International Journal of Development and Sustainability
ISSN: 2186-8662 – www.isdsnet.com/ijds
Volume 8 Number 2 (2019): Pages 179-198
ISDS Article ID: IJDS17032301

Determinants of willingness to participation in collective action among Farmers in Dzindi communal irrigation scheme, Limpopo province, South Africa

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Abstract

This paper examined determinants of willingness to participation in collective action among farmers in Dzindi communal irrigation scheme, Limpopo province, South Africa. From a study population of 106 plot holders, simple random sampling technique was used to select 97 plot holders. Data were collected with structured and face validated questionnaire and analysed with SPSS version 21 using frequency counts, percentages, and multiple regression analysis. The results revealed that majority of the farmers were male, more than 50 years, having at least 20 years of farming experience, having ownership of plots with large household sizes with more female per household than male. The prominent sources of information were television, radio, and extension officers. The results revealed that only three out of a list of 25 collective action activities were commonly practised. Overall, the tendency among irrigators for individualism is higher than collectivism on the irrigation scheme; there is an overwhelming general negative behaviour by farmers towards collective action and high knowledge by farmers on collective action processes. Significant determinants of willingness to participate in collective action activities were concern for in-group ($t = 1.68$, $p < 0.05$), perceived usefulness ($t = -2.11$, $p < 0.05$), gender ($t = -2.16$, $p < 0.05$), age ($t = -2.58$, $p < 0.05$), marital status ($t = 1.74$, $p < 0.05$), educational level ($t = -2.79$, $p < 0.05$) and religious belief ($t = -2.86$, $p < 0.05$).Based on the findings of this study, it is recommended that there is a need to improve on the mechanisms that will reduce the tendency among irrigators for individualism which was higher than collectivism; and to translate their high knowledge on collective action processes into actions.

Keywords: Collective Action; Smallholder Irrigation; Individualism; Collectivism; Livelihoods

Cite this article as: Letsoalo, S. and Oladele, O.I. (2019), "Determinants of willingness to participation in collective action among Farmers in Dzindi communal irrigation scheme, Limpopo province, South Africa", *International Journal of Development and Sustainability*, Vol. 8 No. 2, pp. 179-198.

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1. Introduction

Farming has many dimensions such as bio-physical, technical, economic, and social. In South African agricultural research, the social dimension of farming has received relatively little attention, yet, interactions and relationships among people and groups feature prominently in farming and influence agricultural activities and processes. South Africa is an arid country with limited water resources and moderately traditional irrigation. In addition the emphasis has been on the creation of large and medium scale irrigation schemes, but there has been inadequate support to informal irrigation. In terms of small scale farms, the most successful ones are those which developed from farmers initiatives. The spirit of small scale irrigation is the fact that it is managed and controlled by farmers who are the users. Small scale irrigation is the easiest where a farmer has independent access to a water source (FAO, 2005).

Decentralisation and privatisation have been the hallmark of global irrigation management for the past three decades and many countries have changed the management of smallholder irrigation system from public to private local management entities (Vermillion, 1997). This process of change in irrigation management transfer includes development and empowerment of Water Users Association and granting autonomy to private local management entities. In following global trend, South Africa government introduced decentralisation and privatisation processes to smallholder irrigation schemes in enclaves outside apartheid –era governments referred to as homeland areas (Perret, 2002). Similarly, Malawi has since 1999 implemented new irrigation, land and water policies and supporting legislation have been approved by parliament with the drive to privatise resources under customary tenure such that land title, water permits and transfer of smallholder irrigation schemes to users (Ferguson and Mulwafu, 2005).

Canal irrigation schemes are projects in which a group of farmers share water and irrigation infrastructure. This creates particular domains for interaction among farmers because the functioning of their individual farm enterprises is dependent on resource sharing and maintenance arrangements. Management models for the sharing and maintenance of common resources on canal irrigation can be categorised on the basis of agency in planning, control, allocation and maintenance of these resources. Three main management models have been developed, namely i) public management of the shared resources on behalf of scheme farmers; ii) farmer management; and iii) management by a third party. Prior to the democratisation of South Africa, public management on behalf of farmers prevailed on the country's smallholder irrigation schemes. Following democratisation, a policy of irrigation management transfer (IMT) was adopted. This policy transferred management, operation and maintenance of schemes to plot holder communities. The transfer of power and responsibility from the state to farmers created new arenas for social interaction among farmers. These arenas are somewhat specific to canal irrigation schemes and are critical to the efficient functioning of these schemes through the invigoration of collective action processes.

Collective action occurs in these canal irrigation schemes whereby multiple farmers share water and infrastructure and this brings about particular forms of interdependence among different farming units. The functioning of the individual farm enterprises on these schemes is dependent on organised cooperative planning, control and the maintenance of these common resources. Collective action refers to deeds taken by a group, either directly or on its behalf through an organisation, in pursuit of the perceived shared interests of

members (Marshall, 1998). The success of the community-based management of resources is dependent upon the functioning of the local collective action (Esmail, 1997). Collective actions work with a set of working rules that are used to determine who is eligible to make decisions in an arena, permitted actions, applicable group rules, procedures, information sharing and individuals payoffs (Ostrom, 1986).

