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Title: Factors Contributing to Project schedule delay in Rwanda. Case of horizon construction ltd'.

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ABSTRACT

Delays in the construction industry are a universal phenomenon and the construction industry in Rwanda has no exception. This research discusses the factors contributing to project schedule delay in Rwanda, the case of Horizon Construction Ltd, through the identification of gaps between theory and practice associated with delays in the completion of construction projects. This research aimed at examining the role of contractor, contract, project owner, and consultant factors in contributing to project schedule delay in Rwanda. This research's objectives were achieved by viewing many of the research and references for previous studies, which included study delay factors in many countries, and through set up of questionnaires to some project parties to identify the causes of the project delay. The population was made of contractors, consultants, and contracting firms involved in the projects were obtained from Horizon Construction Ltd. They were selected by random sampling and convenience sampling techniques. The primary data was obtained using questionnaires while the secondary data was gathered from the literature and review of project documents like Project handover reports and Project closure reports. Quantitative data were analyzed using computer software Statistical Package for Social Sciences (SPSS) version 23.0 to enable mathematical computations. From the regression analysis, the most predator the research was contractor factor which indicated that its change contributed to the delay of the project at 81.6%, and the project owners' factors contributes 71.9% to delay the project. The consultants contribute at 67.2% and the contract also contributes at 56.2% to the delay of the project. The study recommends to the Project owner to have a thorough study on the adequate budget in line with the requirements and have a clear concept of what is needed on the project to avoid many changes along with the implementations which lead to change in scope and affects time and cost hence leading the project to delay. (Following the principle of triple constraints). Also recommends the project contractor to pay attention while contracting the projects through applying all project inputs, tools, techniques, and outputs (ITTOs) in all phases of the project (Initiation, Planning, Execution, Monitoring and Evaluation and close up). The study revealed that the delay contributed by a contractor was caused by inadequate planning, monitoring, and evaluation whereby the detected defects and errors along the project would have been identified before the kickoff of the project. And this leads to a stack of the schedule to first address the issue hence leading to the delay of the project.

Introduction

Project delays are considered as time lag in completion of activities from its specified time as per contract or can be defined as late completion or late start of activities to the baseline schedule, directly affecting specified cost (Pmalliance, 2018). Construction delay is a global phenomenon faced by many construction industries for this reason the magnitude of risk and unpredictability is very high in the building industries compared to other industries (Gardezi et al., 2018).

According to (Abedi *et al*., 2017), eight hundred and forty-five of Kick starter top projects in the USA missed their targeted delivery dates. Jonathan and Arditi (2018), studied 50 most funded projects around the USA and found that out of the studied projects; only 8 out of the 50 met their set deadlines. Successful execution of projects and keeping them on time and within budget depends on effective planning and scheduling right from the beginning.

Chan & Kumaraswamy (2018), studied projects delays in Hong Kong. They observed that for projects to be deemed as having been successfully delivered, they should be on time, within budget, and expected quality, otherwise lack of any of these is deemed a project delay. An investigation by Odeyinka &Yusif (2010) shows that seven out of ten projects surveyed suffered delays. There are many factors that contributed to the causes of delays in construction projects. These range from factors inherent in the technology and its management, to those resulting from the physical, social, and financial environment. Delays can give rise to disruption of work and loss of productivity, late completion of the project, increased time-related costs and third-party claims and abandonment, or termination of the contract. Delays are costly and often result in disputes and claims.

According to Rwanda Development Board (RDB), construction spending in 2015 was $546 million, growing at 10 percent, while real estate spending was $471 million, growing at 7 percent. The construction industry contributes more than seven percent to the national GDP. Private and public works were growing at 9.4 percent starting 2014 (Moses Gahigi, 2017). Rwanda's construction sector has been pegged as one of the four vibrant sectors that would propel the country to rebuild itself 22 years after the genocide and spur economic development targets by 2020. While the construction industry is one of the fastest-growing sub-sectors of the economy, accounting for almost 30% of the total turnover of the industrial sector, a big part of the population cannot afford to buy, build or even rent a decent house. Real gross domestic product (GDP) growth averages 8.2% annually, which translates into a GDP per capita growth of 5.1% per year. At the heart of this growth was the industrial sector, which grew at an average of 9.8% per year during the First Economic Development and Poverty Reduction Strategy (EDPRS 1), driven by the rapid expansion of construction whose growth rate averaged 15% annually. In the same period, the industrial sector produced 15.4% of national output, (Daniel Sabiiti, 2017).

