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MITIGATING PROJECT MANAGEMENT FACTORS FOR SUCCESSFUL COMPLETION OF CONSTRUCTION PROJECTS IN NAIROBI COUNTY

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Abstract

Purpose: Many construction projects in Kenya experience performance challenges such as delays, cost overruns, suspension or complete abandonment causing the developers and stakeholders economic losses. The objective of this study was to examine project management functions that showed a strong correlation to mitigate successful project completion focusing on projects in Nairobi County.

Methodology: This study adopted descriptive research design. A total of 90 reputable firms in the construction industry were randomly selected for interview to obtain expert views on 24 selected factors. The target group was Architects, Quantity Surveyors, Project Managers, Engineers, and Construction Managers. 90 structured questionnaires were administered. The null hypothesis was tested using Bartlett's test of sphericity on the data and the results showed a 99.9% level of significance, thus, the null hypotheses were rejected. Various data analysis using statistical package for social science was undertaken including factor analysis and Spearman's rank correlation coefficient.

Results: The findings revealed a significant, strong and positive correlation between dependent and the independent variables. All the 24 factors had a significant strong influence on successful project completion in Nairobi County. The factors under project inception were; clear and well-defined project goals, proper analysis of environment, funding-budget, the involvement of stakeholders and comprehensive assessment of project risks. The design-related factors included procurement of competent experts, well-defined deliverables, explicit project charter, clear design criteria, specifications, and comprehensive contract documentation. Based on Spearman's rank correlation coefficient, principles of management factors were rated the highest in influencing successful project completion and these were proper planning, mobilization, deployment of adequate resources, continuous monitoring and evaluation, scope control, regular and timely project audit and strict adherence to risk management process. The human-related factors were attributed to the contractor's knowledge, skill and experience, funds, adequate equipment, and competent leadership.

Unique Contribution to Theory, Practice and Policy: It was recommended that objectives arising from the project needs should be determined clearly prior to commencement. The key factors are clearly defined goals, source adequate funding, and the involvement of all stakeholders and assess risks and risk management at inception.

Key Words: *Mitigating, Project Management,* and *Construction Projects*

1.0 INTRODUCTION

Governments in developing countries undertake mega construction projects (MCPs) to achieve their social and economic sustainable development objectives (Othman & Ahmed, 2013). This is accomplished by constructing infrastructural, industrial, educational, cultural, transportation, medical, and residential projects that provide societies with their needs and fulfill their requirements (Field & Ofori, 1988). MCPs are complex, risky and time-consuming undertakings that are usually commissioned by governments and delivered by national and international participants with a variety of cultural differences, backgrounds, political systems, and languages (Shore & Cross, 2005). They attract high levels of public attention and political interest due to the substantial cost, direct and indirect impact on the community, environment, and budgets (Van Marrewijk, Clegg, Pitsis, & Veenswijk, 2008). On the hand, due to their unique nature and characteristics, MCPs require high design knowledge and technical skills, competent human resources, professional managerial capabilities and large-scale investment (Sturup, 2009). In contrast, developing countries suffer from having a shortage in providing these essential knowledge, skills, competence, capabilities, and finance, which ultimately challenge the development of MCPs.

A project is a complex, non-routine and one-time effort which is limited by some factors such as scope, time, budget, resources, risk and performance specifications designed to meet a certain societal need (Attarzadeh & Ow, 2008). According to Mantel, Meredith, Shafer & Sutton (2008), to achieve the three main project constraints of scope, cost and time, project management knowledge, tools, and techniques must be applied. Despite the stated clarity on the constraints to be overcome, it has been noted that about 52.7% of projects are said not to be completed on time and 31.1% will not fulfill the scope. The main causes of project delays according to Aibinu & Jagboro (2002) are; financing of the project and payment for completed works, poor contract management, changes in site conditions and shortages of materials. The time it takes to have a project completed is very critical as far as the success of the said project is concerned (Weiss & Potts, 2012). To achieve this success, it is dependent on the decisions by the management or the people in-charge concerning the issues of budgets, targets, and the standards. It is a common scenario around the world to have many projects that never get to the completion stage or whose completion is totally delayed. A 2014 report by Ernest and Young on the Spotlight on Oil and Gas Mega Projects shows clearly different figures on projects delays around most continents in the world as follows; North America with 71%, Asia 80%, Africa 82% and the Middle East with 87%. (Alinaitwe, 2008) equated these delays to the possibility of an increase in costs beyond what had been budgeted for. In some cases, a delay in the project may lead to suspension or outright abandonment. Doraisamy, Akasha, & Yunus (2015) reviewed the causes of abandoned construction projects and found the common causes were; incorrect estimation, unskilled personnel, inadequate planning, poor risk management, misunderstanding of the work requirements, poor quality control by regulatory agencies, corruption and communication gap among the personnel.

A study by Ayodele & Alabi (2011) listed several effects of abandoned projects in Nigeria. The effects were; unemployment, reduction in government revenue, reduction in economic activities, lowering the standard of living, waste of equipment on site and an increase in the final cost of the project. A study by Amade, Ubani, Amaeshi, & Okorocha (2015) identified possible factors that would minimize or contain failure and abandonment of public sector construction projects in Nigeria. They also identified nine factors that were critical in containing failure and abandonment of public sector construction projects. The factors

included; detailed and comprehensive design by the contractors, effective monitoring, understanding of project's mission, technical know-how of the project manager, support from top management, political risks, effective procurement process, provision of adequate finance by the client and effective communication and information management by the design team. According to Abedi (2011) based on literature review from various sources through books, conference proceedings, the internet, and civil engineering journals identified thirty significant mitigation measures that can address issues and problems of delays in construction projects along with avoiding or minimizing the negative consequences of delay causes. A few of the identified methods of avoiding or minimizing delays were; accurate initial cost estimate, performance of preconstruction planning of project tasks and resource needs, selection of competent consultant and a reliable contractor to carry out the work, allocation of sufficient time and money at the design phase, availability of resources, competent project manager and comprehensive contract documentation. The most mentioned factors that make projects more likely to finish on time and budget are; adequate up-front planning, a clear scope of work and shared expectations between firms and clients, realistic scheduling, contract documents that clearly define risks and responsibilities for each partner, and familiarity with the work and the other players involved such as third-party influences including multiple stakeholders, political interest and utilities.

