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Socio-economic Constraints to Community Participation in Rural Water Management: A case of Ndarugu-Thiririka Sub-catchment, Kiambu County

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Abstract The provision of sustainable water supply has been a central issue in Kenya with priority on low-income rural communities and underdeveloped areas with poor water resources. This has forced many rural communities to embrace community management model in rural water systems. Community participation in rural water management is purportedly a key element for community water projects to be sustainable. This paper aims to establish socio-economic constraints to community participation in rural water management in Ndarugu-Thiririka sub-catchment in Kiambu County, Kenya. The study was carried out in four community managed rural water supply projects. Namely; Kinyathena, Juja Farm, Munyu and Kamunyaka. Different types of data were collected using household questionnaires, in-depth interviews and Focus Group Discussions (FGDs). Descriptive statistics such as frequencies and percentages were used to summarize the data while inferential statistics such as chi-square ($\chi^{2)}$ and ANOVA were used to reach conclusions and make generalizations of the population. ANOVA test results (F= 1.67, p= 0.018, p <0.05) reveal that there is a significant difference in the level of community participation on the basis of monthly income while ANOVA test results (F= 1.02, p= 0.45, p >0.05) and (F= 1.22, p= 0.21, p >0.05) reveal that there is no significant difference in the level of community participation on the basis of the level of education and economic activity respectively. In addition, chi-square test value (χ^2=23.88,df=8, p= 0.002, p<0.05) reveals a significant relationship between age and the level of community participation while Chi-square test value (χ^2=1.72,df=2, p= 0.42, p>0.05) reveals no significant relationship between gender and the level of community participation. The study recommends the government, Non-Governmental Organizations and donors to provide programmes for intensifying agricultural production, credit and rural financial support to the communities involved in rural water management. This will form the basis for ensuring water availability for rural development.

Keywords: *socio-economic constraints, community participation, rural water management, Ndarugu-Thirika sub-catchment*

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1. Introduction

In Kenya, water is a finite resource with annual national water availability of about 452m^3 per capita [1] and is projected to drop to 235m^3 by 2025 [2]. The United Nations Sustainable Development Goal 6 aims to achieve universal and equitable access to safe and affordable drinking water for all by 2030. This is in line with the constitution of Kenya (2010) which treats the enjoyment of clean and safe water in adequate quantities by every Kenyan citizen as a basic right [3]. Equally, the National Water Master Plan 2030 aims to increase improved water supply coverage to 100% for both urban and rural area by 2030 [4]. However, growing water demand and water scarcity have turned into a notable challenge in Kenya especially in rural areas [5]. There is a decreasing trend in water availability due to increasing population, expanding economies and increasing degradation of catchment areas [1].

The Ministry of Water and Irrigation adopted a community-based and demand driven but open for commercialization wherever possible approach to rural water supplies in its national strategy [6]. Lack of favourable conditions to implement commercialization leaves the management of most rural water supplies under community based organizations [5]. Facilities developed in rural areas are normally handed over to the concerned community groups after installation and they are expected to meet operation and maintenance costs from the revenues they generate from water sales [7]. According to a pilot report for SDG 6 in Kenya, water coverage in Kenya's rural areas is estimated at 50% [8].

The Water Act 2002 was enacted to tackle the worsening situation in water services experienced over the earlier decades [9]. The Act defines clear roles for the

different actors involved in the decentralized institutional framework. It also led to the separation of institutional services, the decentralization of roles and responsibilities while laying emphasis on the participation of communities in resource management [10]. The water Act 2016 was formulated to align the institutional framework for water and sanitation services to the 2010 constitution [5]. According to section 94, county governments are to provide water services in rural areas and may be supervised by community groups, NGO's or private parties under county contract [11].

Community-based management was widely adopted to promote participatory approaches that leverage local knowledge and decentralized responsibility to the community level [12]. Community participation has been identified by [13] as one of the most essential principles in rural development projects. It is seen as a means to achieve a particular end as it enables communities to better manage their socio-economic environment, improve access to basic social services with the ultimate goal of reducing rural poverty and promote sustainable development [14].

