ISSN 2250-3153

Effect of Change Management Practices on the Performance of Road Construction Projects in Rwanda

A Case Study of Horizon Construction Company Limited

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Abstract- The study entitled Effect of Change Management on the Performance of Road Construction Projects in Rwanda was carried to analyse the Change Management Practices in the Road Construction Projects in Rwanda and establish their relative effect on the Performance of such Projects in Rwanda. The fact that construction projects are continually confronting challenges to remain competitive and successful compels construction project managers to regularly re-evaluate their strategies, structures, policies, operations, processes and culture. Managing changes in such construction projects effectively is however a main challenge due to its massive activities and human involvement. The study was guided by the following specific objectives: to establish the status of construction change management in Rwanda, to determine the sources of change in construction projects in Rwanda and to establish the effect of change management on the performance construction Projects in Rwanda. The study employed a descriptive survey design based on a census design. The target population of 90 employees from Horizon Construction Company Limited was used. A sample size of 90 was drawn by census method. Data was collected using structured questionnaires and document reviews. The reliability and validity of the data collection instruments was tested by Cronbach's Alpha coefficient at an index of 0.70 and based on a 5-point Likert Scale for multiple items obtained from a pilot survey. The content validity of the questionnaires was done by supervisors from the University. Multiple regression analysis, correlation and content analysis were used to establish the effect of Change Management Practices on the Performance of Construction Projects in Rwanda. The findings indicate that there was a significant effect of change management practices on the performance construction projects in Rwanda.

Index Terms- change management, performance, cost effectiveness, Project time delivery

I. Introduction

Construction projects are continually confronting challenges to remain competitive and successful, which compels construction project managers to regularly re-evaluate their strategies, structures, policies, operations, processes and culture. Managing construction project change effectively is however a main challenge in the change management domain because of massive activities and human involvement. Thus, project managers and change agents are eager to know how to encourage and effectively prepare employees for change situation. Most construction project failures have been attributed to inadequate change management and a weak project plan. Construction project managers are doing poorly in managing project changes like activity scheduling, activity duration and cost variation that are encountered during the project life cycle, (Hwang et al., 2009).

Change management is a structured approach to transition individuals, teams, and organizations from current state to a desired future state, to fulfill or implement a vision and strategy (Serkin, 2005). It is an organizational process aimed at empowering employees to accept and embrace changes in their current environment (Kubiciek, Margaret 2006). It involves defining and installing new values, attitudes norms and behaviors within an organization that support new ways of doing work and overcome resistant to change.

The construction industry is one of the sectors that provide significant contributions to Rwanda's economy and thus, it is imperative to sustain successful deliveries of construction projects in Rwanda (RDB, 2015). While construction projects vary in size, duration and complexity, several common features can be found. One of the most common concerns in construction projects is project changes (Ming et al., 2004). Changes usually occur at any stage of a project due to various causes from different sources, and have considerable impacts (Karim and Adeli, 1999; Motawa et al., 2007). Any additions, deletions or modifications to the scope of the project are considered as changes.

II. Statement of the Problem

The fast growing population in Rwanda expected to be over two million by 2020 and increasing business needs has put a lot of pressure on the Rwandan government to quickly improve its road infrastructure within short Project Delivery Times (RDB, 2015). However, in Rwanda construction firms are continually operating against the backdrop of inadequate cash flows, long project delivery times in material supply, inadequate construction equipments, unstable construction designs, slow relocation of utility services and irregular changing weather patterns. In view of this uncertain and unstable construction environment, construction firms in Rwanda are struggling to get competitive, innovative & cost effective ways of achieving short Project Delivery Times faced with frequent changes in design, climate and relocation of utilities but to minimal success (RDB, 2015). This has compelled construction project managers to regularly re-evaluate their strategies, structures, policies, operations, processes and culture for possible changes (PMI, 2008). Managing construction project changes effectively is however a main challenge in the change management domain because of massive activities and human involvement (PMI, 2008). Thus, project managers and change agents are eager to know how to encourage and effectively prepare employees for change situation (RDB, 2015). Most construction project failures have been attributed to inadequate change management and a weak project plan (Hwang et al., 2009). Construction project managers are doing poorly in managing project changes like activity scheduling, activity duration and cost variation that are encountered during the project life cycle (PMI, 2008). In Rwanda, most construction projects take place in a challengeable and competitive environment in which many changes exist that might negatively impact the outcome of project success if not well managed (RDB, 2015). The main focus of this paper is to investigate the effect of Change Management Practices on the Performance of Construction Projects in Rwanda.

III. Research Objective

1.1 General objectives

To establish the effect of Change Management Practices on the Performance of Road Construction Projects in Rwanda.

1.2 Specific objectives

i. To establish the effect of Change Identification on Road Construction Project Performance in Rwanda
ii. To determine the effect of Requirement Review on Road Construction Project Performance in Rwanda
iii. To analyse the effect of Change Evaluation on Road Construction Project Performance in Rwanda
iv. To establish the effect of Change Approval on Road Construction Project Performance in Rwanda

IV. Research questions

i. What is the effect of Change Identification on Road Construction Project Performance in Rwanda?
ii. What is the effect of Requirement Review on Road Construction Project Performance in Rwanda?
iii. What is the effect of Change Evaluation on Road Construction Project Performance in Rwanda?
iv. What is the effect of Change Approval on Road Construction Project Performance in Rwanda?

V. Research Design

The study used a descriptive survey design which Kothari (2004) says is a scientific method involving collecting data in order to answer questions on current status of subjects of the study. The design acts as a precursor to quantitative research design. According to Kothari, (2004), this design was considered appropriate for this study because it restricts to fact finding and is relatively easy to carry out within limited time. The results can also be easily generalized to the whole population.

VI. Target Population

The study comprised of a target population of 90 employees from Horizon Construction Company Limited. This comprised of Construction Director (1), Director Administration (1), Senior Management (6), Technical Managers (13), Site Supervisors (5) and Field Technicians (54).

VII. Sample Design

7.2 Sampling technique

Stratified purposive sampling was employed since the target population was less than 100. In this study the whole population was 90 which was less than 100 so the study employed Stratified purposive sampling in which the whole population of 90 was taken as respondents.