1.2. Statement of the problem

Delays to complete projects under construction on schedule had become habitual and persistent in the industry which made many construction firms in Rwanda inefficient. Not only did it pose a bad reputation of the construction companies, in most cases it imposed very high financial costs and heavy losses. Delays further affected all the stakeholders in the construction project leading to various losses ranging from financial, credibility, and poor performance arising from not achieving their financial performance targets. Because of the unexpected delay to complete construction projects on time, it compelled one to incur costs which would have been otherwise avoided (Pmalliance, 2018).

Emmanuel (2017) marked that, Permanent secretary Isabelle Kalihangabo was speaking at a workshop between the ministry and legal officers from about 150 public institutions, the meeting was convened to discuss the e-Procurement System in public institutions.

The Auditor-General's report for 2015/16. "Delayed and abandoned projects always come with a cost as it involves continuing to pay the entrepreneur and incurring extra payments caused by the rise in prices," Kalihangabo said. Between 2013/14 and 2015/16 financial years, 98 contracts, worth Rwf 95.67 billion, were either abandoned or significantly delayed, according to the AG's report. Some 24 of those contracts, worth Rwf13.39 billion, were abandoned and contractors disappeared after receiving payments of Rwf5.62 billion. The abandoned contracts were in the areas of infrastructure, including water, energy and roads, health, and agriculture. According to the 2012/2013 Rwanda national budget, 46% of construction projects were donor-funded, and worse again where the effort to increase taxpayers' contribution to the budget has resulted in reducing the aid from 85% in 2000. Absent or inadequate risk assessment and management are, in themselves, an important source of risk for projects. Because, until now, no reliable measure has been available for estimating risk in urban construction projects, effective risk assessment, and management have been impossible, (Auditor general report, 2016). Kalihangabo said delayed work contracts have been rising from nine in 2014 to 16 in 2015 and soared to 73 in 2016, which she said is a problem as there are wasted funds, (Emmanuel Ntirenganya, 2017).

Specific objectives of the study

The specific objectives of this study are:

1. To examine the Contribution of contractor factors on the project schedule delay of Horizon construction Ltd;
2. To examine the Contribution of consultant factors on the project schedule delay of Horizon Company Ltd;
3. To examine the Contribution of project owner factors on the project schedule delay of Horizon Company Ltd;
4. To examine the Contribution of contract factors on the project schedule delay of Horizon Company Ltd.

1.5. Research hypothesis

The research tested the following hypothesis:

$H_0$1: Contractors factors has no significant effect on Projects delay in construction

$H_0$2: Consultant factors has no a significant effect on Projects delay in construction

$H_0$3: Project owner factors has no significant effect on Projects delay in construction

$H_0$4: Contract factors has no significant effect on Projects delay in construction

Literature review

Conceptual literature

Conceptual literature are general or abstract ideas that express the factors contributing to project schedule delay phenomena to be studied. They are the subjects of inquiry and analysis that are of interest to users.

Factors Contributing to the Construction Project Schedule Delay

Health and safety authority (2020) said that, construction work is a high-risk activity, it must be managed from procurement, through the design process to the end of the construction stage (completion phase). Everyone involved in a construction project, each parties are important and must appreciate their role, from client, project supervisor, designer, contractor and employees. Takem, Akintoye (2002) and Majid (2016) have revealed that, a construction project as a successful one when some characteristics are contained within it such as: good management, completed on time, within budget, conform to the specifications required, satisfy all parties, and achieve the profitability for the contractor with absence of financial claims and litigation.

