



**FACTORS AFFECTING PERFORMANCE OF ROAD CONSTRUCTION PROJECTS
IN ARID AND SEMI-ARID AREAS IN KENYA**

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This study evaluated the factors affecting performance of road construction projects in arid and semi-arid areas in Kenya and focuses on the Isiolo – Moyale (A 2) and Garissa – Modogashe (C 81) road projects. It sought to establish whether Contractor’s Competency, Construction parties’ Financial Management, Construction Resources, and Conflicts affect performance of road construction projects in arid and semi-arid areas in Kenya. Findings of the study concluded that there is a positive correlation between Contractor’s Competency, Construction parties’ Financial Management, Timely availability of Construction Resources, and Conflicts towards the realisation of increased performance of road construction projects in arid areas in Kenya. The study also found that the independent variables explain 82.7% of variance of the dependant variable performance of road construction in arid and semi-arid areas in Kenya. The study found that the contractor’s competency variable will lead to the greatest change in performance followed by the conflict variable, construction parties’ financial management variable and timely availability of construction resources. The study recommends thorough scrutiny of contractor’s competency before project award; expedition of payment of Interim Payment Certificates by client; conduction of peace, disarmaments and anti-cattle rustling meetings by national and county governments; and fair and equitable compensation and resettlement of Project affected persons.

Keywords: arid, construction projects, semi arid

1. Introduction

In Kenya, the contribution of the infrastructure sector to GDP was 19.1 per cent in 2012 (Kenya Economic Report, 2014). Road construction, is a major component of infrastructure development, and as such is always in the upper percentile of funding amongst development projects in Kenya; funding is estimated at not less than 10 per cent of the national budget. In Tanzania, road construction uses 13 per cent of the national budget (The United Republic of Tanzania National Audit Office, 2010). Thus the Ministry of Roads plays an important role in the attainment of “Kenya vision 2030” goals, Millennium Development Goals (MDGs) and Kenya's Economic Recovery Strategy for wealth and Employment Creation Strategy (ERS) through the provision of basic infrastructure facilities to the public by developing, maintaining, rehabilitating and managing of road networks in the country.

Due to the importance of roads in socio-economic development of the country, the government has in the recent past steadily increased budget allocation to the road sub-sector. However, road projects in Kenya have been facing various challenges, which include delay in completion, cost overruns, demolition of residential and businesses houses and abortive works (Maina, 2013). The arid and semi-arid lands of Kenya cover 80 per cent of the country and are home to ten million Kenyans, 70 per cent of whom live under the poverty line. These areas support 60 per cent of the livestock and 65 per cent of the wildlife. Despite the huge economic potential, the people living in the Arid and Semi-arid areas have remained outside the mainstream economy of the country. Subsistence is the way of life for most of these farmers who are agro-pastoralists and pastoralists. These areas have highly under-developed infrastructural networks and facilities in general and lag behind economically despite being home 30 per cent of the Kenyan population (KRDP; KASAL).

Poor infrastructure was identified under the Economic Recovery Strategy (ERS) for Wealth and Employment Creation 2003-07 as a major constraint to doing business. Likewise, the Kenya Vision 2030 recognises infrastructure as an enabler for sustained development under the economic pillar. The LAPSSET project under vision 2030 recognises the underdevelopment of Northern Kenya and therefore aims to open up Northern Kenya and integrate it into the national economy. The components of the LAPSSET are a new road network, a railway line, oil refinery at Lamu, oil pipeline, Isiolo and Lamu Airports and a free port at Lamu (Manda Bay) in addition to resort cities at the coast and in Isiolo. The road component is made of two major components: Lamu - Isiolo - Southern Sudan border: Lamu - Garissa (D 568); Garissa - Isiolo (C 81, D 586, B 9); Isiolo - Maralal Link Road (C 77, C 78, C 79); Isiolo - Lokichar - Nadapal (D 370, C 113, C 46, A 1); and the Kenya - Ethiopia road link: Isiolo - Moyale (A2) divided into four lots [Isiolo – Merille River; Merille River – Marsabit; Marsabit – Turbi; Turbi – Moyale].

