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Factors Influencing Completion of Water Projects in Kakamega County, Kenya

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***Abstract* – The main aim of this study was to investigate factors that influence completion of water projects in Kenya using Kakamega County as a case study. The specific objectives of the study were to determine the effect of client-related factors and contractor-related factors. The instrument of data collection was questionnaires. The target population consisted of 104 employees working for water projects in Mumias and Lugari, and also contractors and professionals who have been engaged in water projects in Kakamega County. Simple random and purposive sampling was used to select 90 respondents who formed the sample size. The response rate was 82%. The data was analyzed using descriptive statistics and correlation. The main factors that were associated with client included financial capacity, owner interference, the imposition of contract duration , decision-making ability, and change in project scope which had a positive relationship with project completion ($r = 0.302$, $p < 0.05$). The contractor-related factors studied were financial capacity, equipment availability and quality, skilled workforce, site supervision ability, material availability, and control over sub-contractors which had a positive relationship with project completion ($r = 0.668$, $p < 0.05$). Therefore, both client-related and contractor-related factors had a significant relationship with project completion.**

***Keywords* – Client-related factors, contractor-related factors, project completion time, project cost, project quality**

I. INTRODUCTION

The construction industry, in particular, water projects, plays a significant role in socio-economic development as it provides the basic services such as water supply and sanitation which are necessary for the wellbeing of the society. The most common criteria for measuring project success is based on the triple constraint model of time,` cost, and the scope with quality being the central theme. Achieving project completion on time, within budget, at specified quality standards, and most importantly without unprecedented cost escalations is a major criterion of success of a project [1]. This research focused on completion of projects in terms of quality (satisfying client specifications; scope), time and cost.

The study was based on water projects undertaken in Kakamega County in western Kenya. This would fill the gaps left by other researchers in Kenya who have studied projects located in and around Nairobi County and thus they recommended studies on rural and suburban counties [2] which experience unique challenges in their management.

II. PROBLEM STATEMENT

Successful completion of projects is a common problem in the construction industry not only with an immeasurable cost to society but also with debilitating effects on the contracting parties [3]. In construction projects, failure to achieve targeted time, budgeted cost and specified quality results in various unexpected negative effects on the parties involved [4]. Most projects face problems of completion through unmet client satisfaction requirements, cost escalations beyond the budgetary limits and late delivery times.

Kenya has invested heavily in infrastructural projects aimed at making Kenya industrialized by 2030. However, these projects face problems of delays, cost over-runs and failure to achieve the intended quality requirements as found by [3] for road

projects, [2] for housing projects, [5] for water projects and [6] for Constituency Development Fund (CDF) projects. The failure to complete projects leads to various problems such as disputes and litigations [5].

In Kiambu County, 50% of the water projects implemented were successfully completed [5]. This indicates that various water projects face enormous challenges of implementation.

Although studies have been done on the factors influencing completion of construction projects in Kenya, it is necessary to undertake studies in projects in rural and sub-urban areas. Also with the implementation of a devolved system of government where the Counties are responsible for some water projects, it would be interesting to investigate the factors that would inhibit successful completion of these projects. It would also fill the gap in the research on factors influencing completion of water projects undertaken by Athi Water Services Board [5] which covered influence of finance, contractor's capacity, Monitoring, and contract variations. This would help draw conclusions on factors that influence water projects in Kenya and help in implementing mitigation measures.

III. RESEARCH OBJECTIVES

The main objective of this study is to investigate the factors influencing the completion of water projects in Kakamega County. The specific objectives are

i) To determine the effect of client-related factors on project completion

ii) To determine the effect of contractor-related factors on project completion

IV. RESEARCH QUESTIONS

i) What is the effect of client-related factors on project completion?

ii) What is the effect of contractor-related factors on project completion?

V. THEORETICAL REVIEW

The study was based on the theory of constraints and complexity theory.

1) Complexity theory

Project management environment are considered dynamic systems that change over time and are hard to predict. The construction industry is complex in its nature because it comprises large numbers of parties such as owners (clients), contractors, consultants, stakeholders, and regulators [7]. The complexity of construction projects makes them difficult to ascertain their actual cost and durations.