VIII. Data Collection

1.3 Data collection Instruments

Structured questionnaires and documentary review were used. Structured questionnaires were administered to the respondents because of their advantage of being able to obtain wide responses. A five-point Likert-scale rating of questionnaires was employed in this study to collect the views of respondents. This enabled the researcher to ask respondents on how strongly they agree or disagree with a statement or series of statements. The other advantage of the Likert-style rating questionnaire is that it enables numerical value to be assigned to cases for easy quantitative analysis, (Amin, 2005).

This research also reviewed literature obtained (documentary reviews) from the case study organization. This literature included Horizon Construction Company Limited annual reports and other reports from Rwanda Development Board. This method was chosen because it is vital in providing background information and facts about project change management and performance in the construction industry before primary data could be collected. Indeed, before field data was collected, a wide collection of secondary data was collected to cross check with the primary data that was obtained from the field.

1.4 Data analysis

The data collected using questionnaires were analyzed quantitatively using inferential and descriptive statistics and tested using Pearson chi-square test of independence at the level of significance of 0.05 to assess associations. In order to ensure logical completeness and consistency of responses, the completed questionnaires were checked thoroughly by editing, coding, entering and then presented in comprehensive tables which indicated the responses of each category of variables and analyzed through descriptive and inferential statistics.

The quantitative data generated was keyed in and analyzed by use of Statistical Package of Social Sciences (SPSS) version 23 to generate information which was then presented using tables, frequencies and percentages. The linear regression model was used to show the relationship between the change management practices and the construction project performance.

IX. RESEARCH AND DISCUSSION

Table 1: Response Rate of the Study

The response rate of the study is indicated in Table 4.1 below.

Results	Frequency	Percentage (%)
Respondents	87	96.67
Non Respondents	03	02.33
Total	**90**	**100**

Source: Survey Data (2016)

Table 2: Gender of Respondents

Gender	Frequency	Percentage (%)
Male	73	83.91
Female	14	16.01
Total	**87**	**100**

Source: Survey Data (2016)

The study found that 73 (83.91 %) respondents were males and 14 (16.01%) were females. The results indicate the construction industry is dominated by the male gender who account for the overwhelming majority of the respondents. The study results compare well and are consistent with the study of Zaherawati (2010) in which all the respondents were of the male gender i.e. 100% confirming that the construction industry is male dominated.

Table 3: Age of respondents

Ages	**Frequency**	**Percentage (%)**
21-30 yrs	0	0
31-40 yrs	16	18
41-50 yrs	45	52
51 & Above yrs	26	30
Total	**87**	**100**

Source: Survey Data (2016)

Majority of the respondents 45 (52%) fall within 40 to 49 years of age. This was followed by 26 (30%) in the age group of 51 and above years. There were 16 (18%) respondents in the age of 31 to 40 years. A cumulative 80% of the respondents were within 31 – 50 years. Ameh (2011) study made nearly similar observations whereby 91% of the respondents were within 30 - 49 years of age.

Table 4: Highest Education Level

Education level	**Frequency**	**Percentage (%)**
Diploma	45	52
Undergraduate	33	38

Post-Graduate	09	10
Total	**87**	**100**

Source: Survey Data (2016)

The respondents were largely diploma holders as well as undergraduate degree holders. More than half 45 (52%) of the respondents had diploma qualification, 33 (38%) respondents had undergraduate degree and 9 (10%) respondents had a post graduate degree qualification. This is inconsistent to a study by Ameh (2011) who observed that 67 % of the respondents had a first degree or its equivalent. A study by Ade (2013), however, observed that all the respondents in the construction industry had obtained a minimum of diploma qualification and above i.e. 100%. This shows that the respondents were qualified, capable and reliable to explore the underpinning issues related to the study

Table 5: Experience Levels

Ages	Frequency	Percentage (%)
1-3 yrs	13	15
3-5 yrs	18	21
6-9 yrs	41	47
10 & Above yrs	15	17
Total	**87**	**100**

Source: Survey Data (2016)

Table 5 summarizes the distribution of respondents by experience. The majority (47%) of the respondents had between 6-9 years experience compared to 21% who had between 3-5 years experience and 15% of the respondents were having 1-3 years experience while those with more than 10 years experience being 17%. This preliminary indication suggests that the many contractors' staffs have 6-9 years experience, followed by those with 3-5 years experience but there were few staff with 1-3 years experience as well as those with over 10 years in the study area. This showed that all the respondents were experienced enough to make informed choices regarding change management in the road construction industry.

Presentation of Descriptive Statistics According to Research Questions

Descriptive analysis was done on the responses attributed to the effect of project change management practices (project change identification, review of project change requirements, project change evaluation and project change approval) on the performance of construction projects in Rwanda. The results were summarized in table 6 and table 7

Table 6 Descriptive Statistics for Project Change Management Practices and Project Delivery Time

Project Change Management Practices	N	Project Delivery Time		Mean	StdDev
		Frequency	Percentage		
Project Change Identification	87	69	79.31	2.175	0.475
Review of Project Change Requirements	87	62	71.26	1.946	0.395
Project Change Evaluation	87	67	77.01	2.146	0.626
Project Change Approval	87	68	78.16	1.884	0.757

Source: Survey Data (2016)

Table 6 indicates that of 87 respondents the mean response was 2.175 and that 79.31% of the respondents thus agreed that project change identification is being practiced well in the construction industry in Rwanda. They believed that this contributes to the short project delivery times being realized in the construction industry in Rwanda. The lower standard deviation so realized for the project change identification practices indicate that the deviation from the mean response was low thus authenticating the findings.

The table 6 also indicates that of 87 respondents the mean response was 1.946 and that 71.26% of the respondents thus agreed that review of project change requirements is being practiced well in the construction industry in Rwanda. They believed that this contributes to the short project delivery times being realized in the construction industry in Rwanda. The lower standard deviation so realized for the review of project change requirements practices indicate that the deviation from the mean response was low thus authenticating the findings.

The table 6 further indicates that of 87 respondents the mean response was 2.146 and that 77.01% of the respondents thus agreed that project change evaluation is being practiced well in the construction industry in Rwanda. They believed that this contributes to the short project delivery times being realized in the construction industry in Rwanda. The lower standard deviation so realized for the project change evaluation practices indicate that the deviation from the mean response was low thus authenticating the findings.