2. Study Objectives

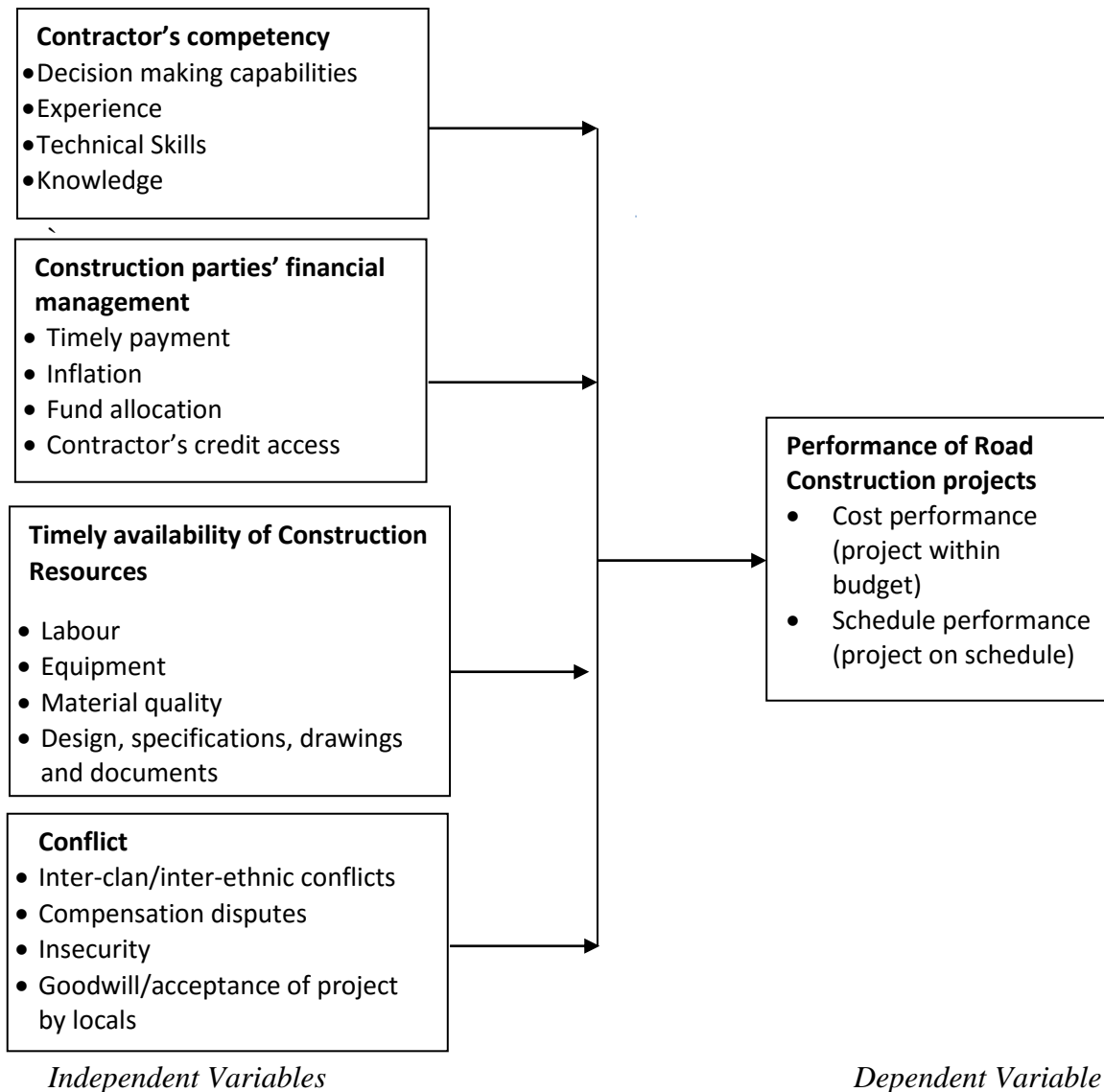
The overall objective of this study was to evaluate the factors affecting performance of road construction projects in arid and semi-arid areas in Kenya, with specific objectives to;