Global perspective on construction projects delivery

The construction industry is the backbone for economic development. (Kenny, 2007) stated that the construction sector role in economic development is undeniable. In view of its importance, large investments were made by governments across the globe for many years. In view of its identity as the world oldest engineering division, construction process and practices have evolved over the centuries. As Kenny (2007) mentioned, during the last 100 years, technology in construction has developed drastically paving way for modern buildings and scientific designs. Jrade & Leesard (2015) further suggested the use of integrated time and cost management system, where an Earned Value Management platform is used in a virtual environment during the planning and construction phases of a project to synchronize the building model with time and cost parameters as well as optimize it through a clash detection process that results in budget and schedule compressions early on. Performance is related to many topics and factors such as time, cost, quality, client satisfaction, productivity, and safety. There are many reasons which affect performance such as closures, amendment of drawings and amendment of the design and delayed release of funds. In addition, there are other different reasons affecting construction projects performance in Kenya such as poor management and leadership, inappropriate participants, poor relations and coordination, absence of motivation, control, monitor or decision-making systems, inadequate infrastructure, political problems, cultural problems and economic conditions (Ngugi, Nzulwa, & Kwena, n.d.). While individual organizations have been measuring their performance for many years, there has been little consistency in the data, and the way it has been published. The performance can be measured by key indicators for evaluation (Huang & Wang, 2006). The purpose of key performance indicators is that clients want their projects delivered; on time, on a budget, free from defects, efficiently, right first time and safely. Therefore, regular clients expect continuous improvement from their construction team to achieve year-on-year reductions in project costs and time.

Kenyan perspective on construction projects delivery

The GOK (2007) is the Government of Kenya development blueprint covering the period 2008 to 2030. It aims to transform Kenya into a newly industrializing middle-income country providing a high-quality life to all its citizens by the year 2030. Under the Second Medium Term Plan (2013-2017), key programmes and infrastructure projects have been prioritized for implementation to realize this goal. Some of these projects are; improvement of shipping and maritime facilities, expansion of railway transport – standard gauge railway (SGR), expansion of roads programme and development of the Lamu Port – Southern Sudan – Ethiopia Transport (LAPSSET) corridor. In the past many construction projects in Kenya failed in performance, for example, the National Youth Service housing estate in Ruaraka, National Social Security Fund Nyayo estate in Embakasi and Komarock housing project in Nairobi. In addition, performance measurement systems are not effective or efficient to overcome this problem. Construction projects performance problem appears in many aspects in Kenya (Ngugi et al., n.d.). There are other construction projects which failed in time performance, cost performance and other performance factors. There are also other important factors affecting project performance in Kenya such as project management competency (Department for International Development (UK Aid), 2014). Construction projects represent a unique set of activities that must take place to produce a unique product. The success of a project is judged by meeting the criteria of cost, time, safety, resource allocation, and quality as determined by the client. The purpose of project management is to achieve goals and objectives through the planned expenditure of resources that meet the project's quality, cost, time, scope, and safety requirements. The construction manager must control, deflect or mitigate the effects of any occurrence or situation that could affect project success (Okoye, Ngwu, & Ugochukwu, 2015). In Kenya, delays in projects are rampant especially due to endemic corruption and poor reporting structures among the public sector (DFID, 2013). It is acknowledged in the Kenya Vision 2030 that a modern and result focused public service is a prerequisite for the country's socio-economic transformation (The Republic of Kenya, 2007). Further, the Constitution of Kenya in the Bills of rights gives every citizen the right to enjoy efficient and quality public services (The Republic of Kenya, 2010b).

Statement of the problem

Governments in developing countries undertake mega construction projects in order to achieve their social and economic sustainable development objectives (UNDP, 2011). This is accomplished by constructing infrastructural, educational, transportation and medical projects that provide societies with their needs and requirements (Othman & Ahmed, 2013). A project is termed successful when it addresses the various needs, concerns, and expectations of the stakeholders as planned and executed (Project Management Institute, 2008)). As such it is, therefore, prudent to identify mitigating factors that influence completion of projects in the construction industry so that the functions of projects are operationalized within constraints of the project namely time, cost and scope.

Several challenges were identified by the researchers in previous studies such as imperfect design, time inefficiency, and lack of adequate funds, cost overruns, lack of timely acquisition of project site and working equipment among others. Hence there is a need to find out mitigating factors to avoid these causes from adversely affecting project completion. It is clear from the review of previous studies that those studies have identified factors that cause delay, cost overruns, abandonment of construction projects and poor-quality outputs only but none has focused on mitigating project management factors for successful completion of

construction projects, particularly in Nairobi County. Hence determination of long-term mitigating project management factors for successful completion of construction projects in Nairobi County is the reason for this study.

2.0 LITERATURE REVIEW

Theoretical Review

Stakeholders Theory

Stakeholder theory is a theory of organizational management and business ethics that address morals and values in managing an organization. It was originally detailed by Freeman (1984) in the book Strategic Management. A Stakeholder approach identifies and models the groups which form stakeholders of a project, describes and recommends methods by which management can give due regard to the interests of those groups. In the traditional view of a company, the owners or shareholders of the company are important, and the company has a binding fiduciary duty to put their needs first. Stakeholder theory, however, is inclusive of all other parties involved and are affected by the firm and its stakeholders. These groups include employees, customers, suppliers, financiers, communities, governmental bodies, political groups, trade associations, and unions. Stakeholder theory is famous not only in the business ethics fields but also as one of the frameworks incorporating social responsibility. Many construction projects have experienced cost overruns due to a lack of ethics and malpractices such as dishonest, fraud and corruption (DFID, 2013). The interests of the stakeholders are important for a project to gain the support of all those affected. The study aimed to establish the influence of incorporating stakeholders' interests in project planning in order to avoid issues which are associated with project delays during execution and completion of projects in Nairobi County.