2. Collective action, water sharing and irrigation scheme

The descriptions by different authors, such as Ostrom (1990:23), Agarwal (1994:51), Kurien (1995:39), Meinzen-Dick *etal*., (1997:42) and Marshall (1998; 11) on the meaning, basis and attributes of collective action imply that the operation of collective action is the product of interaction among three main elements, namely, the group, its action and the common goal. The functioning of a group is determined by its cultural configuration, at times referred to as cultural make-up, and the group's social structure. Application of cultural configuration is conducted through protocol that acknowledges positions and roles in a group, dubbed social structure, resulting in endorsed social structural strategies in the collective action.

Studies on collective action on water sharing in South Africa's irrigation schemes are limited. There are few related studies that have been conducted such as the one that was carried out by Veldwisch in 2005 on local governance of Thabina irrigation scheme. However, in other countries of the world, a number of studies have been carried out. A close examination of these studies presents a typology with four categories. The first category of studies used simulation models to investigate which of several distribution arrangements is best for some class of irrigation systems (Anderson and Maass (1987); Chaudhry and Young (1990); Howe (1990:22); Kelley and Johnson (1990:38). These studies present an essentially condensed version of both irrigation water arrangements and the situations in which they are used. However, the studies fail to clarify full consequences of a given set of irrigation water sharing arrangements.

Studies in the second category of the typology probed into the distribution performance of irrigation systems with reference to the consequences of water distribution arrangements. The ground breaking study conducted by Malhotra (1982) on the Warabandi management system in Haryana explores water distribution institutions and suggests that they contribute to excellent performance. However, Palanisami (1984) states the contrary that in Lower Bhavani System in Tamil Nadu a number of the problems that are prevailing are caused by a rule for rotating water supplies among different sharing groups of farmers. Studies in this category do not try to separate the result cost of the institutions from the consequences of other aspects of system management, such as the physical structures, information systems and other facilities for management.

The third category of studies in the typology paid attention to the mode and extent which institutions of irrigation water distribution were acceptable. The studies in this group elucidated the links between institutions and the behaviour of farmers, but they generally do not deal with the consequences of these behaviours for distribution performance. Bandaragoda and Rehman (1995) proved that Warabandi arrangements in parts of Pakistan are not being followed. The studies conclude that the practice of ignoring the arrangements is attributed to the poor main system performance (Lowdermilk 1990). In the same vein, Wade (1987) illustrates that many farmer actions against the arrangements come due to the failure of the main

system to deliver water as it should. Vermillion (1986:38, 1991:10) explains how and why farmers regularly deviate from the arrangements. He postulates that such deviation is an effective adjustment of inflexible arrangements to varying local situations.

The fourth group of studies in the typology looks at irrigation management as a case of management of common pool resources. This category comprises studies by Ostrom (1992) and Ostrom, Gardner, and Walker (1993). These studies paid more attention to the behaviour of farmers and organisation managers. The extensive studies conducted by Tang (1992, 1993) compare performance evaluations and generalised distribution institutions in at least 47 different irrigation systems. Tang (1992, 1993) does not draw firm conclusions, but the evidence suggests, among other things, that, an arrangement for allocating water to farmers in strict proportion to landholdings leads to poorer performance than allocation to farmers through multiple criteria. Tang's study, however, does not explain how differences in arrangements led to differences in performance.

Perry (1995) offers a broad and persuasive hypothesis about the relation of water distribution institutions and system performance. He argues that, if the physical infrastructure and the management personnel are not capable of delivering water as specified by water distribution arrangements, the result will be poor system performance. Following this lead, it is suggested that a general study of the relation between irrigation water distribution arrangements and irrigation water distribution performance should focus not only on the internal characteristics of the arrangements, but also on the factors to which the arrangements must be adapted to result in good water distribution performance.The first two groups of studies explicitly or implicitly focus on the question: what is the best set of distribution arrangements for specific situations? The latter two groups focus on why a set of arrangement determinants works or do not work. While all these studies are relevant, none attempts to deal with the origin and the nuances around the behaviour in the collective action in the sharing of irrigation water.

3. Historical formal water-sharing arrangements

At the establishment of Dzindi, the state, personified by a white extension officer, presented farmers with a set of rules pertaining to the use of water entering the scheme. The rules were communicated verbally to the farmers. No written records of rules and regulations on water- sharing dating as far back as that time could be found. There is doubt if such records were ever held at the Scheme, because two farmers, who were part of the Scheme Management Committee at its establishment, claimed never to have seen a copy.

The first water-sharing rule governed access to irrigation water. Dzindi was not designed to allow farmers to irrigate whenever and however they wished. Instead, the design allowed farmers to irrigate once a week over and during the day. Farmers were instructed to follow an irrigation timetable, which listed the 106 plot numbers and the days and times during which each plot holder could draw water from the distribution system to irrigate his or her plot. Farmers who failed to make use of their specific water allocation time forsook irrigation for that particular week, or had to irrigate at night. Since water entered the distribution system around the clock, all farmers who were prepared to work at night were free to use water as they wished.

