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INFLUENCE OF PROJECT DESIGN ERRORS ON PROJECT TIME RUN IN KENYA

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Purpose: *The purpose of the study was to recommend the options available to improve on project performance in Kenya. The specific objective of this study was to determine the influence of project design errors on project time run in Kenya. This study was therefore guided by the following the four stage project management theory. The analysis of this theory linked to the study and brought out research gaps.*

Methodology: *Data was analyzed by use of descriptive and inferential statistics such as measures of relationship including Karl Pearson's coefficient of correlation and multiple regression analysis to establish the relationship between each of the independent variables (project design errors, project scope change and procurement procedures).*

Findings: *The findings of the study indicated that the selected predictor variable (project design errors,) account for 52.3% of the variation in the project time run in Kenya. This means that the selected predictor variable was significant in determination of the dependent variable (project time run). However, there are still other variables that influence project time run that are not captured in this particular model and which account for the remaining 47.7% in variation of the project time run.*

Keywords: *Project time run, Project design errors, project management*

1.0 Determinants' of Project Time Runs in Kenya

In Kenya, like other countries, construction industry is one of major industry contributing significantly to the socio-economic development growth. Achieving project completion on time, within budget, at specified quality standards, and most importantly without unprecedented cost escalations was a major criterion of success of project, (GoK, 2012). Although the government of Kenya set aside huge sums of money to be spent in construction sector, the industry was facing a lot of challenges such as the expenditure exceeding the budget, delay to complete the project in time, the building defects and over-reliance on foreign workers, (GoK, 2012). The construction infrastructure had been given the highest priority to ensure that the main projects under the economic pillar are implemented, for example according to the Ministry of Roads Service Charter 2008, there was a need for improvement of roads to a motorable condition because the road transport (mode of transport) carries about 80% of all cargoes and passengers in the country, (GoK, 2012). However, road projects in Kenya have faced various challenges, which included; delay in completion, cost overruns, demolition of residential and businesses houses and abortive works (Maina, 2013). In Nzoia sugar company, many construction projects had either been abandoned, not done according to the specifications, ended up in disputes, had cost over runs, not done to the satisfaction of stakeholders or at some point work is disrupted. A sample of six projects was

examined and they included construction of Factory open space offices, Agriculture registry, cottages, baggase shed, boiler roof and gym. These projects had a time overrun of 220, 136, 273, 96, 71 and 273 days respectively.

From the information above, no project was completed within the project schedule. (Frimpong et al., 2003) named three main criteria for the success of a construction project, it is completed on time, it is finished within budget, and it is consistent with the specifications

2.0 Statement of the Problem

Completing projects on time was an indicator of efficiency, but the process was subject to many variables and unpredictable factors, which result from many sources. These sources included the resources availability, environmental conditions, involvement of other parties, and contractual relations. However, it rarely happened that a project was completed within the specified time.

In Nzoia Sugar Company, many projects had time overruns and they included Open space offices project, agriculture central registry, construction of cottages, boiler roof structure, gym, bagase shed among others. To the Organization, delay meant loss of revenue through lack of production facilities and rent-able space. In some cases, to the contractor, delay meant higher overhead costs because of longer work period, higher material costs through inflation, and due to delay labor cost increases. Due to this, the study intended to establish the influence of project design errors on project time runs in Kenya with reference to Nzoia Sugar Company as a case study.

3.0 Study Objective

The objective was to assess the effect of project design errors on project time runs in Kenya.

4.0 Research Hypotheses

This research was guided by the following null hypothesis:

$H0_{1:}$ Project design errors have no influence on project time run in Kenya.

5.0 Conceptual Framework

This was a scheme of variables which were operationalized in order to achieve the set objective. (Sekaran et al., 2016) avered that a variable is anything that can take different or varying values. Independent variables or explanatory variables were those that influenced the dependent variable in either a positive or negative way. A moderating variable was one that has a strong contingent effect on the independent variable- dependent variable relationship. The dependent variable was the variable of primary interest to the researcher's goal which distorts the dependent factor of project time run as shown in figure 1 below.