C-K design Theory

The C-K theory describes and explains the reasoning of a designer as he thinks of and designs a new object – a new product, service, or process (Hatchuel & Weil, 2009). In addition to its explanatory power, this theoretical framework provides powerful generative mechanisms to overcome cognitive obstacles (Hatchuel, LeMasson & Weil, 2011b) thus improving organizational ability to innovate. The C-K theory relies on the interaction between two spaces, the Concept space, and Knowledge space. In the C-space, various ideas are represented in a form of a tree where the branches represent ideas and are connected to the initial concept forming a tree-like structure. The K-space, on the other hand, enables better management of the knowledge available at the beginning of the exploration and reveal latent knowledge elements. K-space is expandable as new truths may appear in it as an effect of the design process. The findings of this study will add knowledge to the project management body and expand K-space. Reengineering in project management integrates both spaces to create new concepts and simultaneously generate new knowledge. Due to inevitable changes in market demands, organizations are facing major transformations that destabilize their traditional products or services. To cope with these emerging challenges, C-K design theory and new organizational models have been developed aimed to rationalize and optimize any design activity and thus the **r**enewal of the object's identity and the renewal of firms' competencies.

Management Theory

Koontz and Weihrich (20040) defined Management as the process of designing and maintaining an environment in which individuals work efficiently in groups to accomplish selected objectives. Project Managers carry out the managerial functions of initiating, planning, organizing, staffing, leading, monitoring and controlling and closing a project. Modern quality management approaches relate in many ways to modern project management approaches to paying attention to the human aspect of the overall processes to achieve total quality management in projects. Sashkin and Kiser (1993) described total quality management as a relatively established entity with accepted components of teamwork, systems thinking and application of statistical tools to achieve project goals within schedule, cost, and scope. The other important component of modern quality management is its orientation to the client or customer, the ultimate user of the product or service produced. This theory, therefore, points to the need to determine the causes of problems and developing solutions and mitigating factors. The study aimed to establish key factors that can help project managers to minimize factors with adverse effects to successful completion of construction projects in Nairobi County and the country as a whole.

Resource-Based View theory

This is one of the many theories of organizational behavior which aligns itself with the human capital view of people within an organization. Organizations' mission is to create value for their clients in order to succeed in their venture. This is normally achieved using strategy, technology, innovation, and tactics to gain a competitive advantage in the market. The resource-based view (RBV) is a model that sees resources as key to superior firm performance. The approach suggests assessment of resources within the organization to find the sources of competitive advantage without looking at the competitive environment for it (Mata, Fuerst & Barney, 1995). In order to create a workforce that provides a sustainable competitive advantage and value creation, a firm must create an environment that allows their human capital to grow. This human growth is achieved by increased educational opportunity, knowledge management practices and systems, motivation and engagement among other essential factors and must be used to create a competitive advantage that would be very difficult for competitors to imitate (Afiouni, 2007; Agarwal & Ferratt, 2001; Luftman & Kempaiah, 2007). The resource-based view of organizations is based on two main assumptions; resource diversity and resource immobility (Mata, William, & Barney, 1996). Resource diversity (also called resource heterogeneity) involves assessment to ascertain whether a firm owns a resource or capability that is also owned by other competing firms, then that resource cannot provide a competitive advantage. Resource immobility refers to a resource that is difficult to obtain and organized by competitors because the cost of developing, acquiring or using that resource is too high. These two assumptions can be used to determine whether an organization is able to create a sustainable competitive advantage by providing a framework for determining whether a process or technology provides a real advantage over the marketplace.

Conceptual Framework

A conceptual framework is an analytical tool used to make conceptual distinctions and organize ideas in a manner that it is easy to understand. It offers a logical structure of connected concepts that provide a picture of how variables in the study relate to one another (Grant & Osanloo, 2014).