The second rule controlled the flow of water in the conveyance system. At times, the flow reaching farmers' fields was insufficient to complete the irrigation of an entire plot. This commonly occurred immediately after land preparation, when the infiltration rates of the soils were at their highest, or when the flow in Dzindi River was low due to drought. Raising the amount of water reaching a particular plot was achieved by obstructing the flow in the canal just behind the outlet to the distribution furrow that conveys water to the plot, for example, by placing a large stone at the bottom of the canal. Obstructing the flow of water raised the water level in the canal ahead of the obstruction, thus causing more water to enter the furrow. The rule stipulated that farmers were not allowed to manipulate the flow of water in the canal, because this reduced the amount of water made available to farmers farther down. The third rule was aimed at keeping the water in the canal clean. It forbade farmers from washing their bodies or clothes in the canal, especially when that involved the use of soaps.

From the onset, enforcing water-sharing rules was left in the hands of farmers who were assisted by two water-bailiffs. The water-bailiffs were civil servants tasked with policing the use of water in the Scheme. Their duty was to report offenders of the rules to an organisation of farmers, called the Scheme Management Committee (SMC), not to the Extension Officer. The SMC consisted of nine scheme farmers and governed by a constitution. The full body of plot holders elected members to the SMC. The term of office of elected SMC members was three years. When informed of an offence, the SMC invited the accused to a meeting. At the meeting, the charge would be explained to the accused, who was then granted an opportunity to state his or her side of the case. A monetary fine was imposed by the SMC on any member who was guilty of breaking the rules. The value of the fine for transgressing any of the three water-sharing rules was the same, namely, 25 cents. This value remained unchanged until 1982. The money collected from fines remained available for use by the Dzindi plot holder community. Its disbursement was controlled by the SMC, and was primarily used to pay for reparations and maintenance of infrastructure in the Scheme.

A farmer who was accused of an offence, but who failed to attend the appointed SMC hearing, without an acceptable apology, or who refused to pay the fine imposed on him or her, was invited twice again to a SMC meeting. In the absence of a suitable response, the accused was reported to the local headman, who, in turn, forwarded the matter to Chief Tshivhase, under whose jurisdiction the farmers in Dzindi fell. In all cases involving the breach of water-sharing rules brought before the Chief, he enforced the decisions of the SMC without insisting on a verification process. This indicates that the Chief accepted the legitimacy and authority of the SMC to make decisions on the sharing of water in Dzindi. Involvement of the Chief, however, caused the fine to be doubled. One half of the new amount, equal to the original fine, was paid to the SMC, while the other half was paid over to the Chief for settling the case.

Smallholder canal irrigation schemes in South Africa involve groups of individuals who have to share resources such as land and irrigation water. These groups have to collaborate in activities such as maintaining the irrigation infrastructure, accessing input and out markets. External costs in sharing resources are often transferred from one plot holder to another and attempts of one plot holder alone to conserve shared scarce resources may be threatened (Pretty, 1995). For example, weeds on the boundaries of plots will affect neighbouring plots in harbouring pests. The attainment of common goals of these groups depends on the effectiveness of collective action. Although collective action in smallholder agriculture and agricultural projects is important, pathway for analysis remains elusive.

Collective action involving group training in production and storage facilities, negotiation abilities and group marketing, and aiming to improve smallholder benefits in the value chain have been used to improve market access and the bargaining power of producers (Gyau et al., 2012). Despite the potential benefits which have been associated with group marketing, not all producers are willing to participate. Rezaei-Moghaddam and Salehi (2010) argue that the perception of farmers and their attitudes are very important for the adoption of techniques and practices. Lin (2007) maintains that motivation is a key factor that determines human behaviour and action. Therefore, by understanding the attitudes of farmers their opinions and motivation for collective action, an introduction of more effective messages and techniques which can enhance farmers' decision to participate in group activities is conceivable. Previous research involving collective action in agriculture has examined the characteristics and assets of farmers groups which facilitate their involvement in collective action (Barham and Chitemi, 2009); determined the conditions for successful collective action (Wade, 1988; Ostrom, 1990, 1992; Baland and Platteau, 1996) and analysed how the theory of collective action can provide a more holistic understanding of the operations of markets, changes in markets and how market institutions can permit a more equitable distribution of welfare benefits (Kruijssen et al., 2009).

According to several authors, the two basic ways of understanding the relationship between individuals in a group are individualism (that individual actions, choices, and interaction with the rest of the group as individuals) and collectivism (which views the group as the primary entity and individuals are just members of the group). Collectivism views the group as the important element with its values somehow different from those of the individual members and judges the group as a whole. Triandis and Gelfland (1998) state that the four dimensions of collectivism and individualism include vertical collectivism (identification, acceptance of hierarchy and inequality within a collective); vertical individualism (individual autonomy and acceptance of inequality in a collective); horizontal collectivism (identification and acceptance of equality in a collective) and horizontal individualism (individual autonomy and acceptance of equality as ideal in a collective).

