



Original Article

Investigation of the Effectiveness of Construction Works Programming: A Case of Kiambu County Projects.

Peter Waweru Mburu ^{1*}, Dr Abednego Oswald Gwaya, PhD¹ & Prof. Stephen Onyango Diang'a, PhD¹

¹Jomo Kenyatta University of Agriculture and Technology, P. O. Box 62000 - 00200, Nairobi, Kenya.

* Author for Correspondence email: pewaz2012@gmail.com.

Article DOI: <https://doi.org/10.37284/eaje.3.1.417>

Publication Date: **ABSTRACT**

21 September 2021

Keywords:

Construction,
Programming,
Projects,
Management,
Monitoring.

The effective performance of any Construction Project to a large extent depends on how deliberate, well thought, planned and managed works programming is developed and implemented. Effective works programming helps those doing the project to make sure that it is done within scope, time and cost. This study adopted a case study design and simple random sampling technique to identify 102 respondents from a target population of 132 respondents. Descriptive and inferential statistical techniques were employed. The findings were; there was a strong correlation between the predictor variable on the dependent variable. The ANOVA analysis indicated a P-value of 0.000. Therefore, the prevalence of working program applicability, adherence to effective work programming and knowledge of work programming techniques had a significant impact on the effectiveness of construction projects delivery. The study rejected the null hypothesis that the prevalence of working program applicability did not affect the delivery of construction management projects and knowledge of work programming did not affect the delivery of construction management projects in Kiambu County. However, the study failed to reject the null hypothesis that adherence to work programming did not affect the delivery of construction management projects in Kiambu County. Therefore, the study concluded that the prevalence of working program applicability significantly affected the delivery of construction management projects in Kiambu County and knowledge of work programming significantly affected the delivery of construction management projects in Kiambu County. The primary focus of this study was injecting solutions through integrating technology to enhance efficiency in real-time monitoring and evaluation. With the model of planning, control, reporting and proactive remedial action for the performance of construction projects.

APA CITATION

Mburu, P. W., Gwaya, A. O., & Diang'a, S. O. (2021). Investigation of the Effectiveness of Construction Works Programming: A Case of Kiambu County Projects *East African Journal of Engineering*, 3(1), 123-138. <https://doi.org/10.37284/eaje.3.1.417>

CHICAGO CITATION

Mburu, Peter Waweru, Abednego Oswald Gwaya, & Stephen Onyango Diang'a. 2021. "Investigation of the Effectiveness of Construction Works Programming: A Case of Kiambu County Projects". *East African Journal of Engineering* 3 (1), 123-138. <https://doi.org/10.37284/eaje.3.1.417>.

HARVARD CITATION

Mburu, P. W., Gwaya, A., and Diang'a, S. O. (2021) "Investigation of the Effectiveness of Construction Works Programming: A Case of Kiambu County Projects", *East African Journal of Engineering*, 3(1), pp. 123-138. doi: 10.37284/eaje.3.1.417.

IEEE CITATION

P. W., Mburu., A. O. Gwaya., & Diang'a, S. O. "Investigation of the Effectiveness of Construction Works Programming: A Case of Kiambu County Projects," *EAJE*, vol. 3, no. 1, pp. 123-138, Sep. 2021.

MLA CITATION

Mburu, Peter Waweru, Abednego Oswald Gwaya, & Stephen Onyango Diang'a. "Investigation of the Effectiveness of Construction Works Programming: A Case of Kiambu County Projects." *East African Journal of Engineering*, Vol. 3, no. 1, Sep. 2021, pp. 123-138, doi:10.37284/eaje.3.1.417.

INTRODUCTION

Construction accounts for a big proportion of natural resources consumption (Roodman & Lenssen, 1994). This consumption has been estimated to be 50% of global material use, and 40% of global energy use (Price Waterhouse Cooper, 2008). Growth in this consumption is tied directly to global economic growth. Additionally, the current state of the world economy is such that growth in developing nations, especially in Africa, is driving global growth for the first time in modern history (Callen, 2007). The construction industry comprises a wide range of activities involving construction, alteration, and/or repair. Examples include residential construction, bridge erection, roadway paving, excavations, demolitions, and largescale painting jobs. The construction industry is composed of five sectors: residential, commercial, and heavy civil, industrial, and environmental. To facilitate the effective execution of activities involved in construction, it is a prerequisite to have a chronological arrangement of activities. The program clearly outlines the sequence in which tasks must be carried out so that a project (or part of a project) can be completed on time. This arrangement is called a works program.

Construction project management (CPM) entails the entire process of planning, coordination, and control of a project from inception to completion (Lim, 2016). The main objective of CPM is to fulfil a

client's requirement in order to produce a functionally and financially viable project. A construction manager holds the same responsibilities and completes the same processes in each sector. All that separates a construction manager in one sector from another is knowledge of the particular construction site. This may include different types of equipment, materials, subcontractors, and possibly locations. Lack of an effective work program has led to the failure of many projects being completed on time (Lim, 2016). This has informed the need to investigate the effect of work programming on construction project management delivery.