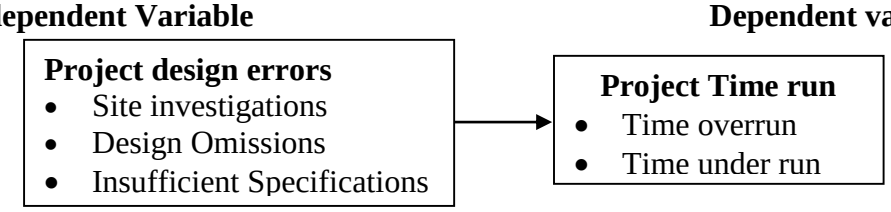

Figure 1: Conceptual Framework

6.0 Review of Variables

Also known as designer errors and omissions; these changes related to plans that were incomplete or contained errors that weren't found until the project contractor found them well after the construction phase of the project

had started (AACE International website 2009). Designer deficiencies were changes that were the result of faulty or confusing aspects of construction designs and specifications, attributable to the designer, which were not discovered until the contractor began working towards building what was shown on paper. As opposed to the other types of change, design deficiencies were often the result of ineffective quality control in the design process, and were controllable.

Designer errors may go beyond the development of the project designs and specifications. In addition to defective designs, according to (Bramble and Callahan, 2000), the owner was also liable for the contractor's costs due to other designer errors, such as unreasonable delays in reviewing drawings, failure to provide drawings or design information in a timely fashion, failure to carry out timely inspections and other delays due to the designer's contract administration problems (Bramble & Callahan, 2000). There were a few theories on why this type of change was most common among construction projects. The most prevalent theory posited that the financial pressures owners were under to complete projects as soon as possible were transferred to the designer, who was asked to complete the design within an unreasonable timeframe that encouraged error through haste. According to the studies by the US Army Corps of Engineers and US Navy, design deficiencies account for nearly 40% of all construction changes on a design-bid-build project, more than any other category of change. It is important to note that proper representation of client's requirement and the blue print to achieving good technical input to project execution were usually mapped out based on project designs. Thus a design with errors practically meant wrong or insufficient representation of project deliverables. This led to wrong application of techniques in achieving the result, such that as the actual execution phase of the project unfolded, an attempt to correct it led to delay and time overrun.

Another way design errors led to cost overrun and delay was seen in the fact that project estimations were done based on the produced designs, as such, having errors in design in a form of omission or misrepresentation meant that the estimation for the project cost also included these omissions, thereby leading to extra works, change order etc., thus resulting in delay and cost overrun.

Similarly, designs that were done without extensive investigation of site contained potential errors. This was because such designs could lead to additional work, revision of scope of work, and contract revision as the actual site conditions began to float up at the construction phase of the project. These, no doubt affected the overall project delivery time and cost. Causes of design errors cited in most projects were inadequate field investigation, error in design and specifications, plan errors, design changes etc. In controlling project delay and cost overrun due to design errors, the basic thing to be considered was the involvement of professional skills and application of competent tools throughout the project. Achieving error free design entails good communication with the entire design team and integrating a design process that was properly planned, giving enough time for corrections, extensive investigation and reviews. Similarly, an effective project planning, controlling and monitoring should be established to enhance project performance throughout the project life cycle. Proper site investigation should be done to ensure that all site conditions are noted in the design, and application of value management could be used to obtain the best Cost effective design options.

8.0 Research Methodology

The study adopted a mixture of both qualitative and quantitative design approach and sample of 30 respondents were considered. A census sampling technique method was used and data collected through the use of questionnaires. Data was analyzed by use of descriptive and inferential statistics such as measures of relationship including Karl Pearson's coefficient of correlation and multiple regression analysis to establish

the relationship between each of the independent variables (project design errors, project scope change and procurement procedures) and the dependent variable (project time run).