Dzindi was chosen as a case because the project has been able to survive the ongoing process of state withdrawal from black irrigation projects, and contributed to the collapse of many similar projects such as the Shilo, Ncora, Tyefu and Keiskammahoek Irrigation Schemes in the Eastern Cape (Bembridge, 1997:74; and Bembridge, 2000:15). Dzindi Irrigation Scheme was among a multitude of projects identified and recommended after World War II for the settlement of black smallholders on irrigation plots, with a view of creating a class of full-time irrigation farmers in the native areas of South Africa (Commission for the socio-economic development of the Bantu areas within the Union of South Africa, 1955:197).

In order to analyse farmers' motivation for collective action, a conceptual model of farmers' collective action behaviour (CAB) was developed based on TAM. According to the CAB, farmers' behavioural intent about the collective action initiative will be influenced by the Perceived Usefulness (PU) and the Perceived Ease of Use (PEU) of the initiatives. Both the PEU and PU are also conceptualised to be influenced by the farmers' intrinsic motivation (IM) for engaging in collective action. Intrinsic motivation is the performance of an activity for its inherent interest other than the direct economic benefits. PU refers to the users' believe of their performance being enhanced by the system (Phillips et al., 1994). The perceived ease of use refers to the extent to which the system to be free of efforts by the user (Zhang et al., 2009). The attitude measures a person's perception about an idea or a system (Ajzen and Fishbein, 1980).

The rehabilitation and improvement of smallholder irrigation needs should be based on the comprehensive understanding of the social organisation of activities. Understanding the patterns of social interaction in the collective management of canal irrigation resources enables the identification of strengths and weaknesses in the collective management style and practices of smallholder communities. Policy measures aimed at re-enforcing the strengths and remedy the weaknesses are expected to enhance the efficiency with which smallholders on canal irrigation schemes manage their resources. The main objective of the study was to analyse the determinants of collective action among farmers in Dzindi communal irrigation scheme, Limpopo Province, South Africa.

4. Methods

Dzindi, (23°01'S; 30°26'E), a smallholder irrigation scheme established in 1954, forms part of the Thulamela Municipality with Thohoyandou as its administrative centre. The distance along the road between Dzindi and the centre of Thohoyandou is about 10 km, but peri-urban settlement extends to the northern boundary of the Scheme. Dzindi is a surface irrigation scheme that covers an area of 136 hectares subdivided into 106 plots of 1.28 ha (1.5 morgen) each. Dzindi obtains its water from a weir in the Dzindi River. At the weir, water enters the main concrete canal that conveys it to plots of farmers. Farmers obtain water from narrow concrete furrows, which directs the water from the main canal to the plots. All plot holders in Dzindi farm on single plots with the exception of the farmers who have double plots. A rotation of maize in summer and vegetables in winter dominates production. When the flow in the river is adequate, the amount of water entering the scheme is sufficient only to permit farmers to irrigate once a week. Low flow in Dzindi River during winter and spring, deterioration of the conveyance system in the form of cracks in the secondary concrete furrows, and subsidence of parts of the main canal further limit the availability of irrigation water.

Dzindi was chosen as a case because to date, the project has survived the process of state withdrawal from black irrigation projects, and contributed to the collapse of many similar projects, such as the Shilo, Ncora, Tyefu and Keiskammahoek Irrigation Schemes in the Eastern Cape (Bembridge, 1997:74) and (Bembridge, 2000:15). Dzindi Irrigation Scheme was among a multitude of projects identified and recommended after World War II for the settlement of black smallholders on irrigation plots, with a view of creating a class of full-time irrigation farmers in the native areas of South Africa (Commission for the socio-economic development of the Bantu areas within the Union of South Africa, 1955:197). Dzindi is a surface irrigation scheme that covers an area of 136 ha subdivided into 106 plots of 1.28 hectares (1.5 morgen) each. Dzindi obtains its water from a weir in the Dzindi River. At the weir, water enters the main concrete canal that conveys it to the plots of farmers. Farmers obtain water from narrow concrete furrows, which directs the water from the main canal to the plots.

4.1. Data and sampling

The population of this study include all plot holders in Dzindi, smallholder irrigation scheme. According to van Averbeke (2013) there are 106 plot holders in the irrigation scheme. Simple random sampling techniques were

used to select 97 plot holders. Data for this study was generated from primary sources based on the objectives of the study. A structured questionnaire consisting of five sections was developed. The questionnaire was face validated by a panel of experts on agricultural extension, collective action and research. The panel consisted of lecturers in Agricultural Extension, Community and Senior Management Officers in the Department of Agriculture and Rural Development as well as research. To ensure the reliability of the questionnaire, a split half technique was used to determine the reliability coefficient with a reliability coefficient of 0.85.Data was analysed using the Statistical Package for Social Sciences (SPSS) 18.0. Descriptive statistics such as standard deviation mean multiple regression analysis was used to determine the effect of predictors on dependent variables of the study.