- i. evaluate the effect of Contractor's competency on performance of road construction

- ii. analyse the extent to which construction parties' financial management affects performance of road construction
- iii. assess the extent to which timely availability of construction resources affect performance of road construction
- iv. evaluate the effect of conflict on performance of road construction

3. Conceptual Framework

The A research model was developed to facilitate the research study. The aim of the model is to facilitate investigation on which factors affect performance in road construction projects in arid and semi-arid areas in Kenya. The research model is represented in *figure 1 below*. In the conceptual framework, the independent variables which are the key attributes of performance of road construction projects are; contractor's competency, financial management, construction resource availability and number of conflicts while the dependent variable is performance.



4. Research Design

This research design employed was a descriptive research design. This is because the study was concerned with the specific predictions, narration of facts and characteristics based on road construction projects in arid and semi-arid areas to provide statistically inferable data to test significance of results on the population. This study had a small population of 77 and thus no sampling was done, a census was carried out. This was achieved by selecting the various levels of employment at Isiolo – Moyale and the Garissa – Modogashe road projects, these being the Project Engineers (PEs), the Regional Engineers and Surveyors, the Consultants, the Contractors, and the Monitoring and Evaluation Officers who are believed to be the best placed to offer the required information for the study.

5. Data analysis and Presentation

The Data analysis refers to interpreting the data gathered in the data collection phase. Within this research both quantitative and qualitative data was collected. In this research qualitative data collected from the questionnaires was analysed by collecting all the relative data, assimilating and categorising similar responses and summarising the responses. Regressions and ANOVA (Analysis of Variance) test was used to assess the factors affecting performance of road construction projects in arid and semi-arid areas in Kenya.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where Y=Dependent variable and X_1 , X_2 , X_3 , and X_4 are the four independent variables, Where Y- Performance of road construction projects

X_1 - Contractor's competency

X_2 - Construction parties' financial management

X_3 - Construction resources

X_4 - Stakeholders' influence

β_0 – Is the constant or intercept

β_{1-4} – Are the regression coefficients or Change induced in Y (Dependent Variable) by each X (Independent variables)

ε – Error term

i) Contractor's competency

The study required the respondents of this study to indicate whether the contractor's competency affected performance of road construction projects in arid and semi-arid areas in Kenya. This is in line with the literature review where Sweis (2013) in his study on factors affecting time overruns in public construction projects in Jordan argued that contractor's competency like shortage of technical professionals in the contractors' organisation and poor qualification of

consultants, engineers and staff assigned to the project highly affected public construction projects.

Table 1: Contractor's competency on performance of road construction projects in arid and semi-arid areas in Kenya

	Frequency	Percentage (%)
Yes	49	84.21
No	8	15.79
Total	57	100.00

From the findings, 84.21% of the respondents indicated that contractor's competency affects performance of road construction projects in arid and semi-arid areas in Kenya while 15.79% of the respondents indicated that contractor's competency did not affect performance of road construction projects in arid and semi-arid areas in Kenya.

Table 2: Extent to which respondents agree with the following issues regarding contractor's competency

Statement	Not at all	Small extent	Moderate extent	Large extent	Very large extent	Mean	Std dev
Contractor's decision making capabilities affect performance of road construction projects	4.4	3.3	4.4	40.7	47.3	4.2	0.91
Contractor's experience affects performance of road construction projects	5.5	2.2	2.2	39.6	50.5	4.3	0.75
Technical skills of the contractor affect performance of road construction projects	5.5	11.0	23.1	35.2	25.3	3.6	0.49
Knowledge of the contractor affects performance of road construction projects	1.1	5.5	24.2	42.9	26.4	3.9	0.70

From the findings, the respondents indicated that contractor's decision making capabilities and contractor's experience affect performance of road construction projects to a very large extent as indicated by a mean of 4.2, knowledge of the contractor affects performance of road construction projects to a large extent as indicated by a mean of 4.3, and that technical skills of the contractor affect performance of road construction projects to a large extent as indicated by a mean of 3.9.