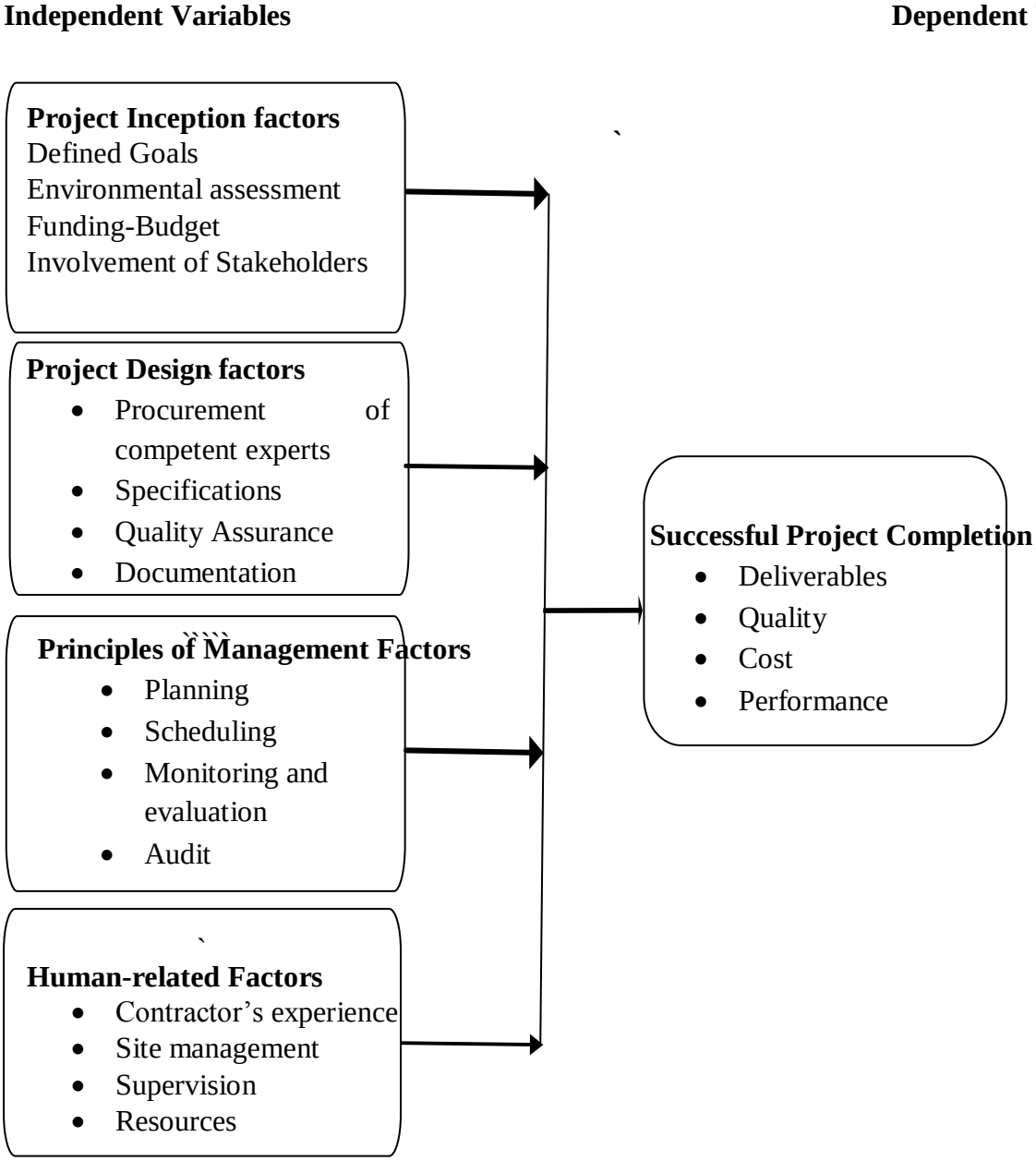

Figure 1: Conceptual Framework

3.0 RESEARCH METHODOLOGY

This study adopted descriptive research design. A total of 90 reputable firms in the construction industry were randomly selected for interview to obtain expert views on 24 selected factors. The target group was Architects, Quantity Surveyors, Project Managers, Engineers, and Construction Managers. 90 structured questionnaires were administered. The null hypothesis was tested using Bartlett's test of sphericity on the data and the results showed a 99.9% level of significance, thus, the null hypotheses were rejected. Various data analysis

using statistical package for social science was undertaken including factor analysis and Spearman's rank correlation coefficient.

4.0 FINDINGS

4.1 Demographic characteristics

4.1.1 Gender of the respondents

The findings showed that there were sixty-five males and two females representing 97% and 3% respectively of the sample. The study revealed that the senior positions in the construction industry are dominantly occupied by men. Table 1 shows the gender composition.

Table 1: Gender composition

Gender	Frequency	Percent
Male	65	97.0
Female	2	3.0
Total	**67**	**100**

4.1.2 Designation in the organization

The composition of the respondents by profession was examined and found that; ten project managers, nineteen architects, twenty-five engineers, and thirteen quantity surveyors participated in the study. The respondents by profession were also found to be directly proportional to the number of selected firms for the study and were considered a fair and good representation of the construction industry. Table 2 shows the designation, frequency, and percent.

Table 2: The designation, frequency, and percent

Designation	Frequency	Percent
Project Managers	10	14.9
Architects	19	28.4
Engineers	25	37.3
Quantity Surveyors	13	19.4
Total	**67**	**100**

4.1.3 Professional experience

For the experience of the respondents, the professionals were categorized into three groups. The first group was professionals with over ten years' experience, the second group between five and ten and the third group were between one and five years. Table 3 shows years of experience, frequency, and percent.

Table 3: Years of experience, frequency, and percent

Years of experience	Frequency	Percent
Over 10 years	54	80.6
5 to 10 years	9	13.6
1 to 5 years	4	6.0
Total	**67**	**100**

From table 3, 94% of the respondents had experience of over 5 years which was considered adequate experience to provide a fair opinion on the research objectives.

4.1.4 Highest level of education

The level of education of the respondents was examined to assess the level of appreciation and degree of understanding of the research objectives. From the findings of the study, there were holders of higher diploma in construction technology, bachelor's degree, master's degree, and Ph.D. holder. Table 4 shows the highest level of education attained by the respondents, frequency, and percent.

Table 4: Highest level of education, frequency, and percent

Highest Level of education	Frequency	Percent
Ph.D.	1	1.5
Master's degree	21	31.3
Bachelor's degree	43	64.2
Higher Diploma	2	3.0
Total	**67**	**100**

From table 4, it was observed that over 97% of the respondents were bachelor's degree holders and above. These cadres formed the majority of project managers; thus, the information was obtained from qualified, relevant and experienced respondents, therefore, the findings were representative of the influence of the factors on the successful completion of construction projects in Nairobi County.

4.2 Respondents' opinion on the influence of the factors

The respondents' general opinion on the effect of the project management factors on successful project completion was summarized as a percent and shown in table 4.8.