2) Theory of constraints

Needs and constraints in a multi-party working situations which are required in construction projects bring complications in project management [8] and therefore, for effective project management, constraints have to be managed. Projects contain an element of uncertainty as to the actual date of completion, actual costs, and scope limitations.

Triple constraints criteria (time, scope and cost) in project management have been accepted as a measure of project success. Project managers regard triple constraints as key to a project's requirements and success. Optimizing these three features ascertain project quality and timely completion. According to [9] all the three constraints of projects - scope (a measure of quality), cost and time - have their respective effects on projects' performance but since these elements have some correlation, any of the constraints bears an effect on the other two, eventually affecting projects deliverables to a greater extent.

VI. CONCEPTUAL FRAMEWORK

A conceptual framework is a representation of the main concepts or variables under study and their presumed relationship with each other. It is a scheme of variables/concepts the researcher will operationalize in order to achieve the research objectives. The conceptual framework used in this study is indicated in Fig. 1

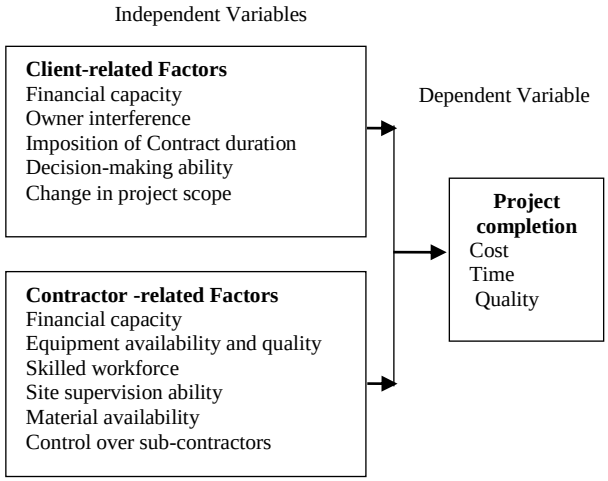

Fig. 1: Conceptual Framework

VII. RESEARCH METHODOLOGY

Research design constitutes the blue- print for the collection, measurement, and analysis of data [10]. This study adopted a descriptive survey research design. Descriptive survey design determines and reports the way things are or answers questions concerning the current status of the subjects in the study [11]. This study was carried out to determine the factors influencing the completion of water projects. It involved the establishment of relationships between the variables considered which can best be described using correlation analysis which is a type of descriptive research design as it does not manipulate

the existing information but it simply captures a pre-existing association between the variables.

Simple random sampling and purposive sampling was used to choose the subjects in this study. The target population comprised of individuals working in water projects in Lugari and in Mumias, and construction professionals and enterprises residing in Kakamega town. The total number of people targeted were 104 out of which 90 were randomly selected to be respondents. Questionnaires were administered to all the identified respondents. The questionnaire contained closed-ended questions for ease of analysis. The respondents were required to rank the factors influencing project completion on a 5-point Likert scale as follows; 1 for strongly disagree, 2- disagree, 3- neutral, 4 – agree and 5 – strongly agree. Out of the 90 questionnaires administered, 74 were filled and returned which translates to 82% response rate.

A pilot study was done by sampling 12 respondents and the reliability and validity of the questionnaire were measured using Cronbach alpha coefficient. The reliability statistics were as indicated in Table 1.

TABLE 1: RELIABILITY STATISTICS

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Client-related factors	.765	.761	10
Contractor-related factors	.753	.757	10
Project completion	.800	.806	9

The reliability coefficients were above 0.7 (Table 1). The questionnaire was, therefore, accepted and used for the study.

VIII. RESULTS AND DISCUSSION

1) Influence of Client related factors on project completion.

The client financial capacity was measured by the ability of the client to pay the contractor for the work done on a timely basis. A large proportion (80%) of the respondents were of the view that the client does not pay the contractor on time.

The client may impose the contract duration based on the need to realize the benefits of the project earlier than the realistic time of completing the project. This will put stress on the parties involved and could affect negatively the other variables such as cost and quality. In this regard, the majority (73%) responded that the client imposed unrealistic contract duration.

Decision-making ability was measured by the length of time taken by the client to approve design documents and variation orders. The majority (70%) of the respondents disagreed to the question as to whether the client approves design documents and variation orders in time.

