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Institutional Factors that Influence the Survival of Traditional Irrigation Schemes in Nyandira: A Case of Mvomero District, Morogoro, Tanzania

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Abstract
Many studies on irrigation institutions in Tanzania have not focused on the survival of the traditional irrigation schemes. Therefore this study aimed to fill that knowledge gap. The main objective of this study was to assess institutional factors that influence survival of traditional irrigation schemes in Mvomero District, Tanzania. The study adopted a cross-sectional research design and data was collected from a sample of 200 respondents through household questionnaire survey. Additionally, focus group discussions and key informant interview methods were used in collecting the data. Multistage, purposive and simple random sampling methods were used. Qualitative data were analysed using content analysis and quantitative data by Statistical package for social science. The results show that enforcement on water payment fees ($\beta = +0.796$), water committee ($\beta = +0.159$) and users conformity to rules and regulations ($\beta = +0.060$) are statistically significant at $p < 0.001$ while rules on water distribution ($\beta = +0.0125$) and land ownership ($\beta = +0.096$) are statistically significant at $p < 0.01$. Also, 57% of respondents had a positive attitude towards the importance of water permits. Furthermore, Gender relations are similar on access to (95%) and control (94%) over resources thus it was practiced jointly. Based on these results it is concluded that water user associations should be registered and apply for water permits to get public funds. This will strengthen the survival of traditional irrigation schemes in Tanzania.
Keywords: Institutional factors, Water permits and Gender Relations.

1.0 Introduction

Irrigation in agriculture is an essential component of any strategy of increasing global food supply. The benefits of irrigation have resulted in lower food prices, higher employment and a more rapid agricultural and economic development (Chazovachii, 2012). Africa has promoted small scale irrigated agriculture as a means of ensuring food security as well as improving the standard of living of the rural people. Despite their important role in improving livehoods of rural farmers, small scale irrigation have had limited performance as well as low survival status (Mwendera and Chilonga, 2013). Research undertaken by the Water Commission has identified 317 small-scale irrigation schemes covering approximately 50 000 hectors in South Africa have been collapsed while many of irrigation schemes are under performance. This experience is not limited to South Africa but it appears to be a challenge facing the majority of African countries (Thomas, 2010).

In Sub-Saharan Africa, Gezira irrigation scheme in Sudan which is one of the largest irrigated agricultural schemes in Africa has been operated by institutions. Institutions involved in the construction, operation and maintenance of water supplies in the Gezira scheme, however people at the local level have been less involved. Lack of local institutionalized has led to schemes that are not effective at responding to local conditions while at the same time they are poorly funded and have limited technical staff (Fadul and Red, 2010). Ultimately, most of the Sub-Saharan Africans' irrigation schemes are less likely to survive.

Due to those challenges, the Tanzanian Government found that water affairs should be under control of the Ministry of Water. The regulatory and institutional framework for sustainable development and management of water resources (including traditional irrigation schemes) is provided in the Water Resources Management Act no. 11 of 2009. The Act outlines principles for water resources management, provides for the prevention, utilization, distribution, control of water pollution, participation of stakeholders and irrigators associations in implementation of National Water Policy of 2002 (Kashaigili, 2010).

In Morogoro region, the Ministry of water and irrigation is implementing that policy through Ruvu/Wami basin at higher level, in that respect all water user associations are supposed to be registered by the basin administration so as to be identified. In Mvomero District, Traditional irrigation schemes were established in 1920s as a supplement for rain-fed crop production to ensure the cultivation of crops throughout the year. The overall objectives were to ensure household food security, improve farmer's income and alleviate poverty through an increase in agricultural production and productivity resulting from access to irrigation water (URT, 2010).

Mvomero District is among the areas which has faced the problem of survival of traditional irrigation schemes (URT, 2010). The extent to which the problem persists has not been empirically proved. The question why traditional irrigation schemes have failed to survive in the District, despite the existence of institutional set

up from national level, river basin and Water User Association (WUA) in signifying Integrated Water Resources Management (IWRM) is debatable. The main reason for the situation is not well known; it may be due to weak institutions under local Government; inappropriate system design; ineffective management; low irrigation efficiencies; poor operations and maintenance or other factors. However, it is not known empirically whether any of these reasons have caused the variation of the survival status of the traditional irrigation schemes in the District. Therefore, there was a need for an investigation on irrigation institutions and survival of traditional irrigation schemes.