Research Purpose

The purpose of this research is to investigate the effect of work programming on construction management project delivery.

Research Objectives

The research is guided by the following objectives:

- To investigate the effect of work programming on project delivery in Kiambu County.
- To investigate the prevalence of work programs on project delivery in Kiambu County.
- To access the extent to which work programming is applied in project management delivery in Kiambu County.

- To develop an appropriate work programming framework to assist on project delivery in Kiambu County.

Research Questions

- What is the effect of work programming on project delivery in Kiambu County?
- What is the prevalence of work programs on project delivery in Kiambu County?
- To what extent is work programming applied in project management delivery in Kiambu County?
- What is the appropriate work programming framework to assist in project delivery in Kiambu County?

Research Hypothesis

H₀₁: Knowledge of work programming has no significant influence on the delivery of construction management projects in Kiambu County.

H_{A1}: Knowledge of work programming has a significant influence on the delivery of construction management projects in Kiambu County.

H₀₂: The availability of work programming has no significant influence on the delivery of construction management projects in Kiambu County.

H_{A2}: The availability of work programming has a significant influence on the delivery of construction management projects in Kiambu County.

H₀₃: Adherence to work programming has no significant influence on the delivery of construction management projects in Kiambu County.

H_{A3}: Adherence to work programming has a significant influence on the delivery of construction management projects in Kiambu County.

Theoretical Scope

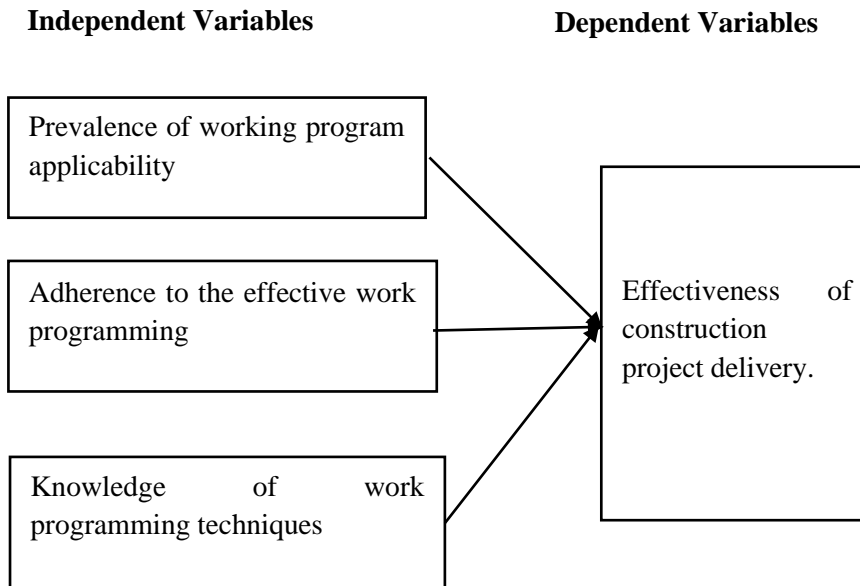
Delaney (2016) argues that a work program is an instructional list often produced on construction projects or for alteration work. He explains that a work program is one of the most important aspects that each constructor must observe in order to achieve the optimum goals of cost-effectiveness and high-quality construction. Harris, McCaffer, and Edum-Fotwe (2013) argue that a schedule should allow the contractor to identify significant work and materials that will be needed to complete the works and to calculate the quantities that will be required. It is from these theoretical positions by different authors that this study seeks to identify the importance of using a work program and the prevalence of its usage. It will involve the assessment of the various degrees of effect or lack thereof on the construction projects under study.

Conceptual Framework

Ravitch and Riggan (2012) define conceptual Framework as the graphical presentation of the linkage between the different identified variables within the study. It is a framework showing how the explanatory variables (independent variables) affect the response variables (dependent variables). In this study, the dependent variable will be the effectiveness of construction project delivery. On the other hand, the prevalence of working program applicability, adherence to effective work programming, and knowledge of work programming techniques will be the independent variables. Since there is an inherent connection between the results – efficiency of project delivery – and the cause – the independent factor, assessing the latter will assist in the conceptualization of the expected results. Furthermore, evaluating the two ends of the study makes it possible to develop a reasonable judgement of the results as compared to the hypothesis and the objective. Ravitch and Riggan (2012) further explain that the use of a conceptual framework is critical towards assessing the ability of the research to fulfil the purpose. The

diagram below is a simple illustration of the relationship that exists between the independent and the dependent variable in this project. Simply, this

is the conceptual framework of the project in a diagrammatical manner.