These findings collate with the literature review where a study carried by Subramani, Sruthi, and Kavitha (2014) who found that there were non-performance of sub-contractors and increase in material/machine prices and that the competence of the contractor was significantly the cause of poor performance in the projects.

ii) Construction parties' financial management

The study sought to determine the extent to which construction parties' financial management affects performance of road construction in arid and semi-arid areas in Kenya. This is in line with the literature review where Flyvbjerg, Holm and Buhl (2002) found that financial management encompasses all aspects and decisions, financial and economic, which have an effect on the construction projects.

Table 3: Construction parties' financial management on performance of road construction projects in arid and semi-arid areas in Kenya

	Frequency	Percentage (%)
Yes	51	89.47
No	6	10.53
Total	57	100.00

From the findings, 89.47% of the respondents indicated that construction parties' financial management affects performance of road construction projects in arid and semi-arid areas in Kenya while 10.53% of the respondents indicated that construction parties' financial management did not affect performance of road construction projects in arid and semi-arid areas in Kenya.

Table 4: Extent to which construction parties' financial management affects performance of road construction projects

Statement	Not at all	Small extent	Moderate extent	Large extent	Very large extent	Mean	Std dev
Client's delay in honouring timely payments certificates has led to project delays	4.4	5.5	4.4	53.8	31.9	4.0	0.90
Inflation in material prices has led to increase in construction costs thus affecting performance of construction projects	7.7	3.3	13.2	39.6	36.3	3.9	0.85

Use of wrong estimation method resulting in erroneous fund allocation affects performance of construction projects	5.5	7.7	12.1	36.3	38.5	3.9	0.84
Difficulties in accessing credit (contractor and sub-contractor) has led to project delays	9.9	5.5	23.1	24.2	37.4	3.7	0.72

From the findings, the respondents indicated that the client's delay in honouring timely payments certificates has led to project delays to the greatest extent as indicated by a mean of 4.0. Followed by inflation in material prices has led to increase in construction costs thus affecting performance of construction projects to a large extent as indicated by a mean of 3.9. The respondents indicated that the use of wrong estimation method resulting in erroneous fund allocation affects performance of construction projects to a very large extent as indicated by a mean of 3.9. Finally, the respondents indicated that difficulties in accessing credit (contractor and sub-contractor) has led to project delays to a very large extent as indicated by a mean of 3.7,

These findings relate with the literature review where Pourrostan and Ismail (2012) identified delay in progress payment by client and financial difficulties by contractors as among the most important causes of delay in Iranian construction projects while Haseeb et al. (2011) indicated that financial ability/ financial arrangement and late payment of bills were amongst the major relevant factors in construction projects in Pakistan.

iii) Timely Availability of Construction Resources

The study sought to determine the extent to which timely availability of construction resources affect performance of road construction in arid and semi-arid areas in Kenya. This is in line with the literature review where Fugar and Agyakwah-Baah (2010) who studied the causes leading to delay in construction projects in Ghana and established that that amongst the top ten factors, was shortage of materials.

Table 5: Timely availability of construction resources on performance of road construction projects in arid and semi-arid areas in Kenya

	Frequency	Percentage (%)
Yes	54	94.74
No	3	5.26
Total	57	100.00

From the findings, 94.74% of the respondents indicated that timely availability of construction resources affects performance of road construction projects in arid and semi-arid areas in Kenya while 5.26% of

the respondents indicated that timely availability of construction resources did not affect performance of road construction projects in arid and semi-arid areas in Kenya.

