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PROJECT MANAGEMENT AND PERFORMANCE OF SMALLHOLDER IRRIGATION PROJECTS: A CASE OF LOWER KUJA IRRIGATION PROJECT IN MIGORI COUNTY, KENYA.

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Abstract

Irrigation is considered to ensure food security in areas experiencing depressed rainfall. About 40% of world food is grown under irrigation (Asian Development Bank [ADB], 2015). However, increase in area under irrigation has led to conflict over land and water resources. Consequently, countries like Mexico, Chile, India, Philippines and Columbia are adopting irrigation management transfer to enhance farmer management of irrigation projects (Siebert et al., 2005). The Government of Kenya constructed Lower Kuja Irrigation Project in 2015 comprising 15 individual smallholder irrigation projects using irrigation management transfer approach. This approach entailed organisation of farmers into a water users association responsible for coordinating farmers' activities. Thus, the study sought to assess the influence of project organisation on performance of smallholder irrigation projects. The study framed the alternate hypothesis in the form H_1: There is a significant relationship between project organisation and performance of smallholder irrigation projects in Migori County. The study was anchored on Citizen Empowerment Theory by Burns et al., (1994). The theory provides a basis for engagement of project beneficiaries in project organisation. The study adopted pragmatism as a philosophy, and used cross sectional and correlational research design. By means of Krejcie and Morgan (1970) Tables, the study selected 341 respondents from a sampling frame of 2,815 registered members of the 15 smallholder irrigation projects that make up Lower Kuja Irrigation Project using systematic random sampling technique. Data was collected using questionnaire and classified using a 5-Point Likert Scale. Data analysis used descriptive statistics (means and standard deviation), and inferential statistics (Pearson's regression analysis at p-value of 5% significance level). The findings show that regular election of leaders (4.196) is the most addressed aspect of project organisation, while enforcement of bylaws (3.967) is the least addressed aspect. The results also show that: $r = .781$, $r^2 = .610$, $F\ [5, 331] = 103.651$, $Fc = 2.2413$, $p<0.000<0.05$. Hence, the study accepted the alternate hypothesis (H_1), and concluded that project structure,

endorsement of constitution, enforcement of bylaws, regular election of leaders, and holding of periodic meetings have significant influence on performance of smallholder irrigation projects. Consequently, the study recommended that Migori County formulate policies that support project organisation in smallholder irrigation projects. The study also recommended creation of bylaws sub-committees in smallholder irrigation projects. Further, the study recommended research on influence of project organisation on performance of smallholder irrigation projects using longitudinal and experimental research design.

Keywords: *Critical Factors, Citizen Empowerment Theory, Irrigation Management Transfer, Migori County, Project Organisation, Smallholder Irrigation.*

Introduction

Inevitably, the ever increasing world population is exerting pressure on natural resources, including land and water resources that are essential pillars in food production and economic development. Lutz and Samir (2010) state that the world's population is expected to increase by 47% from 6.124 billion in year 2000 to 9.021 billion in year 2050, with an increase of 144% in the population of Africa. Lutz and Samir add that population data is important for use in, amongst other things, assessment and planning of food security. In a related study on effects of population increase on food security, Lawal and Idris (2018) confirm the Malthusian Theory that a rising population increasingly relies heavily on agricultural land. Consequently, Lawal and Idris advise on efforts to improve crop varieties and seeds as well as adoption of new technology, including exploitation of irrigation and ground water exploration. The Asian Development Bank [ADB], 2015 states that up to 40% of the world's food is produced under irrigation, and that this is expected to increase to 70% of food production by 2050.

One challenge that is increasingly being experienced in exploitation of irrigation potential includes conflict over land and water use rights either amongst competing irrigating farmers and/or between irrigating farmers and other resource users such as livestock keepers. Appreciating the emerging exploitive competition regarding water resource use, the Government of Kenya through the Water Act 2016, put in place mechanism for establishment of Water Resource Users Associations (WRUAs) comprising of communities located within a water catchment area (GOK, 2016). However, while the act attempted to decentralised control of water resource use to regional bodies in line with the 2010 constitution, the act delegated the matter of irrigation water use to an irrigation act. This highlights failure of government institutions to appreciate commonality in natural resource use.

