DETERMINANTS OF COLLECTIVE ACTION AMONG FARMERS IN DZINDI COMMUNAL IRRIGATION SCHEME, LIMPOPO PROVINCE, SOUTH AFRICA

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THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY (PhD) IN AGRICULTURAL EXTENSION

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

FACULTY OF AGRICULTURE, SCIENCE AND TECHNOLOGY

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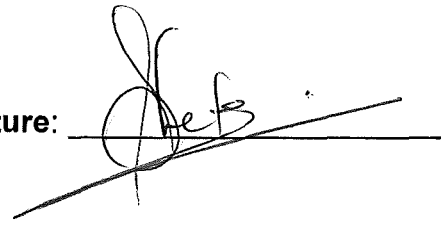
DECEMBER 2014

DECLARATION

I, ***LETSOALO S. S.***, declare that the thesis for the degree of Doctor of Philosophy in Agricultural Extension at the North West University hereby submitted, has not previously been submitted by me for a degree at this or any other university, that it is my own work in design and execution, and that all material contained herein have been duly acknowledged.

Signature: 

Date: 17 April 2015

ACKNOWLEDGEMENTS

My sincere gratitude goes to my supervisor, **Professor Oladimeji Oladele**, for his patience and encouragement during the course of this research. This research would not have been possible without the help, support and patience of my supervisor, not to mention his advice and unsurpassed knowledge. It would not have been possible to complete this study without the help and support of the kind people around me. The list is long and it is impossible for me to mention all of them.

I am grateful to my wife **Mapula** and our sons, **Mkhonto** and **Masia**, for their unequivocal support throughout this journey. My mere expression of thanks does not suffice; I say perseverance is the mother of success. I take full responsibility for any errors or inadequacies that I could not correct in this study. Most importantly, I would like to thank the Almighty God for the wisdom, strength and guidance.

ABSTRACT

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. The specific objectives were to describe the socio-economic profiles, assess livelihood strategies pursued, determine participation in collective action activities, analyse the determinants of participation in collective action activities, examine perceptions of the effect of collective action on livelihood capital, ascertain knowledge about collective action processes and determine the dimensions of collectivism and individualism among farmers involved in the irrigation scheme.

The study was conducted in Dzindi irrigation scheme. The population of this study included all 106 plot holders in Dzindi, smallholder irrigation scheme. Simple random sampling techniques were used to select 97 plot holders. Data for this study was generated from primary source based on the objective of the study. A structured questionnaire consisting of five sections namely, personal characteristics and socio-economic factors of irrigators, offences and conflict resolution in sharing irrigation water in the irrigation scheme, collective action activities, scale on individualism vs collectivism, livelihood strategies among the irrigators, perception of the effect of collective action on livelihood capital and irrigators' knowledge of collective action processes. The questionnaire was face validated by a panel of experts on agricultural extension, collective action and research and a split half technique was used to determine the reliability coefficient. Data was analysed using the Statistical Package for Social Sciences (SPSS) 18.0. Standard deviation, mean and frequency distribution were used to describe the personal characteristics;

multiple regression analysis was used to determine the effect of predictors on the dependent variables of the study.

The results revealed that majority of the farmers were male, more than 50 years, having at least 20 years of farming experience, and being Christians, having ownership of plots with large household sizes with more female per household than male. Maize, lentils and Kale are the most prominent crops on the irrigation scheme. Majority of the 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 officers. The prominent sources of information were television, radio, and extension officers. There is generally a low participation in social organisations listed by farmers. Most common offences and conflict resolution techniques were: caught breaking irrigation rules, apologise immediately when found caught committing an offence, use more days to irrigate and use more irrigation water. The results revealed that only three out of a list of 25 collective action activities were commonly practised. These were replacement of damaged concrete slabs, Weed control in joints and participation in meetings.

The results show that from the list of 44 statements on the individualism scale, 35 statements were above the actual mean score of 3.0. Conversely, 21 of the 35 listed statements on collectivism were above the actual mean of 3.0 which depicts a high tendency towards collective actions. Overall, the tendency among irrigators for individualism is higher than collectivism on the irrigation scheme. The results on the perception of the effect of collective action on livelihood capital among irrigators in

the Dzindi scheme revealed an overwhelming general negative attitude by farmers towards the effect of collective action on livelihood capital. The results revealed an overwhelming general negative behaviour by farmers towards collective action

The results further revealed an overwhelming high knowledge by farmers on collective action processes. Significant determinants of participation in collective action processes were perceived effect on natural capital (t = 3.36, p < 0.05), Perceived effect on social capital (t = 2.33, p < 0.05), Perceived usefulness of collective action (t = 2.40, p < 0.05), perceived ease of use of collective action (t = 2.07, p < 0.05), knowledge of collective action (t = 1.96, p < 0.05), age (t = -3.99, p < 0.05), farming experience (t = 2.08, p < 0.05), educational level (t = 2.06, p < 0.05), religious belief (t = 3.45, p < 0.05), land ownership (t = 1.81, p < 0.10) and distance to market (t = 3.83, 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; perception of the effect of collective action on livelihood capital among irrigators in the Dzindi scheme, mechanism to reduce the overwhelming general negative behaviour by farmers towards collective action and to translate their high knowledge on collective action processes into actions.

Keywords: *Collective action, smallholder irrigation, individualism, collectivism, livelihoods*

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CHAPTER ONE

INTRODUCTION

1.1 Background to the study

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. Examples of arenas in which the social dimension of agriculture is important are the homestead as a social unit, agricultural projects that involve groups of farmers, organised agriculture and the market place. This thesis is concerned with the social dimension of farming in the context of smallholder irrigation.

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 in 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, 2011a).

The term smallholder is often defined and used in an inconsistent manner referring, inter alia, to producers who sell products for cash as a supplement to other sources of income, to those who regularly market a surplus after their consumption needs have been met, and to those who are small scale commercial farmers with primary focus on production for the market (Cousins, 2011a). In South Africa, the term smallholder or small scale irrigation is mainly used when referring to irrigated agriculture practised by black people (Van Averbeke and Mohamed, 2006). On the other hand (Gomo, 2010) explained that the terms smallholder, small scale, subsistence, communal and emergent farmers have been loosely used to mean the same thing although they have different names (Fanadzo, 2012). The different terms used to describe smallholder farmers are as follows: small scale farmers, peasant farmers, food deficit farmers, household food security farmers, land reform beneficiaries and emerging farmers (Machethe, Mollel, Ayisi, Mashatola, Anim and Vanasche, 2004).

Over the past three decades, the world's irrigation sector has been increasingly exposed to decentralization and privatisation. Many countries have embarked on a process to transfer the management of smallholder irrigation system from government agencies to local management entities (Vermillion, 1997). This process of irrigation management transfer (IMT) includes state withdrawal, promotion of participation by water users, development of local management institutions, transfer of ownership and management.

South Africa has just initiated IMT in government smallholder irrigation schemes located in former homeland areas and most transfer operators are still unsure about how to design and implement the process (Perret, 2002).

Similarly, Malawi has since 1999 implemented new irrigation, land and water policies and supporting legislation have been approved by parliament. The thrust is to now to privatise resources which were once under customary tenure or which were viewed as a common good. Customary land is to be titled, use of water for productive purposes will require permits and government run smallholder irrigation schemes are being turned over to users (Ferguson and Mulwafu, 2004).

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.

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: 85). The success of the community-based management of resources is dependent upon the functioning of the local collective action (Esmail, 1997: 47).

Collective actions work with a set of working rules that are used to determine who is eligible to make decisions in an arena, what actions are allowed or constrained, what aggregation rules will be used, what procedures must be followed, what information must or must not be provided and what payoffs will be assigned to individuals dependent on their actions (Ostrom, 1986).

1.2 Problem statement

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 small holder 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 each individual is acting on his or her own, making their own choices, and to the extent they interact 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 (seeing the self as a part of a collective and being willing to accept hierarchy and inequality within that collective); Vertical

Individualism (seeing the self as fully autonomous, but recognising that inequality will exist among individuals accepting this inequality); Horizontal Collectivism (seeing the self as part of a collective but perceiving all the members of that collective as equal) and Horizontal Individualism (seeing the self as fully autonomous, and believing that equality between individuals is the ideal).

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 (hereafter CAB model) was developed based on TAM. According to the CAB model, 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' perception of the extent to which the system will enhance their performance (Phillips *et al.*, 1994). The perceived Ease of Use refers to the extent to which the user considers the system to be free of efforts (Zhang *et al.*, 2009). The attitude measures a person's perception about an idea or a system (Ajzen and Fishbein, 1980).

The study was deemed necessary because rehabilitation and improvement of smallholder irrigation needs to 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 following questions emanates from the study.

1.3 Research questions

The research questions asked were:

a) What are the socio-economic profiles of farmers in the irrigation scheme?

b) What livelihood strategies are pursued by farmers in the irrigation scheme?

c) Do farmers participate in collective action activities in the irrigation scheme?

d) What are the determinants of farmers' participation in collective action activities?

e) What are farmers' perceptions of the effect of collective action on livelihood capital?

f) Are farmers knowledgeable about collective action processes?

g) What are the dimensions of collectivism and individualism among farmers in the irrigation scheme?

1.4 Objectives of the study

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.

The specific objectives were to:

a) Describe the socio-economic profiles of farmers in the irrigation scheme;

b) Assess livelihood strategies pursued by farmers in the irrigation scheme;

c) Determine farmers' participation in collective action activities in the irrigation scheme;

d) Analyse the determinants of farmers' participation in collective action activities;

e) Examine farmers' perceptions of the effects of collective action on livelihood capital;

f) Ascertain farmers' knowledge about collective action processes; and

g) Determine the dimensions of collectivism and individualism among farmers in the irrigation scheme.

1.5 Hypotheses of the study

The hypotheses are stated in the null form:

a) There is no significant relationship between socio-economic characteristics, livelihood strategies, perception, knowledge, dimensions of collectivism and individualism and farmers' participation in collective action activities in the irrigation scheme

b) There is no significant difference in livelihood strategies, perception, knowledge, dimensions of collectivism and individualism and farmers' participation in collective action between male and female farmers in the irrigation scheme

1.6 Significance of study

The present study is intended to contribute to knowledge in the areas of factors determining participation in collective action activities on among smallholder irrigators, the relationship between psychological traits of individualism and collectivism *vis-a-vis* collective action. The findings also expand on the collective

action behavioural model found among irrigators on smallholder communal irrigation schemes. The linkages between knowledge of collective action and the behavioural disposition towards collective action were also explored. The findings in all the areas and dimensions of collective action listed earlier would assist policy and intervention in the proper maintenance of irrigation schemes in South Africa and other parts of the world.

1.7 Chapter summary

This chapter has presented the introduction and the background to the study, the objectives and justification for this study as well as the hypotheses set out in the study. The research questions provided direction for the study and the issues covered in the implementation of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review on the concepts and theories of collective action. It is organised into sections on definitions and meaning of collective action, informal and formal collective action, the basis of collective action, attributes of collective action, conceptual framework of collective action, cultural configuration of the group, institutions, values, norms, social structure, collective action, water sharing and irrigation scheme, distributive justice, equality, formal equality, proportional equality, moral equality, equity, competition, need, historical formal water sharing arrangements, current formal water sharing arrangements, changes to formal water-sharing arrangements and conflict resolution procedure.