Table 6: Extent to which timely availability of construction resources affect performance of road construction projects

Statement	Not at all	Small extent	Moderate extent	Large extent	Very large extent	Mean	Std dev
Insufficient supply of labour (skilled and unskilled) in arid and semi-arid areas has led to delays and increase in construction costs	2.2	5.5	6.6	44.0	41.8	4.2	0.86
Inadequacy of modern equipment and allocation of equipment affects construction projects	8.8	12.1	12.1	37.4	29.7	3.7	0.84
Unavailability of better quality material in arid and semi-arid areas led to poor project performance	8.8	3.3	12.1	26.4	49.5	4.0	0.94
Client's emphasis on quick design and construction (Inadequate design and construction times stipulated; inadequate delivery times) has led to project performance	5.1	10.3	7.7	31.9	45.1	4.0	0.85

From the findings, the respondents indicated that insufficient supply of labour (skilled and unskilled) in arid and semi-arid areas has led to delays and increase in construction costs to a very large extent as indicated by a mean of 4.2, the respondents indicated that unavailability of better quality material in arid and semi-arid areas led to poor project performance and that client's emphasis on quick design and construction (Inadequate design and construction times stipulated; inadequate delivery times) has led to project performance to a very large extent as indicated by a mean of 4.0. Finally, the respondents indicated that inadequacy of modern equipment and allocation of equipment affects construction projects to a large extent as indicated by a mean of 3.7.

These findings are in line with the literature review where Ameh and Osegbo (2011) established that among the various factors that causes time overrun in Nigeria include inadequate tools and equipment, while Omoregie and Radford (2006) in their study of causes and effects of infrastructure delays and cost escalations in Nigeria found that the major causes relating to construction items.

iv) Conflicts

The study sought to determine the effect of conflicts on performance of road construction in arid and semi-arid areas in Kenya. This is in line with the literature review where Malik and Nauman (2013) in their study on factors affecting productivity of infrastructure development projects attributable to insecurity due to terrorism found that construction projects suffered mainly because of reduced availability of the required resources and unwillingness of the stakeholders to work in an insecure environment.

Table 7: Conflicts on performance of road construction projects in arid and semi-arid areas in Kenya

	Frequency	Percentage (%)
Yes	55	96.50
No	2	3.50
Total	57	100.00

From the findings, 96.50% of the respondents indicated that conflicts affects performance of road construction projects in arid and semi-arid areas in Kenya while 3.5% indicated that conflicts does not affect performance of road construction projects.

Table 8: Extent to which conflicts affect performance of road construction projects in arid and semi-arid areas in Kenya

Statement	Not at all	Small extent	Moderate extent	Large extent	Very large extent	Mean	std dev
Inter-community and inter-clan conflicts including cattle rustling has affects road construction projects	5.0	6.2	10.1	37.5	41.2	4.0	0.85
Compensation and resettlement disputes (Legal disputes) has led to project delay and increase in construction costs	8.8	10	7.7	28.6	44.9	3.9	0.79
Insecurity (armed robbery and terrorism) led to poor project performance	3.7	10.1	8.8	43.7	33.7	3.9	0.73
Lack of good will and ownership of road project by local	3.3	11.0	6.6	45.1	34.1	4.0	0.91

community has led to delays
(Conflicts on free movement of
labour and material and ceasing
of land on the Right of Way)

From the findings, the respondents indicated inter-community and inter-clan conflicts including cattle rustling affects road construction projects and compensation and resettlement disputes (Legal disputes) has led to project delays to a very large extent as indicated by a mean of 4.0 respectively. The respondents indicated that insecurity (armed robbery and terrorism) led to poor project performance to a large extent as indicated by a mean of 3.9, and finally, the respondents indicated that lack of good will and ownership of road project by local community affects construction of road projects to a large extent as indicated by a mean of 3.9.

These findings collate with the literature review where Amade (2012) and Sunjka and Jacob (2013) cited insecurity as one of the factors affecting road construction performance regardless of the region in Africa. Major security problems such as large scale robbery and armed attacks were often encountered between and within countries. This has been witnessed in the Central African Republic, DR Congo, Tunisia, the border between Kenya and Ethiopia and Nigeria amongst others (AfDB, 2003).