Lastly Table 6 indicates that of 87 respondents the mean response was 1.884 and that 78.18% of the respondents thus agreed that project change approval is being practiced well in the construction industry in Rwanda. They believed that this contributes to the short project delivery times being realized in the construction industry in Rwanda. The lower standard deviation so realized for the project change approval practices indicate that the deviation from the mean response was low thus authenticating the findings.

Table 7 Descriptive Statistics for Effect of Project Change Management Practices and Project Cost Effectiveness

Project Change Management Practices	**N**	**Project Cost Effectiveness**		**Mean**	**StdDev**
		Frequency	**Percentage**		
Project Change Identification	87	63	72.41	1.132	0.234
Review of Project Change Requirements	87	69	79.31	1.628	0.358
Project Change Evaluation	87	73	83.9	2.137	0.286
Project Change Approval	87	65	74.71	1.214	0.138

Source: Survey Data (2016)

The findings as depicted in table 7 indicates that of 87 respondents the mean response was 1.132 and that 72.41% of the respondents thus agreed that project change identification is being practiced well in the construction industry in Rwanda. They believed that this contributes to the project cost effectiveness being realized in the construction industry in Rwanda. The lower standard deviation so realized for the project change identification practices indicate that the deviation from the mean response was low thus authenticating the findings.

The table 7 also indicates that of 87 respondents the mean response was 1.628 and that 79.31% of the respondents thus agreed that review of project change requirements is being practiced well in the construction industry in Rwanda. They believed that this contributes to the project cost effectiveness being realized in the construction industry in Rwanda. The lower standard deviation so realized for the review of project change requirements practices indicate that the deviation from the mean response was low thus authenticating the findings.

The table 7 further indicates that of 87 respondents the mean response was 2.137 and that 83.9% of the respondents thus agreed that project change evaluation is being practiced well in the construction industry in Rwanda. They believed that this contributes to the project cost effectiveness being realized in the construction industry in Rwanda. The lower standard deviation so realized for the project change evaluation practices indicate that the deviation from the mean response was low thus authenticating the findings.

Lastly Table 7 indicates that of 87 respondents the mean response was 1.214 and that 74.71% of the respondents thus agreed that project change approval is being practiced well in the construction industry in Rwanda. They believed that this contributes to the project cost effectiveness being realized in the construction industry in Rwanda. The lower standard deviation so realized for the project change approval practices indicate that the deviation from the mean response was low thus authenticating the findings.

Presentation of Correlation Analysis According to Research Questions

The research data from the questionnaire was used to determine the effect of project change management on the performance of road construction projects in Rwanda. To do this, the author conducted a correlation analysis to measure the strength between the independent variables of project change management (change identification, review of change requirements, change evaluation and change approval) and the dependent variables of project performance (delivery time and cost effectiveness) in the study. The results on theeffect of project change management on the performance of construction projects in Rwanda were as shown in the subsequent tables

Table 8: Correlation between Project Change Identification and Performance of Construction Projects

		Project Identification	ChangeCost Effectiveness
Project Change Identification	Pearson Correlation	1	0.693*
	Sig. (2-tailed)		0.020
	N	87	87
Cost Effectiveness	Pearson Correlation	0.693*	1
	Sig. (2-tailed)	0.020	
	N	87	87

*. Correlation is significant at the 0.05 level (2-tailed).
Survey Data (2016)

From the figures table 8,itisevidentthatproject change evaluation has a significant positive correlation of 0.693 with project cost effectiveness having a *p*-value of 0.020.This finding is similar to the finding by Ade (2013) in which project change evaluation had a significant positive correlation on project cost effectiveness.

Table 9 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.695[a]	.483	.451	.593

a. Predictor: (Constant), Project Change Identification
b. Dependent Variable: Project Cost Effectiveness
Source: Survey Data (2016)

The regression line assumes that the project change identification is randomly distributed around the regression line in respect to project cost effectiveness. The correlation coefficient is 0.695, and the R-square is 0.483 while adjusted R-square is 0.451. Thus, for this sample, the predictor variable, project change identification, explains 48.3% of the variance in the dependent variable project cost effectiveness of road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that project change identification has a negative correlation on project cost. Project change identification thus can be a powerful tool for road construction project managers when trying to reduce project cost.

Table 10 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.929	5	5.386	15.311	.000[b]
	Residual	28.844	82	.352		
	Total	55.773	87			

a. Dependent Variable: Project Cost Effectiveness
b. Predictor: (Constant), Project Change Identification
Source: Survey Data (2016)

The ANOVA table 10 shows that the computed F statistic (5, 82) = 15.311 and the p-value for the overall regression relationship was ($p = 0.000$), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project change identification on the project cost effectiveness of road construction projects in Rwanda ($F=15.311$, $R^2 = 0.483$, $Sig=0.000$ at $\alpha=0.05$) . This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 11 T-Test and Test of Coefficients[a]

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.904	.465		2.550	.003
	PCI	.692	.045	.248	3.814	.000

a. Dependent Variable: Project Change Identification

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical effect of project change identification on the project cost effectiveness of road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \varepsilon_1$$

which became:

$$\boldsymbol{P_t = 1.904 + 0.692X_1 + \varepsilon}$$

The results in the coefficient table 4.9 thus show that there was a significant statistical effect of project change identification on the project cost of road construction projects in Rwanda since $p=0.000$ which is less than $p<0.05$ at a 95% confidence interval. There is also a negative unstandardized beta coefficient of 0.172 as indicated by the coefficient to the project change identification. The probability of the t-statistic (3.814) for the b coefficient is $p<0.001$ which is less than the level of significance of 0.05. This shows that there was a statistically significant statistical effect of project change identification on the project cost effectiveness of road construction projects in Rwanda. The regression model further demonstrates that a one unit change in the project cost effectiveness is attributed to an increase of 0.692 in the project change identification in the road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011).

Table 12: Correlation betweenReview of Project Change Requirements and Performance of Construction Projects

		Review of Project Change Requirements	Cost Effectiveness
Review of Project P. Change Req'ts	Pearson Correlation	1	0.629*
	Sig. (2-tailed)		0.034
	N	87	87
Cost Effectiveness	Pearson Correlation	0.629*	1
	Sig. (2-tailed)	0.034	
	N	87	87

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

Source: Survey Data (2016)

From the figures in table 12, it is evident that review of project change requirements has a significant positive correlation of 0.629 with project cost effectiveness having a *p*-value of 0.034. This finding is similar to the finding by Ade (2013) in which review of project change requirements had a significant positive correlation on project cost effectiveness.