However, SDG target 6.8 which aims to support and strengthen the participation of local communities in improving water management continues to be a challenge. As noted by [15] community participation is high during planning and construction and waned after commissioning and it is dependent on several factors such as community leadership and organizational capabilities of the CBO, ability to raise and manage the necessary finances, choice of technology ensuring ability to maintain and meet water quality needs over the design life, economies of scale, the need to move away from voluntary to paid labour, need for ongoing training and the need for routine monitoring by external agencies. This study explored on socio-economic constraints that hinder community participation as a continuous and lifelong process in rural water management in Ndarugu-Thiririka Sub-catchment, Kiambu County, Kenya.

2. Methodology

2.1. The Study Area

Ndarugu-Thiririka Sub-catchment covers an area of 1218.5 km^2. It is a section of the upper and middle zones of the Athi catchment. Its altitude ranges from 2600-1500m mean above sea level in the upper zone and 1500-560m mean above sea level across the middle zone. The climate varies across the sub-catchment, typically being sub-humid in the upper region and semi-arid in the middle region. The sub-catchment has two distinct rainy seasons; long rains in March-April-May and short rains in October-November. Land use patterns are highly influenced by rainfall patterns, topography and human activity. Economically, the sub-catchment drains in a highly agricultural and industrialized area.

2.2. Data Collection Techniques

Household questionnaires, key informant interview and Focus Group Discussions guides were used to collect data on socio-economic constraints hindering community participation in rural water management. Household questionnaires consisted of both open-ended and close-ended questions. Key informant interviews were carried out to one water committee official in each community water project so as to collect comprehensive, systematic and in-depth information about socio-economic constraints in rural water management. Five focus group discussions were conducted in order to get more clarification on socio-economic constraints to community participation in rural water management. One focus group discussion was carried out in each of the selected community water projects except in one community water project which was experiencing water-use related conflicts where two focus group discussions were conducted so as to include the sentiments of the two conflicting sides. Each focus group consisted of 8-10 members with gender and age considerations.

2.3. Data Analysis Techniques

The collected field data was analyzed both quantitatively and qualitatively. The data was coded, classified and analyzed using Statistical Package for Social Sciences (SPSS) version 17.0. Descriptive statistics such as frequencies and percentages were used to describe and summarize the data. Inferential statistics such as chi-square and ANOVA were used to reach conclusions and make generalizations about the characteristics of the population.

Focus Group Discussions and key informant questionnaires were transcribed, edited and coded. Each participant comment was simultaneously assigned a separate line on a page as well as each new thought or idea. Each line was labeled with the participant and group number and then entered into Ms Excel Database, compiled and analyzed quantitatively. Tables-were used to present results.

Chi-square(x^2) was used to test hypotheses of the study and to find out any significant relationship between community participation in rural management and gender, age, lack of access to adequate water, poor or lack of communication and sharing of information regarding the project, level of education and awareness relating to rural water management, lack of the required technical skill, inability to pay water tariffs, lack of ownership over the project, lack of external support, inability to meet operation and maintenance costs, complexity of technology used in the project, unavailability of human resources (qualified staff working in the project), availability of other sources of water and lack of motivation.

F-test for ANOVA was used to test hypotheses and to examine the significance of the difference between community participation and age, level of education, monthly income and income generating activity.

3. Results and Discussions

During the study, 61.5% of the respondents showed an average level of participation in rural water management while 21% showed low level of participation. Only 17.5% of the respondents said to have a high level of participation as shown in Table 1.

Table 1. Level of community participation in the Sub-catchment

	Frequency	Percentage (%)	Cumulative Percentage (%)
Low level	42	21.0	21.0
Average level	123	61.5	82.5
High level	35	17.5	100.0
Total	200	100.0	

The socio-economic constraints that were hypothesized to constrain community participation in rural water management include monthly income, level of education, income generating activity, gender and age. More specific socio-economic constraints included lack of access to adequate water, poor or lack of communication and sharing of information regarding the project, lack of education and awareness relating to rural water management, lack of the required technical skill, inability to pay water tariffs, lack of ownership over the project, lack of external support, inability to meet operation and maintenance costs, complexity of technology used in the project, unavailability of human resources (qualified staff working in the project), availability of other sources of water and lack of motivation.

From the research findings, the monthly income ANOVA test results were ($F= 1.67$, $p= 0.018$, $p <0.05$) while the level of education ANOVA test results were ($F= 1.02$, $p= 0.45$, $p >0.05$). On the other hand, the economic activity ANOVA tests results were ($F= 1.22$, $p= 0.21$, $p >0.05$) as in Table 2.