LITERATURE REVIEW

There are several advantages a construction team can attain as a result of utilizing the work program. A construction work program is an instructional list often produced on construction projects. The program describes the sequence in which tasks must be carried out so that a project can be completed on time. It is an alternative to bills of quantities and allows the pricing of items such as builders' work and fixing schedules (Delaney, 2016). A construction work program is prepared by the designer. It may be prepared as part of the production information alongside drawings, specifications, bills of quantities, and preliminaries and is likely to form part of the tender documentation. Subsequently, contract documents (Forbes & Ahmed, 2010). In addition, specifications detail on matters quality while drawings details on location and size. However, where a work program describes the work, it becomes a construction work program (Forbes & Ahmed, 2010).

A schedule should allow the contractor to identify significant work, materials and the quantities that

will be required to complete the works. Consequently, construction work program properly describes every significant item of work (Harris, McCaffer, & Edum-Fotwe, 2013). Failure to do so may result in claims by the contractor (Forbes & Ahmed, 2010). A construction work program can be arranged on an elemental basis or on a room-by-room basis. It is important to have a construction work program before executing a construction project. Small construction projects require a simple hand-drawn bar chart. However, a large construction project with a hundred or even thousands of tasks requires a detailed schedule using specialized software (Smith, 1998). The detailed schedule is developed from a hand-drawn sketch or a pictorial form.

Many construction companies do not produce construction schedules because they are not ready to commit to a completion date. In addition, the is additional work for them (Smith, 1998). However, a construction schedule enhances efficiency in managing the project and to ensures the client meets their obligations. A program of works contains; the dates and durations allocated to each task of the

project, a critical path that clearly outlines the sequence of critical tasks, tasks on the critical path and those on that can be carried out simultaneously (Smith, 1998). In addition, it outlines the activities with float time and may allow crushing, smoothening or levelling of resources, services, materials and time. A program of works generally serves to plan activities, monitor progress, and identify where additional resources may be required (Rumane, 2013).

There are several types of work programs. The client's overall program may detail activities leading to the appointment of consultants, supply of equipment, migration strategy, and an ongoing program for operation and evaluation once the development is complete (Delaney, 2016). A design program scheduling contains tasks from the appointment of the consultant team to the appointment of the contractor. This might be a simple Gantt chart incorporating each consultants' planned resources for each stage. Information release schedules set out when the consultant team should issue production information to the contractor in order for the works to progress and when information produced by the contractor or their sub-contractors should be issued to the consultant team for comment and integration into the overall design (Delaney, 2016). Additionally, there exists the contractor's master program, which contains scheduling construction activities.

The Effective scheduling of the projects through works program injects efficiency in projects costs (Bent & Humphreys, 1996). As works program allows the project manager to create a comprehensive Work Breakdown Structure and Gantt chart in order to define the project milestones (Forbes & Ahmed, 2010). Consequently, scheduling human resources and other project resources and ensure appropriate utilization of project resources (Bent & Humphreys, 1996). Regular meetings are used as monitoring and evaluation tools to inject efficiency and prompt remedy into the project. This avoids delays in

identifying and taking collective actions in project tasks (Forbes & Ahmed, 2010; Cooper et al., 2008). This ensures total quality control. There are six main stages in the construction process, they include; conceptualization stage, preparation of contracts and bid documents stage, bidding stage, construction payments stage, and the completion stage.

The conceptualization stage is the planning and design stage (Harris, McCaffer & Edum-Fotwe, 2013). The architect is the primary designer (Legget, 2001), supervising the structural, mechanical and electrical engineers and plumbing design (Gantt, 2014). The stage comprises planning, architectural programming and schematic plans. The architect(s), engineer(s) and the client meet to determine the purpose and objective of the proposed construction (Harris, McCaffer, & Edum-Fotwe, 2013).

The preliminary programming produces a list of solutions, alternatives, feasibility studies, and costs estimate. Laying background for the schematic plans that show the interrelationship between spaces and activities. Revised schematic plans also called preliminary plans provide a graphic view of the project (Cooper et al., 2008). This gives way for the contract bid documents and working drawings. Contracts and bid documents, solicit construction bids (Sanvido et al., 1992). After bidding architectural plans are developed indicating the layout of the project (Legget, 2001). Which in turn allows the development of structural plans. Structural plans are prepared by structural engineers and show the structural design of a building (Sweet & Schneier, 2008). This allows the development of mechanical plans that show the design of the various mechanical systems in the building (Singh, Hinze & Coble, 1922). In addition, electrical plans are prepared to show the electrical distribution system for the efficient distribution of power in a building (Singh, Hinze, & Coble, 1922). These plans allow for the development of contract specifications. Contract specifications that entail project

specifications, technical specifications of the materials and the quality of the materials to be installed, and the workmanship for installation of the materials (Delaney, 2016). Bidding requirements describe the conditions of the bid to the owner.