The first objective on participation in collective action activities is analysed using an ordinary least square (OLS) model. The OLS model for this study is specified as

$$Y_i = \alpha_0 + \alpha_1 X_{i1} + \cdots + \alpha_{25} X_{i25} + e \quad \text{..... (1)}$$

Where $Y_i = participation\ in\ collective\ action\ activities$,

$Y_i = \alpha_0 + X_1 Gender + X_2 Age + X_3\ Farming\ experience + X_4 Marital\ status + X_5 Educational\ level + X_6 Religious\ belief + X_7 Land\ ownership + X_8 Land\ allocation\ process + X_9 Distance\ to\ market + X_{10} Types\ of\ markets\ used + X_{11} Conflict\ resolution + X_{12} Value\ subscale + X_{13} Team\ member\ exchange + X_{14} Self\text{-}reliance\ with\ competition + X_{15} Concern\ for\ in\text{-}group + X_{16} Distance\ from\ in\text{-}group + X_{17} Horizontal\ individualism + X_{18} Vertical\ individualism + X_{19} Horizontal\ collectivism + X_{20} Vertical\ collectivism + X_{21} Intrinsic\ motivation + X_{22} Perceived\ usefulness + X_{23} Perceived\ ease\ of\ use + X_{24} Behavioural\ intent + X_{25} Knowledge\ of\ collective\ action + e$ *.....(2)*

Where *Y* and *e represent* participation in collective action and error term respectively.

A probit regression model was applied to isolate factors that determine farmers' willingness to participate in collective action due to the binary nature of the dependent variable. Willingness to participate in collective action (Y) was operationalized as a dummy variable as willingness = 1 and unwillingness = 0.

The general probit model is depicted in equation 3:

$Y^* = \beta_1 X_{1i} + \ldots\ldots\ldots \beta_j X_{ji} + ui$ .....(3)

, Y^* in this study is willingness to participate in collective action which is used as a substitute for Y^*. This agrees with Ameniya, (1981) and Maddala, (1983) that probit model is appropriate when the dependent variable to be evaluated is in binary form.

Following from Greene (2003), the binary probit for the two choice models can be written as:

$$Y_i^* = \begin{cases} 1\ if\ Y_i^* > Y \\ 0\ if\ Y_i^* \leq 0 \end{cases} \quad \text{..... (4)}$$

$$P\left(Y=\frac{1}{X}\right)=F(XB)=\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{XB}e^{\frac{-(XB)^2}{2}}dx \quad \text{..... (5)}$$

$$X=(1,x_{1i},x_{2i},\ldots\ldots,x_{ki}) \quad \text{..... (6)}$$

$$\beta'=(\beta_0,\beta_1,\ldots\ldots\ldots\ldots,\beta_k) \quad \text{..... (7)}$$

The actual model specification forwillingness to participate in collective action is

$Y_i = \beta_0 + \beta_1 Gender + \beta_2 Age + \beta_3 Farmingexperience + \beta_4 Marital\ status + \beta_5 Educational\ level + \beta_6 Religious\ belief + \beta_7 Land\ ownership + \beta_8 Land\ allocation\ process + \beta_9 Distance\ to\ market + \beta_{10} Types\ of\ markets\ used + \beta_{11} Conflict\ resolution + \beta_{12} Value\ subscale + \beta_{13} Team\ member\ exchange + \beta_{14} Self\text{-}reliance\ with\ competition + \beta_{15} Concern\ for\ in\text{-}group + \beta_{16} Distance\ from\ in\text{-}group + \beta_{17} Horizontal\ individualism + \beta_{18} Vertical\ individualism + \beta_{19} Horizontal\ collectivism + \beta_{20} Vertical\ collectivism + \beta_{21} Intrinsic\ motivation + \beta_{22} Perceived\ usefulness + \beta_{23} Perceived\ ease\ of\ use + \beta_{24} Behavioural\ intent + \beta_{25} Knowledge\ of\ collective\ action + \mu_i$

Where Y_i and μ_i *represent* willingness to participate in collective action and error term respectively.

5. Results and discussion

Gender is expected to have a significant effect on participation in collective action activities. Males are expected to have higher willingness of participation in collective action activities relative to females. Female farmers usually lack access to productive agricultural resource that enhances their socio-economic conditions. Age as a substitute to experience and availability of resources is expected to influence willingness to participate in collective action activities negatively. According to Etwire et al. ([2013]), younger farmers with characteristics such as innovative and risk loving as being married enhances adoption of new technology. Nnadi and Akwiwu ([2008]) noted that farmer's concern for household welfare and food security increases with marital status which in turn influences their decision to participate in an agricultural project. Enete and Igbokwe (2009), Olwande and Mathenge [2010]) and Martey et al. (2013) stated that educational level, household size, land availability, and membership of association/group influence willingness to participate in collective action activities. Adimado [2001]; Kheralla et al. [2001]; Langyintuo and Mekuria [2005] reported that farm size and decision to join or adopt are significantly related.

Tendency on individualism and collectivism are psychological traits that would influence the behavioural disposition towards collective action. The sub sections for collectivism were values, team- member exchange quality, horizontal collectivism and vertical collectivism. The sub section on individualism consist of self-reliance with competition, concern for in-group, distance from in groups, horizontal individualism and vertical individualism. Stofferahn (2004) found that group-farming arrangements that permit sharing of machinery and labour are more frequent elsewhere than United States. Harris and Fulton (1999) are of the opinion that

the sharing of farm machinery through the formation of a farm machinery cooperative can provide farmers with a number of benefits.