2.2 Definitions and meaning of collective action

Various authors have defined collective action from different perspectives such as sociological, political, economic and philosophical. In sociology, collective action is viewed as the pursuit of a goal or a set of goals by more than one person. Marshall (1998: 85) defines collective action as "deeds engaged by a group, either directly or on its behalf, through an organisation, in pursuit of members' perceived shared interests".

Sociological studies of collective action are particularly concerned with identifying factors that cause the setting of standards of social integration and factors that lead to deviance and conflict. Explanations of collective action in sociology entail the clarification of those issues that present similarities and differences to collective action in varying situations. Sociological theories of collective action are particularly aimed at explaining the behaviour of groups associated with social arrangements. Consequently, Sullivan (2001: 557), Perry and Pugh (1978: 3) and Sills (1972: 19) describe collective action as structured or unstructured involvement of a group of people towards attaining an intended common goal.

Studies on collective action in political science and economics focus on the provision of public goods and other collective action consumption by more than one individual. Meinzen-Dick and Di Gregorio (2004:54) and Bates and Plog (1990: 188) define collective action in the context of property rights for sustainable development as "voluntary action taken by a group to achieve common interests either directly on their own or through an organisation". In explaining the realisation of public goods, Marxwell and Oliver (1993: 4) define collective action as "an action taken by two or more people in pursuit of the same collective action good".

Authors defining collective action from political or economic perspectives explain the ultimate goal of collective action in terms of tangible resources such as land and water, or services, such as, attaining bargaining power in accessing markets. Oslon's theory (1971: 341) relates collective action to the market dynamics arguing that individual consumer rationality and firms' profit-seeking do not lead to the efficient provision of public goods.

In the context of the use of natural resources in rural life, Ostrom (2005: 34) explains that "collective action occurs when more than one individual is required to contribute to an effort in order to achieve an outcome". Texier (1970: 215) defines collective action as "a non-conventional form of cooperation that emanates from mutual aid constituted by various traditional practices in collaborative functions" in the study that traced the origin of cooperatives.

Philosophers consider collective action more broadly as acting together with the intention of achieving immediate goals in everyday life, such as going for a walk together. Gilbert (1989: 56) refers to collective action as "individuals with joint commitment working together". Searle (1990: 91) argues that "collective action involves participants with "we-intention" in mind working together to attain an everyday goal". Two people who share an intention with common knowledge are viewed by Bratman (1993: 81) as being involved in collective action. Collective action rests on a special type of interpersonal joint commitment (Gilbert, 2007: 167). Searle (1990: 43) explains this commitment as the "we-intention" and calls it the "collective action intentionality". The implication is that those in the commitment are in a position to demand corrective action of members deviating from such collective action intentionality (Searle, 1990: 43).

Common elements in all these different definitions is that collective action involves two or more people and that collective action is aimed at achieving a common goal that individually cannot be attained or more difficult to attain. The different definitions assert that outcomes of collective action are two pronged, namely:

a) An outcome being an agreement of a group on the pathway of working together as a goal and

b) The end product of the collective action such as physical production or higher income.

The different perspectives vary in their focus and contents of the common elements. The sociological perspective focuses on inter-group processes by setting standards of social integration as the activities with the common goal of perceived shared interests. The economics and political perspective considers intra-group behaviours, provision of public goods and collective action consumption as the activities with the common goal of attainment of tangible goods. The philosophical perspective highlights interpersonal commitment through joint commitment as the activities with the common goal of immediate everyday life goals.

2.3 Informal and formal collective action

In group behaviour, collective action with an informal foundation is participatory by nature and starts with a "felt need" (Kirsch, Armruster and Lucius, 984: 11). The informal root of collective action originates from spontaneous unaided self-help groups with aims associated with the enhancement and upgrading of societal relations (Sills, 1972: 19). Sills (1972: 19) explains that benefits that members obtain from informal collective action are indirect in the form of social unity, cohesion and well-being. For example, the propensity of people who are often strangers, working together to assist a person involved in an accident is a universal type of informal collective action that offers no direct benefits to participants.

Formal collective action predominantly pursues meta-economic aims. Typically, the rights and duties of members of formal collective action are clearly recognised by officially permitted conduct (Kirch *et al.*, 1984: 11). Formal collective action is observed, for example, in cooperatives in agriculture. Cooperatives are a form of collaborative behaviour of farmers with the aim of accessing markets. Cooperatives offer the potential to provide positive synergies and advantages of economies of scale because in market access, transaction costs of marketing are reduced and the bargaining power for discounted prices on bulk purchases of farm inputs are increased relative to when farmers operate as individuals (Chancelor, Shepherd and Upton, 2003: 12).

Typically, members of agricultural cooperatives are required to contribute money, give attention to cooperative arrangements and take part in duties associated with the cooperative (Kirch *et al.*, 1984: 11). The collective action in this case is governed by the cooperative's constitution and the rules are enforced by members.

2.4 Basis of collective action

Olson (1990: 37 and 1971: 18) and Bates and Plog (1990: 188) argue that the motives for any contribution to collective action are located in the moral or political economy. According to Olson (1990: 37 and 1971: 18), the motive of individuals involved in collective action is moral when members are less concerned about individual profit than about knowing that they will be protected during times of distress.

Typically, such people assign less value to their individual or family interests than to the (moral) value of being a member of a society that culturally envelopes and protects them through communal sharing during times of adversity. This type of collection action is commonly observed in African societies, particularly in rural areas when people voluntary contribute money or goods to a bereaved neighbourhood family and assist with funeral arrangements.

There is no rule that coerces someone to help with funerals of neighbours, but people do support and comfort the bereaved in anticipation that they will be assisted likewise when they experience bereavement in their own families. According to Bates and Plog (1990:188), closed villages place great emphasis on moral collective action in order to create a community in which members have a more or less secure place and where culturally defined rules encourage sharing. This sharing behaviour tends to level out distinctions of wealth. In moral collective action, social status, reciprocity relations, solidarity and kinship play an important role (Ostrom, 1998:43).

The political economy, also called the rational foundation of collective action, entails that individuals decide to participate only when they expect to derive benefits for themselves and for their immediate families from a joint venture. They decline to participate in the collective action when they see no benefit from taking part (Bates and Plog, 1990:188). In other words, in collective action, that has a rational foundation; participants are not motivated by abstract notions of communal well-being but by self-interest.

Baland and Platteau (1999: 773) explain that in this type of collective action, the incentives to contribute are determined by the positive balance between the private benefits and the costs that result from participation. For example, Putnam (1995: 17) found that Tanzanian peasants became members of a collective action farm when it was in their interests to do so. They joined the collective action for the production of sugar cane and fruit, where the combined effort rewarded members directly. They did not join the collective action planned to produce subsistence crops because their homesteads could produce these crops very well on their own. In this example, peasants engaged in collective action when they could gain more than they could by working on their own. They declined to join when the collective action did not present any advantage. In short, when deciding on participation in a collective action, they premeditated their self-interest rather than the likelihood of reinforcing community ties (Bates and Plog, 1990:188).

2.5 Attributes of collective action

Ostrom (1998: 44) points out that each collective action, irrespective of whether located in the moral or political economy arena, is characterised by particular attributes. Ostrom (1998: 45), Ostrom (1990: 23), Agarwal (1994: 51), Kurien (1995: 39), Meinzen-Dick *et al* (2004: 42) and Marshall (1998: 11) all agreed that attributes, which contribute positively to the sustainability of collective action arise and are more likely to be sustained when participation of members is deliberate and group members share socio-cultural values with homogeneity and social cohesion, the work units are small and membership together with the boundaries of the resource being shared are clearly defined management or improvements.

Furthermore, these authors agree that collective action exists where contributions by the participating members are honestly measured with net benefits arising from the collective action being large and relatively certain and equitably allocated.

According to Ostrom (1998: 62), members of collective action display dependency on common resources and share the same history of co-operation. Collective action produces that which would be difficult for the individual to achieve (Agarwal, 1994: 51). Functioning of collective action groups is based on rules and obligations that have to be clearly defined and adapted to local conditions and members are able to collectively modify these rules and obligations in response to changing circumstances (Meinzen-Dick *et al.*, 2004: 42).

Meinzen-Dick *et al.*, (2004: 42) argue that an adequate monitoring system has to be in place, preferably with enforceable sanctions that are graduated to match the seriousness and context of offences while actions of the organisation are not challenged or undermined. The organisation is also entrusted with the duty of making sure that effective mechanisms for conflict resolution are in place.

2.6 Conceptual framework of collective action

The descriptions by different authors, such as Ostrom (1990: 23), Agarwal (1994: 51), Kurien (1995: 39), Meinzen-Dick *et al* (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. Research has shown that 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. **Figure 1** summarises the various elements in the framework for collective action. This is based on the synthesis of different theories by the researcher.

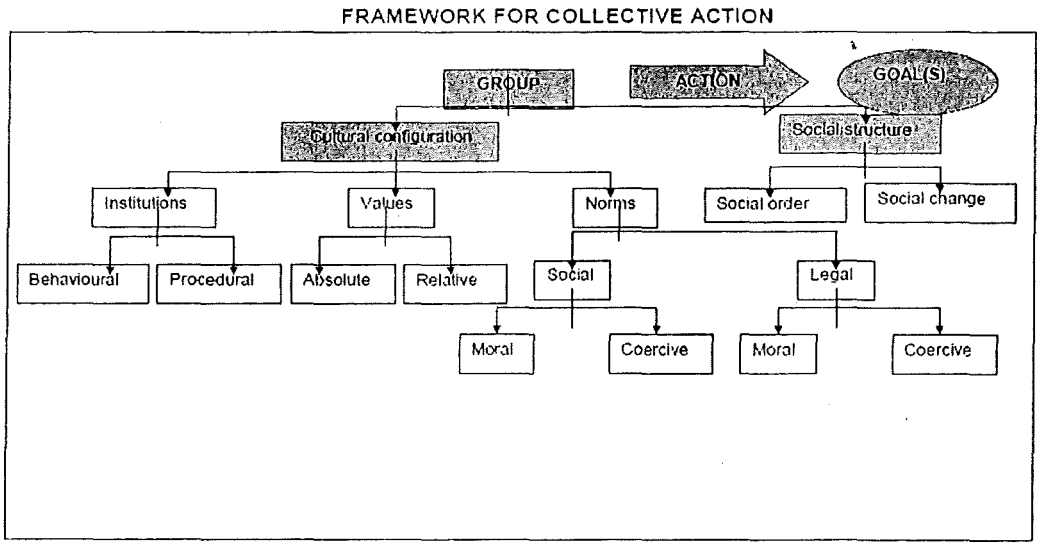

Figure 1: *Framework for collective action*

2.6.1 *Cultural configuration of the group*

Culture is defined by Stolley (2005, 41) and Marsh (2000, 545) as "all ideas, beliefs, behaviours, and products common to, and defining a group's way of life". Culture is beliefs, values, and behaviour and material objects shared by a particular group of people (Macionis, 1997: 60). Levine (1986: 67) defines culture as "a shared organisation of ideas that includes the intellectual, moral and aesthetic standards

prevalent in a community and the meaning of communicative actions". Hofstede (1980: 112), Kluckhohn (1951: 48) and Triandis (1980: 35) consider culture as "a set of norms, according to which things are run, or simply "are" in a particular society and to which most members of the society adhere in terms of values, attitude, interpretation and behaviour".