Transfer of irrigation management is recommended as one of the solutions to addressing conflict in land and water use rights in irrigation projects. Svubure et al., (2007) state that irrigation management transfer requires capacity building of project beneficiaries. Camilleri (2011) identifies organisation structure, among other factors, as crucial for successful project performance, and adds that project hygiene factors (strategic fit, scope, organisation structure, team structure, planning and control) account for 60.12% of outcome success. Highlighting organisational weaknesses as a concern in smallholder irrigation projects, Fanadzo (2012) states that irrigation management transfer cannot be achieved overnight. The development of Lower Kuja Irrigation

Project in Migori County using smallholder irrigation approach is an attempt to transfer management function from governmental institutions to farmers' organisations. Consequently, Alias et al., (2014) state that effective project performance entails user proficiency in planning and management of project resources. In the study, project organisation is an independent variable that refers to project structure, endorsement of constitution, enforcement of bylaws, regular elections, and periodic meetings.

Problem of Research

Project organisation is considered an important factor in performance of smallholder irrigation projects. Salami et al., (2010) state that failure of smallholder irrigation projects to achieve project outcomes is related to organisational and institutional weaknesses. Abdissa et al., (2017) describe weak institutional and organisational capacity, among other factors, as sources of challenges to smallholder irrigation in Ethiopia. Critical factors are inputs into project management that enhance project outcome (Alias et al., 2014). Thus, Costantino et al., (2015) advice on the need to objectively address critical factors to ensure project objectives.

Migori County has an enormous irrigation potential. Up to 16,500 hectares is irrigable from Rivers Kuja and Migori, and has potential to increase food output from 12,011 metric tons to 136,810 metric tons (GIBB Africa, 2011). However, despite this potential, food poverty in Migori County is 32%, twice figures recorded in Nyeri and Meru Counties (KNBS, 2018). The National Irrigation Authority (NIA) proposed Lower Kuja Irrigation Project in Migori County, comprising 15 individual smallholder irrigation projects to address food insecurity, reduce unemployment and increase the economy in Migori County (GIBB Africa, 2011). However, despite the existence of Lower Kuja Irrigation Project since 2015, the project is yet to satisfactorily achieve its development objectives. The study considered project organisation as a critical factor in smallholder irrigation, and that presents an area of research interest.

Literature Review and Research Focus

Project organisation is considered by practitioners in project management as a contributing factor in satisfactory project performance. Ika et al., (2012) state that while World Bank projects identify monitoring, coordination (national), design, training, and institutional environment as five key critical factors that influence project success, a project could still fail to achieve its objectives despite its quality design and implementation strategy due to a poor institutional environment. In a discussion on performance of public irrigation schemes in Kenya, Ngenoh et al., (2015) advice that performance of public irrigation schemes can be improved if farmers are treated as equal partners rather rather than beneficiaries. Implementation of such a recommendation would require that farmers mobilise themselves into water users association to facilitate engagement between project developers and beneficiaries. Consequently countries with significant smallholder irrigation projects such as Mexico, Chile, India, Philippines and Columbia are advocating for transfer of irrigation management from government central management to farmer-based management (Vuren et al., 2004). Kahuro (2012) advices that the future of smallholder irrigation lay in decentralisation of management function to farmers' associations. Svubure et al., (2007) argue that successful irrigation management transfer would entail beneficiary capacity building.

Irrigation introduces organisational requirement on a project community. According to Ika et al., (2012), smallholder irrigation in Sub-Saharan Africa experience systematic challenges that are related to organisational weaknesses. Frefer et al., (2018) stated that failure to adequately address project organisation during project initiation creates challenges during project operations stage, after commissioning and handing over of projects to beneficiaries. Consequently, Frefer et al. state that critical factors, including project organisation affect performance after commissioning of the project. Fanadzo (2012) lists organisational weaknesses as a major cause of inability by smallholder irrigation projects to achieve satisfactory performance. Therefore, Dell'Angelo et al., (2016) advises proponents in irrigation to consider the "8 design principles" by Ostrom's (1990), comprising boundaries of resource users, similarity with local conditions; opportunities for collective choice and local self-determination, monitoring, sanctions, conflict resolution, users rights to organisation, and integration of multiple nested layers of organisation as proposed.