Research Findings

9.1 Response Rate

Out of the total 100 questionnaires that were sent to the respondents, 75 of them were dully filled and returned by the respondents; yielding a response rate of 75 percent. This was considered a very reliable response rate for generalizations of study findings since according to Zikmund et al., (2010) a response rate of 70 percent and above is said to be a reliable response rate.

9.2 Pilot Study

To determine the reliability of the findings, Cronbach's alpha correlation coefficient of reliability was computed at 95% confidence interval for all the variables under study. Total Cronbach's alpha correlation coefficient was found to be 0.752, which indicated that the level of internal consistency for the items was 75.2 percent. Fraenkel and Wallen (2000) stated that items are considered reliable if they yield a reliability coefficient of 0.70 and above. Therefore, the study showed the existence of acceptable level of inter-item consistence.

9.3 Demographic Characteristics of the Respondents

9.3.1 Gender

The study established that majority of the respondents from Nzoia sugar Company 56.4 percent were male while 43.6 percent of them were female. The study findings depicted a good representation of both gender at Nzoia Sugar Company with each gender having at least 30% representation which is in line with the new Constitution of Kenya. Table 9.1 presents the findings of the study.

Table 9.1 gender

Gender	Percent
Female	43.6
Male	56.4
Total	**100**

9.3.2 Age

The respondent age in years was sought by the first item. Table 9.2 below summarizes this information indicating a majority (35.7%) of respondents were aged between 40-49 years old. The group was followed by those in age group (50 – 59) representing 31.3%, 30-39 years (24.7%), 20-29 years 4.4% and 60 or over 3.8% being the lowest. The result showed that the majority of the respondents were between the ages of 40-49 years of age.

Table 9. 1: Age of the respondent

Age	Percent
20-29 years	4.4

30-39 years	24.7
40-49 years	35.7
50-59 years	31.3
60 or over	3.8
Total	**100**

9.3.3 Highest education level

On the highest level of education attained, 41.5 percent have university level, 31.8 percent have college level, 11.9 percent are post graduate level of qualification, 8.5 percent of the respondents said that they have Secondary school certificates, while 6.3 percent have Professional qualifications. The results thus indicate that there is a fair mix of education backgrounds in Nzoia sugar Company. More than 50 percent of the respondents have either a college level of qualification or higher qualification and hence they were qualified to offer information regarding the objectives of the study.

Table 9.3: Highest education level attained

Education level	Percent
Secondary level	8.5
College level	31.8
University level	41.5
Post graduate level	11.9
Professional qualification	6.3
Total	**100.0**

9.3.3 Number of Years in Service

Results showed that 41.5 percent had between 5 – 10 years' experience, 30.7 percent had between 10 – 15 years of experience in the service. 14.8 percent of the respondents had less than 5 years' experience in Nzoia Sugar Company while 6.7 had served for 15 – 20 years, and 6.3 percent had served in Nzoia sugar Company for over 20 years. The results show that the respondents who participated in the study had a mixed duration of service in Nzoia sugar Company. They are thus knowledgeable about the project time runs in the Nzoia sugar Company. This suggested that majority of sampled respondents 41.5 percent have enough experience of 5-10 years.

Table 9.4: Number of Years in Service

No. of Years	Percent
Below 5 years	14.8
5 – 10 years	41.5
10 – 15 years	30.7
15 – 20 years	6.7
Over 20 years	6.3
Total	**100.0**

9.3.4 Duration of Service

Results from table 9.4 above on years of work at the Nzoia sugar Company revealed that majority of the respondents 39 percent had 6-9 years of work experience, 31 percent had 2-5 years of work, 20 percent of the respondents had 10 and above years of work. Only 10 percent of the respondents had 0-1 years of work in Nzoia sugar Company. The duration of service is an important activity in the company since a total of 59% of employees has the necessary experience of over 6 years.

Table 9.5 Years of Work

Years Of Work	Percentage
0-1 years	10
2-5 years	31
6-9 years	39
10 and above years	20

9.4 Project time run in Kenya

The study sought to determine Influence of project time run in Kenya. The findings are presented in a five point Likerts scale where SA=strongly agree, A=agree, N=neutral, D=disagree, SD=strongly disagree and T=total.