Studies on irrigation institutions are vast but they are less conducted in Tanzania. Studies done by Igbadun *et al*. (2007), van Koppen *et al.* (2004), Komakech *et al.* (2011) and Sokile *et al*. (2005) centred on irrigation scheduling, irrigation and poverty alleviation, formal water rights, management of river basin and integrated water resources management between formal and informal institutions respectively. In this respect very little attention has been paid to the survival of traditional irrigation schemes in relation to institutions. Therefore, this study aimed to fill this knowledge gap. This paper has addressed the institutional set up of informal irrigation schemes in relation to IWRM. Specifically the paper has focused on institutional arrangement, gender equality and water permits as the key principles pointed by Dublin Principles in 1992 (Masanyiwa *et al*. 2013).

2.0 Theoretical Review, Empirical Review and Gaps in Literature

2.1 Theoretical review

Structural Functionalism Theory by Emile Durkheim 1858-1917 proposes that a human society is like an organism and is made up of a structure called social institutions. These institutions are specially structured so that they perform different functions on behalf of the society. This theory attempts to provide an explanation on how human society is organized and what each of the various social institutions does in order for the society to continue existing (Kombo and Tromp, 2006). The theory has been adapted so as to conceptualize the significant implication of the roles played by institutions such as rules, regulations, customary laws, governance, policies and taboos to the survival of traditional irrigation schemes in Nyandira. A fascinating question is: Do the institutions which have governed Water User Associations in Nyandira have any significant influence to the survival of the traditional irrigation schemes?

2.2 Empirical Review

A study done by Lauraya and Sala (1995) in the Philippines showed that traditional irrigation systems are managed by smallholder farmers who work under irrigators association with the influence of the National Irrigation Administration (NIA). The NIA began its participatory program in the traditional irrigation systems in 1976, and have survived to date, and this is due to its positive results to the beneficiaries. The National Irrigation Association has enabled to transform national irrigation systems into jointly traditional farmer-managed irrigation systems with the ultimate aim of completely transferring operation and maintenance (O&M) responsibilities to the irrigators associations. Deribe (2008), reported that the involvement of smallholder farmers in the management of traditional irrigation schemes through irrigators' association can accelerate the improvement in the overall systems performance because they will learn and practice about preservation awareness, gender equality, maintenance of water sources, security of canal, conservation of natural vegetation along the canal and fair distribution of water between upstream and downstream users and conflict resolutions.

Institutions enable to govern irrigators' associations so as to ensure sustainable exploitation of water resources. Masanyiwa *et al*. (2013) reported that, any strong institution is obliged to consider gender equality in irrigation activities so as to determine who has access to and control over water resources so as to include all beneficiaries of all ages and sexes. Gender relations are of central importance for processes in which people's practices make and remake the 'rules of the game' because it plays a role in compliance to the rules, norms and agreements about water use. Therefore, survival of a particular traditional canal largely depends on the effectiveness of the institutions in monitoring gender equality and fairness in division of labour so as to regulate the use of the water resources equally (Akudugu, 2013).

2.3 Gaps in Literature

Many studies on irrigation institutions in Tanzania have focused on the performance of river basins (van Koppen *et al*., 2004; Ngana *et al*., 2010; Komakech *et al.,* 2011 and Komakech, 2013). Little attention has been given to the survival of traditional irrigation schemes in relation to institutions. Therefore, this study aimed to fill this knowledge gap.

3.0 Methodology

3.1 Study Area

The study was conducted at Nyandira Ward in Mvomero District, with a total population of 8644 people (4000

males and 4644 females). Kibuko, Ndugutu, Muharazi and Nyandira villages have a population of 1800, 1837, 2580 and 2427 people respectively. They constituted four villages of the Ward. The Ward is bordered by Langali Ward to the north, Tchenzema Ward to south and Kikeo Ward to the west. Nyandira Ward is located in the mountainous zone of Uluguru mountains about 06° 58' South and 37° 41' East and is part of the Eastern Arc Mountains (Lubida, 2004). The Uluguru Mountain's highest attitude is 2630m above mean sea level with rainfall over 3000 mm per annum (Ngana *et al.,* 2010).