Project performance entails effectiveness of project organisation. The Water Act 2016 prescribed the creation of Water Resource Users Associations (WRUAs) to manage exploitation of water bodies (GOK, 2016). However, while proposing an independent irrigation act to address irrigation needs, the act failed to address itself to irrigation. In the absence of a legislative act of parliament to regulate irrigation, a mixture of approaches to irrigation development has cropped up in Kenya. The proposal to develop 7,770 hectares in Migori County under the smallholder development approach represents a desire by the Government of Kenya to implement irrigation management transfer as an approach. However, the study viewed inadequate attention to project organisation in smallholder irrigation as constituting a challenge to performance of smallholder irrigation projects.

Methodology of Research

General Background of Research Methodology

The objective of the study was to examine the influence of project organisation on performance of smallholder irrigation projects in Migori County, Kenya. The study hypothesis was framed in the form of an alternate hypothesis stating as follows: H_1: There is a significant relationship between project organisation and performance of smallholder irrigation projects in Migori County, Kenya. The study adopted pragmatism as a philosophy. Pragmatism enables use of mixed research approach in social and natural settings, without the restrictions that are inherent to either constructivism or positivism (Feilzer, 2009). The restrictions inherent to constructivism and positivism limit objectivity in social research (Morgan, 2014). Morgan argues that an individual's perspective or tradition has influence on an individual's view of life. The study adopted cross-sectional and correlational research design. Cross-sectional and correlational research design is cheaper compared to longitudinal and experimental design (Levin, 2006; Rindfleisch et al., 2008; Sekara, 2003), and is useful in defining relations between variables (Curtis et al., 2016). The study used Citizen Empowerment Theory (1994) by Burns, Hambleton and Hoggett to ground the research. The theory provides a basis for engagement of project beneficiaries in project organisation. According to Burns et al., people are generally aware of their needs, values and goals; possess the ability to address their problems; and are thus best fit to resolve the problems. The study suggests that project

organisation in community-based projects generally follows the argument advanced by citizen empowerment theory. Therefore, the study views project structure, endorsement of constitution, enforcement of bylaws, regular election of leaders, and holding of periodic meetings in smallholder irrigation projects as explainable by the prospect theory.

Sample of Research

The study used Krejcie and Morgan (1970) Tables to select a sample of 341 respondents from the population of 2,815 that comprise registered members in the 15 smallholder irrigation projects operating under Lower Kuja Irrigation Project. The sampling frame encompassed the list of 2,815 registered members of the 15 smallholder irrigation projects in Lower Kuja Irrigation Project.

Research Instruments and Procedures

The study used questionnaire as its research instrument. The questionnaire comprised three parts; an introduction, preliminaries, and research queries. The research instrument was piloted in Lower Sio Irrigation Project in Busia County. This is because of similarities between Lower Kuja Irrigation Project and Lower Sio Irrigation Project in terms of development approach used by the NIA in establishing the two projects, and in terms of similarity in socio-economic conditions in the two areas. Both the communities from Lower Kuja Irrigation Project and Lower Sio Irrigation Project reside in the western region of Kenya, and both undertake fishing, livestock rearing and mostly subsistence agriculture.

Instrument validity was achieved through peer review and criticism by research supervisors (content validity), comparison of observed test scores with existing conditions (criterion validity) and correlation and differentiation of test scores (construct validity). Content, criterion and construct validity ensure instrument validity (Urbina, 2004).

Instrument reliability was achieved by use of Cronbach's alpha coefficient (α) given by Equation (1) below.

$$\alpha = \frac{n}{n-1} \times \frac{S_t^2 - \Sigma (S_i^2)}{S_t^2} \quad \text{..... Equation (1)}$$

Where:

α = Cronbach's coefficient alpha.

n = number of items in the test.