6. Regression Analysis

This section presents a discussion of the results of inferential statistics. The study employed multiple regression analysis so as to assess the factors affecting performance of road construction projects in arid and semi-arid areas in Kenya. The study applied the statistical package SPSS to code, enter and compute the measurements of the multiple regressions for the study.

Table 9: Model Summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.836 ^a	.878	.827	.434

a. Predictors: (Constant), Contractors' competency, construction parties' financial management and conflicts.

b. Dependent Variable: Performance of road construction projects

Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (Performance of road construction projects) that is explained by the 4 independent variables (Contractors' competency, construction parties' financial management and conflicts).

The four independent variables that were studied, explain 82.7% of variance in Performance of road construction projects as represented by the R^2 . This therefore means that other factors not

studied in this research contribute 17.3% of variance in the dependent variable. Therefore, further research should be conducted to investigate more factors affecting performance of road construction projects in arid and semi-arid areas in Kenya.

Table 10: ANOVA (Analysis of Variance)

Model		Sum Squares	of Df	Mean Square	F	Sig.
1	Regression	80.238	3	.167	64.0	.001 ^a
	Residual	10.345	53	.110		
	Total	90.583	56			

a. Predictors: (Constant), Contractors' competency, construction parties' financial management, timely availability of construction resources and conflicts.

b. Dependent Variable: Performance of road construction projects

The F critical at 5% level of significance was 5.44. Since F calculated is greater than the F critical (value = 64.0), this shows that the overall model was significant. The significance is less than 0.05, thus indicating that the predictor variables, (Contractors' competency, construction parties' financial management, timely availability of construction resources and conflicts). Explain the variation in the dependent variable which is performance of road construction projects. Subsequently, we reject the hypothesis that all the population values for the regression coefficients are 0. Conversely, if the significance value of F was larger than 0.05 then the independent variables would not explain the variation in the dependent variable.

Table 11: Coefficient of Determination

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.721	.77		5.654	0.000
	Contractors' competency	2.453	0.241	0.237	0.567	0.001
	Construction parties' financial management	0.233	0.296	0.534	0.256	0.003

Timely availability of construction resources	0.254	0.437	0.356	0.199	0.002
Conflicts	1.967	0.656	0.323	0.198	0.004

From the regression findings, the substitution of the equation ($Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4$) becomes:

$$Y = 2.721 + 2.453X_1 + 1.967X_4 + 0.254X_3 + 0.233X_2 + \varepsilon$$

Where Y is the dependent variable (performance of road construction projects), X_1 is contractors' competency variable, X_2 is construction parties' financial management variable, X_3 is timely availability of construction resources variable and X_4 is the conflicts variable ε is the error term.

According to the equation, taking all factors (contractors' competency, construction parties' financial management, timely availability of construction resources and conflicts) constant at zero, performance of road construction projects will be 2.721. The data findings also show that a unit increase in contractors' competency variable will lead to a 2.453 increase in performance of road construction projects; a unit increase in construction parties' financial management will lead to a 0.233 increase in performance of road construction projects; a unit increase in timely availability of construction resources will lead to a 0.254 increase in performance of road construction projects; and a unit increase in conflicts variable will lead to a 1.967 in performance of road construction projects. This means that the most significant factor is contractors' competency followed by conflicts.

At 5% level of significance and 95% level of confidence, contractors' competency had a 0.001 level of significance; construction parties' financial management had a 0.003, timely availability of construction resources had a 0.002 level of significance while conflicts had a 0.004 level of significance. This implies that the most significant factor is contractors' competency.

7. Correlation Analysis

The study conducted correlation analysis for the combine variables dependent and independent variables. The results show a positive correlation among the variables of study as shown in table 12.