Table 13 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.630[a]	.397	.391	.593

a. Predictors: (Constant), Review of Project Change Requirements

b. Dependent Variable: Project Cost Effectiveness

Source: Survey Data (2016)

The regression line assumes that the review of project change requirements is randomly distributed around the regression line in respect to project cost effectiveness. The correlation coefficient is 0.630, and the R-square is 0.397 while adjusted R-square is 0.391. Thus, for this sample, the predictor variable, project change evaluation, explains 39.1% of the variance in the dependent variable project cost effectiveness of road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that review of project change requirements has a negative correlation on project cost. Review of project change requirements thus can be a powerful tool for road construction project managers when trying to reduce project cost and in effect increase its cost effectiveness.

Table 14 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.434	5	5.131	13.201	.030[b]
	Residual	24.653	82	.247		
	Total	52.087	87			

a. Dependent Variable: Project Cost Effectiveness
b. Predictors: (Constant), Review of Project Change Requirements
Source: Survey Data (2016)

The ANOVA table 14 shows that the computed F statistics (5, 82) = 13.201 and the p-value for the overall regression relationship was ($p = 0.030$), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of review of project change requirements on the project cost effectiveness in road construction projects in Rwanda ($F=13.201$, $R^2 = 0.630$, $Sig=0.030$ at $\alpha=0.05$) . This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 15 T-Test and Test of Coefficients[a]

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.03	1.605		1.320	.024
	RPCR	.629	.045	.623	5.370	.000
a. Dependent Variable: Project Cost Effectiveness						

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical effect of review of project change requirements on the project cost effectiveness of road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \varepsilon_1$$

which became:

$$\boldsymbol{P_t = 1.03 + 0.629X_1 + \varepsilon}$$

The results in the coefficient table 4.13 thus show that there was a significant statistical effect of review of project change requirements on the project cost effectiveness of road construction projects in Rwanda since $p=0.000$ which is less than $p<0.05$ at a 95% confidence interval. There is also a positive unstandardized beta coefficient of 0.629 as indicated by the coefficient to the review of project change requirements. The probability of the t-statistic (5.370) for the b coefficient is $p<0.001$ which is less than the level of significance of 0.05. This shows that there was a statistically significant statistical effect of review of project change requirements on the project cost effectiveness in road construction projects in Rwanda. The regression model further demonstrates that a one unit change in the project cost is attributed to an increase of 0.629 in the review of project change requirements in the road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011).

Table 16: Correlation between Project Change Evaluation and Performance of Construction Projects

		Project Change Evaluation	**Cost Effectiveness**
Project Change Evaluation	Pearson Correlation	1	0.721*
	Sig. (2-tailed)		0.042
	N	87	87
Cost Effectiveness	Pearson Correlation	0.721*	1
	Sig. (2-tailed)	0.042	
	N	87	87

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

Source: Survey Data (2016)

From the figures in table 16, it is evident that project change evaluation has a significant positive correlation 0.526 with project delivery time having a *p*-value of 0.042.This finding is similar to the finding by Ade (2013) in which project change evaluation had a significant negative correlation on project delivery time and cost.

Table 17 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.722[a]	.521	.514	.432

a. Predictors: (Constant), Project Change Evaluation
b. Dependent Variable: Project Cost Effectiveness
Source: Survey Data (2016)

The regression line assumes that the project change evaluation is randomly distributed around the regression line in respect to project delivery time. The correlation coefficient is 0.722, and the R-square is 0.521 while adjusted R-square is 0.514. Thus, for this sample, the predictor variable, project change evaluation, explains 52.1% of the variance in the dependent variable project cost effectiveness in road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that project change evaluation has a positive correlation on project cost effectiveness. Project change evaluation thus can be a powerful tool for road construction project managers when trying to improve project cost effectiveness.

Table 18 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.231	5	4.893	10.104	.027[b]
	Residual	10.841	82	.426		
	Total	50.072	87			

a. Dependent Variable: Project Cost Effectiveness
b. Predictors: (Constant), Project Change Evaluation
Source: Survey Data (2016)

The ANOVA table 4.18 shows that the computed F statistic (5, 82) = 10.104 and the p-value for the overall regression relationship was (p = 0.027), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project change evaluation on the project cost effectiveness in road construction projects in Rwanda (F=10.104, R^2 = 0.521, Sig=0.027 at α=0.05) . This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 19 T-Test and Test of Coefficients[a]

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.07	1.212		2.250	.032
	PCE	.732	1.020	.697	7.830	.013

a. Dependent Variable: Project Cost Effectiveness
b. Predictors: (Constant), Project Change Evaluation
Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical effect of project change identification on the project cost effectiveness of road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \varepsilon_1$$

which became:

$$\boldsymbol{P_t = 1.07 + 0.732X_1 + \varepsilon}$$

The results in the coefficient table 4.17 thus show that there was a significant statistical effect of project change identification on the project cost of road construction projects in Rwanda since *p=0.000* which is less than *p<0.05* at a 95% confidence interval. There is also a positive unstandardized beta coefficient of 0.732 as indicated by the coefficient to the project change evaluation. The probability of the t-statistic (7.830) for the b coefficient is *p*<0.001 which is less than the level of significance of 0.05. This shows that there was a statistically significant statistical effect of project change evaluation on the project delivery time of road construction projects in Rwanda. The regression model further demonstrates that a one unit change in the project cost is attributed to an increase of 0.732 in the project change evaluation in the road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011).

Table 20: Correlation betweenProject Change Approval and Performance of Construction Projects

		Project Approval	ChangeCost Effectiveness
Project Change Approval	Pearson Correlation	1	0.710*
	Sig. (2-tailed)		0.020
	N	87	87
Cost Effectiveness	Pearson Correlation	0.710*	1
	Sig. (2-tailed)	0.020	
	N	87	87

*. Correlation is significant at the 0.05 level (2-tailed).
Source: Survey Data (2016)

From the figures in the table above, it is evident that project change evaluation has a significant negative correlation with project delivery time having a *p*-value of 0.710.This finding is similar to the finding by Ade (2013) in which project change evaluation had a significant positive correlation on project cost effectiveness.