Table 5: Respondents' opinion on influence of factors as percent

Factors	Yes	No	Total
Inception factors	95.5	4.5	100
Design factors	92.5	7.5	100
Principles of project management factors	97.0	3.0	100
Human-related factors	98.5	1.5	100
Successful project completion	84.6	15.4	100

The results showed that over 92.5% of the respondents agreed that the factors influenced successful project completion and 84.6% were of the opinion that the performance indicators showed successful project completion in Nairobi County.

4.3 Reliability and validity tests

Cronbach's Alpha coefficient method was used to estimate the reliability or internal consistency of the study. Table 6 shows the Cronbach's Alpha (α) values for the variables and the number of test items.

Table 6: Reliability statistics

Variables	Alpha (α)	Test items	Number of items (N)
Project inception factors	0.861	5	67
Project design factors	0.821	5	67
Principles of management factors	0913	5	67
Human-related factors	0848	5	67
Successful project completion	0.787	4	66

The findings indicated all the study variables had $Alpha\ (\alpha)$ value greater than 0.7, thus, the study was reliable (Kothari, 2009). A greater alpha implies that the measures for the same constructs have high internal consistency, hence the new latent variable would be more reliable. The obtained values of $Alpha\ (\alpha)$ for all the variables indicated that the study can be replicated on other participants and locations and will produce similar results.

The content validity was achieved through the questionnaire by the participation of experts. Convergent validity and discriminant validity were also adhered to. Convergent validity looks at measures from the same constructs whether they were related and discriminant validity looks at measures from different constructs which were expected to have low correlations.

4.4 Factor analysis

To establish the influence of identified project factors on successful completion of construction projects in Nairobi County, confirmatory factor analysis was used to determine the most important factors. The factors identified were used to determine the extent they influence successful completion of construction projects in Nairobi County. Factor analysis is a data reduction technique which is carried out using a correlation matrix of the variables of interest. A set of variables are combined to a new smaller set of variables called factors. These factors represent a weighted mean of the original data which are latent in the variables that cannot be observed. Factor analysis uses principal component analysis and varimax rotation to extract factors subject to Kaiser-Meyer-Olkin, Bartlett's sphericity tests and an Eigenvalue cut off of 1.0.

4.4.1 Sampling adequacy test

Kaiser-Meyer-Olkin (KMO) index, a measure of sampling adequacy, was used to determine whether factor analysis was appropriate to yield distinct and reliable factors or determine important variables. A value closer to one (1) indicates that there is a strong correlation between variables, hence, they can be used to generate factors or constructs variable. Table 7 presents coefficients of KMO of the variables.

Table 7: Coefficients of Kaiser-Meyer-Olkin

Variables	KMO index
Project inception factors	0.731
Project design factors	0.807
Principles of management factors	0.849
Human-related factors	0.782
Successful project completion	0.651

Table 7 shows the coefficient of KMO is greater than 0.5 for all the variables, hence, the sample was adequate to proceed with factor analysis.

The Bartlett's test of sphericity was the test for the null hypothesis that the correlation matrix had an identity matrix. The main purpose was to determine the relationship between variables in order to reject the null hypothesis and conclude that the correlation matrix was not the identity matrix. Table 8 shows the approximate of Chi-square (Approx.), the degree of freedom (df) and level of significance (Sig.).

Table 8: Bartlett's test of sphericity

Variables	Approx.	df	Sig.
Project inception factors	133.790	10	0.000
Project design factors	150.640	10	0.000
Principles of management factors	216.941	10	0.000
Human-related factors	141.600	10	0.000
Successful project completion	89.480	6	0.000

From table 9, the p-values were all 0.000. Taking a 95% level of significance, the p-value should be less than 0.05. The results showed that all variables had a 100% level of significance; hence the null hypotheses were rejected and it was concluded that Bartlett's test of sphericity was highly significant and the variables were strongly correlated. Therefore, it was appropriate to carry out factor analysis.

4.4.2 Principal component analysis

To establish the influence of selected project management factors on successful completion of construction projects in Nairobi County**,** confirmatory factor analysis was used**.** Factor analysis is a data reduction technique which is carried out using a correlation matrix of variables of interest. A set of variables were combined to a new smaller set of variables called factors. These factors represented a weighted mean of the original data which were latent in the variables that could not be observed. The collected data was analyzed using statistical packages for social science (SPSS). SPSS relies majorly on the principal components in carrying out factor analysis, that process is called a method of principal components. Principal component analysis (PCA) is a mathematical procedure that transforms a large set of measured data of correlated variables to a small set that still contains most of the information in the large set.

4.4.2.1 Analysis of project inception factors

The principal component analysis was used to identify factors that account for more variability and extracted new factors based on the total variance explained as shown in table 9.

Table 9: Total Variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.216	64.326	64.326	3.216	64.326	64.326
2	0.758	15.166	79.492			
3	0.433	8.664	88.156			
4	0.327	6.549	94.705			
5	0.265	5.295	100.000			

Extraction Method: Principal Components Analysis

The components in the first column of table 9 were the numbers of the factors used in the factor analysis. The initial Eigenvalues were the obtained variances of the factors to be extracted. The total column contains the Eigenvalues. Factor 1, timely funding of the budget, would always account for the most variance and hence had the highest Eigenvalues. Comprehensive assessment of project risks was the next factor, it accounted for as much of the left-over variance as it could and the same would continue until the last factor. The percentage of variance represented the percent of total variance accounted for by each factor and the cumulative percentage gave the cumulative percentage of variance accounted by the factors present. The section labeled "Extraction Sums of Squared Loadings" showed those factors that met the cut-off criterion (extraction method) of 1 and were extracted. In this study, there was one factor only with eigenvalues greater than 1. Factor 1 accounted for 64.326% of the variability in all the five variables and explains 64.326% of the total variability. Since factor 1 accounted for most variability it meant that it constituted the main variables in project inception factors that influence successful completion of construction projects in Nairobi County. From the PCA, only one component was extracted with a total variance of 3.216, hence, factor rotation was not necessary. The variables in the factor are shown in table 9