The process of construction can be divided into three distinct and significant phases; the project conception phase, project design phase and the project construction phase. As stated by Chan & Kumaraswamy in 2017 a vast majority of project delay occur during the construction phase where many unforeseen circumstances and factors occur. Completing a construction projects within the estimated time and cost is an indicator of efficiency, but the process of construction is subjected to many unpredictable and changing factors which comes from different sources. These sources include performance of parties, resource availability, environmental conditions, and involvement

of other parties and contractual relations, thus the completion of the project within the estimated time is rare (Asaf, 2016).

Contractors' related factors.

Enshassi *et al*., (2019: 126-151), stated that cash flow issues at the time of construction and poor site administration were the first and second positioning in this group. This shows that the cash flow issue is more discriminating than different variables in the group of contractor obligations.

In Rwanda, between 2013/14 and 2015/16 financial years, 98 contracts, worth Rwf 95.67 billion, were either abandoned or significantly delayed, according to the OAG's report. Some 24 of those contracts, worth Rwf13.39 billion, were abandoned and contractors disappeared after receiving payments of Rwf5.62 billion. The abandoned contracts were in the areas of infrastructure, including water, energy and roads, health, and agriculture. Kalihangabo said delayed work contracts have been rising from nine in 2014 to 16 in 2015 and soared to 73 in 2016, which she said is a problem as there are wasted funds, (Auditor General Report, 2016).

2.3.1.2. Consultants' related factors.

Enshassi *et al*., (2019), this is by all accounts sensible as the advisors are not eager to concede or assume the liability for undertakings delay. Then again, contractors and clients have comparable perspective with respect to consultant's obligations regarding the delay. This can be followed to the way that most projects are managed by consultants. Ahmed et al. (2013); Gardezi et al. (2014); listed some of the possible factors of consultant delays which includes lack of consultant site engineer, lack of adequate knowledge on the part of the consultant, inexperience on the part of the consultant site staff, delayed in making decisions, insufficient documents.

2.3.1.3. Owner Related Factors

There are several reasons for cost overruns and schedule delays caused by the client. The lack of budget planning by clients results in cost overruns and schedule delays in construction projects (Amoatey *et al*., 2015; Choudhry, Aslam, Hinze, & Arain, 2014; Harding, 2012). A late payment to contractors is another factor contributing to schedule

delays because the subsequent effect is the contractor inability to pay subcontractors and suppliers on time (Alinaitwe *et al*., 2013; Amoatey *et al*., 2015; Shehu *et al*., 2014). Most of the financial difficulties that contractors face in the construction business in Qatar are the result of a late payment made by the client because of the lengthy process while releasing the claimed fund (Jarkas & Younes, 2014).

RESEARCH METHODOLOGY

3.2. Research design

Researcher adopted a descriptive research design, the researcher conducted descriptive research for the purpose of using specific methods like observational method, case study method, and survey method. Since the data collected is qualitative and quantitative, it gives a holistic understanding of a research topic.

3.3. Population of the research

The study population was stakeholders in the construction industry in Rwanda. The study was carried out in Kigali due to time and financial constraints as well as easy availability of respondents. The respondents include the project owners, consulting firms and the contracting firms. The population of construction projects and contracting firms involved in the projects was obtained from Horizon Construction Ltd totaling 113 from (2017-April 2021).

3.4. Sampling design

This section of the research presents the population of research, sample size determination and sampling technique. The sample size was calculated the Slovin's formula:

$\boldsymbol{n = \frac{N}{1+N(e)^2}}$ Whereby, n: is the sample size, N: is the total population, e: is the margin of error,

Remember that for this case N= 113 members, taking the confidence level of 95% that is with a permissible error of 5%, e=0.05. Therefore,$\boldsymbol{n = \frac{N}{1+N(e)^2}}$, $\boldsymbol{n = \frac{113}{1+113(0.05)^2}}$ = $\boldsymbol{\frac{113}{1+113(0.0025)} = \frac{113}{1+0.2528} = \frac{113}{1.2528} =}$ **88** respondents.