Table 4.21 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.710[b]	.504	.496	.324

a. Predictors: (Constant), Project Change Approval
b. Dependent Variable: Project Cost Effectiveness

The regression line assumes that the project change approval is randomly distributed around the regression line in respect to project cost effectiveness. The correlation coefficient is 0.710, and the R-square is 0.504 while adjusted R-square is 0.496. Thus, for this sample, the predictor variable, project change approval, explains 50.4% of the variance in the dependent variable project cost effectiveness in road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that project change approval has a positive correlation on project cost effectiveness. Project change approval thus can be a powerful tool for road construction project managers when trying to improve on the project cost effectiveness.

Table 22 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.979	5	1.596	12.697	.000[b]
	Residual	47.794	82	.583		
	Total	55.773	87			

a. Predictors: (Constant), Project Change Approval
b. Dependent Variable: Project Cost Effectiveness

The ANOVA table 4.22 shows that the computed F statistic (5, 82) = 12.697 and the p-value for the overall regression relationship was (p = 0.000), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project change approval on the project effectiveness in road construction projects in Rwanda (F=12.697, R^2 = 0.504, Sig=0.000 at α=0.05) . This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 23 T-Test and Test of Coefficients[a]

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.728	3.263		1.142	.025
	PCA	.711	.052	.153	2.066	.040
a. Dependent Variable: Project Cost Effectiveness						

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical effect of project change approval on the project cost effectiveness of road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \varepsilon_1$$

which became:

$$\boldsymbol{P_t = 1.728 - 0.71X_1 + \varepsilon}$$

The results in the coefficient table 4.21 thus show that there was a significant statistical effect of project change approval on the project cost effectiveness in road construction projects in Rwanda since $p=0.000$ which is less than$p<0.05$ at a 95% confidence interval. There is also a negative unstandardized beta coefficient of 0.711 as indicated by the coefficient to the project change approval. The probability of the t-statistic (1.142) for the b coefficient is $p<0.001$ which is less than the level of significance of 0.05. This shows that there was a statistically significant statistical effect of project change approval on the project cost effectiveness in road construction projects in Rwanda. The regression model further demonstrates that a one unit change in the project cost effectiveness is attributed to an increaseof0.711intheproject change approval in the road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011).

Table 24 Model Summary[b]

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.798[a]	.636	.632	5.66191
a. Predictors: (Constant), PCI				

Source: Survey Data (2016)

The regression line assumes that the project change identification is randomly distributed around the regression line in respect to project delivery time. The correlation coefficient is 0.798, and the R-square is 0.636 while adjusted R-square is 0.632. Thus, for this sample, the predictor variable, project change evaluation, explains 63.6% of the variance in the dependent variable project delivery time in road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that project change identification has a significant correlation on project delivery time. Project change identification thus can be a powerful tool for road construction project managers when trying to shorten project delivery time.

Table 4.25 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.918	5	5.386	8.624	.000[b]
	Residual	29.855	82	.352		
	Total	55.773	87			

a. Dependent Variable: Project Delivery Time
b. Predictors: (Constant), Project Change Identification
Source: Survey Data (2016)

The ANOVA table 4.25 shows that the computed F statistic (5, 82) = 8.624 and the p-value for the overall regression relationship was (p = 0.000), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project change identification on the project delivery time of road construction projects in Rwanda (F=8.624, R^2 = 0.636, Sig=0.000 at α=0.05) . This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 26: Correlation between Project Change Identification and Performance of Construction Projects

		Project Identification	ChangeDelivery Time
Project Change Identification	Pearson Correlation	1	-0.797*
	Sig. (2-tailed)		0.021
	N	87	87
Delivery Time	Pearson Correlation	-0.797*	1
	Sig. (2-tailed)	0.021	
	N	87	87

*. Correlation is significant at the 0.05 level (2-tailed).
Source: Survey Data (2016)

From the figures in the table above, it is evident that project change identification has a significant negative correlation of 0.797 with project delivery time having a *p*-value of 0.021.This finding is similar to the finding by Ade (2013) in which project change identification had a significant negative correlation on project delivery time.

Table 27 T-Test and Test of Coefficients[a]

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.421	3.465		-.378	.583
	PCI	-.797	.013	-.748	2.413	.000
a. Dependent Variable: Project Delivery Time						

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical effect of project change identification on the project delivery time in road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \varepsilon_1$$

which became:

$$\boldsymbol{P_t = 1.421 - 0.797X_1 + \varepsilon}$$

The results in the coefficient table 4.25 thus show that there was a significant statistical effect of project change identification on the project cost of road construction projects in Rwanda since *p=0.000* which is less than *p<0.05* at a 95% confidence interval. There is also a negative unstandardized beta coefficient of 0.797 as indicated by the coefficient to the project change identification. The probability of the t-statistic (2.413) for the b coefficient is *p*<0.001 which is less than the level of significance of 0.05. This shows that there was a statistically significant statistical effect of project change evaluation on the project delivery time of road construction projects in Rwanda. The regression model further demonstrates that a one unit change in the project delivery time is attributed to a decrease of 0.797 in the project change identification in the road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011).

Table 28: Correlation between Review of Project Change Requirement and Performance of Construction Projects

		Review of Project Change Requirements	Delivery Time
Review of Project P. Change Reqt's	Pearson Correlation	1	-0.626*
	Sig. (2-tailed)		0.003
	N	87	87
Delivery Time	Pearson Correlation	-0.626*	1
	Sig. (2-tailed)	0.003	
	N	87	87

*. Correlation is significant at the 0.05 level (2-tailed).
Source: Survey Data (2016)

From the figures in the table above, it is evident that review of project change requirements has a significant negative correlation of 0.626 with project delivery time having a *p*-value of 0.003.This finding is similar to the finding by Ade (2013) in which review of project change requirements had a significant negative correlation on project delivery time.

Table 29 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.626	.392	.381	.354

a. Predictors: (Constant), RPCR
b. Dependent Variable: Project Delivery Time
Source: Survey Data (2016)

The regression line assumes that the review of project change requirements is randomly distributed around the regression line in respect to project delivery time. The correlation coefficient is 0.626, and the R-square is 0.392 while adjusted R-square is 0.381. Thus, for this sample, the predictor variable, review of project change requirements, explains 39.2% of the variance in the dependent variable project delivery time in road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that review of project change requirements has a significant correlation on project delivery time review of project change requirements thus can be a powerful tool for road construction project managers when trying to shorten project delivery time.