Mullins (1999: 31) definition of culture sums up the common elements presented in the different definitions that culture is "a set of ideas and customs that are produced through distinctive behaviour and that are informed by institutions originating and developing from a pattern of values and norms characteristic of a particular society or sub-group within that society". However, this definition is silent on the physical materials and artefacts that characterise cultures.

Stolley (2005: 42) and Newman (1995: 31) explain that material culture includes all tangible products, sometimes referred to as artefacts, created by human interaction. According to Stolley (2005: 42), any physical object created by humans is part of material culture. Material culture, such as technology, may change faster than non-material culture (Stolley, 2005: 42). Emphasis in the study of collective action in smallholder irrigation is on non-material culture, which refers to the knowledge, beliefs, customs, values, morals, and symbols that are acquired and constructed over time and are shared (Newman, 1995: 31).

In collective action, culture is an information-holding system with functions similar to that of cellular DNA in a living organism (D'Andrade, 1986: 88). The DNA provides the information needed for self-regulation and specialised growth of cells.

Similarly, culture informs the behaviour and functional roles of members in collective action. Culture is a quiet guide (Newman, 1995: 77). It prevails through knowledge of institutions, values and norms (D'Andrade, 1986; 115). When cultures are practised over a period, they become internalised cultures. Culture, as internalised by people, affects psychological processes and reactions (Robbins, 2001:300).

Based on Hofstede's (1980) study conducted over more than 40 main cultures of the world, Mullins (1999: 31) and Robbins (2001: 66) argue that the main differences among culture were expressed and manifested in the dimensions of power distance, individualism, collectivism, quality of life, quantity of life, uncertainty avoidance, long-term and short- term perspectives. Power distance describes the extent to which a society accepts that power in institutions and organisations is distributed unequally (Deacon and Firebaugh, 1981:39). The power distance attribute can be high or low. Individualism refers to the degree to which people prefer to act alone rather than in groups (Mullins, 1999: 31).

Collectivism is a tight social framework in which people expect others in the group of which they are part of, to look after them and protect them. Quality of life is the extent to which societies emphasise relationships and concern for others (Robbins, 2001: 66). Quantity of life describes the extent to which societal values are characterised by assertiveness and materialism (Deacon and Firebaugh, 1981:39). Uncertainty avoidance describes the extent to which a society feels threatened by uncertain and ambiguous situations and tries to avoid them (Robbins, 2001: 66).

Long- term perspective emphasise the future, thrift and persistence (Robbins, 2001: 66). Short term perspective emphasises the past and the present, respect for tradition and fulfilling social obligation (Robbins, 2001: 66).

Both material and non-material culture are determined by a group's institutions, values, norms and artefacts (Stolley, 2005: 45), (Mullins, 1999: 31), (Hofstede, 1980: 112); (Kluckhohn, 1951, 48); (Triandis, 1980: 35). However, institutions, norms and values of a group are the main determinants of the behaviour of people involved in collective action in the context of small holder irrigation. These key elements, summed as culture, are branded as critical in the study of behaviour of a group involved in collective action (Newman, 1995: 31).

2.6.2 *Institutions in collective action*

Institutions are a pervasive phenomenon of diverse origin which affects various dimensions of human relationships and interactions (Saleth and Dinar, 2004: 23). They have diverse definitions and interpretations, reflecting different disciplinary perspectives and theoretical traditions. Saleth and Dinar (2004: 26) describe institutions as "the codified knowledge that evolves from the wisdom derived from natural principles and distilled out of the accumulated collective action knowledge of human beings". Commons (1990: 20) defines institutions as "the working rules of going concerns". Institutions are bodies /groups that which provide a basis for making reasonably sound decisions by ensuring the behaviour of others (North, 1990a: 6).

Swift and Hamilton (2001: 85); Hubbard (1997: 240) and Eicher (1999: 3) describes institutions as "a set of rules and regulations that govern individuals and groups in a community". According to Bromley (1982: 3), institutions are "rules and conventions that support collaboration and cooperation among people for collective action to occur". Granovetter (1985; 442) sees institutions as normative systems of expectations in behaviour, powerful enough to impose conformity upon everybody, the behavioural expectations being considered as legitimate in the given situation. Institutions are natural and inevitable enduring patterns of expectations (Newman, 1995: 30).

Eicher (1999: 3) argues that institutions regulate, nurture, protect and govern the operation of a community. Institutions provide social rights and obligations or rules of the game and, therefore, are closely connected to social capital. Institutions provide a cognitive framework to interpret sensory data, habits, and routines and to transform and signal this information as economically and socially useful knowledge. Institutions indicate what individuals must or must not do (compulsory or duty), what they may do without interference from other individuals (permission or liberty), what they can do with the aid of collective action power (capacity or right) and what they cannot expect the collective action power to do on their behalf (incapacity or exposure) (Commons, 1990: 6).

Institutions clarify rights, responsibilities, and obligations of individuals and groups in a society. Swift and Hamilton (2001: 85) suggest that institutions range from customary and local rule systems to formal laws and administrative procedures

governing the use of resources. Institutions also range from legal structures to social arrangements backed by moral pressure or sanctions (Bromley, 1982: 13).

Schmid (1972: 893) states that institutions are ideas about how something should be done, look like or be constituted, in order to be viewed as legitimate. Institutions are mechanisms of social order and cooperation governing the behaviour of two or more individuals. Institutions are identified with a social purpose and permanence, transcending individual human lives and intentions, and with the making and enforcing of rules governing cooperative human behaviour (Bromley, 1982; 740).

Ostrom (1990: 52) postulates that the development and functioning of institutions in society in general may be regarded as an instance of emergence and that institutions arise, develop and function in a pattern of social self-organisation, which goes beyond the conscious intentions of the individual humans involved. As mechanisms of social cooperation, institutions are manifest in both objectively real, formal organisations, and in informal social order and organisation, reflecting human psychology, culture, habits and customs (Berger and Luckmann, 1966: 37). When considered abstractly, most important institutions have both objective and subjective aspects.

According to North (1990a: 4), institutions tend to appear to people in society as part of the natural, unchanging landscape of their lives. Institutions are social constructions, artefacts of a particular time, culture and society, produced by collective action human choice, though not directly by individual intention (Schotter, 1981: 11).

Institutions are important in collective action because collective action occurs with the aid of rules (Bromley, 1982: 48). Introduction of new technology is one of the circumstances in which rules are imposed from the outside. Although externally imposed, rules often ignore the cultural orientations of recipients (Chambers, 1997: 61), they can be internalised. Internalisation is assisted when the rules are compatible with the recipients' way of life and when they govern the use of a new resource that is of benefit to recipients and for which there was a need in the community (Rogers, 1995: 33). Rules created from within are the result of social dynamics within the group, whereby the focus is on matching group goals to the diversity of interests among group members (Beal *et al.*, 1986: 43). Generally, rules crafted through internal social processes are easily understood and well respected by members of the group, because members took part in the negotiations that led to their formulation (Oakley *et al.*, 1999: 11).

To be effective, rules need to be enforced and reinforced (Ostrom, 1990: 32). The intensity of enforcement needed to make rules effective depends on whether the rules are close to moral norms or not (Eggertsson, 2001: 54). When rules are close to moral norms, less external enforcement is required, because individuals sanction themselves through feelings of remorse and guilt. Conversely, rules that are far removed from moral norms typically require a lot of enforcement.

According to Greif (2000: 727), a study of institutions should answer two main questions. Firstly, how do institutions arise and evolve? A fundamentally conservative view on institutions states that: institutions can be seen as "naturally" arising from, and conforming to human nature (North, 1990: 32).

A fundamentally progressive view argues that institutions can be seen as artificial, almost accidental, and in need of architectural redesign, informed by expert social analysis, to better serve human needs. Secondly, how does an institution affect behaviour? Here, the focus is on behaviour arising from a given set of institutional rules.

North (1990: 32) states that institutions should be analysed in terms of interlocking social roles and expectations. Institutions are created and composed of groups of roles, or expected behaviours. The social function of the institution is executed by the fulfilment of roles (North, 1990: 32). Analysis of institutions determines prescriptions and proscriptions on expected behaviours in roles or procedures in the collective action. Furthermore, both the behavioural and procedural institutions vary with degrees of formalisation.

The formal institutions are agreed upon and written while informal institutions are those that are not written but are in the common knowledge of the group involved in collective action. Formal and informal institutions may occur at different scales. Macro scale institutions are the universally accepted and applied institutions to all members of the collective action. Institutions that are not universal but accepted and applied to sub-groups in a collective action group, are regarded as meso- level institutions, while institutions that are accepted and applied only to a particular group and limited to individuals in a group involved in collective action are regarded as micro level institutions.

Decision-making on execution of the rules and conventions of collaboration and co-operation is usually done in an organised manner by groups of people referred to as organisations (Gabriel, 1999: 82). Organisations are social entities that have members, resources, structures, authority and boundaries. Within an organisation, there is often a hierarchy of positions known as the organisational structure (Gabriel, 1999: 82). Selected and appointed people fill positions in this structure (North, 1990: 32). The functions of structures in an organisation are to reinforce and enforce the institutions in maintaining social order.

2.6.3 Values in collective action

When deciding on the content of institutions, people use their values and value system as a frame of reference. Stolley (2005: 45) argues that "values are culturally defined ideas of what is important and central to culture". For example, harmonious relationships could be the most important factor in a group. Values represent basic convictions that particular modes of conduct or end-states of existence are personally or socially preferable to others (Stolley, 2005: 45). Macionis (1997: 66) describes values as standards by which members of a culture define what is desirable or undesirable, good or bad, beautiful or ugly. According to Stolley (2005: 45), values delineate how culture should be. Values are transmitted from generation to generation and among people through the process of socialisation such as family influence, political influence, religious influence and/or formal or informal education. Values have both content and intensity attributes.

The content attribute is concerned with the importance of a mode of conduct or end-state of existence while the intensity attribute specifies how important it is. Values ranked in terms of their intensity form a value system (Deacon and Firebaugh, 1981: 39).

Values are classified according to their magnitude of flexibility and may be absolute, or relative. Absolute values are firmly held regardless of surrounding factors or conditions. They are deeply rooted, resistant to change and often justified on spiritual or other fundamental grounds. Absolute values pose unchanging meanings that interpret what is desirable or of worth, regardless of circumstances (Deacon and Firebaugh, 1981: 39). Absolute values tend to be prescriptive and binding (Deacon and Firebaugh, 1981: 39). They are reinforced through people's own experiences and by the expectations of those around them. Often, they have evolved historically from a consensus on how to deal with particular recurring situations.

