

Effect of Capacity Building on Sustainability of Irrigation Projects in Rwanda a case of Kirehe Watershed Management Project (KWAMP)

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Abstract

In Rwanda, Agriculture is the main driver of the economy at the moment and irrigation is the engine of agriculture. Irrigation development is integrated into value chains which have transformative industries. The study assessed the effects of capacity building on sustainability of irrigation projects in Rwanda a case study of Kirehe Watershed Management Project. The study will be important to Kirehe Watershed Management Project and other irrigation projects and ministry of agriculture in Rwanda. The descriptive research design was used. The targeted population was 86 composed by employees of Kirehe Watershed Management Project and sample of was 86 respondents using census method where target population is small for better result. Data were collected using questionnaires. Data was analyzed by qualitative and quantitative methods by help of IBM SPSS software Version 21. Both inferential statistics (regression and correlation) and descriptive statistics (mean and standard deviation) was used. Data was interpreted using tables and frequencies. On capacity building, the overall mean of results was 3.88 presented that high number of respondents agreed that capacity building affect the sustainability of project. The correlation between capacity building and sustainability of project was $r=0.929$, it shows that there was a high positive correlation and there was high significant relationship between capacity building and sustainability of project. The results presented that the variables were statistically significant with $F=532.108$ and $P\text{ value}=0.000b$, it means there was a significant relationship between capacity building

and sustainability of irrigation project, and it presented that variables of capacity building were statistically significant with $p\text{ value}=0.000$ on sustainability of projects. It concludes that there was high significant relationship between capacity building and sustainability of project. It recommends that the beneficiaries should participate dynamically in order to promote the sustainability of project.

Keywords: *capacity building, Sustainability, Irrigation, Agriculture, Community participation*

1. Introduction

According to Mansuri and Rao, (2014) the implementation of community development projects is a positive step in responding to the needs of the society, the operation process and consultative participatory approaches extension will not necessarily provide sustainable community development and project performance. In this way the participation of the local community groups in development initiatives will increasingly contribute to project ownership and sustainable achievements. According to Khawaga (2006), community participation is the deliberate involvement of community members and the public in the decision making and execution of an intended projects. There is a dire need for extension agents and policy planners to better understand the importance of community participation in the implementation of community development projects. It is also important to recognize that a need exists to better realize the benefits and opportunities that can be achieved through community involvement in the

implementation of community development projects (Mansuri & Rao, 2014).

The global water crisis has drawn worldwide attention to the urgency of achieving a more efficient use of water resources, particularly in agriculture, to increase crop production and achieve world food security. Considering that a major share of the world's water resources is used in agriculture and that food requirements are increasing while global water resources are limited, irrigated agriculture and the role of efficient irrigation systems and techniques have recently assumed greater importance in increasing food production (FAO, 2011).

In Africa, majority of the population resides in rural areas (Lowe, Phillipson, Proctor & Gkartzios, 2019). Majority of this population consists basically of youth in Sub-Saharan countries. Many of them practice small agricultural projects and the majority population survives below a dollar per day (Lowe et al, 2019). Most of the governments in various countries within the Sub-Saharan countries have put in place different initiative to develop rural areas in order to support farmers so that they can increase their income. A lot of infrastructure and resources have been pumped into irrigation projects so that farmers may not rely only on rain-fed agriculture which have become so erratic due to inconsistent whether patterns.

The greatest potential for expanding irrigated agriculture, considering both land and water resources, is in the Sub-Saharan Africa region, where only one fifth of the irrigation potential has been equipped, or 7.7 million ha out of a potential of 38 million ha, and in the Southern America region, where only one fourth of the potential has been equipped, or 16 million ha out of a potential of 60 million ha. The efforts of expanding irrigated areas may leads to increase in control of water and eventually leads to high-yield and increase in farm income, (FAO,2011). In Rwanda, Agriculture is the main driver of the economy at the moment and irrigation is the engine of agriculture as water is the major factor of production. Irrigation development is integrated into value chains which have transformative industries. Secondary industries based on processing of produce from the irrigation schemes such as paddy rice mill, soya oil extraction, livestock feed, maize flour among others will be sources of employment. Irrigation also demands a supportive manufacturing industry for the fabrication of the various equipment (Fraser, 2022).