3.2 Research Design, Sampling Procedure and Techniques

Cross sectional research design was used in this study because it allows collection of data in more than one case at a single point in time (Bryman, 2004). A multistage sampling technique was used to select District, Ward, Village and respondents. A simple random sampling technique was also used to select four irrigators' associations from the list of ten WUAs. Lastly the simple random sampling technique was used to select non-members' categories such as private users, non-members along the canal and pipeline water supply irrigators from a list which was provided by the Village Government office.

3.3 Data Collection

A combination of qualitative and quantitative methods of social research was employed to collect data for this particular study. Data was collected using a structured questionnaire with both open and closed ended questions. A checklist was used to collect data from twelve key informants who were knowledgeable with traditional irrigation schemes during key informant interview in Nyandira Ward. A Focus group discussion (FGD) approach was used to collect information from 20 participants. Two FGDs composed of 10 participants each were conducted. Gender was considered in the selection of the participants in the FGD.

3.4 Data Analysis

Qualitative data was analysed using content analysis, while quantitative data were analysed using Statistical Package for Social Sciences (SPSS) where relationships between variables were shown. Both descriptive and inferential statistical analyses were used in the study. SPSS was used to analyse descriptive statistics such as frequencies, percentages and cross tabulation. Inferential statistics such as chi-square, independent sample t-test and multiple linear regression models were also used to analyse the quantitative data. The linear regression equation was constructed based on borrowing what was written by Pallant (2011), in order to analyse variables by using SPSS as follows;

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots \beta_{10} X_{10} + \varepsilon_n$$

Where;

Y_1	=	Rehabilitation of irrigation infrastructure in a year (Annual cost spent in rehabilitation of irrigation infrastructures)
β_0	=	Constant of the equation
β_1 - β_{10}	=	Coefficient of the *n*th predictor
X_1 - X_{10}	=	Independent variables entered in the model
ε_n	=	Random error term
X_1	=	Age (Number of years)
X_2	=	Education level of Household head (0=Otherwise, 1=Educated)
X_3	=	Land ownership (0=Otherwise, 1=Own land)
X_4	=	Location of the canal (0=Tail, 1=Head)
X_5	=	Household size (Number of household members)
X_6	=	Water committee (0=Inactive, 1=Active)
X_7	=	Rules on water distribution between head and tail (0=Otherwise, 1=Strong)
X_8	=	Users conformity to rules and regulations (0=Bad, 1=Good)
X_9	=	Provision of punishment for users who don't abide the rules (0=Weak, 1=Strong)
X_{10}	=	Enforcement of water payment fees (0=Otherwise, 1=Adequate)

4.0 Empirical Findings

4.1 Institutional Factors Governing Traditional Irrigation Schemes

In the study, a multiple linear regression model was used to determine the institutional factors that had influenced survival of the traditional irrigation schemes. Five variables out of ten estimated in the model were found to be statistically significant at $p<0.001$, $p<0.01$ and $p<0.05$ level. Those variables were enforcement on water payment fees, water committee, users conformity to rules and regulations, rules on water distribution and land ownership. This implies that they were the most influencing factors for the survival of traditional irrigation schemes.

Findings in Table 1, show that the linear regression model was statistically significant (F-value = 73.512; p-value < 0.001). Significance of the model indicates that it could be used to predict the variables under the study. Multicollinearity was evaluated using the Tolerance and Variance Inflation Factors (VIF) estimated for each independent variable in the regression equation. Mtelevu and Kayunze (2014) argued that the Tolerance value of less than 0.1 and VIF above 9 suggests a problem of multicollinearity. Independent variables tested for multicollinearity agreed with the assumptions, which means the model was fine.