Table 9: Component Matrix[a] by extraction Method

Variables	Component 1
Clear and well-defined project goals can reduce misunderstanding of the project deliverables and abandonment.	0.795
Proper analysis of the project environment can mitigate project failure.	0.831
Timely funding of the budget can mitigate project financial constraints and failure.	0.853
Involvement of all stakeholders will support the smooth implementation of a project and can mitigate project insubordination and failure.	0.512
Comprehensive assessment of project risks and the identification of the necessary mitigating measures can reduce and minimize failure.	0.838

Extraction Method: Principal Components Analysis

In table 9, all the factors were found to be greater than 0.1, it meant that all the variables belonged to that factor. Therefore, it was concluded that all factors were key in influencing the successful completion of construction projects. Frequency tables were used to provide a further perception of the respondents as a percent and are shown in table 10**.**

Table 10: Respondents' level of agreement as a percent

Project inception factors	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Clear and well-defined goals.	3.0	1.5	1.5	28.3	65.7	100
Proper analysis of the project environment.	1.5	6.0	1.5	49.3	41.8	100
Involvement of all stakeholders.	3.0	0	1.5	22.4	73.1	100
Comprehensive assessment of project risks.	0	3.0	3.0	31.8	62.1	100

Table 10 showed that 94% of the respondents agreed that inception factors strongly influence successful project completion.

4.4.2.2 Analysis of project design factors

The principal component analysis was used to identify variables that account for more variability and extracted new factors based on the total variance explained as shown in table 11.

Table 11: Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.231	64.622	64.622	3.231	64.622	64.622
2	0.759	15.189	79.812			
3	0.434	8.679	88.490			
4	0.329	6.582	95.072			
5	0.246	4.928	100.000			

Extraction Method: Principal Component Analysis.

Table 11 shows the actually extracted factors. Well-developed project charter and design manual was the only factor with eigenvalues greater than 1 and accounted for 64.622 % of the variability in all the 5 variables and explained 64.622% of the total variability. Since the well-developed project charter and design manual accounted for most variability, it meant that it constituted the main variables contributing to the successful completion of the construction project. From the PCA, the extracted component had a total variance of 3.231, hence, factor rotation was not necessary. The variables in the factor are shown in table 12.

Table 12: Component Matrix[a] by extraction Method

Variables	Component 1
Procurement of competent project team/experts can mitigate project errors and failure.	0.838
Appropriate project design criteria, clearly stated deliverables and specifications will minimize changeovers and mitigate delays and cost overruns.	0.769
Carefully planned, detailed and comprehensive designed package will ensure project quality assurance and minimize variations.	0.776
Well-developed project charter and design manual can mitigate failure	0.867
Comprehensive contract documentation can minimize project disruptions, disputes and mitigate claims.	0.763

Extraction Method: Principal Components Analysis

From table 12, it was concluded that all the project design factors significantly influenced the successful completion of the construction project. Frequency tables based on variables in factor 1 were used to provide the further perception of the respondents as percent shown in table 13**.**

Table 13: Respondents' level of agreement as a percent

Project design factors	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Procurement of competent project team/experts.	3.0	1.5	4.5	17.9	73.1	100
Appropriate project design criteria clearly stated deliverables and specifications.	1.5	1.5	3.0	31.8	62.7	100
Carefully planned detailed and comprehensive designed package.	1.5	1.5	4.5	37.3	55.2	100
Well-developed project charter and design manual.	3.1	3.1	10.8	47.7	35.4	100
Comprehensive contract documentation.	3.0	3.0	4.5	31.8	57.6	100

From table 13, 91% of the respondents agreed that the factors were important and had a significant influence on successful project completion. It was concluded that all the factors

were important and significantly influenced successful completion of construction projects in Nairobi County.

4.4.2.3 Analysis of principles of management factors

The principal component analysis was used to identify factors that accounted for more variability and extracted new factors based on the total variance explained as shown in table 14.

Tables 14: Total variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.723	74.463	74.463	3.723	74.463	74.463
2	0.514	10.283	84.746			
3	0.323	6.468	91.214			
4	0.248	4.956	96.170			
5	0.192	3.830	100.000			

Extraction Method: Principal Component Analysis.

Table 14 shows the actually extracted factor with eigenvalues greater than 1. The factor was continuous monitoring, evaluation and scope control. This factor accounted for 74.463 % of the variability in all the 5 variables and explained 74.463% of the total variability. Since the factor accounted for most variability, it meant that it constituted the main variables contributing to the successful completion of a construction project in Nairobi County. From the PCA, only one factor was extracted hence factor rotation was not necessary. The variables in the factor are shown in table 15.

Table 15: Component Matrix[a] by extraction Method

Variables	Component 1
Proper planning of project execution in terms of Work Breakdown Structures (WBS), scheduling and resource allocation can mitigate project delays and failure.	0.878
Mobilization and deployment of adequate plant and competent personnel can mitigate project delays and cost overrun.	0.862
Continuous monitoring, evaluation and scope control can mitigate project cost overrun and ensure total quality.	0.897
Regular and timely project audit can mitigate project cost overrun and delays.	0.813
Strict adherence to the risk management process can mitigate delays and failure.	0.863

Extraction Method: Principal Component Analysis

From table 15, it was concluded that all the factors were key in determining the influence of construction management factors on successful completion of construction projects in

Nairobi County. Frequency tables were used to further provide the perception of the respondents as percent shown in table16**.**

Table 16: Respondents' level of agreement as a percent

Project management factors	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Proper planning of project execution in terms of Work Breakdown Structures, scheduling, and resource allocation.	1.5	1.5	6.0	40.3	50.7	100
Mobilization and deployment of adequate plant and competent personnel.	1.5	1.5	4.5	43.3	49.3	100
Continuous monitoring, evaluation and scope control.	3.0	0	6.3	19.4	71.6	100
Regular and timely project audit.	1.5	3.0	4.5	32.8	58.2	100
Strict adherence to risk management process.	0	3.0	7.6	50.0	39.4	100

From table 16, 91% of the respondents agreed that the variables were important and significant. It was concluded that all the factors were important and had a significant influence on the successful completion of construction projects in Nairobi County.