Data collection methods

The primary data used questionnaire and document reviews (Project closure report and project handover reports and project worksheet gattchart)

Reliability

The Researcher achieved reliability by employing the test-retest reliability as a type of answers the question, to determine whether the scores would be stable over time." Sometime later, the same test was re-administered to the same or highly similar group. The test was subject in three weeks later with a reliability coefficient of r = 0.70, giving evidence of consistency. This was developed by Lee Cronbach in 1951 for the uniformity of a test or scale, and normally expressed as a number between 0 and 1.

The following equation applies. Equation (Cronbach, 1951)

$$\infty = \frac{N.C}{V + (N-1).C}$$

Where *N* is equal to the number of items, *C* is the average inter-item covariance among the items and *V* equals the average variance.

Validity

Evaluating the validity of a qualitative study by us of Content Valid Index (CVI) Content validity was also sought, is a scale developed by computing or ranking the relevant items in the instrument or questionnaire by checking their clarity, their meaningfulness in line with all objectives stated dividing by the total number of items (Neville, 2007). Content Validity is the degree to which an instrument has an appropriate sample of items for the construct being measured and is an important procedure in scale development. CVI is the most widely used index in the quantitative evaluation. According to Amin (2005), the CVI of above 0.6 is an appropriate validity.

The validity was tested using Content Validity Index (CVI).

$\text{CVI} = \frac{33}{37} = 0.89$

The content validity index of the questionnaire was 0.89 which is greater than 0.60 thus**,** the questionnaire was valid to provide information needed by the researcher.

3.8. Data analysis

The Quantitative data was analyzed using computer software Statistical Package for Social Sciences (SPSS) version 23.0 to enable mathematical computations since analysis of data manually would be tedious and would lead to errors. The analyzed data was presented using frequencies, percentages, correlation and mean. In reporting the study findings, the highest percentage and mean was considered.

Regression Analysis

The model used in the study took the form below:

$Y= \alpha+\beta 1X1+ \beta 2X2+ \beta 3X3 +ę$

Where: Y= Project schedule delay.

α= Constant Term

β= Beta Coefficient –This measures how many standard deviations a dependent variable will change, per standard deviation increase in the independent variable.

DATA PRESENTATION, INTERPRENTATION AND DISCUSSION

Table: Gender of respondents

Gender	Frequency	Percent
Males	56	63.6
Females	32	36.4
Total	88	100.0

Source: Primary data, April 2021

Correlation analysis

Table 4.10: Summary of Correlation

		Contractor factors	Consultant factors	Project owner factors	Contract factors
Project delay	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	88			
Contractor factors	Pearson Correlation	.663**	1		
	Sig. (2-tailed)	.000			
	N	88	88		
Consultant factors	Pearson Correlation	.358**	.207*	1	
	Sig. (2-tailed)	.000	.000		
	N	88	88	88	
Project owner factors	Pearson Correlation	0.562**	- 0.056	.393**	1
	Sig. (2-tailed)	.000	.000	.000	
Contract factors	Pearson Correlation	0.342**	0.41	0.562	1
	Sig. (2-tailed)	.000	.000	.000	

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

Key 1- Projects delay

2- Contractor factors 3- Consultant factors 4- Project owner factors, 5- Contract factors.

Results in Table 4.10 revealed that there was a positive and significant relationship between Contractor factors and projects delay (rho=0.663, p value<0.05). This implies that a unit change in the contractor factors in construction projects increases projects delay by 66.3%. Secondly, there was a positive significant relationship between consultant factors and projects delay (rho =0.358, p value <0.05). This implies that a unit change in consultant factors in construction projects increases projects delay by 35.8%.

Thirdly, there was a positive and significant relationship between project owner factors and projects delay (rho =0.562, p value <0.05). This implies that a unit change in project owner factors in construction projects increases projects delay by 56.2%.

Lastly, there was a positive and significant relationship between contract factors and projects delay (rho =0.342, p value <0.05). This implies that a unit increases in contract factors in construction projects increases projects delay by 34.2%.

Regression analysis

In regression the researcher analyzed the model summary, variances and coefficients of variables.