Table 1. Summary statistics of variables used in regression

Variables	Description	Min	Max	Mean	SD
Gender	Male is 1, 0 if otherwise	-	-	-	-
Age	Actual age in years	21.00	77.00	57.29	12.80
Farming experience	Actual experience in years	4.00	55.00	29.13	11.82
Marital status	Married is 1, 0 if otherwise	-	-	-	-
Educational level	Number of years of education	.00	5.00	2.97	1.25
Religious belief	Christianity is 1, 0 if otherwise	-	-	-	-
Land ownership	Personal is 1, 0 if other wise	-	-	-	-
Land allocation process	First comer basis is 1, 0 if otherwise	-	-	-	-
Distance to market	Actual number of kilometres	.00	100.00	6.70	16.71
Types of markets used	Farm gate is 1, 0 if otherwise	-	-	-	-
Conflict resolution	Pooled score for 3 items on a 2 point scale	.00	18.00	11.08	4.03
Collective action [c]	Pooled score for 25 items on a 5 point scale	28.00	109.00	64.42	20.11
Value subscale [a]	Pooled score for 3 items on a 5 point scale	.00	15.00	8.92	3.73
Team member exchange [a]	Pooled score for 14 items on a 5 point scale	14.00	70.00	42.39	15.57
Self-reliance with competition [a]	Pooled score for12 items on a 5 point scale	.00	60.00	39.65	13.14
Concern for in-group [a]	Pooled score for 9 items on a 5 point scale	.00	45.00	26.98	10.04
Distance from in-group [a]	Pooled score for 7 items on a 5 point scale	.00	35.00	24.21	9.37
Horizontal individualism [a]	Pooled score for 8 items on a 5 point scale	.00	40.00	27.95	9.30
Vertical individualism [a]	Pooled score for 8 items on a 5 point scale	.00	60.00	37.24	13.12
Horizontal collectivism [a]	Pooled score for 10 items on a 5 point scale	.00	50.00	32.49	11.86
Vertical collectivism [a]	Pooled score for 8 items on a 5 point scale	.00	40.00	22.62	9.80
Intrinsic motivation [b]	Pooled score for 3 items on a 5 point scale	.00	15.00	8.05	3.44
Perceived usefulness [b]	Pooled score for 4 items on a 5 point scale	.00	20.00	11.15	4.26
Perceived ease of use [b]	Pooled score for 3 items on a 5 point scale	.00	15.00	7.98	3.34
Behavioural intent [b]	Pooled score for 3 items on a 5 point scale	.00	15.00	7.88	3.15
Knowledge of collective action	Pooled score for 38 items on a 2 point scale	.00	76.00	59.92	15.65
Willingness to participate	Willing is 1, 0 if otherwise	.00	1.00	.53	.50

[a] Scale of 1= no, not at all to 5= yes indeed; [b] Scale of 1 (strongly disagree), 2 (Disagree) 3 (Uncertain) 4 (Agree) and 5 (Strongly agree). [c] Scale of participation and extent of participation Yes 2, no 1, Regularly (3), occasionally (2) rarely (1)

Table 2 shows a list of 25 collective action activities in the irrigation scheme. The respondents were asked to rate the activities on a 2 point scale of Yes (2) and No (1) for participation and a 3 point scale of regularly (3), occasionally (2) and rarely (1) for the frequency of participation. Due to these rating scales, the actual mean for participation is 1.5 while for frequency of participation, the actual mean is 2. The implications of these actual mean were that mean scores above the actual mean show high participation while those below the actual mean indicate low participation. The same interpretation holds for the frequency of participation.

The results revealed that only 3 activities were above the mean for participation. These were replacement of damaged concrete slabs (1.57), weed control in joints (1.54) and participation in meetings (1.53). These results may be due to the fact that these activities are important to water distribution in the scheme for farmers to have access to water

. Fischer and Qaim (2012) found that among smallholder banana farmers in Kenya, wealthier households are more likely to join and found positive income effects for active group members. Yet, price advantages of collective marketing are small, and high-value market potentials have not yet been tapped. Naziri et al. (2013) found that collective action affects provide members with technical assistance, monitoring and certification. Mukundi, Mathenge and Ngigi (2013) found that collective market participation is predominantly determined by the resource base of a household whereby, size of land owned is a fundamental factor. Limnirankul (2007) reports that in Northern Thailand, many small-scale rice farmers practise collective action to overcome production constraints, and to generate and redistribute benefits for maintaining improved household livelihoods.

In terms of frequency of participation in collective action activities, all mean scores were below the actual mean of 2. This might be due to the fact that there exist free-rider problems among irrigators in the scheme. Alboiu (2013) found that farmers' participation in collective actions in the Romanian supply chains, is influenced by institutional arrangements. André Devaux, Claudio Velasco, Gastón López, Thomas Bernet, Miguel Ordinola, Hernán and Pico, (2007) reported that collective action to reduce poverty in the Andes, through market niches and adding value to potatoes. Mabuza, Ortmann and Wale (2012) identified the key factors that unify members of informal collective initiatives. In contrast to formal organisations, which are regulated by law, informal groups are fully autonomous and not regulated by any legal instrument in Swaziland.