2. Review of Literature

2.1 Sustainability of Irrigation Project

A participatory approach should be conceived and implemented so that it is clearly in the interests of intended beneficiaries. Otherwise, incentives and group dynamics will defeat the effort. At the same time, participation is not simply a technical activity

based only on self-interest. It is important to foster some sense of community and mutual interests in order for participation to be effective and sustained, (Fraser, 2022). Project can be regarded to be sustainable when there is continued use of the outcomes even after the project is completed or even after the donors have left, (Mansuri, & Rao, 2014). In this regard a sustainable project is one that the intended beneficiaries continue enjoying the fruits of the project. This is seen to bring a more extended life of the project where project is seen to be working after the donors have left. In a similar manner, a project can be said to be sustainable when it is able to support the socioeconomic sustenance of the community. Project sustainability should also be looked depending on how much the project contributes to the sustainability of the environment. The impact of the project should therefore be felt even in its overall contribution to the beneficiaries and the surrounding environment. Moreover, a sustainable project is seen to be self-supportive in terms of maintain its running costs and other associated costs. Consider the above definition, the researcher gave its own definition as project sustainability is how the durable project (Khawaga, 2006).

Most development project donors operating in developing countries have identified community participation as one of the prerequisites for the improved performance of the water sector. This is because it soon turned out that sustainable rural development approaches of irrigation projects could not be achieved without involving the community not just in manual work, but also in the planning of programs and the selection of technology (Therkildsen et al; 2018). Many projects therefore started by involving the community members in maintenance of irrigation projects.

2.2 Community Participation

Participation is a process through which stakeholders influence and share control over development initiatives and the decision and resources which affect them. Unless the poor are given an opportunity to participate in the development of interventions designed to improve their livelihood, they will continue to miss the benefits of any intervention (Kumar, 2009). He defines community participation to include involvement of members of the beneficiary community in development, empowering people and helping them make decisions on desired developmental outcomes. FAO (2011) also advocates for community participation in health issues globally, since is the best strategy of ensuring improved health and better livelihoods for global citizens.

Fraser (2022) opines that participatory development emerged to curb the drawbacks of top down development, which entails conception, planning and

implementation of projects by the elite without involvement or consultation with the masses, the latter being considered too uninformed and unsophisticated to engage in development work. However, this is not the usual practice thus the current topic deserves a discussion.

Besides, Mbui and Wanjohi (2018) supports participatory development by asserting that people require opportunities to participate in development projects designed for their benefit as this entrenches a sense of responsibility and ensures project sustainability. Participatory development is therefore a grass root movement that rejects „top-downism“ and „statism“ as the recognized channels of development. However, despite the latter definitions of participation, it has been common practice in developing countries that the public are left out in water projects and to affirm the latter, the current study is being conducted. They observed that lessons from successful community projects in Western Canada suggest that a sustainable community development must be demand driven? The implementing of community development projects programs provide an enabling environment, and that the community be legally empowered to assume control, ownership and responsibility for the completed projects. They further noted that participation in which the youth get directly involved in community projects ensures that they can take control of their decisions that have direct influence in their lives. They concluded that community involvement in the implementation of community development activities would lead to community empowerment.

Lowe; *et al* (2019) indicate that participation in a project includes the involvement of stakeholders in directing and executing the project with a view of attaining the stated goals. Different researchers have conceptualized community participation differently depending on the project being implemented; (Afande, 2013); concluded that the community should be part of the project selection and implementation, they indicated that the community should be involved in planning, implementation and project management; it is of the view that the community should participate in identification and planning of the project. Khwaja, (2006) is of the view that community participation should not be excessively encouraged however they can be included in advisory committees. From the above it's evident that different scholars have conceptualized community participation differently. In the current study community participation was contextualized in the project identification, project planning, project implementation and the project monitoring and evaluation. The project identification process refers to the community involvement in the prioritization and selection of the most appropriate development project. The identification process involves a

continuous analysis of the viable projects and the selection of the most ideal projects (Lowe; *et al*, 2019).

2.3 Capacity Building

Capacity building activities that focus on training, for example, or creating shared experiences among members of a team (e.g., strategic planning, board development) lose their effectiveness when the staff who were trained leave for another job or turnover yields a team with a critical mass of members who did not share that wonderful experience a few years ago. On the other hand, system focused efforts also fail. Witness the many agencies that use only a tiny fraction of the capabilities of their computer systems or the many efforts to create policies, procedures, job descriptions, and other hard systems that have zero influence on what employees actually do. People are the fundamental building blocks of any organization. An overview of NGOs and their impressive ability to impact local communities, megacities and global challenges demonstrates that when people join together to act collectively they are a powerful force for change. Capacity refers to the ability of an organization to achieve its mission, doing so effectively over time (Minzner; *et al*; 2013).