Table 12: Correlation Analysis

		Performance of road construction projects	Contractor's competency	Construction parties' financial management	Construction resources	Conflicts
Performance of road construction projects	Pearson Correlation	1	.947**	.974**	.915**	.963**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	57	57	57	57	57
Contractor's competency	Pearson Correlation	.947**	1	.920**	.930**	.919**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	57	57	57	57	57
Construction parties' financial management	Pearson Correlation	.974**	.920**	1	.894**	.954**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	57	57	57	57	57
Construction resources	Pearson Correlation	.915**	.930**	.894**	1	.861**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	57	57	57	57	57
Conflicts	Pearson Correlation	.963**	.919**	.954**	.861**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	57	57	57	57	57

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

8. Summary of findings

Contractor's competency

Contractor's competency which entails the contractor's decision making capabilities, the contractor's management skills and contractor's experience affect performance of road construction projects to a very large extent. This is in line with the findings of Subramani, Sruthi, and Kavitha (2014), Danso and Antwi (2012) and Mbaluku and Bwisa (2013) who found that improper technical study by the contractor during the bedding stage; poor planning and scheduling of the project by the contractor; and non-performance of sub-contractors all affected performance of infrastructural projects

Construction Parties' Financial Management

Client's delay in honouring timely payments certificates has led to project delays to a very large extent which relates with the literature review where identified delay in progress payment by client and financial difficulties by contractors as among the most important causes of delay in Iranian construction projects. Difficulties in accessing credit (contractor and sub-contractor) has also led to project delays in a large extent as in line with Pourroostam and Ismail (2012) and Memon, Rahman and Azi (2010) who in a study in Malaysia found fluctuation in prices of materials as the most significant factor affecting construction cost performance followed by Cash flow and financial difficulties faced by contractors. Inflation in material prices has led to increase in construction costs thus affecting performance of construction project.

Timely availability of construction resources

Insufficient supply of labour (skilled and unskilled) in arid and semi-arid areas has led to delays and increase in construction costs to a very large extent as indicated by a mean of 2.3. The respondents indicated that unavailability of better quality material in arid and semi-arid areas leads to poor project performance and that client's emphasis on quick design and construction (Inadequate design and construction times stipulated; inadequate delivery times) has led to project performance to a very large extent. These findings are in line with the literature review where Sweis (2013) found that amongst the top ten factors four were related to the construction items. These are presence of unskilled labourers; shortage of technical professionals in the contractors' organisation; improper technical study by the contractor during the bedding stage; and lastly, ambiguities and mistakes in specifications and drawings; and Ameh and Osegbo (2011) who established that among the various factors that cause time overrun in Nigeria include inadequate tools and equipment.

Conflicts

The study sought to determine the effect of conflicts on performance of road construction in arid and semi-arid areas in Kenya and found that inter-community and inter-clan conflicts, compensation and resettlement legal disputes has led to project delay thus affecting road construction projects to a very large extent. The respondents also indicated that insecurity (armed robbery and terrorism) led to poor project performance to a large extent. Malik and Nauman (2013) in their study of factors affecting productivity of infrastructure development projects

attributable to insecurity due to terrorism found that construction projects suffered mainly because of reduced availability of the required resources and unwillingness of the stakeholders to work in an insecure environment. Bubshait and Al-Juwait (2002) found insecurity as one of the major causes of cost overrun on construction projects in Saudi Arabia.

9. Conclusions

Therefore, the contractor's competency, the contractor's decision making capabilities and contractor's experience greatly affect performance of road construction projects as contractor's competency is the greatest studied factor affecting project performance in arid and semi-arid areas. Further, the study establishes that difficulty in accessing credit (contractor and sub-contractor) and delay in payment of IPCs by the client has led to poor project performance. Insufficient supply of labour (skilled and unskilled), unavailability of better quality material and client's emphasis on quick design and construction (Inadequate design and construction times stipulated; inadequate delivery times) in arid and semi-arid areas has led to delays and increase in construction costs. Finally, inter-community and inter-clan conflicts, compensation and resettlement legal disputes, insecurity (armed robbery and terrorism) and lack of goodwill by local communities has led to poor project performance to a large extent.

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