S_t^2 = variance of total scores in the test.

$\Sigma (S_i^2)$ = sum of the variance of item scores.

Urbina (2004) describes Cronbach's alpha (α) range as from 0-1.0 (where <0.5 is unacceptable; 0.5-0.6 is poor; 0.6-0.7 is questionable; 0.7-0.8 is acceptable; 0.8-0.9 is good; while >0.9 is excellent).

Data was collected from the 15 smallholder irrigation projects that constitute Lower Kuja Irrigation Project Nyatike Sub-County, Migori County. Data collection lasted 5 days, comprising one day for introductory briefing of farmers' leaders and recruitment of 15 research assistants, three days for administration of the questionnaire, and one day for debriefing the leaders and research assistants.

Data Analysis

The study classified data using of a 5-Point Likert Scale, where: <1.5 (strongly disagree), 1.5≤2.5 (disagree), 2.5 ≤ 3.5 (neutral), 3.5 ≤ 4.5 (agree), and >4.5 (strongly agree). Consequently, the data was analysed using descriptive statistics comprising central tendency (mean) and variability (standard deviation); and inferential statistics comprising linear regression analysis (Pearson's correlation analysis at 5% significance level). Pearson's correlation equation adopted the following form:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \varepsilon, \ldots\ldots\ldots\ldots\ldots \text{Equation (2)}$$

Where:

Y = performance of smallholder irrigation projects

a = Y intercept.

b_1, b_2, b_3, b_4, b_5 = regression coefficients.

ε = error term

The study conducted Analysis of variance (ANOVA) using least significant difference test at p = 0.05, and compared the means using SPSS computer package.

Results of Research

Descriptive Statistics

The participants were asked to give information on various aspects of project organisation. Tables 1-5 below present findings of the study.

Table 1. Project structure

	Mean	Std. Dev.
The project has positions of chairperson, secretary and treasurer.	4.208	0.653
All leadership positions in the project have office bearers.	4.119	0.648
The project leaders have clear roles and responsibilities.	3.867	0.762
The project leaders perform their roles and responsibilities.	3.650	0.810
The project leaders play an important role in project performance.	4.110	0.585

Table 2. Endorsement of the constitution

	Mean	Std. Dev.
The project has a constitution.	4.080	0.725
Farmers approved the project constitution.	3.697	0.888
The constitution treats all farmers equally.	3.232	0.982
The constitution has clear guidelines for irrigation activities.	3.460	0.899
A constitution plays an important role in project performance.	4.036	0.539

Table 3. Enforcement of bylaws

	Mean	Std. Dev.
The project has rules and regulations.	4.042	0.689
Farmers approved project rules and regulations.	3.596	0.953
The project enforces its rules and regulations.	3.484	0.845
Farmers support enforcement of project rules and regulations.	3.496	0.839
It is important to enforce project rules and regulations.	3.967	0.624

Table 4. Regular election of leaders

	Mean	Std. Dev.
Farmers elect their leaders from members of the project.	3.994	0.791
Any farmer in the project can stand for election as a leader.	4.030	0.667
The project leaders represent farmers in decision-making.	3.650	0.867
I have participated, at least once, in election of project leaders.	3.730	1.024
Election of leaders by farmers is important for project performance.	4.196	0.485

Table 5. Holding of periodic meetings

	Mean	Std. Dev.
The project holds monthly meetings.	2.923	1.147
I have attended all meetings held in the last six months.	2.226	0.901
I have attended at least one meeting in the last six months.	3.353	1.153
I have not attended any meeting in the last six months.	2.617	1.152
Holding of project meetings is important for project performance.	4.131	0.583

Diagnostic Tests

Diagnostic tests included test for normality, heteroscedasticity, autocorrelation and multicollinearity.

Kolmogorov Smirnov test and Shapiro Wilk test results, presented in Table 6, and Quantile-Quantile (Q-Q) plot, presented in Figure 1 were used to test for normality. Table 6 shows that *p*-value for project organisation is < 0.05, implying normally distributed data. Figure 1 shows that observed and expected normal values ley along the 45^0 line, thus affirmed normality of the data set. According to Paul and Zhang (2009), Quantile-Quantile (Q-Q) plot enables resolution on normality of dependent and independent variables, and is useful when exploring data prior to calculation of correlation coefficients or fitting regression curves at early stages of analysis, and indicates aptness of a linear regression model.