Relative values depend on an evaluation of circumstances (Ostrom, 2005: 462). Individuals and groups characterised by the dominance of relative values are open to new alternatives and broaden the potential for management (Deacon and Firebaugh, 1981: 40). Conversely, individuals and groups who primarily adhere to absolute values reduce alternatives and have narrow options for change and adoption potential. Finding meaningful ways of dealing with the tension between absolute and relative value interpretations is part of a process of coping with stability and change. In reality, evolving circumstances often foster a change from an absolute to a relative position.

Increasing complexity tends to be accompanied with a shift from absolute values and stable frameworks for decisions and actions to more relative value stances (Deacon and Firebaugh, 1981: 40).

2.6.4 Norms in collective action

Norms are derived from values (Stolley, 2005: 46). Marsh (2000, 657) defines norms as unwritten rules of conduct related to society's values and roles that influence people's behaviour. For example, greeting other members of the group is considered normal. Norms are the shared rules or expectations specifying appropriate behaviours in various situations. Norms are culturally defined rules of conduct (Newman, 1995: 33). Norms are rules that guide behaviour (Macionis, 1997: 68). According to Newman, (1995: 33) and Macionis (1997; 68), norms specify what people should do and not do and how they should pursue values.

Norms are cultural phenomena that prescribe and proscribe behaviour (Stolley, 2005: 46; Macionis, 1997: 68; Deacon and Firebaugh, 1981: 39). Norms reflect shared beliefs and ideas about various facets of society. They include formal rules and laws, as well as informal social controls. They encourage or give permission to behave in certain ways and discourage other ways of behaviour. Norms also sanction undesirable behaviour (Ellickson, 1991: 30). A system of norms mimics a legal system. It explains the expected behaviour, including its procedural characteristics and clarifies how aberrant behaviour is dealt with (Eggertsson, 2001: 52).

Hechter and Opp (2001: 71), Kanazawa and Still (2000) distinguish between *(i)* moral norms, which prescribe behaviour that most people would practise anyway, or proscribe behaviour which most people would not practise even in the absence of such norms and the associated threat of sanctions; and ***(ii)*** coercive norms, which prescribe behaviour that most people would not otherwise practise or proscribe behaviour that most people would practise in the absence of such norms.

Norms rely on decentralised enforcement. A person who violates a norm can receive punishment in three different ways: ***a)*** from an actor who is directly affected by the violation; ***b)*** from a third party who acts to uphold community standards; and ***c)*** from the violator's own consciousness (Eggertsson, 2001: 76). Norms are statements that regulate behaviour. These statements identify expectations. Expectations concerning habits that emerge and crystallise in the course of repeated interactions might be regarded as latent norms (Wrong, 1994: 48; Bicchieri, 1997: 25).

Norms are descriptions of a concrete course of action regarded as desirable, combined with an injunction to make certain future actions conform to this course. Norms are considered at least, partly responsible for regulating social behaviour. Without norms, it is hard to imagine how interaction and exchange between strangers could take place at all. To a high degree, public order and enforcement of rules depend on social norms (Eggertsson, 2001: 76). Systems of norms mimic legal systems (or vice versa). Some norms govern substantive entitlements, while others govern remedies and procedures; and there are controller-selecting rules that specify for each type of activity how to achieve social order.

In some circumstances, control-selecting norms even forbid a grievant from using the legal system (Ellickson, 1991: 30). This implies that norms can be either legal or social. Legal norms are created by design, usually through some kind of deliberative process, precisely specified in written texts, linked to particular sanctions and enforced by specialised bureaucracy (Coleman, 1990: 243).

Social norms by contrast, often are spontaneous rather than deliberately planned, hence uncertain origin. According to Hechter and Opp (2001: xi) social norms are unwritten; hence, their content and rules for application are often imprecise. Social norms are enforced informally although the resulting sanctions can sometimes be a matter of life and death (Hechter and Opp, 2001: xi).

Scholars differ in their views on exactly what makes norms effective. Individuals apply sanctions to their own behaviour and respond to these internally generated rewards or punishments (Coleman, 1990: 243). Norms may also be internalised when individuals come to value the behaviour specified by norms for its own sake. In such instances, they follow social norms because they want. Internalisation can be an enforcement mechanism brought about by external sanctions. Norms are ordinarily enforced by sanctions, which are either rewards for carrying out those actions regarded as correct or punishments for carrying out those actions regarded as incorrect (Coleman, 1990: 242). Social enforcement is an essential component of norms (Parsons, 1952: 38). A rule advocated by an individual is not a norm at all but merely a personal idiosyncrasy (Horn, 2001: 37).

2.6.5 Social structures in collective action

Collective action entails the social structure in terms of behavioural patterns and categories of members involved in the collective action. Macionis (1997: 17) defines social structure as a relatively stable pattern of social behaviour. According to Macionis (1997: 17), social structures range from broad patterns including the family and religious system to forms of greeting and other patterns that characterise face-to-face social contact. In the absence of social structure, there is no way of making sense out of any social situation. The social world can be disorienting, even frightening, when behavioural guidelines are unclear. Social structure places some constraints on everyday life by establishing social patterns, inevitably discouraging what is unconventional.

All social structures are related in terms of their social functions, which refer to consequences for the operation of society as a whole. Thus, all the elements of society, from religious belief to a simple handshake, have important functions that help society to persist, at least in its present form. Social structure is constituted by social order and social change. Social order is a set of linked social structures, social institutions, and social practices which conserve, maintain, and enforce "normal" ways of relating and behaving in collective action (Bates and Plog, 1990: 188). Thus, a "social order" is a relatively stable system of institutions, pattern of interactions and customs, capable of continually reproducing at least those conditions essential for its own existence.

According to Bates and Plog (1990: 188), the concept thus refers to all those facets of society which remain relatively constant over time. These conditions could include property, exchange and power relations, but also cultural forms, communication relations and ideological systems of values. Bates and Plog (1990: 188) consider social change as "social development" and this implies that the status quo is modified, changed or broken down. Social change refers to change in the nature, social institutions, social behaviour, or the social relations of a society, community of people, or other social structures. When an event or action affects a group of individuals that have shared values or characteristics, it manifests as acts of advocacy for the cause of changing society in a normative way (subjective) (Bates and Plog, 1990: 188).

Bates and Plog (1990: 188) explain that one of the most basic conflicts in community politics is between those seeking to conserve social order and those seeking social change. Social order is rarely absolute, since there will always be something that is changing. Nevertheless, there is both continuity and discontinuity in social existence that is some things change while other things stay the same. Bates and Plog (1990: 188) state that the human brain is unable to cope with a situation where everything changes continuously and thus and it seeks to impose order, even where it does not truly exist.

Social change may be linear, cyclical, or dialectical. Linear social change is characterised by cumulative and non-repetitive developmental patterns which are usually permanent (Bates and Plog, 1990: 188). Linear change is viewed as broad historical patterns of change in societies involving transition from undifferentiated

societies with homogeneous culture to societies with high degree of structural differentiation and heterogeneous culture. Cyclical change is repetitive; that is expressions history repeats itself. Dialectical social change contains elements of both cyclical and linear change, and thus change is spiral. Significant change takes place as an attempt to resolve the accumulation of intolerable contradictions, the unravelling of stresses that are inherent in social life. Short term repetitive change occurs with long term cumulative directional change. The processes of change persist but the contents of the processes are changing (Bates and Plog, 1990: 188).

2.7 Collective action, water sharing and irrigation scheme

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. Examples of such studies are: Anderson and Maass (1987: 67); Chaudhry and Young (1990: 41); 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's (1982: 59) on the warabandi management system in Haryana explores water distribution institutions and suggests that they contribute to excellent performance. However, Palanisami's (1984: 55) study states the contrary.

According to the study, the performance of the Lower Bhavani System in Tamil Nadu leaves much to be desired. He further maintains that 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 elucidate the links between institutions and the behaviour of farmers, but they generally do not deal with the consequences of these behaviours for distribution performance. Classical studies conducted by Bandaragoda and Rehman (1995: 31) have proven 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: 91).

In the same vein, Wade (1987: 22) illustrates that many farmer actions against the arrangements come due to the failure of the main system to deliver water as it should. Vermillion (1992: 38,) 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: 33) and Ostrom, Gardner, and Walker (1994: 76). These studies paid more attention to the behaviour of farmers and organisation managers. The extensive studies conducted by Tang (1992:3, 1993:18) compare performance evaluations and generalised distribution institutions in at least 47 different irrigation systems. Tang (1992: 56, 1993: 17) 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 lead to differences in performance.

Perry (1995: 34) 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 Perry's 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.

2.7.1 Distributive justice in collective action

Equality, equity, need, competition and social utility are among the most common criteria of distributive justice (Folger, Blair, Sheppard and Buttram, 1995: 43). Equality is the distribution of a resource equally among all concerned persons, implying that each member will get the same amount of irrigation water in this case irrespective of circumstances or background (Fogler, *et al.*, 1995: 46). However, due to differences in levels of need, because of circumstances or background, the principle of equality may not result in equal outcomes. Therefore, the distributive principle of need could be seen as appropriate. This principle states that goods are distributed according to need. According to this principle those who need more of a benefit or resource will receive more. For example, a farmer planting crops with high water requirement will need more water than the one with crops that require relatively less water, and a farmer who plants on a larger portion of land will require more irrigation water compared to the one who plants on a small portion of land.

Another possibility is to proceed according to the principle of equity, and distribute benefits in proportion to the individuals' contribution. This means that those who make a greater productive contribution to their group deserve to receive more benefits (Rescher, 1982: 3; Folger, *et al*,. 1995: 108). For example, management committee members in an irrigation scheme contribute their personal time in the running of scheme matters such as maintaining order within the scheme, therefore, deserve more irrigation water since they contribute to the group more than ordinary members. According to Folger, *et al* (1995: 112), this sort of distribution is typically associated with a system where there is equal opportunity to compete in accordance with effort or ability. For example, a member of an irrigation scheme who is selected to a position in the irrigation management committee might be regarded as contributing more to the group more than other members. Folger, *et al* (1995: 108) and Morton and Knopff (2000: 20) further put forward a system of competition that those who are legally smart in tactics in accessing the resource let them do so. For example, that whoever comes first can irrigate or whoever has better methods of extracting water from the source may use more.

Finally, distribution of resources could be carried out following the distributive principle of social utility. According to Morton and Knopff (2000: 20), this principle observes what is in the best interests of society as a whole. For example, the irrigating community may decide to allow extended access to irrigation water to the poor. The choice in the application of the distributive justice principles in any group involved with collective action depends on the cultural configuration and the social structure.

