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Effect of Project Design Practices on Sustainability of Information Communication Technologies Infrastructure Projects in Rwanda: A Case of Regional Communication Infrastructure Project

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Abstract: ***The study entitled Effect of project design practices on sustainability of ICT infrastructure projects in Rwanda analyzed the project design practices in Rwanda and established their relative effect on the sustainability of ICT infrastructure projects in Rwanda. The fact that infrastructure projects are continually confronting challenges to remain sustainable, ICT infrastructure project managers are compelled to regularly re-evaluate the effect of their project designs on project sustainability. The study was guided by the following specific objectives: to determine the effect of project identification practices on the sustainability of ICT infrastructure projects in Rwanda, to assess the role of project formulation practices on the sustainability of ICT infrastructure projects in Rwanda, to analyze the contribution of project implementation planning practices on the sustainability of ICT infrastructure projects in Rwanda and to evaluate the effect of project monitoring & evaluation planning practices on the sustainability of ICT infrastructure projects in Rwanda. The study employed a cross-sectional descriptive survey design. A census was used since all 43 people in the population were part of the research. Data were collected using structured questionnaires and document reviews. Multiple regression analysis and content analysis were used to establish the effect of project design practices on sustainability of ICT infrastructure projects in Rwanda. The findings provided a practical and useful tool for the ICT infrastructure industry, Regional Communication Infrastructure Project and the Government of Rwanda for policy formulation, design management and regulation and for the academicians to do more researches.***

Keywords: Project Design Practices, Sustainability, ICT Infrastructure Projects

1. Introduction

A truly sustainable infrastructure project needs to include not only social considerations for the final users but also considerations such as the project's impact on the surrounding community and the safety, health, and education of the workforce. Project design practices involve project identification, project formulation, project implementation planning as well as project monitoring & evaluation planning (PMI, 2008). Project Identification involves earmarking the project to be undertaken based on the needs to be fulfilled (PMI, 2008). The potential for identification of correct project design would take a leading edge approach to integrate project sustainability into significant ICT infrastructure projects. Project Formulation involves is a concise, exact statement of a project to set the boundaries or limits of work to be performed by the project. It is a formal document that gives a distinctive identity of the project and precise meaning of project work to prevent conflict, confusion, or overlap. Designing a project requires an upfront investment. Nevertheless, the less people are willing to invest in designing their project, the higher the risk of compromising its quality when the time for implementation comes.

2. Statement of the Problem

The increasing business needs has put a lot of pressure on the Rwandan government to quickly improve its infrastructure within short lead times (RDB, 2015). In 2000, the government of Rwanda established Vision 2020 as an economic blueprint to achieve a knowledge-based economy and become a middle-income country by 2020. Along with Vision 2020, the first of the Economic Development and Poverty Reduction Strategy 2007 - 2012 (EDPRS I) and later EDPRS II 2013 -2018, further acknowledged ICT as a key driver for this economic growth. The national information and communication technology plans, NICI Plans I~III 2000 – 2015 were initiated to guide the ICT4D programs and initiatives linked to the objectives and goals outlined in Vision 2020 and EDPRS I & II. Though the government strategy was clear, the ICT services costs were still expensive with low quality, limited infrastructure, small ICT private sector, limited technical expertise and lack of competition. Tele-density remained low; computer access was still very low and the few Internet subscribers were concentrated in the urban areas. Infrastructure firms in Rwanda are struggling to get competitive, innovative & cost effective ways of achieving short lead time faced with frequent changes in design, climate and relocation of utilities but to minimal success (RDB, 2015). This has compelled infrastructure project managers to regularly re-evaluate their design and structures to realign with sustainable project outcomes (PMI, 2008).