Table 6. Normality test (Kolmogorov-Smirnova, Shapiro-Wilk and Q-Q test)

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
Project organisation	0.418	336	0.012	0.811	336	0.001

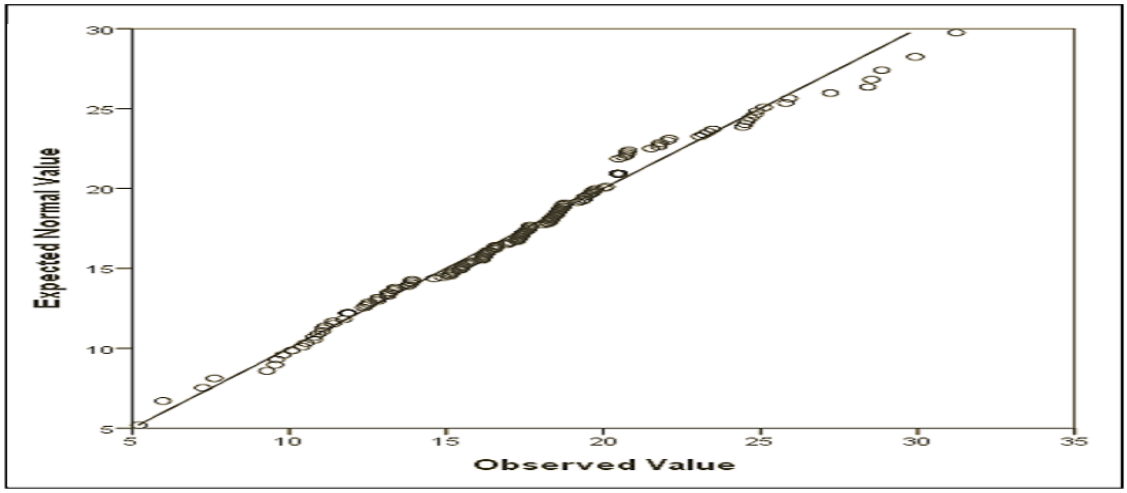

Figure 1: Normal Q-Q Plot for Performance of Smallholder Irrigation Projects

Heteroscedasticity test results, presented in Table 7, was ensured by use of Levene test. Table 7 shows that *p*-value for project organisation is < 0.05, implying no heteroscedasticity in the data set.

Table 7. Heteroscedasticity test (Levene test)

	Levene Statistic	Df1	Df2	Sig.
Project organisation	1.093	1	335	0.020
Performance of smallholder irrigation projects	2.817	1	335	0.030

Autocorrelation test results, presented in Table 8, was determined using Durbin-Watson test. Table 8 gives test results value of 2.000, implying no autocorrelation. Morgan (1966) states that Durbin Watson statistic value of 2 implies no autocorrelation, while 0 implies positive autocorrelation, and 4 implies negative autocorrelation.

Table 8. Autocorrelation test (Durbin-Watson test)

Model	Durbin-Watson
1	2.000a

Multicollinearity test results, presented in Table 9, determined using collinearity statistics, gives VIF for project organisation as 1.355 and VIF for performance of

smallholder irrigation projects as 1.834. VIF values below 5 imply low multicollinearity (Keith, 2006).

Table 9. Multicollinearity test (Collinearity statistics)

Collinearity Statistics	Tolerance	VIF
Project organisation	.738	1.355
Performance of smallholder irrigation projects	.408	1.834

Inferential Statistics

The study used Pearson's regression analysis to test the following alternate hypothesis: H_1: There is a significant relationship between project organisation and performance of smallholder irrigation projects in Migori County. Findings of the study are presented in Tables 10-12 below.