The client usually varies the scope during project implementation where 75% of the respondents were of the affirmative.

The client (owner) can interfere with the work of the contractor through the selection of workers and suspension of work during contract implementation. In response to the question as to whether the client gets involved in the selection of the contractor's personnel, 45% agreed that the client sometimes gets involved in the selection of workforce. The majority of respondents (58%) agreed that the client sometimes suspends work or project activities in the course of project implementation.

Correlation analysis showed that financial capacity had a significant positive relationship with all the project completion parameters. It had a moderately stronger relationship with $r = 0.615$, $r = 0.514$ and 0.568, $p < 0.05$ with completion time, cost and quality respectively. This means that client financial capacity is an important factor that influences project completion.

Owner interference had a weak but significant negative relationship with project completion parameters (project completion time, $r = -0.457$, $p < 0.05$, quality, $r = -0.03$, $p < 0.05$, and project cost, $r = -0.399$, $p < 0.05$). Decision making ability of the client had significant positive relationship with project completion ($r = 0.519$, $p < 0.05$ with completion time, $r = 0.264$, $p < 0.05$ with project cost). Scope variation had significant negative relationship with client satisfaction (quality) albeit a weak one ($r = -0.384$, $p < 0.05$).

Imposition of contract duration by the client had an insignificant and weak negative relationship with project the completion parameters ($r = -0.013$, $p > 0.05$, $r = -0.12$, $p > 0.05$ and $r = -0.056$, $p > 0.05$ for project quality, time and cost respectively). This meant that unrealistic contract duration did not affect the project completion.

The overall correlation analysis for client-related factors and project completion (as indicated in Table 2) showed there is a weak but significant positive relationship between client-related factors and project completion ($r = 0.302$, $p < 0.05$). This concurred with a similar study by [5] who found client's financial ability in terms of payments in time as the most important factor influencing project completion. The main role of a client is to provide the financial requirements of the project and therefore, the ability to mobilize resources is significant to successful completion of the project. Slow decision making in terms of delay in approving variation orders, owner interference and imposition of unrealistic contract duration also influenced project completion as found by [4].

TABLE 2: CORRELATION CLIENT RELATED FACTORS AND PROJECT COMPLETION

		Client-related	Project completion
Client- Related	Pearson Correlation	1	.302*
	Sig. (2-tailed)		.009
	N	74	74

* Correlation is significant at the 0.05 level (2-tailed).

2) Contractor Related Factors

Contractor financial capacity was measured in terms of the ability to finance a large percentage of the project work without relying on the client to provide the funds. In response to the question as to whether the contractor had enough funds to finance the project, 86% disagreed. Therefore, it meant that the contractor had inadequate funds to finance the project without requesting for funds from the owner.

The use of skilled personnel by the contractor minimizes construction mistakes and errors and thus lead to quality work. The respondents were asked whether the contractor had skilled personnel of which 62% disagreed.

Construction projects require machinery and therefore, the availability of equipment in the right quantity can influence the ability of the contractor to finish the work in time. The majority of respondents (70%) disagreed when asked whether the contractor had adequate equipment. This meant that the contractor's ability to finish the work in time is unlikely. Also, if the contractor has inadequate equipment and relies on hired machinery, then the cost of the project might increase.

Construction machinery of poor quality has a higher chance of failure and increases the time required to complete the project tasks and the cost of maintenance may increase thereby escalating the overall project cost and sometimes lead to poor quality work. In response to the question as to whether the contractor had equipment of the right quality, 74% disagreed which indicated that the contractor's capability to successfully finish the project is deficient.

In response to the question as to whether the contractor had control over subcontractors in the project, a total of 69% of the respondents indicated that the contractor had no control over sub-contractors involved in the project. This hampered the ability of the contractor to control the rate of completion of specific tasks assigned to sub-contractors thus impeding project completion. In the construction industry, nominated sub-contractors have no direct relationship with the contractor and therefore, the contractor of the main works do not supervise their activities. This may jeopardize the quality of work if the sub-contractor lacks the capacity for the specific tasks of the project.