2.7.2 *Equality in collective action*

Equality is a principle which states that all people should be treated the same in sharing resources (Menne, 1962: 44). Equality has been considered a constitutive feature of fair sharing (Albernethy, 1959: 12; Benn, 1967: 87; Brown, 1988: 15; Dann, 1975: 93; Thomson 1949: 119). Gosepath (2008: 1) explains that the terms equality in the sharing of goods as signify a qualitative relationship. Equality signifies correspondence between individuals or a group of different persons who have the same qualities in at least one respect, but not in all respects, that is, regarding one specific feature, with differences in other features (Dann, 1975: 997; Westen, 1990: 39). Equality implies similarity rather than sameness. The postulate of equality implies that underneath the apparent differences, certain recognizable entities or units exist that, by dint of being units, can be said to be equal (Thomson, 1949: 4). Fundamental equality means that persons are alike in important relevant and specified respects alone, and not that they are all generally the same or can be treated in the same way (Nagel, 1991). Sociological and economic analyses of equality mainly pose the questions of how equalities can be determined and measured and what their causes and effects are.

Equality can be used in the very same sense to both describe and prescribe (Oppenheim, 1970:28). Oppenheim (1970: 56) views the approach taken to defining the standard of comparison for both descriptive and prescriptive assertions of the concept of equality as very important.

In the case of descriptive use of equality, the common standard is itself descriptive, for example two people farming in the same scheme. A prescriptive use of equality is present when a prescriptive standard is applied, that is, a norm or rules, for example farmers in the scheme shall irrigate equally as the regulations of the scheme require. Equality in its prescriptive usage has a close connection with morality and justice in general and fair sharing of resources in particular. Dworkin (1981b: 11) argues that the standards grounding prescriptive assertions of equality contain at least two components. On the one hand, there is a descriptive component, since the assertions need to contain descriptive criteria, in order to identify those people for whom the regulations apply. The question of identification of members who belong to certain categories, may itself be normative, for example, to whom do the scheme regulations apply? On the other hand, the comparative standards contain something normative that has to do with a moral or legal rule. For example, the scheme's regulations that specify how those falling under the norm are to be treated. Such rule constitutes the prescriptive component (Westen, 1990: 10; Nagel, 1979; Rae, 1981; Sen, 1992: 13).

Formal equality: When two persons have equal status in at least one normatively relevant respect, they must be treated equally with regard to this respect. This is the generally accepted formal equality principle that Aristotle formulated in reference to Plato: "treat like cases as like" (Aristotle, Nicomachean Ethics, V.3. 1131a10-b15; Politics, III.9.1280 a8-15, III. 12. 1282b: 23). Some researchers such as Berlin (1955) consider this formal principle of equality as a specific application of a rule of rationality.

But most researchers instead stress that what is here at stake is a principle of justice, basically corresponding with acknowledgment of the impartial and universalisable nature of judgments. The postulate of formal equality demands more than consistency with one's subjective preferences. What is more important is possible justification *vis-à-vis* others of the equal or unequal treatment in question and this on the sole basis of the objective features of a situation.

Proportional equality: Proportional equality indicates what produces an adequate equality and further specifies formal equality. It is the more precise and detailed form of equality, hence actually the more comprehensive formulation of formal equality. Proportional equality in the treatment and distribution of goods to persons involves at least the following concepts or variables: Two or more persons (P1, P2) and two or more allocations of goods to persons (G) and X and Y as the quantity in which individuals have the relevant normative quality E. This can be represented as an equation with fractions or as a ratio. If P1 has E for X and if P2 has E in the amount Y, then P1 is due G in the amount of X′ and P2 is due G for Y′, so that the ratio X/Y = X′/Y′ is valid.

When factors speak for unequal treatment or distribution, because the persons are unequal in relevant respects, the treatment or distribution proportional to these factors is just. Unequal claims to treatment or distribution must be considered proportionally: that is the prerequisite for persons being considered equally.

This principle states that persons should be assessed according to their differing deserts, understood by them in the broad sense of fulfilment of some relevant criterion. The rewards and benefits should be proportional to such deserts (Hinsch 2003: 19).

Moral equality: The principle advocates that everyone deserves the same dignity and the same respect and natural equality in the tradition of natural law and social contract theory. Wingert (1993: 90) argues that moral equality can be understood as prescribing treatment of persons as equals, that is, with equal concern and respect, and not the often implausible principle of treating persons equally. This fundamental idea of equal respect for all persons and of the equal worth or equal dignity of all human beings (Hinsch, 2003: 88) is accepted as a minimal standard. Forst (1994: 68) postulates that in their natural condition, individuals possess equal rights. Locke (1690) argues that all human beings have the same natural right to both (self-) ownership and freedom.

According to Tugendhat (1993: 374), the categorical imperative formulates the equality postulate of universal human worth. His transcendental and philosophical reflections on autonomy and self-legislation lead to a recognition of the same freedom for all rational beings as the sole principle of human rights (Habermas 1983: 53). According to Kymlicka (1990: 5), to recognise that human beings are all equally individual does not mean having to treat them uniformly in any respects other than those in which they clearly have a moral claim to be treated alike.

2. 7. 3 Equity in collective action

An individual will consider being fairly treated if the perceived ratio of inputs to the outcomes is equivalent to those around (Guerrero, Andersen, and Afifi, 2007: 18). According to Walster, Traupmann and Walster (1978: 34), equity is measured by comparing the ratios of contributions and benefits of each person within the relationship. Partners do not have to receive equal benefits or make equal contributions, as long as the ratio between these benefits and contributions is similar. (Guerrero, *et al.*, 2007). Thus, all else being equal, it would be acceptable for a more senior member to receive higher compensation, since the value of experience (an input) is higher. The way people base their experience with satisfaction for their contribution is to make comparisons with themselves to the people they work with. Equity is a justice theory that attempts to explain relational satisfaction in terms of perceptions of fair distributions of resources within interpersonal relationships (Spector, 2008: 20).

The belief is that people value fair treatment which causes them to be motivated to keep the fairness maintained within the relationships to others and the organisation. Spector (2008: 29) argues that the structure of equity in a group is based on the ratio of inputs to outcomes. Inputs are the contributions made by individuals for the organisation; this includes the work done by the members and the behaviour brought by the members as well as their skills and other useful experiences the members may contribute for the good of the organisation.

Equity theory proposes that individuals who perceive themselves as either under-rewarded or over-rewarded, will experience distress, and that this distress leads to efforts to restore equity within the relationship (Spector, 2008: 29). It focuses on determining whether the distribution of resources is fair to both relational partners. In any position in an organisation, members want to feel that their contributions are being acknowledged and rewarded in one way or the other. According to Messick and Cook (1983: 2), if a member feels that contribution is not recognised, then it will result in the member feeling hostile towards the organisation and perhaps to other members, which may result in the member not performing well for the organisation anymore. It is the subtle variables that also play an important role for the feeling of equity. Just the idea of recognition for the contribution and the mere act of thanking the member will cause a feeling of satisfaction and therefore, help the member to feel worthwhile and have more outcomes (Messick and Cook, 1983: 16).

When individuals find themselves participating in inequitable relationships, they become distressed (Traupmann, 1978: 98). The more inequitable the relationship, the more distress individuals feel. According to equity theory, both the person who gets "too much" and the person who gets "too little" feel distressed. The person who gets too much may feel guilty or ashamed. The person who gets too little may feel angry or humiliated. Individuals, who perceive that they are in an inequitable relationship, attempt to eliminate their distress by restoring equity. The greater the inequity, the more distress people feel and the more they try to restore equity (Walster, Traupmann, and Walster, 1978).

2.7.4 Competition in collective action

Kohn (1986: 30) defines competition as "a rivalry between individuals or groups for a niche or allocation of resources. According to Kohn (1986: 31), competition arises whenever two or more parties strive for a goal which cannot be shared. Competition can have both beneficial and detrimental effects (Jacob, 2009). Benefits of competition exist when incentives are given for self-improvement to competitors in cooperative competition (Buckley, 1988: 107). Cooperative competition is a process where individuals compete to improve their level of happiness but compete in a cooperative manner through peaceful exchange and without violating other people. This kind of competition is based upon promoting mutual survival whereby everyone wins (Jacob, 2009).

Competition may also exist at different levels; some competitions may be between two individuals while other forms of competitions may occur between groups. An example of competition between two individuals or farmers would be considered small compared to competition between groups of farmers. As a result, the consequences of the competition would also vary implying that the larger the competition, the larger the effect. Buckley (1988: 107) found that the detrimental side of competition exists when it leads to the compromising of ethical standards in order to gain an advantage: For example, stealing from the competing party in order to increase personal gains. Destructive competition seeks to benefit an individual or a group by damaging and/or eliminating competing individuals or groups (Buckley, 1988: 108).

According to Güth, Ockenfels and Wendel (1997: 15), this kind of competition opposes the desire for mutual survival. It is "winner takes all", the rationale being that the challenge is a zero-sum game; the success of one group is dependent on the failure of the other competing groups (Buckley, 1984: 120). Destructive competition tends to promote fear, a "strike-first" mentality and embraces certain forms of trespass (Güth, Ockenfels and Wendel, 1997: 15).

Competitiveness is as an innate biological trait which coexists along with the urge for survival and this inclination to compete gives rise to aggressiveness and ambition (Kohn, 1986: 12). According to Kohn (1986: 12), more advanced civilisations integrate aggressiveness and competitiveness into their interactions, as a way to distribute resources. Jacob (2009) argues that competition is a learned behaviour. Jacob (2009) further maintains that if survival requires competitive behaviours, the individual will compete. The tendency toward extreme, unhealthy competition expressed by the highly aggressive personality types characterised by moving against people has been termed hyper-competitiveness (Ryckman, Thornton and Butler, 1994). According to Ryckman *et al* (1994), these characters have a need to compete and win at all costs as a means of maintaining their self-worth. These individuals are likely to turn any activity into a competition, and they will feel threatened if they find themselves losing. Researchers have found that men and women, who score high on the trait of hyper-competitiveness, are more narcissistic and less psychologically healthy than those who score low on the trait. Hyper-competitive individuals generally believe that winning is not everything; it is the only thing.

2.7.5 *Need in collective action*

A need is that which is necessary for human beings to live a normal life (Clark, 2005: 21). An individual's needs are representative of the costs of being human within society. A person who does not have needs fulfilled will function poorly in society and a shortage of a need would cause an obvious negative outcome, such as a dysfunction or death. Gough (1994: 33) classifies needs as either objective or physical, such as the need for food and water, and subjective or psychological, such as the need for self-esteem. According to Gough (1994: 35), the attainment of objective (physical) need accomplishes physical health and the achievement of subjective (psychological) need brings about personal autonomy. A need in its psychological feature arouses an organism to action toward a goal and the reason for the action, giving purpose and direction to behaviour (Gough, 1994: 33).

People have a pecking order of psychological needs, which range from security to self-actualisation. One person's view of a need may easily be seen as paternalistic by another. Each person has an objective interest in avoiding serious harm that prevents the endeavour to attain vision of what is good, no matter what that is exactly about. This attempt requires the ability to participate in the societal setting in which an individual lives. The latter refers to the capacity to make informed choices about what should be done and how to implement it. This requires mental health, cognitive skills, and chances to participate in society's activities and collective decision-making.

"Need" may vary radically between different cultures or different parts of the same society.

2.8 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, which 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 what 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.