4.4.2.4 Analysis of human-related factors

The principal component analysis was used to identify variables that account for more variability and extracted new factors based on the total variance explained as shown in table 17.

Table 17: Total variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.127	62.539	62.539	3.127	62.539	62.539
2	0.784	15.674	78.214			
3	0.528	10.555	88.769			
4	0.320	6.393	95.161			
5	0.242	4.839	100.000			

Extraction Method: Principal Component Analysis.

From table 17, Skilled and experienced contractor's project management team was the only factor with eigenvalues greater than 1. The Factor accounted for 62.539 % of the variability in all the 5 and explained 62.539% of the total variability and meant that it constituted the main variable contributing to the successful completion of a construction project in Nairobi County. From the PCA, only one factor was extracted hence factor rotation was not necessary. The variables in the factor are shown in table 18.

Table 18: Component Matrix by extraction Method

Statement	Component 1
Contractor's knowledge, skill, and experience can minimize project risks and mitigate project disruption.	0.735
Skilled and experienced contractor's project management team can optimize the utilization of resources to mitigate project delays and risks.	0.870
Qualified and experienced site supervisors are able to organize site operations adequately to ensure timely performance and can mitigate delays and cost overrun.	0.767
Readily available funds, construction plant, and equipment for a project can ensure timely performance and mitigate delays.	0.810
Leadership talents such as interpersonal skill, the ability of decision-making, innovation and creativity are imperative to project success	0.766

Extraction Method: Principal Component Analysis.

From table 19, it was concluded that all the variables from human-related factors were important and strongly influenced successful completion construction project in Nairobi County. Frequency tables were used to further provide the perception of the respondents of the factors as percent shown in table 20**.**

Table 19: Respondents' level of agreement as a percent

Project human-related variables	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Contractor's knowledge, skill, and experience.	1.5	3.0	4.5	38.8	52.2	100
Skilled and experienced contractor's project management team can optimize the utilization of resources.	3.0	1.5	3.0	32.8	59.7	100
Qualified and experienced site supervisors are able to organize site operations.	1.5	0	4.5	35.8	58.2	100
Readily available funds, construction plant, and equipment.	1.5	0	6.0	28.4	62.2	100
Leadership talents such as interpersonal skill, the ability of decision-making, innovation and creativity.	3.0	0	4.5	34.8	57.6	100

From table 19, 92.5% of the respondents agreed that the human-related factors were important in influencing successful project completion. It was concluded that all the human-related factors were important and strongly influenced successful project completion in Nairobi County.

4.4.2.5 Analysis of successful project completion

The principal component analysis was used to identify variables that account for more variability and extracted new factors based on the total variance explained as shown in table 20.

Table 20: Total variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.503	62.584	62.584	2.503	62.584	62.584
2	0.687	17.164	79.748			
3	0.570	14.247	93.996			
4	0.240	6.004	100.000			

Extraction Method: Principal Component Analysis.

From table 20, the realization of deliverables within project scope was the only factor with Eigenvalues greater than 1. The factor accounted for 62.584 % of the variability in all the 4 and explained 62.584% of the total variability, it meant that it was the major variable contributing to the successful completion of a construction project in Nairobi County**.** From the PCA, only one factor was extracted hence factor rotation was not necessary. The variables in the factor are shown in table 21.

Table 21: Component Matrix[a] by extraction Method

Statements	Component 1
Realization of deliverables within project scope is an indicator of successful completion of the construction project.	0.875
Project outputs that conform to specified quality standards indicate successful completion of the construction project.	0.769
Construction project completed within time and cost is an indicator of a successful project.	0.761
Efficiency and effectiveness of a project are key indicators of performance of a successful completion of the construction project.	0.753

Extraction Method: Principal Components Analysis

From table 21, it was concluded that all the measures in successful project completion factors were important. The factors were the key performance indicators of successful project completion in Nairobi County. Using the factors in successful project completion, frequency tables were used to further provide the perception of the respondents as percent shown in table 22**.**

Table 22: Respondents' level of agreement as a percent

Successful project completion	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Realization of deliverables within the project scope	0	3.0	9.1	53.0	34.8	100
Project outputs that conform to specified quality standards	0	1.5	3.0	48.5	47.0	100
Construction project completed within time and cost	0	6.1	6.1	31.8	56.1	100
Efficiency and effectiveness of a project	3.0	3.0	4.5	37.9	51.5	100

From table 22, 88.6% of the respondents agreed that the successful project completion factors were key performance indicators for successful project completion. It was concluded that all the factors were important and measures of successful project completion in Nairobi County.

4.5 Summary of factor analysis

From factor analysis, it was evident that all measures were significant in this research hence no variable was dropped from analysis thus latent variables were not necessary. Measures of central tendency were then used to combine the measured to come with a variable which would be used to determine the relationship between the independent and dependent variables. Since the study measures were ordinal measures, the best measure of central tendency deployed was the mode.

4.5.1 Correlation analysis

Spearman's rho correlation analysis was conducted to determine whether there was a relationship between the dependent and the independent variables and the strength of the relationship if present. The non-parametric method was used since the study variables were not normally distributed or they don't follow any underlined distribution. The correlation coefficient value from this analysis determined the measure of linear association between two variables where the coefficient should always be between -1 and +1. A coefficient of -1 meant that variables are perfectly related in a negative linear sense and +1 indicates that the variables are perfectly related in a positive linear sense. A value of 0 meant that there is no relationship between the variables. The findings are shown in table 23.