Once the client determines that a project is feasible and that construction financing is available, the owner will solicit bids. So that the contractor starts the actual construction process of the project (Forbes & Ahmed, 2010). Fieldwork is broken down into building permits, subcontractors, scheduling subcontractors, shop drawings, project submissions, and change orders. The construction process extends over a period of time (Rumane, 2013). Giving way for the construction payments, where the client pays the contractor for the completed work. Allowing for the final phase of the construction process also called the completion stage. This stage readies the building for occupancy (Rumane, 2013). The process allows the architect and contractor to prepare built plans, that represent the exact constructed project. Incorporating all the changes to the original construction plan (Rumane, 2013).

MATERIALS AND METHODS

The Study Area

Kiambu County neighbours Nairobi and Kajiado Counties to the South, Machakos to the East, Murang'a to the North and North East, Nyandarua to the North West, and Nakuru to the West. It lies between latitudes 00 25'and 10 20'South of the

Equator and Longitude 360 31'and 370 15'East and covers a total area of 2,543.5 Km². The study will concentrate on 6 out of the 12 sub-counties that is: Lari, Kiambu, Ruiru, Thika and Githunguri.

Study Design

The study employed a case study design as it allows intensive examination of a phenomenon and allows a mixed methodology framework (Bryman, 2004). This was an advantage for this study that was set to investigate the impact of work programming on construction management project delivery in Kiambu County. The case study here is an exemplifying type, meaning it provides a suitable context for investigating the effect of work programming on construction management project delivery. In particular, the case study entailed was that of investigating the use of work programs in the construction industry of Kiambu County. By traversing a different section of the region to analyse the usability of the programs and the impacts they had on the construction industry in general in the area and the delivery of projects, the case study design was exemplified.

Study sample

Simple random sampling technique was employed to identify 102 respondents from a target population of 132 respondents to monitor the usage of different work programs across the sub-counties. The focus of the research was centred on work programming on construction management and its impact on projects delivery.

Table 1: Number of projects studies by sub-counties

No	Sub County	Projects Being Done	% of Project
1	Lari Sub County	34	26
2	Kiambu Sub County	21	16
3	Ruiru Sub County	24	18
4	Thika Sub County	22	17
5	Kikuyu Sub County	15	11
6	Githunguri Sub County	16	12
	TOTAL	132	100

Source: *Quantity Surveyors Department office*

Table 1 indicates the number of projects by their sub-counties, that were studied.

Data Collection

Primary data was sourced using questionnaires from 102 respondents who included: construction Managers, contractors, site Agents, architects, civil and structural engineers, site engineers, quantity surveyors and foremen. An interview schedule was employed to interview 6 key informants from each sub-county and observation schedules were used to observe 102 projects. The respondents were drawn from the Kiambu, Juja, Thika, Kikuyu, Githunguri, and Ruiru towns. In particular, the focus of the research was centred on work programming on construction management and its impact on projects delivery. As such, the interviewees were selected randomly, as the aim of the study was to monitor the usage of different work programs across the sub-counties.

Data Analysis

The quantitative data from the questionnaires, interview schedules and observation schedules were recorded and coded and analysed using SPSS. The data was analysed for measures of percentage, frequency, mean, variance and standard deviation. Correlational analysis was conducted to find out the relationship between the independent and the dependent variables. A one-way ANOVA test was performed to test any significant influence in the independent and that define the dependent variables. Regression analysis was employed to

examine the relationship between the independent and the dependent variables. The study relied on the following regression model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + E$$

Where: $X = (X_1, X_2, X_3)$

Where: Y = Effectiveness of construction project delivery (dependent variable); β_0 = Constant; $\beta_1 \dots \beta_3$ = Coefficients of independent variables; X_1 = Prevalence of working program applicability; X_2 = Adherence to the effective work programming; X_3 = Knowledge of work programming techniques

RESULTS

The quantitative data from the questionnaires, interview schedules and observation schedules were recorded and coded and analysed using SPSS. The data was analysed for measures of percentage, frequency, mean, variance and standard deviation. Correlational analysis was conducted to find out the relationship between the independent and the dependent variables. A one-way ANOVA test was performed to test any significant influence in the independent and that define the dependent variables. Regression analysis was employed to examine the relationship between the independent and the dependent variables. The study relied on the following regression model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + E$$

Response rate

Out of a total of 132 questionnaires distributed to respondents, 102 were returned. This was equivalent to a response rate of 77%. According to Mugenda and Mugenda (2003), a 50% response rate is adequate, and a response rate greater than 70% is very good, making the response to be satisfactory. The response rate was made possible by good data collection procedures, where the researchers noted that the participants involved wanted the drop and

pick the method to allow the respondents ample time to fill the questionnaires.