Table: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.853[a]	.7276	.623	.16282	.1653	102.031	3	65	.000

a. Predictors: (Constant), contractors factors, Consultant factors, Project owner factors, contract factors)

The table 4.11 deals with combination of predictors of contractor's factors, Consultant factors, Project owner factors and contract factors to assess the effect of variation in predictors, multiple regressions were performed. Table 4.11 indicates that 73.4% of the variation in Projects delay is explained by the variation in the independent variables active in the interaction. (Or 73.4% of the changes in Projects delay could be attributed to the

combined effect of the predictor variables or 82.4% of the variance in Projects delay is explained uniquely or jointly by the predictor variables).

Table: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.992	4	.248	55.11	.015[a]
	Residual	.369	82	.0045		
	Total	1.360	87			

a. Dependent Variable: Projects delay

b. Predictors: (Constant), contractor's factors, Consultant factors, Project owner factors and contract factors.

The table: established regression model foretell that the dependent variable is strongly significant and brings various changes to the independent variable. In that way, the regression value as indicated in the table above shows that the statistical significance was tested and brought the results of the regression to be approximately at 0.015[a]. As a simple interpretation, this coefficient indicates that there is a positive and very high relationship to exit between contractor factors and project schedule delay. Therefore, the regression model remains statistically significant and helped us to predict the behavior for each variable against another.

Table: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	.562	.863		.292	.774	.262	.601
	Contractors factors	.816	.255	.212	3.200	.046	.185	.322
	Consultant factors	.672	.482	.237	1.394	.047	.056	.443
	Project owner factors	.719	.288	.461	2.496	.012	.023	.076
	Contract factors	.572	.322	.452	2.708	0.04	.068	.210

a. Dependent Variable: Projects delay

From the data in table 4.13, the established regression equation was:

$$Y = 0.562 + 0.816X_1 + 0.672X_2 + 0.719X_3 + 0.572X_4$$

Table 4.13, revealed that holding contractors' factors, Consultant factors, Project owner factors, contract factors to a constant zero, Projects delay would be 0.562. Indeed, this constant called y-intercept is not realistic but it is a needed parameter in the model.

Also, a unit change in contractors factors, would lead to increase in projects delay by a factor of 0.816 which is the most predator of the research, a unit change in consultant factors, lead to increase in projects delay by a factor of 0.672 and a unit change in project owner factors would lead to increase in projects delay by a factor of 0.719 and a unit change in contract factors, lead to increase in projects delay by a factor of 0.572.The study also found that all the p-values were less than 0.05, this indicates that all the variables were statistically significant in influencing the projects delay.

From the table 4.13, it clear that the most predator is contactor factors which is 0.816. This indicate how contactor skills in analyzing the project before kickoff contribute the completion of project on time. Contrary; if the contractor is unable to make a deep analysis of project, it will contribute to the delay of that project due to different problems raised during the execution of project.

Summary of Hypotheses Testing Results

The results presented in Table below 4.12 showed the summary of linear regression model. Thus, the table shows (R^2), the main effects as well as the choice on the formulated hypothesis.

Table 4. 14: Summary of Hypotheses Testing Results

Hypothesis Formulated	Beta (β)	ρ – values	Choice	R^2
$H_0$1: Contractors factors has no significant effect on Projects delay of construction projects	.212	.046	Rejected	.734
$H_0$2: Consultant factors has no a significant effect on Projects delay of construction projects	.237	.047	Rejected	
$H_0$3: Project owner factors has no significant effect on Projects delay of construction projects	.461	.012	Rejected	
$H_0$4: Contract factors has no significant effect on of construction projects	.452	0.045	Rejected	

Source: (Researcher, 2021)

The table 4.14 the summary of hypothesizes test results, the first hypothesis said that contractors factors has no significant effect on projects delay of public institution in Rwanda, second hypothesis said that Consultant factors has no a significant effect on Projects delay of construction projects, the third hypothesis said that Project owner factors has no significant effect on Projects delay of construction projects and fourth said that Contract factors has no significant effect on of construction projects; therefore since the t-values were greater than 0.05 the researcher rejected all hypothesis of the research as it has been revealed that contractor factors, consultant factors, project owners factors and contract factors contribute to the delay of construction projects.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary on objective one of the study: Contribution of contractor factors on the project schedule delay of Horizon Company Ltd.