Material availability is important for successful completion of projects. Material quality has a relationship with project quality. Inadequate materials may increase the cost of the project through idle machinery and labour which may also delay the project completion. In this regard, the majority of the respondents (68%) agreed that the contractor had access to material of the right quantity and quality.

The ability of the contractor to supervise and co-ordinate project activities and tasks largely affect the project completion. In response to the question as to whether the contractor had the capacity to supervise project activities, a majority (51%) agreed that the contractor had the capacity to supervise project work.

Correlation analysis showed that financial capacity of the contractor had strong positive relationship $r = 0.706$ $p<0.05$ for project quality, $r =0.658$, $p <0.05$ for project completion time and $r = 0.584$, $p <0.5$ with project cost. This indicates that the financial capacity of the contractor has great influence on project completion.

Contractor's skilled workforce had a relatively weak but significant positive relationship with project quality ($r = 0.428$, $p < 0.05$), project cost ($r = 0.409$, $p <0.05$). It had weak and insignificant positive relationship with project completion time ($r = 0.216$, $p > 0.05$).

Adequate equipment availability and quality had a significant positive relationship with project completion time ($r =0.670$, $p < 0.05$) and cost ($r = 0.644$, $p < 0.05$). It had significant but weak relationship with project quality ($r = 0.216$, $p < 0.05$).

Control over subcontractors had significant positive relationship with project completion time ($r = 0.607$, $p < 0.05$), quality ($r =0.501$, $p < 0.05$) and project cost ($r = 0.519$, $p < 0.05$).

The ability of the contractor to supervise project activities on site had a weak but significant positive relationship with project completion time ($r =0.318$, $p < 0.05$), project quality ($r = 0.361$, $p < 0.05$) and project cost ($r =0.423$, $p < 0.05$).

Material availability had weak but significant positive relationship with project completion time ($r = 0.466$, $p < 0.05$), project quality ($r = 0.231$, $p < 0.05$) and project cost ($r = 0.381$, $p < 0.05$).

The overall correlation analysis for contractor related factors is shown in Table 3.

TABLE 3: CORRELATION OF CONTRACTOR RELATED FACTORS AND PROJECT COMPLETION

		Contractor-Related	Project Completion
Contractor-Related	Pearson Correlation	1	.668*
	Sig. (2-tailed)		.000
	N	74	74

* Correlation is significant at the 0.05 level (2-tailed)

From Table 3, it can be deduced that contractor-related factors have a strong and significant positive relationship with project completion ($r = 0.668$, $p < 0.05$). The contractor related factors considered were financial capacity, skilled personnel, equipment availability and quality, material availability, control over subcontractor and site supervision. This concurred with similar studies by [2], who found the financial capacity of the contractor and [12], who found equipment failure besides financial capacity as one of the factors influencing project completion. Material access by the contractor, presence of sub-contractors, skilled personnel, and site supervision ability were among the contractor related factors that influenced project completion for construction projects in Malaysia [4]. If the contractor does not have the adequate equipment, the option available is to hire which can affect negatively the project cost or its unavailability delays project completion time. Sub-contractors in a project are involved in various sub-tasks that could influence the quality, cost, and scope of the project if the contractor does not have control over them.

IX. CONCLUSION AND RECOMMENDATION

The main factors that were associated with client included financial capacity, owner interference, and an imposition of contract duration, decision-making ability and change in project scope. Correlation analysis indicated that these factors had a weak but significant positive relationship with project completion ($r = 0.302$, $p < 0.05$).

The contractor-related factors studied were financial capacity, equipment availability, and quality, skilled workforce, site supervision ability, material availability, and control over sub-contractors. These factors had a strong and significant positive relationship with project completion ($r = 0.668$, $p < 0.05$).

The following recommendations could be deduced from the findings of the study. (1) Clients should ensure there is enough funds to finance the project without delaying any payment to the contractor and (2) contractors selected for any construction project should have enough financial capacity and adequate equipment of the right quality and should have some control over sub-contractors. This would ensure the project is completed within budget, time and meet client specifications.

The following are the suggestions for further research (1) the effect of the contract types employed in the project on project completion (2) the effect of unforeseen site conditions on project completion (3) the effect of human resources management practices on project completion, and (4) the effect of planning tools on project completion

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