Table 30 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.831	5	5.102	10.281	.001[b]
	Residual	26.934	82	.347		
	Total	55.765	87			

a. Dependent Variable: Project Delivery Time
b. Predictors: (Constant), RPCR
Source: Survey Data (2016)

The ANOVA table 4.30 shows that the computed F statistic (5, 82) = 10.281 and the p-value for the overall regression relationship was ($p = 0.001$), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of review of project change requirements on the project delivery time of road construction projects in Rwanda ($F=10.281$, $R^2 = 0.392$, Sig=0.001 at $\alpha=0.05$). This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 31 T-Test and Test of Coefficients[a]

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.542	3.465		-.834	.042
	RPCR	-.625	.056	-.602	3.562	.001
a. Dependent Variable: Project Delivery Time						

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical effect of review of project change requirements on the project delivery time in road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \varepsilon_1$$

which became:

$$\boldsymbol{P_t = 0.542 - 0.625X_1 + \varepsilon}$$

The results in the coefficient table 4.29 thus show that there was a significant statistical effect of review of project change requirements on the project delivery time in road construction projects in Rwanda since $p=0.001$ which is less than $p<0.05$ at a 95% confidence interval. There is also a negative unstandardized beta coefficient of 0.625 as indicated by the coefficient to the project change identification. The probability of the t-statistic (3.562) for the b coefficient is p=0.001 which is less than the level of significance of 0.05. This shows that there was a statistically significant statistical effect of review of project change requirements on the project delivery time of road construction projects in Rwanda. The regression model further demonstrates that a one unit change in the project delivery time is attributed to a decreaseof0.625inthereview of project change requirements in the road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011).

Table 32: Correlation betweenProject Change Evaluation and Performance of Construction Projects

		Project Evaluation	**ChangeDelivery Time**
Project Change Evaluation	Pearson Correlation	1	-0.751*
	Sig. (2-tailed)		0.000
	N	87	87
Delivery Time	Pearson Correlation	-0.751*	1
	Sig. (2-tailed)	0.000	
	N	87	87

*. Correlation is significant at the 0.05 level (2-tailed).
Source: Survey Data (2016)

From the figures in the table above, it is evident that project change evaluation has a significant negative correlation of 0.751 with project delivery time having a p-value of 0.751. This finding is similar to the finding by Ade (2013) in which project change evaluation had a significant negative correlation on project delivery time.

Table 33 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.751[a]	.564	.559	.458

a. Predictors: (Constant), PCE
b. Dependent Variable: Project Delivery Time
Source: Survey Data (2016)

The regression line assumes that the project change evaluation is randomly distributed around the regression line in respect to project delivery time. The correlation coefficient is 0.751, and the R-square is 0.564 while adjusted R-square is 0.559. Thus, for this sample, the predictor variable, project change evaluation, explains 56.4% of the variance in the dependent variable project delivery time of road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that project change evaluation has a negative correlation on project delivery time. Project change evaluation thus can be a powerful tool for road construction project managers when trying to shorten project delivery time and subsequent cost.

Table 34 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.039	5	5.201	14.896	.000[b]
	Residual	28.734	82	.247		
	Total	55.773	87			

a. Dependent Variable: Project Delivery Time
b. Predictors: (Constant), PCE
Source: Survey Data (2016)

The ANOVA table 4.34 shows that the computed F statistic (5, 82) = 14.896 and the p-value for the overall regression relationship was (p = 0.000), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project change evaluation on the project delivery time in road construction projects in Rwanda (F=14.896, R^2 = 0.564, Sig=0.000 at α=0.05) . This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 35 T-Test and Test of Coefficients[a]

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.704	3.465		-.360	.023
	PCE	-.751	.067	-.748	4.261	.000
a. Dependent Variable: Project Delivery Time						

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical effect of project change evaluation on the project delivery time in road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \varepsilon_1$$

which became:

$$\boldsymbol{P_t = 0.704 - 0.751X_1 + \varepsilon}$$

The results in the coefficient table 4.33 thus show that there was a significant statistical effect of project change evaluation on the project delivery time in road construction projects in Rwanda since $p=0.000$ which is less than $p<0.05$ at a 95% confidence interval. There is also a negative unstandardized beta coefficient of 0.751 as indicated by the coefficient to the project change identification. The probability of the t-statistic (4.261) for the b coefficient is $p<0.001$ which is less than the level of significance of 0.05. This shows that there was a statistically significant statistical effect of project change evaluation on the project delivery time of road construction projects in Rwanda. The regression model further demonstrates that a one unit change in the project delivery time is attributed to a decreaseof0.751intheproject change evaluation in the road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011).

Table 36: Correlation betweenProject Change Approval and Performance of Construction Projects

		Project Change Approval	**Delivery Time**
Project Change Approval	Pearson Correlation	1	-0.661*
	Sig. (2-tailed)		0.001
	N	87	87
Delivery Time	Pearson Correlation	-0.661*	1

	Sig. (2-tailed)	0.001	
	N	87	87

*. Correlation is significant at the 0.05 level (2-tailed).
Source: Survey Data (2016)

From the figures in the table above, it is evident that project change approval has a significant negative correlation of 0.661 with project delivery time having a *p*-value of 0.001.This finding is similar to the finding by Ade (2013) in which project change approval had a significant negative correlation on project delivery time and cost.

Table 37 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.661[a]	.437	.434	.073

a. Predictors: (Constant), Project Approval
b. Dependent Variable: Project Delivery Time
Source: Survey Data (2016)

The regression line assumes that the project change approval is randomly distributed around the regression line in respect to project delivery time. The correlation coefficient is 0.661, and the R-square is 0.437 while adjusted R-square is 0.434. Thus, for this sample, the predictor variable, project change approval, explains 43.7% of the variance in the dependent variable project delivery time of road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that project change evaluation has a negative correlation on project delivery time. Project change approval thus can be a powerful tool for road construction project managers when trying to shorten project delivery time.