The dependent variable (cost spent in rehabilitation of irrigation infrastructure) was regressed against ten independent variables including age, education level, land ownership, location of the canal, household size, water committee, rules on water distribution between upstream and downstream users, users conformity to rules and regulations, provision of punishment and enforcement of water payment fees. The regression results show a multiple correlation of R = 0.793. This means that, the independent variables used in regression model were associated with the dependent variable by 79.3%. The multiple coefficient of determination (R^2) obtained was 0.692, which is regarded as the strength of the dependent variable to explain the fitness of the model. This means that the independent variables entered in the model had the ability of explaining the variation in the dependent variable by 69.2% (Pallant, 2005).

Table 1 below shows that all independent variables had positive coefficients of explanatory factors Beta (β) indicating that the more the independent variables increase the more they influence survival of traditional irrigation schemes in Nyandira. Furthermore, P-value shows whether the variables which were included in the Linear Regression model were statistically significant or not. If the variable was not statistical significant it means it did not influence survival of traditional irrigation schemes. If the variable was statistical significant it means it influenced the survival of tradition irrigation schemes in Nyandira very strongly.

Table 1: Results from Multiple Linear Regression Model

Independent Variable (X)	Beta (β)	Std. Error	t-value	p-value	Collinearity Statistics	
					Tolerance	VIF
Constant		0.111	73.636	0.000		
Age	+0.028	0.001	0.847	0.399	0.848	1.180
Education level of HH head	+0.007	0.043	0.210	0.834	0.906	1.104
Land ownership	+0.096	0.045	2.466	0.015	0.626	1.598
Location of the canal	+0.033	0.097	0.605	0.546	0.314	3.180
Household size	+0.021	0.011	0.609	0.543	0.835	1.197
Water Committee	+0.159	0.051	3.843	<0.001	0.557	1.795
Rules on water distribution	+0.125	0.047	3.140	0.002	0.597	1.676
Users conformity to rules and regulations	+0.060	0.201	4.546	<0.001	0.488	2.050
Provision of punishment	+0.045	0.043	1.233	0.220	0.703	1.423
Enforcement of water payment fees	+0.796	0.026	20.623	<0.001	0.637	1.570

R = 0.793, R Square (R^2) = 0.692, Adjusted R Square (R^2) = 0.631

Based on the question raised from the theoretical review which has been discussed in Section 2.1, institutions proved to be the influencing factor for survival of the traditional irrigation schemes in Nyandira.

Enforcement of water payment fees had a standardized coefficient of β = +0.366, statistically significant at p < 0.001 level of confidence. The positive regression coefficient implies that rules of water payment fees and rehabilitation of irrigation infrastructure were positively related. Increase in rules of water payment fee increases the chance of collecting more money that could be used for rehabilitation purposes. This is because the fees which has been contributed by users covered the rehabilitation cost, and as a result, the traditional irrigation schemes survived.

Water Committee has influenced the survival of traditional irrigation schemes. The findings showed that the Committee's fulfillment of their obligations had a positive influence (β = +0.159), statistically significant at the p < 0.001 level of confidence. This implies that the water Committees in WUAs fulfilled their tasks that made the performance of the canals to be good. The water committee had been enforcing the maintenance of the canal differently among the WUA. For instance in Fuku the enforcement was very strong and a person who did not attend the maintenance work was punished for example he/she will compensate for each day he/she missed by paying 5000 Tshs. Mbakana and Mzinga had the same system of enforcing rehabilitation of the canal by punishing its members.

Rules on water distribution had a standardized coefficient of β = +0.125, statistically significant at p < 0.01 level of confidence. The positive regression coefficient implies that rules on water distribution and rehabilitation of irrigation infrastructure were positively related. Rules on water distribution has enabled an equity of irrigation water supply between the upstream and downstream users especially at Fuku and Mzinga

WUAs. Due to that reason, water users' had been motivated to engage fully in operation and rehabilitation of their canals that has made their canals to survive.