From table 9.6 below, the respondents were asked whether achieving project completion on time, within budget, at specified quality standards without unprecedented cost escalations is major criterion of success of project. The distribution of findings showed that 10.3 percent of the respondents strongly agreed, 45.2 percent of them agreed, 26.2 percent of them were neutral, 12.9 percent disagreed while 5.5 percent of them strongly disagreed. These findings implied that achieving project completion on time, within budget, at specified quality standards without unprecedented cost escalations is major criterion of success of project.

The respondents were also asked whether commitment and proper communication is very important for success of projects. The distribution of the responses indicated that 8.7 percent strongly agreed to the statement, 30.9 percent of them agreed, 30.7 percent of them were neutral, 20.7 percent of them disagreed while 8.9 percent of them strongly disagreed to the statement. These findings implied that commitment and proper communication is very important for success of projects.

The respondents were also asked whether companies are now using projects in their daily work to achieve their goals. The distribution of the responses indicated that 7.3 percent strongly agreed to the statement, 47.3 percent of them agreed, and 29.1 percent of them were neutral, 5.5 percent of them disagreed while 10.9 percent of

them strongly disagreed to the statement. These findings implied that companies are now using projects in their daily work to achieve their goals.

The respondents were further asked whether the stakeholders insist on timely projects. The distribution of the responses indicated that 27.3 percent strongly agreed to the statement, 23.6 percent of them agreed, 20 percent of them were neutral while 17.3 percent and 11.8 percent of them disagreed strongly and disagreed to the statement respectively. These findings implied that the stakeholders insist on timely projects.

The respondents were further asked whether organizations spend a lot for the completion to realize success. The distribution of the responses indicated that 33.6 percent strongly agreed to the statement, 28.2 percent of them agreed, 10 percent of them were neutral, 22.7 percent of them disagreed while 5.5 percent of them strongly disagreed to the statement respectively. These findings implied that organizations spend a lot for the completion to realize success.

The respondents were asked whether the organization encourages trainings to enable competency on project management. The distribution of the responses indicated that 19.1 percent strongly agreed to the statement, 46.4 percent of them agreed, 17.3 percent of them were neutral; another 17.3 percent of them disagreed while none of them strongly disagreed to the statement respectively. These findings implied that the organization encourages trainings to enable competency on project management.

The respondents were further asked whether organizational effectiveness requires project management to combine technical competency. The distribution of the responses indicated that 10.3 percent strongly agreed to the statement, 42.7 percent of them agreed, 24.3 percent of them were neutral, 11.8 percent of them disagreed while 10.9 percent of them strongly disagreed to the statement respectively. These findings implied that organizational effectiveness requires project management to combine technical competency.

Finally, the respondents were asked whether projects are considered delayed when their stipulated completion durations have not been achieved. The distribution of the responses indicated that 30.5 percent strongly agreed to the statement, 42.3 percent of them agreed, 16.4 percent of them were neutral and 10.9 percent of them disagreed while none of them strongly disagreed to the statement respectively. These findings implied that projects are considered delayed when their stipulated completion durations have not been achieved.

Table 9.6: project time run

Statements		**SA**	**A**	**N**	**D**	**SD**	**T**
Achieving project completion on time, within budget, at specified quality standards without unprecedented cost escalations is major criterion of success of project	%	10.3	45.2	26.2	12.9	5.5	100
Commitment and proper communication is very important for success of projects	%	8.7	30.9	30.7	2O.7	8.9	100
Companies are now using projects in their daily work to achieve their goals	%	7.3	47.3	29.1	5.5	10.9	100
The stakeholders insists on timely projects	%	27.3	23.6	20.0	17.3	11.8	100

Organizations spend a lot for the completion to realize success	%	23.6	38.2	10.0	22.7	5.5	100
The organization encourages trainings to enable competency on project management	%	19.1	46.4	17.3	17.3	0	100
Organizational effectiveness requires project management to combine technical competency	%	10.3	42.7	24.3	11.8	10.9	100
projects are considered delayed when their stipulated completion durations have not been achieved	%	30.5	42.3	16.4	10.9	0	100

9.5 Influence of project design errors on project time run in Kenya

The study sought to evaluate if project design errors on influences project time run in Kenya. The findings are presented in a five point Likert scale where SA=strongly agree, A=agree, N=neutral, D=disagree, SD=strongly disagree and T=total.