The studies by Mogoi et al. (2012) stated that local users often have intimate knowledge of the resource and because their livelihoods depend on it, they have the greatest incentive to maintain the resource base. Mogoi et al. (2012) emphasised that community-based natural resource management can only succeed through building social capital, enhancing collective action, and empowering communities to be involved in policy and decision making.

The OLS model is used to analyze participation in collective action activitiesand the results are presented in Table3. Participation in collective action was regressed against socio-economic characteristics, tendency on individualism and collectivism and knowledge of collective action. The model is well fit and significant at 1 %. The results show that there is a significant relationship between participation in collective action and the independent variables $F = 3.86$, $p < 0.05$. Also the R value of 0.71 shows strong correlation between participation in collective action processes and the independent variables. The independent variables were

able to explain 55 percent of the variation in participation in collective action processes by the irrigators. Significant determinants of participation in collective action process were intrinsic motivation ($t = -2.14$, $p < 0.05$), perceived usefulness of collective action ($t = 1.79$, $p < 0.05$), knowledge of collective action ($t = 1.83$, $p < 0.05$), conflict resolution methods ($t = 2.39$, $p < 0.05$), age ($t = -4.19$, $p < 0.05$), farming experience ($t = 2.44$, $p < 0.05$), educational level ($t = -2.47$, $p < 0.05$), religious belief ($t = 2.28$, $p < 0.05$), and distance to market ($t = -3.21$, $p < 0.05$). Due to the positive relationship between the significant independent variables and the a priori sign that were matched, the results implies that as these variable increases, irrigators' participation in collective action processes will increase. The negative sign implies an inverse relationship between the independent variables and participation in collective action activities.

Table 2. Dzindi's irrigators, participation in collective action activities in the scheme

	Participation		Frequency of participation	
	Mean	SD	Mean	SD
Replacement of joints	1.49	0.63	1.56	1.17
Replacement of damaged concrete slabs	1.57	0.61	1.57	1.16
Weed control in joints	1.54	0.65	1.57	1.25
Weed control on surface of concrete slabs	1.47	0.65	1.48	1.23
Control and removal of silt	1.41	0.63	1.14	1.18
Maintenance of roadways	1.36	0.62	0.99	1.12
Consultation with scheme management committee	1.38	0.60	1.39	1.18
Participation in meetings	1.53	0.60	1.55	1.23
Membership of groups	1.39	0.60	1.23	1.20
Division of work activities	1.19	0.55	1.06	1.15
Monitoring of irrigation at night	1.25	0.50	0.97	1.12
Greasing of the control gates	1.31	0.55	1.01	1.17
Greasing of the valves	1.32	0.53	1.03	1.19
Detection of leakages	1.40	0.59	1.24	1.26
Detection of seepages	1.38	0.57	0.98	1.12
Detection of canal cracks	1.36	0.54	0.97	1.15
Detection of leaking aqueduct	1.24	0.55	0.80	1.11
Detection of leaking subsidence of sections of the main canal	1.25	0.54	1.03	1.15
Fees for maintenance	1.30	0.56	0.97	1.14
Adherence to water rosters	1.30	0.65	1.22	1.26
Consultation before plot transfer	1.33	0.61	1.05	1.17
Expenses for irrigation maintenance	1.39	0.59	1.11	1.13
Expenses for ceremonial events	1.40	0.61	1.16	1.16
Labor participation in irrigation maintenance	1.43	0.63	1.42	1.16
Labour participation in community work	1.37	0.75	1.63	1.04

Fischerand Qaim (2013) found that collective action helps smallholders farmers to remain competitive in rapidly changing markets. Willy and Holm-Müller (2013) found that social capital, neighbourhood social influences, subjective norms, gender, education level, farm size, access to credit and livestock ownership as key determinants of soil conservation effort. Haque et al. (2011) reported that factors influencing collective action for common resource management in Bangladesh include resource scarcity, market distance from the resource, group size, heterogeneity in the community and involvement of other institutions.

Kirui (2013) reported that farmer/household specific variables, farm specific variables, endowment variables and regional variables influence the decision to participate as well as the extent of participation in collective action initiatives. Also, there exist significant differences in output and input market participation (commercialisation) and in mean incomes as a result of participation in collective action initiatives which influence the decision to participate in collective action initiatives. Fischer and Qaim (2013) investigated determinants of smallholder participation intensity and free-riding, using the example of banana groups in Kenya and found that the availability of family labour and group benefits influence collective marketing. Haque and Bauer (2009) found that individuals cooperate less when they are less educated, farm size is small and non-farm income share is more than farm income. Involvement in organization is also an important factor. Similarly, smaller groups cooperate more. Members of larger groups sometimes split into smaller subgroups that interact badly with each other.

Ayieko et al. (2013) found that group activity, group age, access to market information, gendr, education, land size, off- farm income and distance to market had a significant effect on joining groups. Kola et al. (2014) investigated the determinants of collective action in a strategic and fast-growing sector - greenhouse vegetables in Albania – looking at the impact of individual farmers' characteristics on their likelihood of cooperating, using a logistic regression model. The findings revealed that social capital, human capital, leadership and the problems farmers faced by farmers in terms of input supply are important determinants of collective action. Ouma and Abdulai (2009) examined the factors that influence collective action behaviour in crop-livestock and pastoralist production systems in Kenya by employing a binary logit model and found that age, gender of household members, wealth status of households and education level of the household head exert significant influence on the decision to take up collective action. Mabuza, Ortmann and Wale (2012) identified the key factors that unify members of informal collective initiatives and trust is positively influenced by gender, age and religion.

