformance to code	Correlation	.241	1.000	.407	.343
		Significance (2-tailed)	.092	.	.003	.015
		df	48	0	48	48
	Adherence to building codes	Correlation	.258	.407	1.000	.362
		Significance (2-tailed)	.070	.003	.	.010
		df	48	48	0	48
	Detailed Bills of quantities	Correlation	.001	.343	.362	1.000
		Significance (2-tailed)	.993	.015	.010	.
		df	48	48	48	0

This analysis indicates a positive but weak association between the variables implying that they are independent in this category. However there exists a significant correlation between conformance to codes and standards and adherence to specifications that translates to 0.407. Regression

Case Processing Summary

Valid Active Cases	51
Active Cases with Missing Values[a]	3
Supplementary Cases	0
Total	54
Cases Used in Analysis	51

Coefficients					
	Standardized Coefficients		df	F	Sig.
	Beta	Bootstrap (1000) Estimate of Std. Error			
Drawings prep	.481	.335	2	2.061	.141
Conformance to code	.024	.221	1	.012	.914
Adherence to codes	-.487	.414	4	1.385	.257
BQ detailed	.684	.492	4	1.932	.124

Out of the sample (n=54) 51 cases were tested due to three missing values. This means that 3 respondents did not give their opinion on this question.

H_0: Factors related to design do not affect the quality of building and construction projects.

H_1: Factors related to design do affect the quality of building and construction projects.

Model Summary

Multiple R	R Square	Adjusted R Square	Apparent Prediction Error
.815	.664	.570	.336

In this model summary, $R^2 = 0.664$ meaning that the model is adequate as the probability is greater than 0.5. The R^2 shows that 66.4% of the quality of projects is due to factors related to design is caused by Completeness and consistency of design documents, Drawings are prepared in full details, Conformance to codes and standards, Adherence to specifications and Bill of quantity is very detailed and accurate.

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	33.876	11	3.080	7.014	.000
Residual	17.124	39	.439		
Total	51.000	50			

The table above shows the analysis of variance of the regression model. The significance value is as small as it tends to zero meaning it is less than the pre-determined alpha level (p-value 0.000 < 0.05) which makes it fall in the unwanted region. In this case we reject the null hypothesis and conclude that in so doing we are 95% confident of not committing a type I error.

The model in this case will be of this form:

$Y= \beta_0 + \beta_1X_1 + \beta_2X_2+ \beta_3X_3 + Ɛ$

Where Y is the independent variable (Factors related to design)

ßi ; i= 1,2,3,4 are the unknown coefficients

x; i=1, 2, 3,4 are the predictor variables measured without error (Completeness and consistency of design documents, Drawings are prepared in full details, Conformance to codes and standards, Adherence to specifications and Bill of quantity is very detailed and accurate.

Ɛ refers to the random error which allows each response to deviate from the average value of Y by the amount Ɛ

The model translates to the following after fitting analysis coefficients:

$$Y= 0.481 + 0.024X_1 - 0.487X_2+ 0.684X_3 + Ɛ$$

VI. CONCLUSIONS

In light of the construction process in developed countries, there is in Kenya, pertinent differences that are identifiable between the two processes in terms of the practice of quality management. Pertinent quality planning, control, and assurance measures are lacking in the Kenyan context which forms the check list for quality manual for construction of buildings. To highlight just but a few; the construction process in Australia which is customised in the integration of factors affecting strategic quality in construction, requires that all government construction projects follow the requisite approval and vetting process a provision that is not persistent in the construction process for government and public premises in Kenya (Kuta & Nyaanga, 2013). Further, a lot of emphasis has been laid in the professional qualification of the expertise utilized by the process in Australia. In Kenya little legal and practice prominence has been laid on the accreditation of the professionals involved in the construction project especially in the construction of public and government premises (Kivaa, 2008).

VII. RECOMMENDATION

As earlier highlighted most quality management strategies employed in other countries like china Britain and the United States are coined to adapt to the ever-changing operational environment. Technology and increased competitive environment has grown the creative space for the industry. However, as highlighted a clear gap exists in strategy execution especially in the construction process in Kenya. Thus, it is the contention of this paper that an empirical review of the quality manual in Kenya is eminent. The review should conform to internationally accepted standards like Total Quality Management and ISO9001 : 2008.

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