Project design provides the structure of what has to be achieved, how it is to be implemented and how progress will be verified. Therefore the project design is the most crucial phase. Its quality will influence the following stages in the project cycle and in effect its sustainability. Too often, little time is devoted to this phase due to scarcity of resources. Designing a project requires an upfront investment. Nevertheless, the less people are

willing to invest in designing their project, the higher the risk of compromising its quality when the time for implementation comes. In the case of resources, it is best to allocate a considerable amount to this stage, which can facilitate and improve the quality of analysis and identification of real needs. If financial resources are not available, time is still an important factor, one that can, for instance, contribute to cohesion among stakeholders and familiarity with the context and its main problems and challenges. This study thus seeks to bridge this gap by establishing the effect of project design practices on the sustainability of ICT projects in Rwanda, with a specific attention on Regional Communication Infrastructure Project.

3. Objectives of the Study

The general objective of this study is to establish the effect of project design practices on the sustainability of ICT projects in Rwanda. This research was guided by four specific objectives that are:

1. To determine the effect of project identification on the sustainability of ICT infrastructure projects in Rwanda
2. To assess the role of project formulation on the sustainability of ICT infrastructure projects in Rwanda
3. To analyze the contribution of project implementation planning on the sustainability of ICT infrastructure projects in Rwanda
4. To evaluate the effect of project monitoring & evaluation planning on the sustainability of ICT infrastructure projects in Rwanda

Conceptual framework of the study

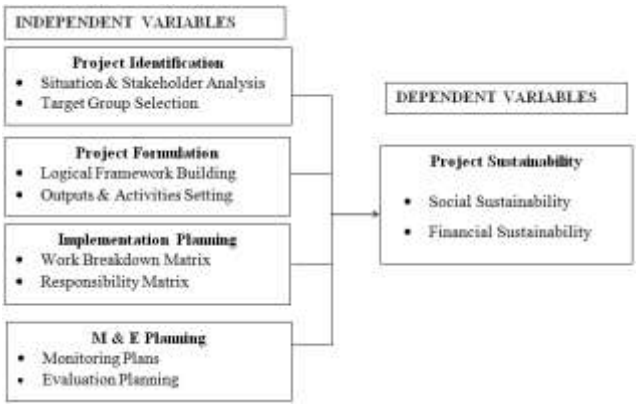

Figure 1: Conceptual Framework

4. Research Methodology

The study used a cross-sectional survey design, the study comprised of a target population of 43 employees in the higher learning institutions that benefited from the project and the employees of the project who have been involved in project design. The size of the population being not such big, the researcher preferred to use a census; meaning that all individuals in the population were considered as sample. The study adopted two methods of data collection since the questionnaires are relatively quick in gathering responses in a standardized way. Both methods are more objective compared to other tools of data collection. Primary data were collected using the questionnaires while secondary data were collected from the annual reports and other reports from Regional Communications Infrastructure Project. 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 show the responses of each category of variables and analyzed through descriptive and inferential statistics.

5. Research Findings

Table 1: Pearson's correlation coefficients and significance level

		Project_identification	Project_formulation	Project_implementation_planning	Project_M_E_planning	Project_sustainability
Project_identification	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	43				
Project_formulation	Pearson Correlation	.253	1			
	Sig. (2-tailed)	.102				
	N	43	43			
Project_implementation_planning	Pearson Correlation	.059	.220	1		
	Sig. (2-tailed)	.708	.156			
	N					
Project_sustainability	Pearson Correlation	.491**	.423**	.466**	.405**	1
	Sig. (2-tailed)	.001	.005	.002	.007	
	N	43	43	43	43	43
**. Correlation is significant at the 0.01 level (2-tailed).						

The table above revealed that the correlation between project sustainability and project identification is significant. The Pearson's correlation coefficient between them is 0.491, hence the existence of moderate positive correlation between them. A significant positive moderate correlation at 0.01 levels has been noticed between project sustainability and project formulation; its value is .0.423.

The existence of a positive moderate relationship at 0.01 level of significant has also been noticed between project sustainability and project implementation planning with a value of 0.466. Lastly at 0.01 level of significant, a moderate positive relationship between project sustainability and project monitoring and evaluation planning is noticed with a Pearson correlation coefficient of 0.405. In order to know if there is a causal link between the variables, the regression analysis is necessary.