According to Millar and Doherty (2016) building the capacity of the individual makes possible improvement to the capacity of the organization. Strengthening organizations individually enhances the ability of all organizations to work collectively for the greater good. Finally, individuals working through stronger organizations contribute to an improved community and to better lives for citizens. In this sense, capacity, capacity building, and both organizational and community effectiveness are separate but also much related to each other. Building the capacity of individuals, organizations, community-based partnerships and collaborations, and of the community overall is complex work. As a process, it typically involves training and education in a wide variety of areas and designed to improve skills, knowledge, and abilities at multiple levels. In many instances, the focus of capacity building targets the organizational setting, and because of their important place and role within and with regard to community vitality, a great deal of emphasis in recent years within capacity building circles has been centered around improving the capacity of Nonprofit organizations, (Minzner; *et al*, 2013).

2.4 Facilitation Theory

This study was based on the facilitation theory. This theory was developed by Wayne; *et al* (2007). One of the basic premises of this theory is that learning is possible because human beings have a "natural eagerness to learn" and they are responsible for and at the center of the learning process. Capacity building is possible only because individuals signed up in it are self-driven and eager to learn despite

their location in relation to learning institutions. The role of the teacher is to act as a facilitator- no amount of effort on the part of the teacher can guarantee success, unless the learner has a desire and predisposition to learn. An interesting contribution of Rogers's Facilitation Theory is the notion that learning involves changing one's self-concept. Such changes may involve discovering one's strengths or weaknesses. Learners in the capacity building set up have to perceive the possibility that there is value in the learning system for knowledge acquisition. A freshly perceived self-concept has a consolidating impact on learning in that it allows the learner to attack a target skill with confidence or with an adjusted 'updated' approach. Implicit in the non-direct facilitative approach is the assumption that learners can find the information by themselves (teachers merely facilitate that process), an assumption which downplays the role of information transmission, (Wayne; *et al*, 2007)

3. Materials and Methods

The researcher used a descriptive design because it allows the researcher to get in depth responses from the respondents that became the basis of analysis and therefore data analyzed based upon percentage and frequencies of responses given by respondents. According to Chinelo (2016), a descriptive research determines and reports the way things are. It also attempts to describe such things as possible behavior, attitudes and characteristics. Descriptive survey research design enabled the study to generate statistical information on effects of rural development approaches on sustainability of irrigation projects in Rwanda using a case study of Kirehe Watershed Management Project (KWAMP). The population involved in this study was be 6 employees and 80 beneficiaries were taken a target population.

Table 3.1 Target population and sample size

Category of respondents	Number
Program Director	1
Program Coordinator	1
Value Chain Development Specialist	1
Nutrition coordinator	1
Finance Coordinator	1
Project Field officers	1
Direct beneficiaries	80
Total	86

Source: Kirehe Watershed Management Project, (2022)

The researcher took all targeted population as sample size respondents. Hence, the sample size was the total target population which is 86 respondents. Using this technique is more applicable in situation where the target population is small and manageable because Chinelo (2016), said that researchers should use census where target population is small for better result. In selecting respondents stratified sampling technique was used because the population is heterogeneous i.e., employees categorized into Program Director, Program Coordinator, Nutrition coordinator, Finance Coordinator, Field officers. Thus, 80 beneficiaries were also targeted in this study plus 6 employees from the project. Thus, the sample size was 86 respondents.

The major instrument of the study were questionnaires. Questionnaire is advantageous because one can collect a lot of information within a very short period of time. The structured questions measured the subjective responses to clarify the objective responses and at the same time, enhance

formulation of recommendations of the study. The structured questionnaire was used in this research where the researcher made use of a 5-point Likert scale to measures the respondents' views on effects of rural development approaches on sustainability of irrigation projects in Rwanda. By using 5-point Likert Scale, the respondent indicated whether he/she strongly to agree (SA), agree (A), neutral (N), disagree (D). Strongly disagree (SD). The administration of data collection instrument was done by the researcher and was used the self-administration data collection procedure. The researcher gave the respondents the questionnaires to fill at their respective work station.