2.9 Current formal water sharing arrangements

Despite the fifty-year old history of Dzindi, and its exposure to several important political changes that occurred in South Africa during its existence, the formal institutions and organisations governing the sharing of water within the project were never modified in any substantial manner. All three rules introduced within the establishment still apply. The formal enforcement of the rules is still the task of two water-bailiffs and the SMC, and does not involve the Extension Officer. Even the role of Chief Mukhumo has been maintained. As in the past, with regards to offences involving the breaking of water-sharing rules, the Chief does not alter the decisions of the SMC, and when such cases do reach the Chief, the fines are still doubled and distributed as before. Most farmers found guilty of offences against water-sharing rules comply with the fines imposed by the SMC, and few have to be reported to the Chief. Farmers have since realised that when it comes to sharing of water within Dzindi, the Chief is little more than an extension of the SMC. Therefore, most prefer to accept SMC rulings rather than involve the Chief and end up paying a double fine. The SMC still receives controls and disburses the money for fines.

2.10 Changes to the formal water-sharing arrangements

In 1982, the SMC decided to write down water-sharing rules. This decision was made to provide transparency and consistency in application, and to adjust the value of the penalties to the prevailing value of the Rand. In a mass meeting, the rules were first recalled, and then confirmed by all plot holders present, and finally written down. The mass meeting also decided on the value of the new fines.

The fine for obstructing a distribution canal was raised from 25 cents to R10 and that for obstructing the main canal from 25 cents to R25. One farmer, who drew water directly from the canal, was granted permission to obstruct the canal when it was his turn to irrigate, because the water level in the canal was too low for water to enter his field. The fine for bathing or washing clothes with soap in the canal was also increased to R25. This offence became a lot more common when parts of the rangeland of Dzindi were made available for settlement. Insufficient provision was made to supply newcomers with water, causing them to rely heavily on the water in the canal for most purposes. Taking water from the canal was allowed, but some people did not bother scooping the water out of the canal to do their washing. Instead, they washed directly in the canal.

The 1982 general meeting of farmers did not reach an agreement on the value of the fine imposed on persons irrigating on days or times not allocated to them. The meeting awarded the SMC with discretionary powers to decide on the value of the fine, and insisted that SMC members should be punished more severely than ordinary farmers because their behaviour was supposed to be exemplary. The records kept by the SMC indicate that the fines for irrigating on non-scheduled days during the period (1982 to 2003) ranged between R10 and R250. High fines usually applied to cases involving an SMC member. The highest fine on record was imposed on an SMC member found guilty of irrigating on the wrong day.

Several farmers were granted permission to expand their plots onto land that was not scheduled for irrigation when the scheme was established. Usually, these expansions were situated on slopes too steep to irrigate safely or had soils that were

too shallow for irrigation. The SMC's position was that the water-sharing rules applied, meaning that expanding one's plot did not give one the right to more water. It was up to the farmer concerned to decide on how to use the water available to him or her in the most efficient manner. Farmers were also granted permission to exchange irrigation days or times among each other. This removed some of the rigidity of the water-sharing rule.

2.11 Conflict resolution procedures

Discovery of the offence of blocking the canal typically occurs when an irrigating plot holder lower down the canal becomes aware that the quantity of water reaching his or her plot is less than normal. When inconvenienced, the plot holder will go in search of the cause for the low flow. On occasions flow reduction is caused by an object floating in the canal being caught in a diversion weir, but usually, obstructions are deliberate and manmade. When such an obstruction is discovered, the aggrieved farmer confronts the offender. Normally, the offender hurries to remove the obstruction from the canal, pleading for forgiveness. When the apology is accepted, the matter is settled there and then.

In cases where the aggrieved plot holder does not want to forgive the offender, even after the obstruction has been removed from the canal, the offender will then seek the assistance of a mediator to resolve the conflict. Old grudges between aggrieved and offending plot holders are typical circumstances for an offence not being settled amicably and immediately. People requested to mediate are usually elderly members of the scheme.

Mediators are peacemakers. Their role is to listen to the accounts of the conflict from the affected parties without taking side, and to create the necessary conditions to restore the relationship between them. Mediators help detect the underlying reason why the conflict was not settled immediately, and in this way, steer the two parties towards reconciliation. Throughout the negotiations, mediators avoid the use of harsh language. Instead, they make use of reconciliatory idiomatic expressions and proverbs aimed at building the personalities of the affected persons. In this way, the mediator creates opportunities for the offender to help him or herself out of the situation by being humble, co-operative, and be remorseful. The conflict is resolved when the mediator succeeds in calming down the aggrieved, and gets him or her to forgive the offender. Resolving conflicts through mediation keeps all what is said and done within the closed circle of affected people.

When mediation fails to bring about a resolution of the conflict, the matter is reported to the block leader. Each of the four blocks has an elected leader, which is an informal position of authority of indefinite duration, to be discontinued only for reasons of incompetence. The main task of the block leader is to exert authority in order to help resolve conflicts over the sharing of irrigation water. The competence of the block leader is judged accordingly. When an aggrieved plot holder reports a conflict to the block leader, the block leader calls the offender to order, and urges for a resolution. **Figure 2** shows the illustrative description of the conflict resolution procedure in Dzindi.

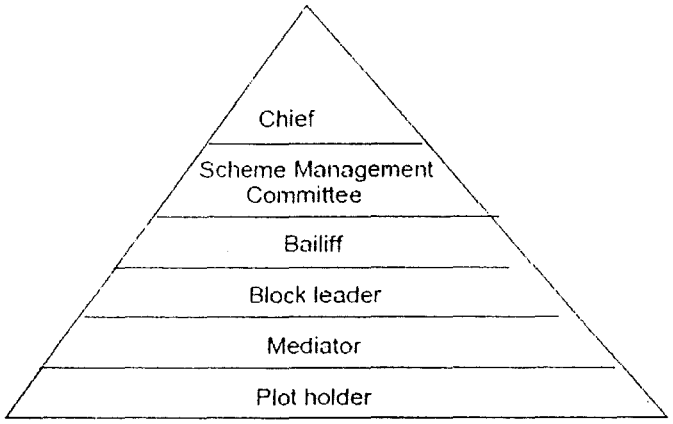

Figure 2: *The illustrative description of the conflict resolution procedure at Dzindi*

In some cases, aggrieved plot holders by-pass block leadership and report the problem directly to one of the bailiffs. Although the bailiffs are expected to report offences directly to the SMC, their first action is to enquire whether the parties involved have attempted to resolve the matter in an amicable manner, using mediation or the intervention of the block leader.

In cases where these avenues have not been explored, the bailiffs encourage the affected parties to do so. The bailiffs only report cases to the SMC when various attempts at reconciliation have failed. When an offence is brought before the SMC, it enters the formal institutional level, to be resolved by the imposition of a monetary fine on the offender, who is informed of the amount in writing. Refusal to pay the imposed fine results in the delivery of a reminder, and a second refusal, in a letter from the SMC. At the second refusal, the SMC orders the offender to appear before the committee to explain why the fine has not been paid. Any offender, who still

refuses to comply, is then reported to the Chief. As explained earlier, this action invariably results in the fine being doubled.

The conflict resolution procedure in Dzindi has two levels, namely, a visible formal and an invisible informal level. The results of the survey involving 10 plot holders provided an indication of the relative importance of formal and informal levels and their respective sub-levels in the resolution of conflicts among plot holders over water. Considering the sensitivity of the matter, during the interviews referral to conflicts in which respondents were personally involved were avoided. Instead, participants were asked to identify the different levels and sub-levels at which conflicts over irrigation water were resolved in their neighbourhood.

This suggests that the institutional and organisational arrangements in Dzindi are sufficiently flexible to provide plot holders the necessary room for manoeuvre, without causing permanent conflict that can affect the social sustainability of farming in this community. This includes breaking water-sharing rules when conditions demand such action. The results also show that conflict resolution is not centralised in Dzindi. All plot holders have the authority and ability to resolve conflicts arising from the use of water.

The seeking for resolution and reconciliation at the informal level is an expression of the importance of togetherness in the value system of this community. The rules governing the sharing of water provide the regulatory framework, but the value awarded to togetherness constitutes the fabric on which the sustainability of the

institutional arrangements depends. When the value of togetherness is challenged, institutional sustainability is threatened.

This was evident from a case where a plot holder was granted permission to cultivate and irrigate a non-scheduled parcel of land. This parcel was located above the canal, and in 2003, the plot holder purchased a pump to irrigate it. When pumping, the water level in the canal dropped significantly, reducing availability of water lower down. The matter caused a great concern among plot holders, and was reported to the SMC. When the SMC confronted the plot holder, he explained that pumping was the only way in which he could irrigate his new parcel of land. Since he was granted official permission by the SMC to use it, and only pumped water on the day and time of the week allocated to him, he was not breaking any rules. His argument was clearly valid when the rules were considered literally, but his action broke the spirit of the rules, namely, the equitable sharing of resources, and, therefore, challenged the value of togetherness.

The community and its leadership have been at a loss on how to resolve this particular case, and in September 2004, still had not arrived at a settlement. The SMC has the authority to revert to its earlier decision, and withdraw permission for use of the parcel, but has not used that authority. Instead, it counts on the plot holder concerned to re-embrace the value of togetherness, and modify his actions accordingly. The question arises whether explicitly stating the values underlying the water sharing rules, in this case the principle of equal access, would assist conflict resolution in such cases.

2.12 Chapter summary

This chapter has examined literature in relation to smallholder irrigation schemes, the concepts and theories of collective action. The chapter covered sections on definitions and meaning of collective action, informal and formal collective action, basis of collective action, attributes of collective action, conceptual framework of collective action, cultural configuration of the group, institutions, values, norms, social structure , collective action, water sharing and Irrigation scheme distributive justice, equality, formal equality, proportional equality, moral equality, equity, competition, need, historical formal water-sharing arrangements, current formal water sharing arrangements , changes to the formal water-sharing arrangements and conflict resolution procedure.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the description of the study area and the research methodology used in the study. The sections covered in the chapter include; the study area, population of study, sampling procedure and sample size, data collection, validity and reliability, data analysis and ethical considerations. Multiple regression analysis was used in this study to determine the determinants of participation in collective action.

3.2 Study area

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 that comes 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.