Table 10. Model summary

Model	R	R^2	Adjusted R^2	Std. Error
1	.781[a]	.610	.604	.309

a. Predictors: (constant): project structure, endorsement of constitution, enforcement of bylaws, regular election of leaders, and holding periodic meetings.

Table 11. Analysis of variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	50.208	5	10.042	103.651	.000[b]
	Residual	32.067	331	0.097		
	Total	**82.275**	**336**			

a. Predictors: (constant): project structure, endorsement of constitution, enforcement of bylaws, regular election of leaders, and holding periodic meetings.

b. Dependent variable: performance of smallholder irrigation projects.

Table 12. Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.394	.168		8.298	.000
	Project structure	.874	.049	.94	17.837	.000
	Endorsement of constitution	.862	.042	.865	20.524	.000
	Enforcement of bylaws	.608	.044	.761	13.818	.000
	Regular election of leaders	.509	.043	.614	11.837	.000
	Holding periodic meetings	.570	.045	.671	12.667	

Discussion

Descriptive Statistics

According to Tables 1 - 5, regular election of leaders (4.196) is the most addressed project organisation component. Thereafter, holding of periodic meetings (4.131), project structure (4.110), endorsement of constitution (4.036) and enforcement of bylaws (3.967) are listed in order of successful implementation. Respondents pointed out that they had not been involved in writing of the constitution and were not aware of its details. Further, respondents felt that enforcement of bylaws was weak. In addition, while respondents felt that elections were irregular, all respondents had participated at least once in election of project leaders.

The results also show that the importance of enforcement of bylaws has not been assimilated in smallholder irrigation in Migori County. While farmers are aware of the demerits of not adhering to project bylaws, farmers indicated that illegal activities such as abstracting water from unauthorised points often go unsanctioned leading to widespread disregard of bylaws. According to Golini et al., (2017), poor project performance is an indicator of inability by project leadership to take into account an organisation's strategic objectives, experience and external environment to ensure project outcomes.

Inferential Statistics

As provided by Table 10, r=0.781 and r^2 = 0.610, indicating that project structure, endorsement of constitution, enforcement of bylaws, regular election of leaders and holding of periodic meetings have a strong influence on performance of smallholder irrigation projects, and explains 61% of variation in performance of smallholder irrigation projects. Likewise, Table 11 shows that p = 0.000 (below 0.05) and that F-calculated = 103.651 (above F-critical, [2.2413]). Hence, the regression model is significant in explaining influence of project structure, endorsement of constitution, enforcement of bylaws, regular election of

leaders and holding of periodic meetings on performance of smallholder irrigation projects.

In addition, test of significance (Table 12) shows that project structure (β=0.874, p=0.000), endorsement of constitution (β=0.862, p=0.000), regular election of leaders (β=0.509, p=0.000), enforcement of bylaws (β=0.608, p=0.000) and holding of periodic meetings (β=0.570, p=0.000) are significant at $p<0.05$ and 95% confidence level. This implies that project organisation (project structure, endorsement of constitution, enforcement of bylaws, regular election of leaders and holding of periodic meetings) has a significant influence on performance of smallholder irrigation projects in Migori County. Hence, the study accepted the alternate hypothesis (H_1). Mathenge, et al., (2014) advised governments in SSA to adopt policies that support institutional and organisational development in smallholder irrigation.

Conclusion and Recommendations

The study concluded that project organisation has significant influence on performance of smallholder irrigation projects. Therefore, inadequate attention to project structure, endorsement of constitution, enforcement of bylaws, regular election of leaders and holding of periodic meetings inhibits performance of smallholder irrigation projects in Migori County. Hence, the study recommends that Migori County formulate policies that support project organisation in smallholder irrigation projects, including procedures on establishment of project structure; development of project constitution; regular election of project leaders; holding of periodic project meetings and enforcement of bylaws. Further, the study recommends that bylaws sub-committees be created to enforce bylaws alongside similar models to irrigation sub-committees. In addition, the study recommends use of longitudinal and experimental research design to examine influence of project organisation on performance of smallholder irrigation projects in Migori County. This is because the study used cross-sectional and correlational research design. This would provide additional data for use in comparison with that from the study

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