Land ownership had a standardized coefficient of β = +0.096, statistically significant at $p < 0.01$ level of confidence. The positive regression coefficient implies that land ownership and rehabilitation of irrigation infrastructure were positively related which means the more people own land it increases their chance of irrigating and rehabilitating their canals simply because they would be practicing farming and irrigation more than the ones who don't have plots. The more the users own land the more chance of rehabilitation of irrigation infrastructure. This is because people would be motivated to engage themselves in irrigated agriculture which has a bearing on water availability in a canal. To ensure constant water supply for agricultural and other domestic uses such as bricks making, washing dishes, feeding animals and cooking they do not have a choice other than to maintain their canals.

Users conformity to rules and regulations had a standardized coefficient of β = +0.060, statistically significant at $p < 0.001$ level of confidence. The positive regression coefficient implies that users conform to rules and regulations and rehabilitation of irrigation infrastructure were positively related, thus the more the users conform to rules and regulations the more chance of rehabilitation of irrigation infrastructure. This has a direct implication on the survival of their irrigation canals.

Respondent's location at the canal had a standardized coefficient of β = +0.033, statistically insignificant at $p > 0.05$ level of confidence. The positive coefficient Beta implies that the more balanced number of respondents at the head and tail the more it influences survival of schemes, this is because being located at the head could motivate the users to keep their canal function. The reason for insignificance was because of several conflicts on water distribution that had an effect on rehabilitation and maintenance of canals especially at Nyamiseta and Mbakana WUAs. It was observed that conflicts emanated due to some upstream users who deliberately blocked water even though they knew it was against rules and regulations of WUAs. If people were abiding on rules and regulations on water distribution perhaps this variable would have been significant towards the survival of traditional irrigation schemes.

4.2 Water Permit in Nyandira

The Water Resources Management Act of 2009 under Section (43.1) requires any person who diverts, dams, stores, abstracts or uses water from surface or underground water sources, or for any such purpose constructs or maintains any works, shall apply for a Water Use Permit in accordance with the Act except for those who use water for domestic purpose in the limited condition defined by the Act. Nevertheless, JICA (2014) has revealed that 988 permits have been issued by Wami/Ruvu Basin. In case of Nyandira all WUAs have been extracting water for irrigation activities and they haven't had a water permit so far. Following discussion with Wami/Ruvu Basin officer, they have started baseline survey in four villages of Mgeta namely Nyandira, Ndugutu, Langali and Pinda as the platform in forming WUA that could enable to introduce water permit in Mgeta.

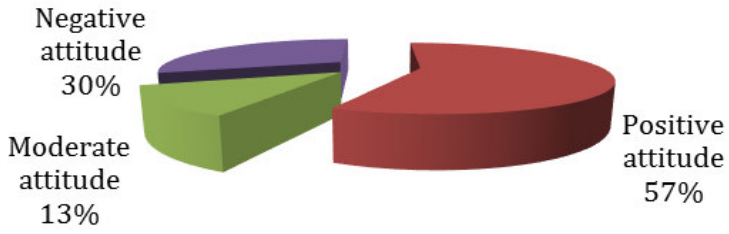

Figure 1: Overall Attitude of Respondents

With reference to the study findings in Nyandira (Figure 1), shows that more than half of the respondents were in the highest category of positive attitude (57%). Those with negative attitude were 30% and those with moderate attitude were 13%. This implies that most of irrigators in the study area believed that water permits had a significant factor towards survival of traditional irrigation schemes in Tanzania therefore they would like to have it. These results concurs with the study conducted by Akudugu (2013), which insisted that water permits can have a significant relationship towards sustainability of traditional canals. This is because they create awareness in water management, resources management and rehabilitation of irrigation infrastructure which has an implication towards survival of the traditional canals.

The mean score of the attitude between members and non-members were compared with the independent sample t-test, and the results in Table 2 shows that they were statistically significant at $p < 0.001$ level of confidence. This indicates a difference between the groups (members and non-members). The reason may be due to awareness which members had about water permit systems than non-members. It was found out that members have been attending trainings and workshop which were organised by UMADEP and MVIWATA on the matter. Also they have been pressed by the local Government to register for the water permits so that they can be in a position to receive Government funds for rehabilitation of their canals. If this is done, it may enhance

the survival of traditional irrigation schemes.