From table 9.7 below, the respondents were asked whether project drawings / designs are reviewed on time. The distribution of findings showed that 32 percent of the respondents strongly agreed, 41.8 percent of them agreed, 20.7 percent of them were neutral, 5.5 percent disagreed while 0 percent of them strongly disagreed. These findings implied that project drawings / designs are reviewed on time.

The respondents were also asked whether all drawings and design information are provided on time. The distribution of the responses indicated that 33.0 percent strongly agreed to the statement, 16.4.0percent of them agreed, and 9.1 percent of them were neutral, 17.3 percent of them disagreed while 19.3 percent of them strongly disagreed to the statement. These findings implied thatmajority of the respondents indicated that all drawings and design information are provided on time.

The respondents were also asked whether regular inspections are carried out in the course of the project. The distribution of the responses indicated that 18.2 percent strongly agreed to the statement, 19.1 percent of them agreed, and 19.1 percent of them were neutral, 28.2 percent of them disagreed while 15.5 percent of them strongly disagreed to the statement. These findings implied that regular inspections are not carried out in the course of the project.

The respondents were further asked whether there is sufficient time to carry out project drawings without haste. The distribution of the responses indicated that 13.6 percent strongly agreed to the statement, 10.2 percent of them agreed, 23.6 percent of them were neutral while 34.5 percent and 18 percent of them disagreed strongly and disagreed to the statement respectively. These findings implied that majority of the respondents disagreed on the statement that there is sufficient time to carry out project drawings without haste.

Finally, the respondents were asked whether designs are done with extensive site investigations. The distribution of the responses indicated that 36.4 percent strongly agreed to the statement, 40 percent of them agreed, 22.7 percent of them were neutral, 0.9 percent of them disagreed while 0 percent of them strongly disagreed to the statement respectively. These findings implied that designs are done with extensive site investigations.

Table 9.7: project design errors on project time run

Statements		SA	A	N	D	SD	T
project drawings / designs are reviewed on time	%	32.0	41.8	20.7	5.5	0	100
all drawings and design information are provided on time	%	33.0	16.4	9.1	17.3	19.3	100
regular inspections are carried out in the course of the project	%	18.2	19.1	19.1	28.2	15.5	100
there is sufficient time to carry out project drawings without haste	%	13.6	10.2	23.6	34.5	18	100
designs are done with extensive site investigations	%	36.4	40.0	22.7	0.9	0	100

Finally, the respondents were asked whether risks and uncertainties' of strikes, floods, fires etc affect project time runs. The distribution of the responses indicated that 30.1 percent strongly agreed to the statement, 28.9 percent of them agreed, 10 percent of them were neutral, 15.3 percent of them disagreed while 15.7 percent of them strongly disagreed to the statement respectively. These findings implied that risks and uncertainties' of strikes, floods, fires etc affect project time runs.

9.6 Inferential Statistics

Inferential statistics was done in order to establish the relationship between each of the independent variables (project design errors, project scope change and procurement procedures) and the dependent variable (project time run). These were carried out while testing the hypotheses in line with the objectives of the study.

9.6.1 Effect of project design errors on project time run in Kenya

The correlation between project design errors on project time run in Kenya was calculated using Pearson's Correlation in order to establish the relationship between the two variables. The results are as shown in the table below:

Table 9.8: Correlation between project designs errors and project time run in Kenya

			Project Design Errors	Project Time Run
Project Design Errors		Pearson Correlation	1	.489**
		Sig. (2-tailed)		.000
		N	75	75
Project Time Run		Pearson Correlation	.489**	1
		Sig. (2-tailed)	.000	
		N	75	75

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

The correlation between project design errors on project time run is 0.489 ($p = 0.000$). This means there is a moderate positive relationship between project design errors on project time run. We thus fail to accept the null hypothesis and state that there is a significant relationship between project design errors on project time run.