Table 23: Spearman's correlation coefficient (rho) and significance (p-value)

		Successful project completion	Project inception	Project design	Principles of management factors	Human-related factors
Successful project completion	rho	1.000	.397**	.357**	.568**	.457**
	p-value		0.001	0.003	0.000	0.000
Project inception	rho	.397**	1.000	.443**	.438**	.426**
	p-value	0.001		0.000	0.000	0.000
Project design	rho	.357**	.443**	1.000	.431**	.548**
	p-value	0.003	0.000		0.000	0.000
Principles of management factors	rho	.568**	.438**	.431**	1.000	.488**
	p-value	0.000	0.000	0.000		0.000
Human-related factors	rho	.457**	.426**	.548**	.488**	1.000
	p-value	0.000	0.000	0.000	0.000	

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

The findings in table 23 showed that the correlation coefficient between the successful completion of a construction project in Nairobi County and project inception was positive and significant (coefficient = 0.397, p = 0.001 < 0.01). The level of significance is 99.9%, thus, there was a strong significant positive influence of project inception factors on successful project completion in Nairobi County. It was, therefore, concluded that; clear and well-defined project goals, proper analysis of environment (PESTEL), timely funding-budget, the involvement of stakeholders and comprehensive assessment of risks influence project positively and mitigate successful completion of construction projects in Nairobi County. The correlation coefficient for project design factors was positive and p-value was significant (coefficient= 0.357, p-value = 0.003 < 0.01). The level of significance is 99.7%. This meant that project design factors; procurement of competent experts, clear design criteria, defined deliverables, specifications, project charter, and comprehensive contract documentation lead to an increased success rate of project completion in Nairobi County. The findings were in line with Eriksson's (2008) study which found that holistic and systemic approach to procurement procedures is crucial to achieving successful governance of construction projects.

The correlation coefficient for principles of management factors was strongly positive and p-value was significant (coefficient= 0.568, p-value = 0.003 < 0.01). The factors attained 99.7% level of significance and therefore it was concluded that there was a strong positive influence of construction management factors on successful completion of construction projects in Nairobi County. The findings of the study concurred with the findings by Muldoon (2014) that with the changing workplace and increasingly global market, businesses today depend on knowledge both the hard skills and professional soft skills.

The correlation coefficient for human-related factors was positive and p-value was significant (coefficient= 0.457, p-value = 0.000 < 0.01). The level of significance was 100% and it was concluded that human-related factors lead to increased success rate of project completion in Nairobi County. The results corroborated Chua et al (1999) and Dissanayaka & Kumaraswamy (1999) findings that project participants are key players in successful project completion and outlined the variables in human-related factors as contractor experience, site management, effective cost control system and speed of information flow. The study findings in Nairobi County strongly corroborated previous studies on factors influencing the successful completion of construction projects.

4.5.2 Ranking of mitigating project management factors

The influence of mitigating project management factors was compared using ranking based on the strengths of Spearman's rank correlation coefficients for successful completion of construction projects. The factor with the highest correlation coefficient was ranked 1 and the rest of the factors were ranked accordingly. The ranking was as shown in table 24.

Table 24: Ranking of mitigating project management factors

Factors	Spearman's rho	Rank
Principles of management factors	0.568	1
Human-related factors	0.457	2
Project inception factors	0.397	3
Project design factors	0.357	4

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

From table 24, principles of management factors were found to be fundamental mitigating factors for the successful construction of projects in Nairobi County. The second in the ranking was human-related factors. It was noted that the two factors were dependent on knowledge, skills, and experience which are essential for project designers, managers, and contractors. Project inception was third in the ranking. However, it emphasized the importance of identifying a project needs correctly for the project to be relevant and sustainable. Project design factors were ranked fourth but with a fairly strong correlation. It was nevertheless noted that it is a significant mitigating factor because to the most needed expertise of the design team, correct specifications, and good documentation which are the key determinants in the production of satisfactory deliverables.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The study concluded that clear and well-defined project goals, proper analysis of environment (PESTEL), timely funding-budget, the involvement of stakeholders and comprehensive assessment of risks influence project positively and mitigate successful completion of construction projects in Nairobi County. From the findings the study it was concluded that project design factors lead to an increased chance of successful project completion, thus procurement of competent experts, clear design criteria and charter, defined deliverables, specifications, and comprehensive contract documentation are mitigating factors for successful completion of construction projects in Nairobi County. It was concluded that; proper planning of project execution, mobilization, and deployment adequate resources, continuous monitoring and evaluation, scope control, regular and timely project audit and

strict adherence to risk management process mitigate successful completion of construction projects in Nairobi County. The study concluded that realization of deliverables within project scope, outputs that conform to specified standards, a project completed within time and cost, efficient and effective project were key performance indicators for successful completion of construction projects in Nairobi County.

Recommendations

The study recommends It was recommended that objectives arising from the project needs should be determined clearly prior to commencement. The key factors are clearly defined goals, source adequate funding, the involvement of all stakeholders and assess risks and risk management at inception. This will minimize and mitigate negative effects on successful project completion.

Competent and experienced professionals with relevant discipline knowledge, skills and experience should be procured for project design and preparation of contract documents. The involvement of experts will minimize project changeovers, discrepancies, disputes, cost overruns, and delays.

Principles of management factors: The key factors are planning, organizing, commanding coordinating and controlling, thus, project managers should be experts with vast knowledge, skills, and experience on similar projects. Construction projects should be well-planned, scheduled, monitored, evaluated and controlled on regular basis.

The study focused on the capabilities of the contractor's personnel and equipment. The study showed that the contractor's knowledge, skill, and experience are important for a project to be completed successfully. Availability of Contactor's resources such as qualified personnel and equipment influence greatly successful completion of construction projects.

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