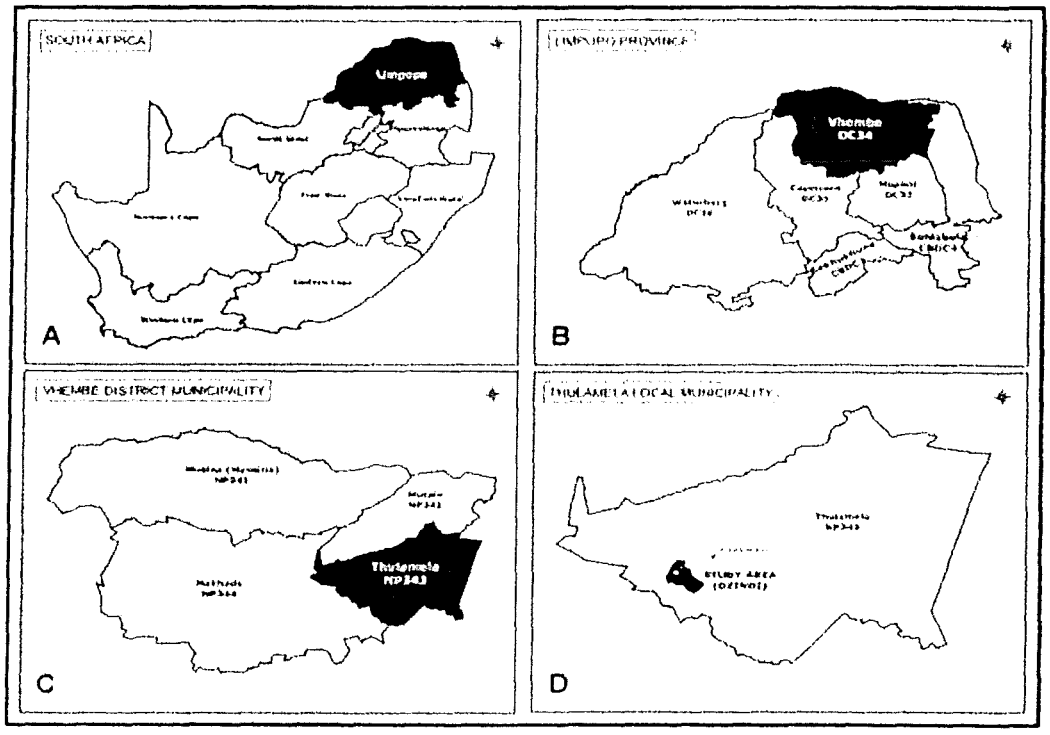

Figure 3: *Map of South Africa showing study site*

Plot holders practise 'short furrow irrigation'. This is a form of surface irrigation, whereby a field is subdivided into small narrow basins separated from each other by earth ridges (De Lange, 1994: 12). By opening the earth ridge, each little basin is filled with water, later, the ridge is closed and the next basin is filled up. This practice is generally considered as reasonably efficient, and well suited to labour-intensive farming systems (De Lange, 1994: 12). Crops grown in Dzindi include vegetables during winter (cabbage, Swiss chard and indigenous vegetables) and maize in summer (Van Averbeke, *et al.*, 2004: 37). Maize is used mainly for home consumption and vegetables are essentially cash crops. The scheme is situated on sloping and terraced land. On the ridges separating the terraces, farmers grow sugarcane, bananas and mangoes (Van Averbeke, *et al.*, 2004: 37).

Dzindi was chosen as a case because to date, the project has survived 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).

Dzindi is a surface irrigation scheme that covers an area of 136 ha which is 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. These plots are grouped into four blocks as depicted in **Figure 4**.

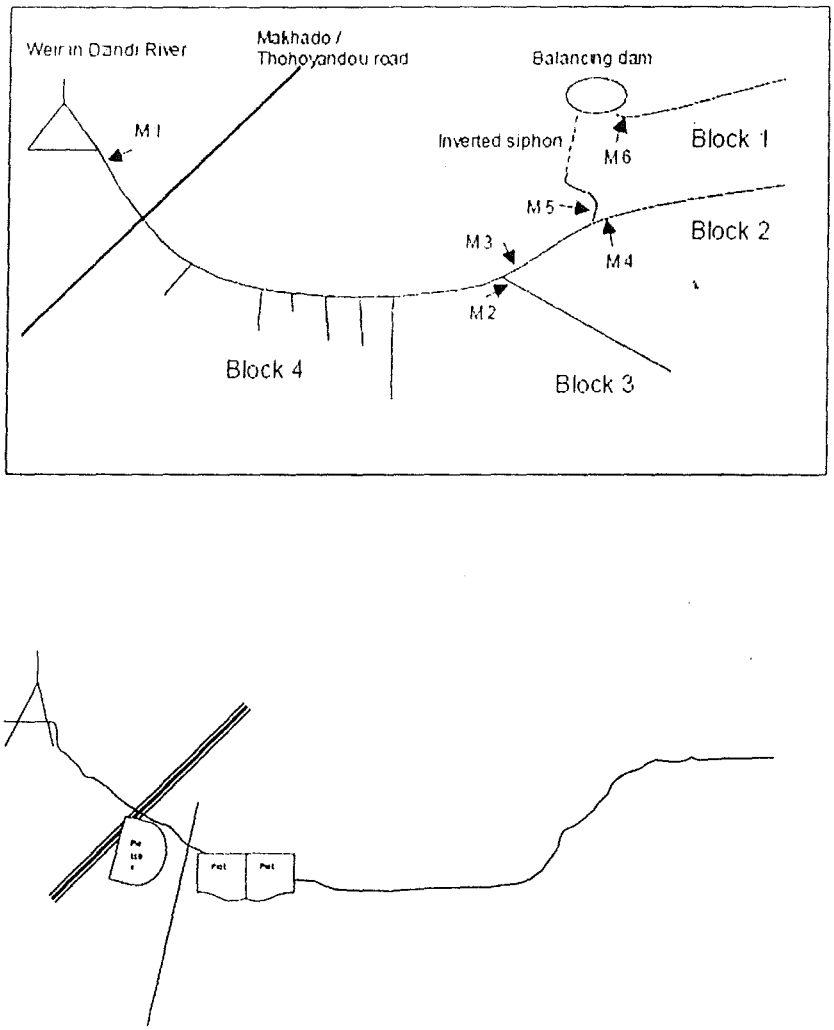

Figure 4: *Schematic layout of the water distribution network in Dzindi (Van der Stoep and Nthai, 2005)*

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.

3.3 Population of study

The population of this study include all plot holders in Dzindi, smallholder irrigation scheme. Van Averbeke, *et al* (2004) reported that there are 106 plot holders in the irrigation scheme.

3.4 Sampling procedure and sample size

Simple random sampling techniques were used to select 97 plot holders. This sample size represents 1 percent margin of error and confidence level of 99 percent. Raosoft (2004) indicates that when choosing a random sample, the sample size does not change much for populations larger than 20 000. The creation of the sample size will give correct answers than form a large sample where only a small percentage of the sample will respond.

In addition, the stratified random sampling will allow the researcher to statistically calculate the relationship between the sample and the population that is the sampling error. Krejcie and Morgan (1970) further state that as the population increases, the sample size increases at a diminishing rate and remains constant at slightly more than 380 cases. Frame error was controlled by excluding non-plot holders but farmers on the scheme, while selection error was eliminated by ensuring that all sampled farmers were plot holders currently farming in the scheme. Non response error was controlled by administering data at the farmers' convenience in order to allow time to go through all the items in the questionnaire.

3.5 Data collection

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. Open and closed–ended questions were used to obtain information about respondents on age, marital status, educational level, and household size, religion including other demographic and socio-economic variables.

The questionnaire was subdivided into the following sections:

Section A – focussed on the personal characteristics and socio-economic factors of irrigators.

Section B – determined the offences and conflict resolution in the sharing irrigation water on the irrigation scheme.

Section C– consisted of items relating to collective action activities

Section D – consisted of items related to scale on individualism vs collectivism - vertical collectivism, horizontal collectivism, vertical individualism, horizontal individualism, distance from in-groups, concern for in-group, self-reliance with competition, and team-member exchange quality

Section E– ascertained the livelihood strategies among the irrigators

Section F – focused on the perception of irrigators on the effect of collective action on livelihood capital

Section G – determined irrigators' knowledge of collective actions processes

3.6 Validity and reliability

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.

3.7 Data analysis

Data was analysed using the Statistical Package for Social Sciences (SPSS) 18.0. Descriptive statistics such as standard deviation, mean and frequency distribution were used to describe the personal characteristics of extension officers; tables, graphs and percentages were used to summarize the data and enhance the readability of the results. Multiple regression analysis was used to determine the effect of predictors on dependent variables of the study. The following multiple regression model was used:

$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 \ldots\ldots\ldots + e$. Where,

Y	Represents	*participation in collective action activities*
a	Represents	*the intercept*
b_i	Represents	*regression coefficients*
X_1	Represents	*perceived effect on financial capital*
X_2	Represents	*perceived effect on human capital*
X_3	Represents	*perceived effect on physical capital*
X_4	Represents	*perceived effect on natural capital*
X_5	Represents	*perceived effect on social capital*
X_6	Represents	*intrinsic motivation for collective action*
X_7	Represents	*perceived usefulness of collective action*
X_8	Represents	*perceived ease of use of collective action*
X_9	Represents	*behavioural intent on collective action*
X_{10}	Represents	*knowledge of collective action*
X_{11}	represents	*gender*
X_{12}	represents	*age*
X_{13}	represents	*farming experience*
X_{14}	represents	*marital status*
X_{15}	represents	*educational level*
X_{16}	represents	*religious belief*
X_{17}	represents	*land ownership*
X_{18}	represents	*land allocation process*
X_{19}	represents	*distance to market*
X_{20}	represents	*types of market used*
e	represents	*the error term*

3.8 Ethical considerations

Ethical considerations were addressed through, voluntary participation. Respondents' right to privacy was exercised by obtaining direct consent from them. Respondents were made aware of the positive and negative aspect of aspects of participation. Anonymity was also ensured to avoid biased responses from respondents.

3.9 Chapter summary

This chapter has provided a detailed description of the study area and research methodology used in the study. Based on the distribution numbers of plot holders in the Dzindi irrigation scheme, Raosoft sample calculator (2004) was used to calculate the sample sizes for the respective districts. The design and contents of the questionnaire for the data collection was informed by the objectives of the study. Multiple regression analysis was used in this study to determine the determinants of participation in collective action.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results of the study. The chapter is organised based on the objectives of the study. The respective sections are based socio-economic profiles of farmers in the irrigation scheme, livelihood strategies pursued by farmers in the irrigation scheme, farmers' participation in collective action activities in the irrigation scheme, determinants of farmers' participation in collective action activities, farmers' perceptions of the effect of collective action on livelihood capital, farmers' knowledge about collective action processes and dimensions of collectivism and individualism among farmers in the irrigation scheme.

4.2 Socio-economic profiles of farmers on the irrigation scheme

Table 1 presents the results on the personal characteristics of farmers in the irrigation scheme. Majority of the farmers were male (56%) and (70%) were more than 50 years with 71% having at least 20 years of farming experience. This may be attributed to the fact that there is male dominance in agricultural practices in the irrigation scheme.

The pattern of plot allocation and inheritance might have also influenced the proportion of males relative to females in the scheme. The location of the irrigation scheme in a core rural area with the attendant push factors of migration might have influenced the age group of farmer on the irrigation scheme. Balarane and Oladele (2014) reported that majority of farmers in irrigation schemes in the North West Province of South Africa were above 50 years. Chigavazira (2012) states that more male than female are involved in subsistence agriculture at Dzindi and that high numbers of women are also as a result of the death of a spouse leading to widow-led families.

Chigavazira (2012) specified an age distribution of 40 percent of respondents being between 40-49 years; with a majority (50%) being between 50-59 years while the remaining 10% were above 60 years old in Dzindi irrigation scheme, 3% were married while 65% had primary and secondary school education level. This may be because marriage provides extra hands for farm labour for farmers. The educational level may be as a result of the distance to the nearest tertiary institutions and the cost associated with tertiary education.