Demographic

Level of Education of the Staff who Carried Out the Project Planning

Various levels of education considered were Doctorate, Masters, Bachelors, Diploma, Certificate, Secondary Education, Primary Education and short-term Training.

Table 2: Level of education of staff conducting project planning

Level of education	Frequency	Percent (%)
Doctorate (PhD.)	0	0
Master Degree	21	20
Bachelor Degree	40	39
Diploma	14	14
Certificate	14	14
Secondary Education	8	8
Primary Education	0	0
Short Term Courses	5	5
Total	102	100

Table 2 indicated that doctorate (Ph.D.) 0%, Masters 20%, Bachelors 39%, Diploma 14%, Certificate 14%, Secondary Education 8% and short-term Training was 5%. This could be justified by the fact that with the doctorate level of education, managers perform strategic planning, while staff with Primary level of education major with menial work.

Effectiveness of Construction Project Delivery and Prevalence of Working Program Applicability

The effectiveness of construction project delivery was analysed to assess the influence of predictor variables which included: prevalence of working program applicability, adherence to effective work programming and knowledge of work programming techniques

Table 3: Effectiveness of construction project delivery and prevalence of working program applicability

Variables	SA (%)	A (%)	U (%)	D (%)	SD (%)
Prevalence of working program applicability	19.6	19.6	23.5	20.6	16.7
Adherence to the effective work programming	17.6	24.5	24.5	20.6	12.7
Knowledge of work programming techniques	12.7	18.6	24.5	25.5	18.6
Mean	16.6	20.9	24.2	22.2	16.0

Key: SA-strongly agree, A-agree, N-Neutral, D- disagree, SD- Strongly disagree.

Table 3 indicated that 37.5% of the respondents are of the opinion that the predictor variables; the prevalence of working program applicability, adherence to effective work programming and knowledge of work programming techniques had an impact on the construction programs.

Effectiveness of Construction Project Delivery

The effectiveness of construction project delivery was analysed and the following results were recorded in Table 4.

Table 4: Effectiveness of construction project delivery

Effectiveness	Frequency	Percent (%)
Very high	32	31.1
High	19	18.4
Moderate	30	28.8
Low	12	12
None	9	9.7
Total	102	100

Table 4 indicated that there was effectiveness in the delivery of 31.1% of projects. However, 9.7% of the projects were not delivered. This indicates that there is great loss undergone ineffective project delivery.

Preference of working program applicability

Preference of working program applicability was analysed and this was illustrated in Table 5 below.

Table 5: Prevalence of working program applicability

Consultants	Frequency	Percent (%)
Directors Head Office	11	11.2
Project Managers	17	16.6
Project Coordinator	18	17.9
Construction Manager	22	21.4
Site Agent	28	27.1
Other	6	5.8
Total	102	100

Table 5 indicates that 11.2% of the directors from the Head Office conducted project planning. While Project Managers, Project Coordinators, Construction Manager and site Agents conducted planning in the following percentages; 17.9%, 16.8%, 21.4% and 27.1% respectively. This could be justified by the fact that seniority in project management determined the management roles, strategic, tactical and operational. Therefore,

construction managers and site agents were employing the scheduled programming more.

Adherence to the effective work programming

Adherence to effective work programming was analysed and the results were recorded in Table 6 below.

Table 6: Level of adherence to work programming

Level of Work Programming	Frequency	Percent (%)
None	10	10
Low	12	12
Moderate	16	16
High	35	34
Very high	24	24
Not identified	5	4
Total	102	100

Table 6 detailed the difference in work programming by various companies. 24% of the companies practised work programming while 10% did not do any programming. This would be justified by the size of the companies and the expertise in the firms.

Table 7: Knowledge of work programming techniques

Profession	Frequency	Percent (%)
Quantity Survey	12	11.7
Construction Management	15	14.9
Civil/Structural Engineer	14	13.6
Construction Project Manager	9	8.6
Architect	10	10.2
Others	42	41
Total	102	100

Table 7 indicated that the following professionals had knowledge on the use of the program schedule: quantity survey; 11.7%, construction Management; 14.9, civil/structural Engineer; 13.6%, construction project manager; 8.6% and architects; 10.2%. This could be justified by the fact that construction managers did most of the planning while many organizations had a lean staff. Therefore, they did not engage construction project managers. Coefficients of Effectiveness of construction project delivery and prevalence of working program applicability, adherence to the effective work programming and knowledge of work programming techniques.