Table 9.9: ANOVA using project time run in Kenya

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	106.734	3	75.661	32.245	.000[a]
	Residual	658.801	103	1.244		
	Total	764.532	75			

a. Predictors: (Constant), project design errors, project scope change and procurement procedures
b. Dependent Variable: project time run

Table 9.10: Correlation Coefficients for the Independent Variable on project time run

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
1	(Constant)	2.830	.154		12.965	.000	1.307	1.967
	Site investigations	.450	.035	.452	6.073	.000	.141	.287
	project design omissions	.365	.028	.276	.818	.378	-.025	.052
	Insufficient specifications	.543	.076	.243	3.142	.000	.261	.154

a. Dependent Variable: project time run

The estimated model from the study is therefore:

$Y= 2.830 + .452X_1 + .365X_2 + .543X_3$

Where:

β0, β1, β2 and β3 are coefficients to be estimated

Regression coefficients 0.45, 0.365 and 0.543 represent the mean change in the dependent variable for one unit of change in the predictor variable while holding other predictors in the model constant. This statistical control of the regression isolates the role of one variable from all of the others in the model. Therefore from the model generated by the study, for a unit change in the unforeseen conditions, the project time run changes by 0.45, while for a unit change in the project design omissions, the time run changes by 0.365 and for a unit change in the project design specifications, the time run changes by 0.543.

10.0 Conclusions

Results on whether project drawings/designs are reviewed on time implied that project drawings/designs are reviewed on time and that all drawings and design information are provided on time together with majority of the respondents disagreeing that regular inspections are carried out in the course of the project. Results also revealed that majority of the respondents disagreed on the statement that there is sufficient time to carry out project drawings without haste. Finally, the respondents agreed that designs are done with extensive site investigations.

The respondents were asked whether potential dispute contract clauses are clearly stated in the contract. The distribution of the responses indicated that 40.9 percent strongly agreed to the statement, 53.6 percent of them agreed while 5.5 percent of them were neutral. None of the respondents disagreed or strongly disagreed to the statement. These findings implied that majority of the respondents agreed that potential dispute contract clauses are clearly stated in the contract. In conclusion basing on the findings, the correlation between project design

errors on project time run was 0.489 (p = 0.000). This means there was a moderate positive relationship between project design errors on project time run. We thus failed to accept the null hypothesis and state that there is a significant relationship between project design errors on project time run.

The correlation between project scope change on project time run was 0.507 (p = 0.000). This means there was a strong positive relationship between project scope change and project time run. We thus failed to accept the null hypothesis and state that there was a significant relationship between project scope change and project time run. The correlation between procurement procedures on project time run was 0.263 (p = 0.000). This means there was a weak positive relationship between procurement procedures on project time run. We thus failed to accept the null hypothesis and state that there was a significant relationship between procurement procedures on project time run.

11.0 Recommendations

The study came up with a number of recommendations. The study recommended that the management of Nzoia Sugar Company should build capacity to the stakeholders to manage the project time runs by reviewing project drawings/designs on time and providing the drawings and design information on time to be more effective and efficient.

Sufficient time and regular inspections should be provided to avoid hasty and misappropriations that leads to time delays of the projects. Nzoia Sugar Company should plan their projects with laws and regulation, finances etc in advance to avoid the unforeseen site conditions during contract implementation. The company should provide independent officer and competent procurement committee to select capable contractors for projects which should specifies every aspect of the project (payment terms, pricing, & service level agreements). The organization should also provide clear laws in case of any disputes arising from the projects.

A similar study to be carried out in other Sugar companies to fill the gaps in this study and determine if the findings can be generalized. Further research to be conducted to establish the influence of project funding, planning, supervision and contractors' experience on project time runs. These factors have not been investigated in this study but are useful.

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