Table 38 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.928	5	5.124	13.214	.000[b]
	Residual	27.845	82	.428		
	Total	55.773	87			

a. Dependent Variable: Project Delivery Time
b. Predictors: (Constant), Project Change Approval
Source: Survey Data (2016)

The ANOVA table 4.8 shows that the computed F statistic (5, 82) = 13.214 and the p-value for the overall regression relationship was ($p = 0.000$), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project change approval on the project delivery time of road construction projects in Rwanda ($F=13.214$, $R^2 = 0.437$, $Sig=0.000$ at $\alpha=0.05$) . This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 39 T-Test and Test of Coefficients[a]

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.344	3.124		-.350	.583
	IHC	-.661	.075	-.661	3.458	.000
a. Dependent Variable: Project Delivery Time						

Source: Survey Data (2016)

Regression analysis was conducted to investigate the statistical effect of project change identification on the project cost effectiveness of road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \varepsilon_1$$

which became:

$P_t = 0.344 - 0.661X_1 + \varepsilon$

The results in the coefficient table 4.9 thus show that there was a significant statistical effect of project change identification on the project cost of road construction projects in Rwanda since $p=0.000$ which is less than $p<0.05$ at a 95% confidence interval. There is also a negative unstandardized beta coefficient of 0.172 as indicated by the coefficient to the project change identification. The probability of the t-statistic (3.458) for the b coefficient is $p<0.001$ which is less than the level of significance of 0.05. This shows that there was a statistically significant statistical effect of project change approval on the project delivery time of road construction projects in Rwanda. The regression model further demonstrates that a one unit change in the project delivery time is attributed to a decrease of 0.661 in the project change approval in the road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011).

Table 40 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.771[a]	.595	.592	.513

a. Predictors: (Constant), PCI, RPCR, PCE, PCA
b. Dependent Variable: Project Delivery Time
Source: Survey Data (2016)

The regression line assumes that the project change management is randomly distributed around the regression line in respect to project delivery time. The correlation coefficient is 0.771, and the R-square is 0.595 while adjusted R-square is 0.592. Thus, for this sample, the predictor variable, project change management, explains 59.5% of the variance in the dependent variable project delivery time of road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that project change management has a negative correlation on project delivery time. Project change management thus can be a powerful tool for road construction project managers when trying to shorten project delivery time.

Table 41 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.929	5	5.386	11.671	.000[b]
	Residual	28.844	82	.352		
	Total	55.773	87			

a. Dependent Variable: Project Delivery Time
b. Predictors: (Constant), PCI, RPCR, PCE, PCA
Source: Survey Data (2016)

The ANOVA table 4.38 shows that the computed F statistic (5, 82) = 11.671 and the p-value for the overall regression relationship was (p = 0.000), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project change management on the project delivery time of road construction projects in Rwanda ($F=11.671$, $R^2 = 0.595$, Sig=0.000 at $\alpha=0.05$) . This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 42: Table for Tests of Coefficients withProject Delivery Time as Dependent Variable

Coefficientsc						
Model	**Unstandardized Coefficients**		**Standardized Coefficients**		**t**	**Sig.**
	Beta	**Std. Error**	**Beta**			
1 (Constant)	1.468	1.831			1.468	0.006
Change Identification	-0.552	0.008	0.531		1.727	0.003
Review of Change Requirements	-0.439	0.016	0.423		1.141	0.000
Change Evaluation	-0.527	0.041	-0.513		1.408	0.001
Change Approval	-0.464	0.023	-0.459		1.543	0.021
c. Dependent Variable: Project Delivery Time						

Source: Survey Data (2016

Regression analysis was conducted to investigate the statistical effect of project change management on the project delivery time of road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_6$$

which became:

$\mathbf{P_{dt} = 1.035 - 0.552X_1 - 0.439X_2 - 0.527X_3 - 0.464X_4 + \varepsilon}$

The results in the coefficient table 4.39 thus show that there was a significant statistical effect of project change management on the project delivery time of road construction projects in Rwanda since $p=0.006$ which is less than $p<0.05$ at a 95% confidence interval. The regression model further demonstrates that a one unit change in the project delivery time is attributed to a decrease of 0.550 in the project change identification, 0.439 in review of project change requirements, 0.527 in project change evaluation and 0.464 in project change approval respectively in the road construction projects in Rwanda. From the model, it can be observed that improving management of project change identification contributes more (β=.550), followed by improving management of project change evaluation (β=.0527), improving management of project change approval (β=.464) and lastly improving management of review of project change requirements (β=.439) respectively in reducing the project delivery time of road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011). The negative coefficients of the project change management practices indicate inverse correlation of the various project change management practices with project delivery time. This implies improving management of project change management practices results reduced/shortened project delivery time.

Table 43 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.695[a]	.483	.451	.593

a. Predictors: (Constant), PCI, RPCR, PCE, PCA
b. Dependent Variable: Project Cost Effectiveness
Source: Survey Data (2016)

The regression line assumes that the project change management is randomly distributed around the regression line in respect to project cost effectiveness. The correlation coefficient is 0.695, and the R-square is 0.483 while adjusted R-square is 0.451. Thus, for this sample, the predictor variable, project change management, explains 48.3% of the variance in the dependent variable project cost effectiveness in road construction projects in Rwanda. This finding seemed to conform to the finding by Ade (2013) in which he argued that project change evaluation has a negative correlation on project delivery time and cost. Project change management thus can be a powerful tool for road construction project managers when trying to shorten project cost effectiveness.

Table 44 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.929	5	5.386	15.311	.000[b]
	Residual	28.844	82	.352		
	Total	55.773	87			

a. Dependent Variable: Project Cost Effectiveness
b. Predictors: (Constant), PCI, RPCR, PCE, PCA
Source: Survey Data (2016)

The ANOVA table 4.44 shows that the computed F statistic (5, 82) = 15.311 and the p-value for the overall regression relationship was (p = 0.000), which was also less than the level of significance of 0.05. This indicates that there was a statistically significant effect of project change management on the project cost effectiveness in road construction projects in Rwanda (F=15.311, R^2 = 0.483, Sig=0.000 at α=0.05) . This finding was thus consistent with the findings of Ade (2013) and Ameh (2011).