Table 2. ANOVA Results of socio-economic constraints to community participation

		Sum of Squares	Df	Mean Square	F	Sig.
Level of education	Between Groups	32.880	33	.996	1.020	.447
	Within Groups	162.115	166	.977		
	Total	194.995	199			
Monthly income	Between Groups	33.725	33	1.022	1.685	.018
	Within Groups	100.655	166	.606		
	Total	134.380	199			
Economic activity	Between Groups	119.313	33	3.616	1.217	.211
	Within Groups	493.082	166	2.970		
	Total	612.395	199			

The study results indicate that the monthly income of the community is one of the socio-economic constraints that significantly hinder community participation in rural water management in the sub-catchment. Results on monthly income indicate that 81.5% of the respondents earn less than 10,000 Kenya Shillings per month. Kenya National Bureau of Statistics ranks lower income earners as those spending less than 23,670 Kenya Shillings per month [16]. Therefore, 94.5% of the respondents in Ndarugu-Thiririka Sub-catchment who earn less than 20,000 Kenya Shillings can be classified as low income earners. This figure is higher than 72% of low income earners in Kenya according to Economic Survey 2011. According to [17], in rural water management, community members are expected to contribute to initial system installation costs and to meet all ongoing maintenance and repair costs through regular payment of appropriate tariffs. Therefore, according to this study, low income earners may not be in a position to meet the financial demands of their community water projects.

The study findings also reveal that the level of education and the income generating activity do not significantly constrain community participation in rural water management. This study therefore supports [18] who in a study on community participation in rural water supply found that household characteristics were relatively more influential on the rate of participation defined based on attendance of meetings and making decisions. The author further notes that, even though, as per capita increased, participation rate also increased, the occupation of household head and percentage of earners in the family was highly insignificant.

This implies that regardless of the level of education and the economic activity of the community, people will always participate in rural water management. A study on the factors affecting the sustainability of community managed rural water supply schemes in Sri Lanka by [15] also concludes that, it cannot necessarily be concluded that the higher the number of educated persons, the better the management capacity. This is contrary to [18] who found that the level of education of the head of the household significantly influences beneficiary participation. This could be because [18] definition of participation is limited to attending meetings and decision making only unlike this study which looks at participation as a process through which the public influences and shares control over development initiatives, decisions and resources which affect them by helping to prepare development plan, providing funds to meet initial costs, helping in project implementation, providing support for operation and maintenance in form of money and unpaid labour, making decisions concerning their project, attending project meetings and having control and ownership over the project.

Further analysis of the study reveals that the monthly income of the community significantly constraints community participation depending on other factors such as the level of leadership and the available opportunities in rural water management. This is evidenced by the fact that, even though the community at Kamunyaka community water project has a relatively higher monthly income, where 54.5% of the respondents earn more than 20,000 Kenya Shillings per month, compared with Munyu water project, where only 18.2% of the respondents earn that amount of income per month, its level of community participation in rural water management is relatively low. The figure shows that 68% of the respondents in Munyu community water project felt there is a high level of community participation unlike Kamunyaka where only 6.1% of the respondents said there is high level of participation. The level of leadership and available opportunities also vary significantly between the two community water projects. From the findings of the study, 33.8% of the respondents in Munyu water project felt their leadership is good unlike 3.9% of the respondents who felt the same in Kamunyaka water project. Moreover, 60% of the respondents in Munyu community water project said

the level of available opportunities is high compared to 6.1% in Kamunyaka community water project.

From the research findings, Chi-square test value for gender indicate that there is no significant relationship between gender and the level of community participation in rural water management. During the study, 21% of the respondents who showed low level of community participation, 11.5% were males while 9.5% were females. Consequently, 17.5% of the respondents who showed high level of community participation, 12% were males while 5.5% were females. Of the 61.5% of the respondents with average level of community participation, 35.5% were males while 26% were females as shown in Table 3.

Table 3. Level of participation * Gender of the respondent Cross tabulation

			Sex of the respondent		Total
			Female	Male	
Level of participation	Low level	Count	19	23	42
		% of Total	9.5%	11.5%	21.0%
	Average level	Count	52	71	123
		% of Total	26.0%	35.5%	61.5%
	High level	Count	11	24	35
		% of Total	5.5%	12.0%	17.5%
Total		Count	82	118	200
		% of Total	41.0%	59.0 %	100.0%

Therefore, these findings indicate that both males and females participate equally in rural water management. This is due to the fact that both males and females have realized the benefits that accrue from access to adequate water. This contradicts [18] who concludes that sex of the household head was another influencing factor affecting participation. The community in Ndarugu-Thiririka Sub-catchment has realized the important role played by both men and women in rural water management. It has therefore supported one of the Dublin principles for the management of water resources by recognizing the central role played by women in providing, managing and safeguarding water. This is also in line with United Nations Sustainable Development Goal 5 which aims to achieve gender equality by ensuring women's full and effective participation at all levels of decision making.