The Probit model is used in estimating factors that influence willingness to participate in collective action activities by irrigators. The estimated coefficients of the Probit model, along with the standard error, z-values and p-values are presented in Table 3. The likelihood ratio statistics as indicated by the $\chi 2$ statistic is significant at 1%. This implies that all the variables included in the Probit model are jointly significant in influencing farmers' willingness to participate in collective action activities. Therefore, the socioeconomic and psychological characteristics of farmers have a significant effect on their willingness to participate in collective action activities. Significant determinants of willingness to participate in collective action activities were Concern for in-group ($t = 1.68$, $p < 0.05$), Perceived usefulness ($t = -2.11$, $p < 0.05$), Gender ($t = -2.16$, $p < 0.05$), Age ($t = -2.58$, $p < 0.05$), Marital status ($t = 1.74$, $p < 0.05$), Educational level ($t = -2.79$, $p < 0.05$) and Religious belief ($t = -2.86$, $p < 0.05$). The results imply that Concern for in-group and marital status are the only positive related independent variable with willingness to participate in collective action activities while others independent variables are inversely related to willingness to participate in collective action activities. This implies that an increase in perceived usefulness of collective action activities, age, educational level and religious belief of irrigators as well as change in pattern of gender distribution on the irrigation scheme will lead to decrease in willingness to participate in collective action activities.

Table 3. Determinants of participation and willingness to participation

	Participation (OLS)		Willingness to participate (Probit)	
	B(Std. Error)	t	Estimate(SE)	Z
(Constant)	83.600(15.864)	5.270***		
Value subscale	.772(.750)	1.029	.013 (.010)	1.302
Team member exchange	.153(.175)	.876	-.003(.002)	-1.293
Self-reliance with competition	-.254(.264)	-.964	.003(.003)	.798
Concern for in-group	.325(.380)	.856	.008(.005)	1.681*
Distance from in-group	-.419(.462)	-.907	-.003(.006)	-.555
Horizontal individualism	.085(.395)	.214	.001(.005)	.177
Vertical individualism	-.071(.292)	-.242	-.002(.004)	-.523
Horizontal collectivism	.189(.379)	.499	.008(.005)	1.622
Vertical collectivism	-.080(.368)	-.218	.003(.005)	.568
Intrinsic motivation	-2.403(1.123)	-2.140**	-.004(.014)	-.272
Perceived usefulness	1.960(1.094)	1.792*	-.032(.015)	-2.114**
Perceived ease of use	-.092(1.648)	-.056	.040(.023)	1.719
Behavioural intent	-.295(1.488)	-.198	.011(.019)	.603
Knowledge of collective action	.234(.128)	1.828*	.003(.002)	1.561
Conflict resolution	1.350(.566)	2.387**	-.003(.007)	-.375
Gender	5.237(3.846)	1.361	-.098(.045)	-2.155**
Age	-1.335(.318)	-4.191***	-.010(.004)	-2.576**
Farming experience	.820(.336)	2.444**	.012(.004)	2.811
Marital status	.238(2.182)	.109	.048(.027)	1.740*
Educational level	-4.586(1.854)	-2.474**	-.069(.025)	-2.793**
Religious belief	5.948(2.606)	2.282**	-.083(.029)	-2.863**
Land ownership	-.835(3.139)	-.266	.040(.045)	.875
Land allocation process	-.531(1.677)	-.316	-.013(.022)	-.586
Distance to market	-.457(.142)	-3.211**	.000(.002)	.109
Types of markets used	.000(.005)	.098	.000(.000)	.084
F	3.28		Chi Square	3370.94
p	0.00		df	70
R	0.74		p	0.00
R square	0.55			

6. Conclusion

Majority of the farmers were male, more than 50 years, having at least 20 years of farming experience, Christians, having ownership of plots with large household sizes with more female per household than male. Majority of farmers were allocated land on the irrigation scheme on first come, first served basis, used flood irrigation systems, practised double, multiple, and multiple cropping system and had contact with extension. The prominent sources of information were television, radio, and extension officers. There is generally low participation in social organisations listed by farmers. Overall, the tendency among irrigators for individualism is higher than collectivism in the irrigation scheme. The results revealed an overwhelming general negative behaviour by farmers towards collective action.The results revealed an overwhelming general high knowledge

by farmers on knowledge of collective action processes. Based on the findings of this study, it is recommended that: There is a need to improve on the diversification of personal and social characteristics of irrigators. There is a need to improve on the practices that will reduce the tendency among irrigators for individualism which was found to be higher than collectivism. There is a need to improve on practices in order to reduce the overwhelming general negative behaviour by farmers towards collective action. There is a need for farmers to translate their high knowledge on collective actions processes to actions. There is a need to properly consider the significant variables for effective policy and mechanisms to support collective actions.

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