Table 45: Table for Tests of Coefficients withCost Effectiveness as Dependent Variable

Coefficientsc						
Model	**Unstandardized**		**Standardized**		**t**	**Sig.**
	Coefficients		**Coefficients**			
	Beta	**Std. Error**	**Beta**			
1 (Constant)	2.468	3.731			1.468	0.002

Change Identification	0.496	0.288	0.491		1.327	0.004
Review of Change Requirements	0.449	0.073	0.443		1.213	0.000
Change Evaluation	0.515	0.034	-0.063		2.516	0.001
Change Approval	0.535	0.002	0.533		1.903	0.003
c. Dependent Variable: Project Cost Effectiveness						

Source: Survey Data (2016

Regression analysis was conducted to investigate the statistical effect of project change management on the project cost effectiveness of road construction projects in Rwanda. The identified model equation to understand this relationship was:

$$P_t = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_6$$

which became:

$$\mathbf{P_{ce} = 2.468 + 0.496X_1 + 0.449X_2 + 0.515X_3 - 0.535X_4 + \varepsilon}$$

The results in the coefficient table 4.39 thus show that there was a significant statistical effect of project change management on the project cost effectiveness of road construction projects in Rwanda since $p=0.002$ which is less than $p<0.05$ at a 95% confidence interval. The regression model further demonstrates that a one unit change in the project cost effectiveness is attributed to an increase of 0.496 in the project change identification, 0.449 in review of project requirements, 0.515 in project evaluation and 0.535 in project approval respectively in the road construction projects in Rwanda. From the model, it can be observed that improving management of project approval contributes more (β=.535), followed by improving management of project change evaluation (β=.0515), proper management of project change identification (β=.496) and lastly improving management of review of project change requirements (β=.449) respectively in increasing the project cost effectiveness in road construction projects in Rwanda. This position further supports the findings of Ade (2013) and Ameh (2011). The positive coefficients of the project change management practices indicate direct correlation of the various project change management practices with project cost effectiveness. This implies improving management of project change management practices directly improves the project cost effectiveness.

X. Conclusion and Recommendation

10.0 Summary of Findings

The study investigated the effect of project change management on the performance of road construction projects in Rwanda in terms of project cost effectiveness and project delivery time. The response rate of 97 % was considered very adequate for the study. Respondents of the study comprised Horizon Construction Company staff, consultants and sub-contractors. The outcome of the study shows that the industry is male dominated implying gender imbalance. The respondents had attained high education at the level of diploma and above with majority being diploma holders. More than half 45 (52%) of the respondents had diploma qualification, 33 (38%) respondents had undergraduate degree and 9 (10%) respondents had a post graduate degree qualification. The majority (47%) of the respondents had between 6-9 years experience compared to 21% who had between 3-5 years experience and 15% of the respondents were having 1-3 years experience while those with more than 10 years experience being 17%.

10.1 Conclusion

The construction industry is a major component, a key contributor and major player in the economic development of any given economy. It provides numerous employment opportunities to the skilled, semi skilled and unskilled segments of society's labour force, offers market for construction materials hence uplifting living standards to many people and provides the infrastructural platform for further economic development. Due to numerous advantages derived from the industry to the economy, it is critical and imperative to facilitate its effectiveness in performance in terms of cost effectiveness and delivery time. The study sought to establish the effect of project change management on the performance of road construction projects in Rwanda.

In effect the study concludes that improving management of project change identification, review of project change requirements, project change evaluation and project change approval increases project cost effectiveness. The contribution of each change management variable on this increase in cost effectives reduces in the order of management of project approval, followed by management of project change evaluation, management of project change identification and lastly management of review of project change requirements respectively. The study also concludes that improving management of project change identification, review of project change requirements, project change evaluation and project change approval reduces project delivery time. The contribution of each change management variable on this timely project delivery reduces in the order of managing project change identification, followed by management of project change evaluation, management of project change approval and lastly management of review of project change requirements respectively

10.1 Recommendations

The study suggests the need to apply all the project change management control mechanisms proactively. First and foremost, accurate and realistic preliminary estimates and designs should be prepared by professionals like the Quantity Surveyors, Cost Engineers, Material and Civil Engineers. This process should be undertaken even as the developments of road designs unfold. The information so arrived at should be communicated to the client and developer in order to confirm availability of funding. Alternatively, designs should be developed bearing in mind the allocated amount of funds for the specific projects a process known as designing to cost. This forestalls a situation of designing projects whose scope is beyond the funds available or allocated that may later require changes and subsequent change management.

The other issue is budgeting. Project budgets should be prepared and this should depict the approved financial plan of the operations, indicating the amounts required for achieving assigned targets and the expected value of the work. Variance Analysis and financial appraisals should form a critical component of the contract management and administration. Other cost control tool like Earned Value Analysis when applied in construction projects assists to determine the cost performance of a project

The study suggest that clients or developers, once they receive communication regarding cost estimates of the proposed project, should without delay confirm availability of adequate funds to undertake the project and in what arrangement the funds will be forthcoming. The client should facilitate adequate and sufficient funds to the project and ensure he deals with unexpected delay in payments to the contractors as work progresses on site. This enables contractors to organize their operations and activities as well as prepare the projects cash flow requirements.

The study suggests that Project scheduling should entail as realistic time period as is practicable for the duration required constructing the project. The project schedule should bear in mind the list of resources i.e. work force, materials, machines since they correspond to the project. Different program scheduling tools should be applied depending on the size, nature and complexity of the project. CPM scheduling tool should be applied where there is ability to identify the critical path or the longest path of work through the network which predicts the earliest date that the project can be completed. PERT would best be suited in highly uncertain individual activity durations estimate.

With regard to contractors selection process, the study suggests an effective Pre- qualification Method based on sufficient Multi Criteria Evaluation Model. The model entails consideration of many important contractors' attributes like competence and sufficiency of contractor in financial capacity, bid price/cost, technical capacity, managerial ability, past experience in terms of size and complexity of projects and current workload. This will ensures only quality contractors are invited to participate in the bidding process for the project to avoid the intricacies of project change management.

The study finally suggests that should there be inevitable changes, then they should be kept to the minimum possible number. This can be achieved through allocating sufficient and reasonable time period for development of road construction designs. The clients should be clear in their minds what they intend to develop and hence provide sufficient briefing details to the consultants (Architects, Material Engineers, Civil Engineers and Quantity Surveyors) who have been engaged to undertake the road construction designs. Approvals of the designs with the clients and other relevant stakeholders should be obtained before commencement of implementation of the project. However, if changes to road construction designs are inevitable, then the financial as well as time extension implications should be identified, reviewed, evaluated and approved accordingly as soon as is practicable.

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