Data analysis was carried out as an exercise to ensure that the research is complete in capturing the research objectives. Data collected was sorted, classified and coded then tabulated for ease of analysis. The Statistical Package for Social Sciences (SPSS version 21) was used for this exercise of data analysis. Descriptive statistics were employed to

analyze the data where mean score and standard deviations while inferential statistics (regression and correlation analysis) were employed to help provide further interpretation of data. In addition, data was presented in table form and by use of graphs. The following regression equation was formulated

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$$

Equation. (1)

Where:

y = sustainability of irrigation projects in Rwanda

β_0 = Constant

β_1 - β_3 = Model Coefficients

X1-X3: capacity building variables

ϵ = the unknown random error assumed as normally distributed

4. Results and Discussion

4.1 Demographic characteristics of respondents

In this study was very important to know the demographic characteristics of respondents, these characteristics were gender, age, educational level and working experience of respondents. The results are presented in table 4.1.

Table 4.1 Demographic characteristics of respondents

Characteristics	Frequency (n=86)	(%)
Gender		
Male	55	64.0
Female	31	36.0
Age group		
21-35 years	42	48.8
35-50 years	33	38.4
51 years and above	11	12.8
Educational level		
Primary school	22	25.6
Secondary school	51	59.3
Undergraduate	10	11.6
Postgraduate	3	3.5
Working Experience		
1-3 years	38	44.2
3-5 years	40	46.5
5 years and above	8	9.3
Total	86	100.0

Source: Primary data, (2022)

Table 4.1 presents the demographic characteristics of respondents and it was on the concern of this study. Gender distribution of respondents was on concern of the study, study wanted to know the gender distribution of respondents, out of 86 respondents, 55 of 64% were the men and 31 of 36% were the women. On the age, researcher wanted to know the old years of respondents distribution, 42 of 48.8% were in the range of 21-35 old years, 33 of 38.4% were in range of 35-50 old years while only 11 of 12.8% respondents had the 51 old years and above. On educational level, researcher wanted to know the educational level of respondents, 22 of 25.6% had a

primary school, 51 of 59.3% had the secondary school, 10 of 11.6% had undergraduate while only the 3 of 3.5% of respondents were post graduated. On working experience, research wanted to mention the experience the respondents had, the 38 of 44.2% had an experience in range of 1-3 years, the 40 of 46.5% had an experience in range of 3-5 years and only 8 of 9.3% of respondents had an experience in range of 5 years and above working experience.

4.2 Effect of capacity building on sustainability of project management

Table 4.2 Effect of capacity building on sustainability of project management

Statement	Strongly Disagree (1)		Disagree (2)		Neutral (3)		Agree (4)		Strongly Agree (5)		Total		
	N	%	N	%	N	%	N	%	N	%	N	Mean	Std
Training of irrigation project beneficiaries lead to community empowerment	7	8.1	7	8.1	0	0	63	73.3	9	10.5	86	3.70	1.041
Building the capacity of community overall is complex work	11	12.8	10	11.6	4	4.7	57	66.3	4	4.7	86	3.38	1.160
Coaching irrigation project beneficiaries lead to improved efficiency and effectiveness of the irrigation project	0	0	0	0	0	0	54	62.8	32	37.2	86	4.37	0.486
Capacity of beneficiaries is built such that they can repair and maintain the irrigation project by themselves	4	4.7	8	9.3	5	5.8	57	66.3	12	14.0	86	3.76	0.969
Providing extension services irrigation project beneficiaries contributes to the project sustainability	0	0	0	0	4	4.6	62	72.1	20	23.3	86	4.19	0.497
Overall Mean												3.88	

Source: Primary data, (2022)

Table 4.2 presents the findings of the second objective where the study wanted to assess the effect of capacity building on sustainability of irrigation projects in Rwanda a case of Kirehe Watershed management project. Out of 86 respondents, 8.1% of 7 respondents strongly disagreed, 8.1% of 7 disagreed, the 73.3% of 63 agreed and 10.5% of 9 respondents strongly agreed that training of irrigation project beneficiaries lead to community empowerment in Kirehe watershed management project. The study wanted to know if building the capacity of community overall is complex work, 12.8% of 11 respondents strongly disagreed, 11.6% of 10 disagree, 4.7% of 4 were neutral, 66.3% of 57 respondents agreed and 4.7% of 4 respondents strongly agreed that building the capacity of community overall is complex.