The community in this study therefore emphasizes on overall community participation of both males and females measured in terms of helping to prepare development plan, providing funds to meet initial costs, helping in project implementation, providing support for operation and maintenance in form of money and unpaid labour, making decisions concerning their project, attending project meetings and having control and ownership over the project. This supports [19] who examines participation of women in water committees in 45 villages in two Indian states and who concludes that women's participation as measured by monetary contribution, attendance of committee meetings and asking questions at meetings does not matter for project success but overall community participation does.

An analysis of age as a constraint to community participation in rural water management indicates a significant relationship between the age of the members of the community and the level of community participation in rural water management.

Findings from the study indicate that between the ages of 21-50 years, representing 79.4% of the respondents, people are participating more in rural water management than 20.6% of the respondents who represent the population between 18-20 years of age and those above 50 years of age. Out of 17.1% of the respondents with a high level of participation, 12% is between the ages of 21-40 years. However, the percentage of the respondents showing low levels of participation is also high between the ages of 21-40 years which represent 13.5% out 21.1% of the total sample population showing low levels of community participation. Generally, across all the age groups, the study reveals 17.1% high level participation, 21.1% low level of participation and 61.8% average level of participation as shown in Table 4.

Table 4. Age (Years) * Level of participation Cross tabulation

			Level of participation			Total
			Low level	Average level	High level	
Age (Years)	18-20	Count	9	6	0	15
		% of Total	4.5%	3.0%	.0%	7.5%
	21-30	Count	12	25	11	48
		% of Total	6.0%	12.6%	5.5%	24.1%
	31-40	Count	15	42	13	70
		% of Total	7.5%	21.1%	6.5%	35.2%
	41-50	Count	4	31	5	40
		% of Total	2.0%	15.6%	2.5%	20.1%
	50+	Count	2	19	5	26
		% of Total	1.0%	9.5%	2.5%	13.1%
Total		Count	42	123	34	199
		% of Total	21.1%	61.8%	17.1%	100.0%

This is due to the fact that persons between 21-50 years of age are highly energetic, productive and economically stable unlike persons between 18-20 years and above 50 years of age. Moreover, out of 17.1% of the respondents with a high level of participation, 12% are between the ages of 21-40 years. However, the percentage of the respondents showing low levels of participation is also high between the ages of 21-40 years which represent 13.5% out 21.1% of the total population showing low levels of community participation. This shows that there are other underlying factors that constrain community participation within that age bracket.

This study also analyzed other specific socio-economic constraints to community participation in rural water management in the sub-catchment. These included lack of access to adequate water, poor or lack of communication

and sharing of information regarding the project, lack of education and awareness relating to rural water management, lack of the required technical skills, inability to pay water tariffs, lack of ownership over the project , lack of external support, inability to meet operation and maintenance costs, complexity of technology used in the project, unavailability of human resources (qualified staff working in the project), availability of other sources of water and lack of motivation as shown in Table 5.

Table 5. Other socio-economic constraints to community participation

Socio-economic factors	Pearson chi-square value	Df	Asymp. Sig. (2-sided)
Inability to meet O & M costs	1.963[a]	4	0.069
Lack of access to adequate water	18.013[a]	8	0.021
Complexity of technology used in the project	8.894[a]	8	0.351
Poor/lack of communication and sharing of information regarding the project	31.944[a]	8	0.000
Lack of education and awareness relating to rural water management	16.973[a]	8	0.030
Lack of required technical skills in rural water management	19.846[a]	8	0.011
Unavailability of human resources (Qualified staff working in the project)	14.679[a]	8	0.066
Inability to pay water tariffs	21.626[a]	8	0.006
Availability of other sources of water	7.290[a]	8	0.506
Lack of ownership over the project	40.194[a]	8	0.000
Lack of motivation/incentives	14.488[a]	8	0.070
Lack of external support	16.298[a]	8	0.038