Table 2: T-test Results for Attitude between Members and Non-members

Variable	Levene's Test for Equality of Variances			T-test for Equality of Means					
Membership status	**F-value**	**Sig**	**T-test**	**Degree of freedom**	**Sig (2-tailed)**	**n**	**Mean**	**Mean difference**	**Standard deviation**
Members	0.108	0.743	5.042	13	<0.001	85	43.14	4.650	5.566
Non-members			5.173	124.9	<0.001	55	38.49	4.650	4.940

Despite the efforts that have been made to disseminate information on the importance of water permit systems in WUAs, its enforcement seems to have a challenge. The study done by van Koppen *et al.* (2004) has shown that the implementation of water permits and fees system in small scale water users in Tanzania is still a challenge because most of irrigators seems not to have them. Komakech *et al.* (2011) reported that, implementing the water permits and fee system in a basin where the majority of the water users are smallholder farmers who often already use and manage water under their own locally developed water rights regimes is a significant challenge.

4.3 Gender Relations in Irrigation

The Tanzania Vision 2025 aims a high quality livelihood characterised by sustainable and shared growth (equity), and freedom from abject poverty in a democratic environment. From that view, gender equality has been given a room so to address any kind of inequalities in water resources management (NAWAPO, 2002). In Nyandira Ward, Mvomero District, Morogoro similar situation has been happening. Irrigation and Drainage Policy (2010) has insisted a fair representation of both women and men in irrigators association, promoted effective participation of both women and men in initiation, implementation, operation and maintenance of irrigation schemes.

Table 3: **Gender vs Age Group (n = 200)**

Age group	Sex of Respondents			
	Male		Female	
	n	%	n	%
Children (under 18 years)	24	23.30	26	26.80
Youth (18 years to 54 years)	60	58.25	49	50.51
Elders (55 years and above)	19	18.45	22	22.68
Total	**103**	**100.00**	**97**	**100.00**

Table 3 shows how gender and age group are represented in Nyandira. It was observed that all gender were included in irrigation and farming activities regardless of sex and age groups. Youth of both sex dominated in these activities because most of them were energetic and were mostly demanded by WUAs as members. Nevertheless, children of both sex had been participating in agricultural activities to support their parents or grandparents. On the other hand elders of both sex were also participating in irrigation and farming activities. These findings imply a well representative of gender equality in irrigation activities which projects a milestone towards survival of irrigation schemes. Because all genders are included then it creates a sense of ownership to each individual in the WUA, therefore, it could influence intensive care, security, full participation and team work among members in decision making, planning, operation and maintenance of the canal. According to Bentvelsen (2004), gender mainstreaming in irrigation should be given first priority because it influences fair decision making that touches all genders whose target is to deliver as one, if this is done it would ensure endless irrigation management in an association.

Plate 1 shows gender is considered imperative in irrigation activities and maintenance of canals. This is very common in Nyandira, it creates a good chance of developing and maintaining their canals. It was observed that children were very keen to participate in irrigation activities and they were also very strict in maintaining irrigation scheduling especially watering plants at the exact time as required, and also to keep an eye on the progress of their parents/grandparents farms. From that view, when they grow up they will have been keeping and taking the same spirit to ensure their canals are sustainable.

The Harvard analytical framework was adopted from March and Mukhopadhyay (2005) to capture

access to and control as well as activity profiles. This was done to indicate who had more access to and control over resources, and to highlight the division of labour on farm and irrigation activities between male and female of all age groups such as children, youth and elders.

Plate 1: Gender Manifestation in Irrigation Activities in Nyandira

Table 4: Gender Participation in Farm and Irrigation Activities (n = 140)

Variable		**Activity Profile (%)**		
No		**M**	**F**	**B**
1.	Farm preparation	0	0	100
2.	Cultivation	0	0	100
3.	Irrigation	0	0	100
4.	Harvesting	0	0	100
5.	Selling	0.7	1.4	97.9
6.	Budgeting	31.4	20.7	47.9
7.	Fetching water	1	2.1	96.9
8.	Rehabilitation of canal	0.7	1	98.3
9.	Conflict resolution	0	0	100
10.	Water distribution	0	0	100
11.	Fee collection	0	0	100
12.	Security of canal	0	0	100
Mean average		**3**	**2**	**95**
Total mean average			**100**	