Table 8: Coefficients ^a

Model 1		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.050	.067		.748	.456
	Preference of working Program applicability	.442	.082	.460	5.372	.000
	Adherence to effective work	.075	.076	.074	.991	.324
	Knowledge of work	.471	.061	.464	7.656	.000

a. Dependent Variable: Effectiveness of construction project deliverance

Table 8 indicates that the Beta value is positive. Therefore, multi-collinearity was ok. The Beta values showed that the variables: prevalence of working program applicability and knowledge of work programming techniques were relatively stronger predictors to the effectiveness of construction projects. Adherence to effective work programming was the least predictor of the Effectiveness of the construction project. Prevalence of working program applicability and Knowledge of work programming techniques had a P-value of less than 0.05. The study rejected the null hypothesis that prevalence of working program applicability had no significant influence on the effectiveness of construction project delivery in Kiambu County and Knowledge of work programming techniques had no significant influence on the effectiveness of construction

project delivery in Kiambu County. Conclusion; the prevalence of working program applicability and Knowledge of work programming techniques influenced the effectiveness of construction project delivery in Kiambu County. However, the study failed to reject the null hypothesis that adherence to effective work programming had no influence on the effectiveness of construction project delivery. Therefore, concluded that adherence to effective work programming did not influence the effectiveness of construction project delivery in Kiambu County.

The model summary of the effectiveness of construction project delivery and prevalence of working program applicability, adherence to effective work programming and knowledge of work programming techniques.

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.983 ^a	.966	.965	.245
<i>a. Predictors: (Constant), Knowledge of work, Adherence to effective work, Preference of working Program applicability</i>				

Table 9 indicates that the coefficient correlation of the predictor variable on the dependent variable was 0.98. This was an indication that there was a strong correlation between the predictor variable on the dependent variable. The correlation of determination was 96.6%. Therefore, the predictor variables could predict 96.6% of the dependent

variable only 13.4% of the dependent variable could not be predicted by the predictor variable.

The ANOVA analysis of the effectiveness of construction project delivery and prevalence of working program applicability, adherence to the effective work programming and knowledge of work programming techniques.

Table 10: ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	168.632	3	56.211	935.596	.000 ^b
	Residual	5.888	98	.060		
	Total	174.520	101			
<i>a. Dependent Variable: Effectiveness of construction project deliverance</i>						
<i>b. Predictors: (Constant), Knowledge of work, Adherence to effective work, Preference of working</i>						

Table X indicates that the significance level is below 0.05. This is an indication that the independent variables had a significant influence on the dependent variables.

Results Summary

The respondents' opinion on the effectiveness of construction project delivery was that 38.2% of the respondents supported there was the effectiveness of construction project delivery. However, 39.2% of the respondents differed and indicated there was no effectiveness of construction project delivery. The coefficient correlation of the predictor variable on the dependent variable was 0.98. This was an indication that there was a strong correlation between the predictor variable on the dependent variable. The correlation of determination was 96.6%. Therefore, the predictor variables could predict 96.6% of the dependent variable only 13.4% of the dependent variable could not be predicted by the predictor variable. The ANOVA analysis indicated a P-value of 0.000 which is less than 0.05. Therefore, the predictor variables; the prevalence of working program applicability, adherence to effective work programming and knowledge of work programming techniques had a significant impact on the dependent variable; the effectiveness of construction project deliverance. The study rejected the null hypothesis that prevalence of working program applicability had no significant influence on the effectiveness of construction project delivery in Kiambu County and Knowledge of work programming techniques had no significant influence on the effectiveness of construction project delivery in Kiambu County. Therefore concluded, the prevalence of working program applicability and Knowledge of work programming techniques influenced the effectiveness of construction project delivery in Kiambu County. However, the study failed to reject the null hypothesis that adherence to the effective work programming had no influence on the effectiveness of construction project delivery. Therefore, concluded that adherence to effective work

programming did not influence the effectiveness of construction project delivery in Kiambu County. The objectives of the study were met as the researcher was able to answer the research questions by determining the factors that significantly influenced the effectiveness of construction project delivery in Kiambu County and to what extent and the ones that did not.

DISCUSSION

The primary objective of the research topic was to establish whether construction projects in Kiambu County used work programming. Work programming is a critical function in the construction industry since it ensures that a given construction project is completed within the predetermined time, cost and scope. The construction industry accounts for a significant portion of the overall natural resources consumption, and the process of planning, managing, and controlling a construction project from its inception to completion was defined as Construction Project Management (CPM). As such, CPM is a critical resource-sensitive function that is affected by various factors, including the availability of adequate resources. The specific business problem being investigated was the effect of work programming on the overall delivery of construction management projects.