Results revealed that there was a positive and significant relationship between Contractor factors and projects delay (rho=0.663, p value<0.05). This implies that a unit change in the contractor factors in construction projects increases projects delay by 66.3%.

Summary on objective two of the study: Summary of Contribution of consultant factors on the project schedule delay of Horizon Company Ltd.

Secondly, there was a positive significant relationship between consultant factors and projects delay (rho =0.358, p value <0.05). This implies that a unit change in consultant factors in construction projects increases projects delay by 35.8%.

Summary on objectives three of the study: Summary of Contribution of project owner factors on the project schedule delay of Horizon Company Ltd.

Thirdly, there was a positive and significant relationship between project owner factors and projects delay (rho =0.562, p value <0.05). This implies that a unit change in project owner factors in construction projects increases projects delay by 56.2%.

Summary on objective four of the study: Summary of the Contribution of contract factors on the project schedule delay of Horizon Company Ltd.

Lastly, there was a positive and significant relationship between contract factors and projects delay (rho =0.342, p value <0.05). This implies that a unit increases in contract factors in construction projects increases projects delay by 34.2%.

Conclusion

From the regression analysis, the most predator the research was contractor factors which indicated that changes in contractor factors contribute to the delay of project at 81.6%, it is followed by project owners' factors which indicated that changes in project owners' factors delay the project at 71.9%. Other factors like consultants contribute at 67.2% and the contract also contributes at 56.2%. According to the analyzed results, the Project owner factor contributes higher to project schedule delay seconded by the Project contractor factor.

The study recommends to the Project owner to have a thorough study on the adequate budget in line with the requirements and have a clear concept of what is needed on the project to avoid many changes along with the implementations which lead to change in time and affects the cost hence leading the project to delay. (Following the principle of triple constraints scope, cost, and time).

The study revealed that delay contributed by a contractor was caused by inadequate planning, monitoring, and evaluation whereby the detected defects and errors along the project would have been identified before the kickoff of the project. And this leads to a stack of the schedule to first address the issue hence leading to the delay of the project. From the results of the research the researcher concludes that there are different factors that contribute to the delay of construction projects which are contractor factors, consultant factor, project owner factors and contract factors.

Recommendations

As a researcher, I recognize the evolution in ideas based on technology industry and some scientists' discoveries still going on in improving construction facilities around the world. The study considered only basic factors that hinder construction and feasibility in running projects schedule. With this in mind, we regret not having worked on every possible factor

that might come in line with construction activities in Rwanda and we encourage future studies to work on different factors rather than this study was able to.

a. The study revealed that project owners contribute to project schedule due to a lot of changes in the scope of project works and delays to pay contractors. Going forward I recommend project owners and contractors to set clear project work plans especially with scope, schedule, and cost.

b. Setup a strong and independent Change Control Board (CCB) that helps review and restrict changes from project owners. This will help regulate changes.

c. Engage project owners in all project phases, initiation, planning, implementation, monitoring and control and closure, this total involvement will help to attain continuous feedback hence reducing schedule delays in project.

d. The research recommends the contractors of the projects to always ensure validate scope before project implementation starts while ensuring proper monitoring and evaluation to reduce late defects detections which always results in lagging in project schedule.

e. Manage project schedule using crashing activities and schedule compression to enable catching up with planned projected schedule hence minimizing project schedule delays.

f. Ensure proper schedule management including but not limited to proper define activities, sequence activities and create work break down structure.

g. Involvement of subject matter experts that will guide the contractors on how well to manage project schedules.

h. Researcher recommends to the project contractor to pay attention while contacting the projects through applying all project inputs, tools, techniques, and outputs (ITTOs) in all phases of the project (Initiation, Planning, Execution, Monitoring and Evaluation and close).

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