From the findings, lack of access to adequate water (χ^2=18.013,df=8, p= 0.021, p<0.05), poor or lack of communication and sharing of information regarding the project (χ^2=31.944,df=8, p= 0.000, p<0.05), lack of education and awareness relating to rural water management (χ^2=16.973,df=8, p= 0.030, p<0.05), lack of the required technical skills in rural water management (χ^2=19.846,df=8, p= 0.011, p<0.05), inability to pay water tariffs (χ^2=21.626,df=8, p= 0.006, p<0.05), lack of ownership over the project (χ^2=40.194,df=8, p= 0.000, p<0.05) and lack of external support (χ^2=16.298,df=8, p= 0.038, p<0.05) significantly constrain community participation in the sub catchment.

Access to water is influenced by environmental factors which influence sustainability and they include the quality of water resource, its quantity and continuity [20]. It was found that lack of access to water affects participation in two ways. First, lack of access to adequate water may motivate the community to actively participate in rural water management hoping to get adequate water in future. On the other hand, lack of access to adequate and quality water makes some communities give up in their participation in rural water management and opt for other means.

Furthermore, external support is often required because resource (financial and technical) at the local level may not be sufficient to meet the development needs of a poor community [21]. Equally, [22] identified effective external support as one of the preconditions of community participation and must be available from the governments, donors and the private sector. Lack of such long-term support is increasingly being seen as one of the main impediments to the sustainability of rural water systems [23]. In their study in Molino Water Project, [24] found that, although the community was confident that they would be able to self-manage the facility, they felt there should be some kind of long-term support in place from NGO in order to achieve sustainability of the project.

In addition, local groups and individuals are often without access to information and are excluded from decision-making and thus lack capacity to act [25]. Communication and sharing of information, not only impacts on a project but also determines the understanding that a community has on specific issues and general status of the project [24]. Without information that is relevant, timely and presented in a form that is easily understood the poor cannot take effective action [21]. It is essential that communities have detailed information on what their local representative governments and their community group representatives are supposed to be doing, what resources are available and how they are being used. Thus, [26] notes that in order to include the knowledge, expectations, constraints and priorities of the community in the project, it is necessary to have a good communication and information flow between different stakeholders involved.

From the findings, the level of education ANOVA test results (F= 1.02, p= 0.45, p >0.05) reveals that there is no significant difference in the level of community participation on the basis of level of education. However, chi-square test value (χ^2=16.973,df=8, p= 0.030, p<0.05) indicate that lack of education and awareness relating to rural water management significantly constrain community participation in rural water management. This implies that the level of education of members of the community does not significantly constrain community participation in rural water management but education and awareness relating to rural water management does. This research therefore supports [27] who note that without training, the ability of people in the different participating agencies to scale up is very limited. Communities need a great amount of training over a long period of time to be able to take rural water supply management [28]. Similarly, [15] highlights that the government needs to provide some long-term support through on-going training and monitoring of project activities to enhance long-term viability.

On the other hand, the study reveals that socio-economic factors such as inability to meet operation and maintenance costs, (χ^2=1.963,df=8, p= 0.069, p>0.05). complexity of technology used in the project (χ^2=8.894,df=8, p= 0.351, p>0.05)., unavailability of human resources (qualified staff working in the project) (χ^2=14.679,df=8, p= 0.066, p>0.05)., availability of other sources of water (χ^2=7.290,df=8, p= 0.506, p>0.05) and lack of motivation (χ^2=14.488,df=8, p= 0.07, p>0.05) do not significantly constrain community participation in rural water management in Ndarugu-Thiririka Sub-catchment. Therefore, regardless of the inability to meet operation and maintenance costs, the level of complexity of technology used in the project, unavailability of human resources, availability of other sources of water and lack of motivation, the community participates in rural water management.

4. Conclusion

The monthly income of the community is the most significant socio-economic factor that constrains community participation in rural water management. Other factors that significantly constraint community participation in rural water management include age, lack of access to adequate water, poor or lack of communication and sharing of information regarding the project, lack of education and awareness relating to rural water management, lack of the required technical skills, inability to pay for water tariffs, lack of ownership and lack of external support. However, the level of education, the income generating activity and the gender of the community are insignificant as far as community participation in rural water supply is concerned. Nevertheless, the study findings indicate that there is a significant relationship between community participation and education and awareness relating to rural water management.

Conflict of Interest

The author has no any conflict of interest.

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