The research responded to the primary question of how work programming affects the delivery of construction management projects. There was also the question of the implications of using different approaches to work programming since there were various approaches to work programming. Therefore, in the research context, the study investigated how work programming affected the delivery of construction projects in Kiambu County. Part of the reason Kiambu County was chosen was owing to the fact that it was experiencing growth. Business growth in the region, along with changes in the demographics of the county have led to a rapid increase in the number of construction

projects within different parts of the county. There was a growing demand for residential as well as commercial properties in Kiambu County. This research was established on the framework of three main hypotheses. The study rejected the null hypothesis that prevalence of working program applicability did not affect the delivery of construction management projects in Kiambu County and knowledge of work programming did not affect the delivery of construction management projects in Kiambu County. However, the study failed to reject the null hypothesis that adherence to work programming did not affect the delivery of construction management projects in Kiambu County. Therefore, the study concluded that the prevalence of working program applicability significantly affected the delivery of construction management projects in Kiambu County and knowledge of work programming significantly affected the delivery of construction management projects in Kiambu County. However, adherence to work programming did not affect the delivery of construction management projects in Kiambu County.

The reviewed literature highlighted work programming and its relevance in the construction industry. This study introduced new perspectives to the study and allowed for an objective assessment of the relationship between work programming and the construction industry in general. Different authors focused on the various aspects that are crucial to the debate on the relevance of work programming. Harris, McCaffer, and Edum-Fotwe (2013) explained that a work schedule is crucial since it enables the contractor to identify the work that needs to be done. Besides that, a work schedule ensures that there is a clear breakdown of the entire project and what is required at each phase of the project. The absence of a work schedule can explain some aspects of the project, as Smith (1998) explains. The author explains that a project may not have a work schedule because the contractor does not want to commit to a specific completion date.

The reviewed literature indicated that the lack of an effective work program has led to the failure of many projects being completed on time (Lim, 2016). This study supported that as there was effectiveness in the delivery of 31.1% projects. However, 9.7% of the projects were not delivered. This indicates that there is great loss undergone ineffective project delivery. According to Forbes and Ahmed (2010) construction work program properly describes every significant item of work to which it relates. Failure to do so may result in claims by the contractor. This was supported by this study as the study found that poor work definition and inadequate project documentation was the greatest challenge to project programming contributing to 24.5% and 25.2% of the project programming challenges. However, this was opposed to the findings by Smith (1998) that many construction companies do not produce construction schedules because they are too scared to commit a completion date to the client, and fearful that a schedule will create additional work for them.

A contractor may also have the fear that the work schedule will create additional work for the construction crew. Smith (1998) further explained that a work program is a document that contains the dates as well as the durations attached to each project task. This includes the outline of a critical path that identifies and defines the sequence of critical activities. The critical path is especially crucial to a construction project since it enables the determination of how and when certain project tasks have to be completed. As such, a work program is basically an outline that helps with the planning of project activities and progress monitoring. This helps solve some of the problems that may arise at some point during the project. For instance, a project may be short on funds during a critical phase, and the work program helps with the allocation of additional resources to meet the ongoing project needs. There are different types of work programs, and the client's program is the most crucial since it outlines the client's requirements. A

client work program is more of a plan that explains how the client would prefer his or her project plan implemented. This may include budgetary and time constraints, according to the client.

There were different approaches to work programming, and the most common approaches include delaying non-critical tasks within the available float and extending non-critical task duration. Also, crashing activities, authorizing overtime, and splitting tasks into non-sequential pieces are other common techniques that firms use to apply work programming. The latter three are deemed the most effective, with over 35 percent of the respondents preferring them to the other approaches. Meanwhile, materials shortage or late delivery, poor work definition, ICT compliance challenges, contract disputes, and project risks and uncertainty are the key challenges affecting work programming in up to 40% of the construction firms. In this study respondents related factors such as lack of experience, poor site management and supervision, and poor project planning affect the implementation of work programming more than client-related factors such as delayed payments, design changes, and change orders. Overall, the data collected indicates that while work programming is not a strange concept, it is not practised in the majority of the construction projects in Kiambu County. In conclusion, construction projects can be complex and difficult to manage to completion, and the research uses the underlying assumption that construction projects in Kiambu County use work programs to reduce the complexity of managing construction projects.

CONCLUSION

The study found that the construction sector in Kiambu County is conversant with work programming, but only a few construction projects in Kiambu County apply work programming. While the concept of project planning is crucial to the management of construction projects, it is evident that the project planning conducted for projects in

Kiambu County does not include work programming. The various construction firms use different forms of project planning, with the written and unwritten format as the most common approaches to project planning. However, it is crucial to take note of the fact that work programming should work hand in hand with project planning.

Recommendations

Evidently, CPM in Kiambu County requires the incorporation of work programs to ensure the effectiveness of project completion. Work programming ensures that there is a logical flow when it comes to the aspect of conducting various project tasks. As such, there are two main recommendations.

Areas Recommended for Further Study

The following are the suggested areas for further study:

- A study to investigate on: conflicts resolution strategies and how they could enhance successful completion on construction projects. Conflicts derail projects performance, but they could be used as catalysts to promote the performance of construction projects. Therefore, a study would be important to identify ways to maximize conflicts in construction projects and reduce their negative impact.
- A study to investigate on: How the client technical team would be motivated to learn on the technical aspects of the project so that they could represent the client appropriately.
- A study to investigate on: common risks that derail projects performance and how they could be planned for well in advance in order to ensure timely and successful project completion.