Table 2: Regression model summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.755[a]	.570	.524	.32696

a. Predictors: (Constant), Project_M_E_planning, Project_identification, Project_formulation, Project_implementation_planning

b. Dependent Variable: Project_sustainability

The above Table 2 shows that R^2 equal to 0.570; this means that the independent variables are responsible of 57 % of variations in dependent variable. This means that the project identification, the project formulation, the project implementation planning and the project Monitoring and Evaluation planning all together contribute 57% to the project sustainability. The remaining 43% are due to other factors that may be subjected to further research. Now the question is how much each independent variable contributes to prediction of dependent variable? This is revealed in the following Table 3.

Table 3 : Regression coefficients and their significance

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.649	.584		1.111	.274
	Project_identification	.276	.074	.412	3.748	.001
	Project_formulation	.180	.086	.235	2.085	.044
	Project_implementation_planning	.229	.084	.308	2.724	.010
a. **Dependent Variable**: Project_sustainability						

The 3 shows how much every independent variable contributes to the prediction of the dependent variable. This table gives the coefficients (β1, β 2, β 3, β 4) that correspond respectively to the independent variables (project identification, project formulation, project implementation planning and project monitoring and evaluation planning). Using them the model is constructed as follow:

PS= C+ β1PI+ β2PF+ β3PIp + β4PMp, hence PS= 0.649+0.276PI+0.180PF+0.229Pip+0.258PMp+0.32696

C= constant, PS=Project sustainability, PI= Project identification, PF=Project formulation, PIp=Project implementation planning, PMp= Project Monitoring and Evaluation Planning. From equation (1) we notice that all estimates (β i) are positive. So we expect any change in Xi (independent variables) to affect positively changes in Y (dependent variable). For instance an increase of one unity in project identification will increase the sustainability of a project by 0.276 units, keeping all other variables constant. In the table 3 above, one can notice that p-values for all of four independent variables are less than 0.05, which means that there are less than 50 chances in 1000 that each parameter could be zero, which implies that the term of the regression equation containing each parameter cannot be eliminated without significantly affecting the accuracy of the prediction.

6. Discussions

7.1 Project identification and Project sustainability

At 0.01 significant levels, the correlation between Project identification and Project sustainability is moderate and positive with Pearson correlation coefficient of 0.491 (Table1). In other words there is a moderate positive relationship between project identification and project sustainability. In order to appreciate the effect of Project identification on Project sustainability, the regression analysis (Table3) has been carried out. The regression coefficient for the parameter project identification is 0.276. This value means that if the variable project identification increases by one unity, it will cause the project sustainability to increase by 0.276. The p-value for Project identification is 0.001 (Table 3) which means that there is only 1 chance in 1000 that the variable Project identification could be zero, which implies that the term of the regression equation containing the variable Project identification cannot be eliminated without significantly affecting the accuracy of the regression. This is in line with the findings of Abdulla, Rahman and Azis (2010) who studied the causes of delay in ICT infrastructure projects in Malaysia, where the results showed that the major causes of delay were project site identification and design changes.

7.2 Project formulation and Project sustainability

The correlation analysis (Table1) shows that there is a moderate positive relationship (r=0.423) between project formulation and Project sustainability. The regression analysis (Table3) helps to appreciate the causality relationship between the two variables. The variable Project formulation has a regression coefficient of 0.180 which implies that if the variable project formulation is increased by one, the contract performance is increased by 0.180. The Table 3 shows also that p-value of the parameter project identification is 0.44 which means that project formulation is one of important factors to take into consideration if one want a project to be sustainable. This P-value means that there are only 44 chances out of 1000 that the parameter project formulation could be eliminated without affecting the accuracy of the prediction, which show that it is a very important factor for project sustainability. These results are confirmed by Khang and Moe (2008) who found that competency of project team, planning alignment with development priorities and adequate resource support are among critical success factors for the project sustainability in Thailand.