The researcher analyzed how coaching irrigation project beneficiaries lead to improved efficiency and effectiveness of the irrigation project, 62.8% of 54 respondents agreed and 37.2% of 32 respondents strongly agreed that coaching irrigation project beneficiaries lead to improved efficiency and effectiveness of the irrigation project. The study also

analyzed how the capacity of beneficiaries is built such that they can repair and maintain the irrigation project by themselves, the 4.7% of 4 respondents strongly disagreed, 9.3% of 8 respondents disagreed, and 5.8% of 5 respondents were on neutral side, and 66.3% of 57 respondents agreed and 14.0% of 12 respondents strongly agreed capacity of beneficiaries is built such that they can repair and maintain the irrigation project by themselves. And researcher analyzed how the providing extension services irrigation project beneficiaries contributes to the project sustainability, the 4.6% of 4 were on neutral side, 72.1% of 62 respondents agreed and 23.3% of 20 respondents strongly agreed that providing extension services irrigation project beneficiaries contributes to the project sustainability. The Kirehe watershed management project is requested to all factors of capacity building in order to sustain the management project. The overall mean of results (3.88) that is between Agree (4) and Strongly Agree (5), it presented that the high number of respondents agreed that capacity building give any effect on sustainability of irrigation project in Rwanda a case of Kirehe watershed management project.

Table 4.3 Correlations between capacity building on sustainability of project management

		Capacity Building	Sustainability of Irrigation Project
Capacity Building	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	86	
Sustainability of Irrigation Project	Pearson Correlation	.929**	1
	Sig. (2-tailed)	.000	
	N	86	86

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

Source: Primary data, (2022)

Table 4.3 presents the relationship between capacity building and sustainability of irrigation projects in Rwanda a case of Kirehe watershed management project. The statistical product and service solutions (SPSS) software was used to determine the results of pearson coefficients. A pearson coefficient correlation is between -1 and 1 where -1 to 0 present negative correlation (-1 to -0.5 shows high negative correlation and -0.5 to 0 shows low negative correlation); and 0 to 1 present positive correlation (0

to 0.5 shows low positive correlation and 0.5 to 1 shows high positive correlation). According to the results, the correlation between capacity building and sustainability of project was $r=0.929$, it shows that there was a high positive correlation and there was high significant relationship between capacity building and sustainability of irrigation projects in Rwanda a case of Kirehe watershed management project.

Table 4.4 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.929a	.864	.862	.327

a. Predictors: (Constant), Capacity Building

Source: Primary data, (2022)

Table 4.4 presents Model Summary, the results shows that the R Square=0.864. It was clear that 86.4% of all variables of sustainability of irrigation

projects in Rwanda a case of Kirehe watershed management project can be clarified by one's of all variables of capacity building.

Table 4.5 ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	56.761	1	56.761	532.108	.000b
	Residual	8.960	84	.107		
	Total	65.721	85			

a. Dependent Variable: Sustainability of Irrigation Project

b. Predictors: (Constant), Capacity Building

Source: Primary data, (2022)

Table 4.5 presents ANOVAa, the results presented that the variables were statistically significant with $F=532.108$ and P value=0.000b, it means there was a

significant relationship between capacity building and sustainability of irrigation projects in Rwanda a case of Kirehe watershed management project.

Table 4.6 Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.300	.157		1.908	.060
	Capacity Building	.905	.039	.929	23.067	.000

a. Dependent Variable: Sustainability of Irrigation Project

Source: Primary data, (2022)

Table 4.6 presents the constant of independent variable of capacity building. It is statistically significant since p value is less than 0.05. The results

presented that variables of capacity building were statistically significant with p value =0.000.

5. Conclusions

The study analyzed the effect of rural development approaches on sustainability of irrigation projects in Rwanda a case of Kirehe watershed management. The indicators of capacity building were analyzed. The study concluded based on results, the overall mean of results of capacity building was 3.88, and it concluded that the high number of respondents agreed that capacity building affect the sustainability of irrigation project. The correlation between capacity building and sustainability of project was $r=0.929$, it concluded that there was a high positive correlation and high significant relationship between capacity building and sustainability of irrigation project. It presented that the variables were statistically significant with $F=532.108$ and P value= $0.000b$, it means there was a significant relationship between capacity building and sustainability of irrigation project.

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