Limitations

The limitations of the literature review were that no new information was being collected and, as such, the researcher relied on existing information. If there was limited information on the impacts of work programming on construction management projects delivery, then this would have negatively influenced the quality of this study. However, the researcher was confident that an abundance of literature currently existed in the field. Another potential limitation was the fact that the researcher was relying partially on other people's data, which may be subject to bias or misinformation. In order to address this potential limitation was by ensuring that all research was cross-referenced and checked with multiple sources to determine the validity and reliability of the information collected. Another limitation could come from the bias in the information provided by the interviewees as personal attitudes could have led to incorrect data.

ACKNOWLEDGEMENTS

First is to thank the almighty God for His mercies during the preparation of this work. I could not surely be where I am today without his protection and unending grace. Special thanks to servants of God who have continually prayed for me who includes Bishop Stanly Mwalili, Bishop Joseph Njuguna, Rev Albert Shitakwa, Rev Ezekiel Kamuyu, Pastor Peter Ndungu to mention but a few. I would like to extend my gratitude to the Jomo Kenyatta University of Agriculture and Technology for giving me a chance to fulfil my dreams of pursuing this noble course and also funding this study.

Special thanks go to my supervisors Dr. Abednego Gwaya and Prof Stephen Diang'a for their support and academic guidance during the accomplishments of this work. My sincere gratitude to my colleagues in the Department of Construction Management Chairman Marcan Masudi, Eng Daniel Saiva, Dr.

Titus Kivaa and Lucy for their encouragement and guidance during the whole thesis exercise.

REFERENCES

- Bent, J. A., & Humphreys, K. K. (1996). *Effective project management through applied cost and schedule control*, Vol. 26. New York, NY: Taylor & Francis.
- Bryman, A. (2004). Encyclopedia of social science research methods. *Encycl. Soc. Sci. Res. Methods*, 1143-1144.
- Callen, T. (2007). BASICS: PPP Versus the Market Which Weight Matters? *Finance & Development*, 44(001).
- Cooper, R., Lee, A., Fleming, A., Aouad, G., Wu, S., & Kagioglou, M. (2008). *Process management in design and construction*. John Wiley.
- Delaney, J. (2016). *Construction program management*. Boca Raton, FL: Auerbach Publishers.
- Forbes, L. H., & Ahmed, S. M. (2010). *Modern construction: Lean Project delivery and integrated practices*. Boca Raton, FL: CRC Press.
- Gantt, team. (2014, July 21). Seven shocking project management statistics. Retrieved September 28, 2016, from Project Management, <https://www.teamgantt.com/blog/seven-shocking-project-management-statistics-and-lessons-we-should-learn/>
- Harris, F., McCaffer, R., & Edum-Fotwe, F. (2013). *Modern construction management* (7th ed.). Hoboken, NJ: Wiley, John & Sons.
- Legget, R. F. (2001, January 31). History of construction industry. Retrieved September 28, 2016, from

- <http://www.thecanadianencyclopedia.ca/en/article/history-of-construction-industry/>
- Lim, R. (2016, August 31). Top 10 main causes of project failure. Retrieved September 28, 2016, from Project Management Articles, <http://project-management.com/top-10-main-causes-of-project-failure/>
- Mugenda, O. M., & Mugenda, A. G. (2003). *Research Methods: Quantitative and Qualitative Approaches*. African Centre of Technology Studies: Nairobi, Kenya.
- Price Waterhouse Cooper. (2008). Economic Outlook.
- Ravitch, S. M., & Riggan, M. (2012). *Reason & rigor: How conceptual frameworks guide research*. Los Angeles: Sage.
- Roodman, D. M., & Lenssen, N. (1994). Our Buildings, Ourselves. *World Watch*, 7(6), 21-29.
- Rumane, A. R. (2013). *Quality tools for managing construction projects*. Boca Raton: Taylor & Francis.
- Sanvido, V., Grobler, F., Parfitt, K., Guvenis, M., & Coyle, M. (1992). Critical success factors for construction projects. *Journal of construction engineering and management*, 118(1), 94-111.
- Singh, A., Hinze, J. W., & Coble, R. J. (Eds.). (1992). *Implementation of safety and health on construction sites: Proceedings of the second international conference of CIB working commission W99, Honolulu, Hawaii, 24 - 27 March 1999*. Rotterdam: A A Balkema Publishers.
- Smith, G. R. (1998). *State dot management techniques for materials and construction acceptance*. Washington, DC, United States: National Academy Press.
- Sweet, J., & Schneier, M. M. (2008). *Legal aspects of architecture, engineering and the construction process* (8th ed.). Stamford, CT: Nelson Engineering.