7.3 Project implementation planning and Project sustainability

The correlation between Project implementation planning and Project sustainability is moderate and positive with a Pearson correlation coefficient of 0.466 (Table1). This means that there is a moderate positive relationship between project identification and project sustainability. Regression analysis (Table.3) helped to appreciate In order to appreciate the effect of Project implementation planning on Project sustainability. The regression coefficient for the parameter project implementation planning is 0.299. This value means that if the variable project implementation planning increases by one unity, it will cause the project sustainability to increase by 0.299. The p-value for Project identification is 0.010 (Table3) which means that there are only 10 chances in 1000 that the variable Project implementation planning could be zero, which implies that the term of the regression equation containing the variable Project implementation planning cannot be eliminated

without significantly affecting the accuracy of the prediction. And practically for a project to be sustainable it is indispensible to plan ahead its implementation. This is collaborated by Frese and Sauter (2003) who conclude that generally, good planning, clear responsibility and schedule control as well as project leadership and governance, are key areas of sustainable projects in Ghana which means that, a clear project plan and a plan for risk management, are the critical success factors for project sustainability.

7.4 Project Monitoring and Evaluation planning and Project sustainability

In order to know if there is a relationship between project Monitoring and Evaluation Planning and Project sustainability, the Pearson correlation coefficient has been computerized. As shown in the Pearson correlation coefficient between those variables is 0.405 which means that there is a moderate positive relationship between them. This is confirmed by Frese and Sauter (2003) who conclude that during project design, a clear plan for monitoring and evaluation schedule is the critical success factor for project success and sustainability. The Table of the regression coefficients shows that the regression coefficient for the parameter Monitoring and evaluation planning is 0.258. This means that if the parameter monitoring and Evaluation planning is enhanced by one unity, the project sustainability will be enhanced by 0.258 unity, other parameters remaining constant.

7.5 Model Summary

The table 2 summarizes the model as a whole and helps to know if it is a good fit or not by appreciating the coefficient of determination (R2). The Table2 shows that R^2 equal to 0.570; this means that the independent variables are responsible of 57 % of variations in dependent variable. This means that the project identification, the project formulation and the project implementation all together contribute 57% to the project sustainability. The remaining 43% are due to other factors that may be subjected to further research because this study is concerned only by project design.

7. Conclusions and Recommendations

8.1 Conclusions

This study has been guided by the following research questions: (a) what is the effect of project identification on the sustainability of ICT infrastructure projects in Rwanda? (b) What is the role of project formulation on the sustainability of ICT infrastructure projects in Rwanda? And (c) What is the contribution of project implementation planning on the sustainability of ICT infrastructure projects in Rwanda. Based on the findings, all of those four parameters in research question have effect on project sustainability. This is illustrated by the fact that all of them registered a moderate positive correlation with the project sustainability. Regarding the effect of Project identification on the sustainability of ICT infrastructure projects in Rwanda, the increase of 1 unity in project identification, cause the project sustainability to increase by 0.276 unities other parameters remaining constant, whereas the role of project formulation is illustrated by the fact that the increase of 1% in project formulation causes an increase of 0.180% in project sustainability. Regarding the contribution of project implementation planning on the sustainability of ICT infrastructure projects in Rwanda, research found that the increase of project implementation by one unity causes the project sustainability to increase by 0.229. Other factors remaining constant. Regarding prediction of project sustainability, the three project design parameters under this study may predict 57% of the outcome. The remaining 43 % are caused by other parameters beyond this research.

8.2 Recommendations

Based upon the findings of the study, the following recommendations are made: The government project managers and their institutions should put into action the project design practices namely: project identification, project formulation, project implementation planning and project monitoring and evaluation planning by putting measures on how to initiate all the stated practices at the conceptualization stage of the project so that the projects should sustain themselves after their completion and end of funds.

8.3 Suggestions for further Studies

Further researches are needed in future to include more projects implemented in Rwanda in order to have the real comparison of data.

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