Key: M = Male (Children, Youth and Elders), F = Female (Children, Youth and Elders), B = Both Gender

Table 4 shows that majority (95%) of the respondents stated that both gender have opportunities for farm and irrigation activities (children, youth and elders). This indicates that both gender had been working together in farm preparation, cultivation, irrigation, harvesting, selling, budgeting, fetching water for domestic purposes, rehabilitation of the canal, conflict resolution, water distribution, fee collection and security of the canal. The plausible reason for that could be the dominance of matriarchal system where women are given power over land. Because women are being given land as a gift or inheritance, then when they get married they share the lands with their husbands. Husbands consider the land which has been given to their wives as part of family

where they have got to invest for the family, luckily enough they are not restricted by their wives when they want to invest in it. In that case, all genders were included in irrigation and agricultural activities because nobody could not restrict either sex of all age groups to participate in irrigation activities. Nosheen *et al.* (2008) reported that gender relations in agricultural activities were carried jointly in a study conducted in Pakistan because of capacity building and sensitization. At first women and children of both sex were considered less important in agricultural activities but it came the time when they discovered that their contribution in agricultural activities were much important because they were the one who had been working hard on farm and they had an interest than males of all age groups.

Table 5: **Overall Access to and Control over Resources (n = 140)**

Variable		**Access %**			**Control %**		
No		**M**	**F**	**B**	**M**	**F**	**B**
1.	Farm equipment -Hand hoe -Panga	0	0	100	0	0	100
2.	Irrigation equipment -Pumps -Canal and Pipeline water supply	0	0	100	2	2	96
3.	Decision Making	4	3	93	4	4	92
4.	Benefits	0	0	100	4	3	93
5.	Land	0.7	1.4	97.9	2	5	95
Mean average		**3**	**3**	**94**	**2**	**3**	**95**
Total mean average			**100**			**100**	

Key: M = Male (Children, Youth and Elders), F = Female (Children, Youth and Elders), B = Both Gender

Table 5 shows that majority (94%) of the respondents uncovered that both genders had access to agricultural resources. Furthermore, 95% of the respondents, revealed that both genders had an equal chance over control agricultural resources. It was revealed that some of the men did not have their own land, but they cultivated on their spouse's plots. They did all irrigation activities together as well as the selling of crops to the market and the income from the sales was equally shared. The reason behind gender equality and equity was the dominance of the matriarchal system in which women had more power over the access to and control of land which they had inherited from their parents. Most men relied on buying land or cultivating on spouses plots.

From Table 5, access to and control over resources were done by both gender such as farm equipment, irrigation equipment, decision making, benefits and land it indicates that gender equality was motivated them to participate equally in irrigation activities. In that respect, they had created a sense of ownership and patriotism that increased their participation to do operational and rehabilitation related activities in their WUAs. This influenced the survival of traditional irrigation schemes.

7.0 Conclusions

- Five factors were found to be statistically significant in influencing survival of traditional irrigation schemes. These factors were enforcement of water payment fees, water committee, rules on water distribution between upstream and downstream, land ownership and users conformity to rules and regulations.
- Irrigators have a positive attitude towards contribution of water permit systems for the survival of traditional irrigation schemes. However, dissemination of information about the significance of water permits to non-members have been a challenge as most of them were less informed. Therefore, the attitude between members and non-members on water permit differed significantly.
- Gender relations among the irrigators were found to be practiced jointly by males and females of all age. These were shown in access to and control over resources as well as activity profile which captured farm and irrigation activities.
- Village Government and Ward office have paid less attention to the WUAs. They lack expertise in the irrigation issues and most of technical matters has been done based on indigenous skills.

8.0 Recommendations

- All WUAs in Nyandira must be registered.
- The Government/NGOs must support WUAs financially/technically to strengthen their irrigation activities.
- WUAs must apply for water permits.
- Government and NGOs must give financial and technical support to the non-registered WUAs so as to give them a chance to maintain their canals.

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