Balarane and Oladele (2014) reported that majority of farmers in irrigation schemes in the North West Province of South Africa were married. About 76% are Christians and only 43% had their plots at the upper parts of the irrigation canal with 65% having ownership of the plots. Balarane and Oladele (2014) noted that in irrigation schemes in North West Province, South Africa, only 7.6% of irrigation land is privately owned and 92.4% belongs to the chief.

Table 1: *Personal characteristics of farmers in irrigation scheme*

VARIABLES	FREQUENCY	PERCENTAGES
Gender		
Male	55	56.70
Female	42	43.30
Age		
Less than 40	11	11.34
40 - 50	17	17.53
51-60	25	25.77
above 60	44	45.36
Farming experience		
Less than 10	5	5.15
10 to 20	23	23.71
20 to 30	30	30.93
Above 30	39	40.21
Marital status		
Single	15	15.46
Married	61	62.89
Divorced	2	2.06
Widowed	19	18.59
Highest educational level		
Abet	6	6.18
Primary	34	35.05
Secondary	30	30.93
Tertiary	8	8.25
None	19	19.59
Religion		
Christian	74	76.29
Traditional	19	19.59
Muslim	4	4.12
Location of plots along the canal		
Upper	42	43.30
Middle	40	41.24
Lower	15	15.46
Number of plots along the canal		
Upper	24	24.74
Middle	62	63.92
Lower	11	11.34
Land ownership		
Own land	63	64.95
Communal land	8	8.25
Leased land	11	11.34
Land reform	15	15.46
Rent		

Table 2 presents the description of households and farm characteristics among irrigators in the Dzindi scheme. These variables were described in terms of means and standard deviation scores due to the level of measurement (interval) at which the variables were measured. The results adult ($\bar{X} = 4.12$, SD = 2.05); children ($\bar{X} = 3.93$, SD = 2.28); male ($\bar{X} = 3.73$, SD = 1.81); female ($\bar{X} = 5.26$, SD = 8.01); total household size ($\bar{X} = 7.51$, SD = 2.95) show that large household sizes exist among respondents in Dzindi irrigation scheme. The trend, however show higher female per household than male.

Van Koppen, Hope, and Colenbrander (2012) identified that female-headed households (FHHs) in irrigation schemes required and used more family labour because (FHHs) adopted irrigation technologies at a rate that is at least two-thirds of that of male-headed households (MHHs) and that FHHs adopted manual irrigation technologies such as buckets more often, while MHHs favoured motor pumps and river diversions. This finding contradicts van Koppen, Hope, and Colenbrander (2012) that men generally provided more labour for irrigation activities. Women in FHHs provided the least labour: only 35% of total household labour.

The mean score for distance to market and all costs associated with transaction of their produce remain very high. These may be responsible for the prevalence of the non-participation of farmers in high value markets for the different produce from the Dzindi irrigation scheme. Makhura, *et al* (2003) reported high transaction costs among farmers in Limpopo area of South Africa.

Table 2: *Description of households and farm characteristics among irrigators in Dzindi*

HOUSEHOLDS AND FARM CHARACTERISTICS	MEAN	STANDARD DEVIATION
Adult	4.12	2.05
Children	3.93	2.28
Male	3.73	1.81
Female	5.26	8.01
Total household size	7.51	2.95
Dependants	4.30	2.30
Plot size	1.33	1.01
Distance to market	6.70	16.72
Transaction cost	424.85	285.51
Transport cost	141.57	302.54
Storage cost	45.37	287.30
Levy costs	34.4	21.39
Handling costs	12.54	63.28

Table 3 presents the results on features of crop production and marketing activities among irrigators in the Dzindi Scheme, which show that maize($\bar{X} = 74.67$, SD = 389.49), lentils ($\bar{X} = 3.19$, SD = 30.45) and Kale($\bar{X} = 87.69$, SD = 535.26) are the most prominent crops in the irrigation scheme. This may be attributed to the prevailing farming system of the area and the demand of maize as the main staple food crop as well as vegetables as part of the menu. The preference for Kale over other leafy vegetables could be responsible for its high production. There is a similar trend on the results on marketing activity in terms of quantity sold. Fanadzo, *et al* (2010) reported that the cropping intensity on the irrigation scheme in Eastern Cape of South Africa shows, grain maize (*Zea mays*) and butternut (*Cucurbita moschata*) as the most prevalent.

Van Averbeke and Mohamed (2006) noted that in smallholder irrigation scheme in South Africa, diversity of farming was expressed in different farming styles, with specific characteristics pertaining to choice of crop, crop husbandry, attitude towards risk, allocation of produce and marketing practices and that diversity in livelihood and farming on smallholder irrigation schemes is a natural socio-economic phenomenon that has evolved historically and expected to persist.

Table 3: *Features of crop production and marketing activities among irrigators in Dzindi Scheme*

	PRODUCTION AREA		QUANTITY HARVESTED		QUANTITY SOLD	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Maize	74.67	387.49	107.91	569.28	71.42	150.40
Sunflower	0.16	0.48	70.24	613.74	105.98	570.05
Spinach	1.07	1.74	320.62	1515.86	181.28	1144.27
Cabbage	1.21	1.48	12095.59	101397.11	271.01	1358.29
Carrots	0.36	0.79	38.25	164.19	3105.14	12369.81
Beetroot	0.50	0.83	68.14	484.66	80.20	479.60
Tomatoes	0.98	1.35	305.69	2120.22	27.36	127.76
Potatoes	0.30	1.10	0.10	1.02	100.44	642.54
Butternut	0.39	0.77	4.21	28.56	1.76	15.25
Onion	0.23	0.71	13.40	85.85	4.33	28.55
Lettuce	0.10	0.42	0.02	0.14	9.39	64.26
Cauliflower	0.06	0.32	0.04	0.25	0.13	0.57
Green beans	0.06	0.27	2.65	25.38	0.16	0.69
Lucerne	0.49	2.87	0.41	2.71	2.75	25.38
Green Pepper	0.07	0.32	0.11	0.54	0.18	0.61
Lentils	3.19	30.45	8.27	58.93	13.81	93.29
Kale	87.69	535.26			0.37	1.67

Table 4 shows the description of land allocation, irrigation types and contact with extension officers in the Dzindi irrigation scheme. The results show that majority of the farmers were allocated land in the irrigation scheme on first come, first served basis (64.95%), used flood irrigation systems (88.65%), practised double, multiple, and multiple cropping system (82%) and had contact with extension (71%). These trends of results may be due to the fact that the irrigation scheme was developed to improve the livelihoods of the black population during the apartheid days in South Africa.

Table 4: *Description of land allocation, irrigation types and contact with extension officers in the Dzindi irrigation scheme*

VARIABLES	FREQUENCY	PERCENTAGES
Land allocation process		
Acquired the preferred area without process	22	22.67
Lottery within or outside the claimed area	5	5.15
First come, first served basis	63	64.95
Negotiation among re-settlers	2	2.06
No formal permission regarding land use	5	5.15
Type of market used		
Farm gate	65	67.0
High value	8	8.25
Others	24	24.74
Type of irrigation systems		
Central pivots irrigation systems	5	5.15
Flood irrigation systems	86	88.65
Sprinkler irrigation systems	4	4.12
Micro irrigation systems	1	1.03
Drip irrigation systems	1	1.03
Source of water for the irrigation scheme		
Dam	9	9.26
River	73	75.26
Reservoir	9	9.28
Bore hole	5	5.15
Fountain	1	1.03
Irrigation ownership		
Privately owned	5	5.15
Community owned	51	52.58

Government department	36	37.11
Private stakeholders	5	5.15
Cropping systems		
Mono cropping system	17	17.53
Double cropping system	29	29.90
Multiple cropping system	22	22.68
Mixed cropping	29	29.90
Extension contact		
No	28	28.87
Yes	69	71.13
Frequency of extension contact		
Rarely	45	46.39
Occasionally	39	40.21
Regularly	13	13.40

Table 5 presents results on the sources of information among farmers. The prominent sources of information were television (63.92%), radio (67.01%), and extension officers (74.23). Conversely, the least used information sources by farmers were cell phone (73.20%), university (72.16%), internet (85.57%), ARC (92.79%), newspaper (88.66%), magazine (93.82%) and computer (93.81%). The low use of cell phone, university, internet, ARC, newspaper, magazine and computer could be due to the high illiteracy level of farmers, lack of ICT-based extension services in the area and distance of university and agricultural research institute to the study site.

Table 5: *Sources of information among irrigators*

	No	**Yes**
Television	35 (36.08)	62(63.92)
Radio	32(32.99)	65(67.01)
Phone	71(73.20)	26(26.80)
Extension officer	25(25.77)	72(74.23)
University	70(72.16)	27(27.84)
Internet	83(85.57)	14(14.43)
ARC	90(92.79)	7(7.22)
Newspaper	86(88.66)	11(11.34)
Magazine	91(93.82)	6(6.19)
Computer	91(93.81)	6(6.19)

The results on Dzindi's irrigators' participation in social organisations are presented in **Table 6**. This is predicated on the fact that an irrigation scheme consists of four mutually interlinked systems: the physical system, the cropping system, the economic system and the social-organisational system (Mwendera and Chilonda 2013). There is generally low participation in social organisations listed by farmers. The results show that, prominent participation by farmers were through workshops by Scheme management committee (21.65%), canal management committee (17.53%) and YARD/BAYOFA (10.31). The low proportion of irrigators' participation in social organisations indicates low social capital among irrigators and reduced impact of how social capital could have contributed to their livelihoods.

Table 6: *Dzindi's irrigators' participation in social organisations*

Farmers organisations	None	Meetings	Conferences	Workshops
AFASA	81 (83.51)	7(7.22)	8(8.25)	1(1.03)
Water user association	83(85.57)	1(1.03)	8(8.25)	5(5.15)
Agricultural cooperatives	81(83.51)	4(4.12)	5(5.15)	7(7.22)
Scheme management committee	64(65.98)	4(4.12)	8(8.25)	21(21.65)
Canal management committee	71(73.2)	2(2.06)	7(7.22)	17(17.53)
YARD/BAYOFA	80(82.47)	3(3.09)	4(4.12)	10(10.31)
Local community clubs	80(82.47)	7(7.22)	6(6.19)	4(4.12)
Other (specify)	80(82.47)	11(11.34)	4(4.12)	2(2.06)

4.3 Offences and conflict resolution

Table 7 presents results on the types of offences and conflict resolution in sharing irrigation water at Dzindi. The prominent offences were: Get caught breaking the irrigation rules (1.36); apologise immediately when found caught committing an

offence (1.31); use more days to irrigate (1.28) and use more irrigation water (1.24). The results show that in Dzindi, plot holders breaking the rules governing the sharing of water was common. During the period 2001 to 2003, only 16 offences against the water-sharing rules were brought before the SMC, an average of about five per year. However, these were not the only offences against the rules that occurred. There were also instances, involving plot holders who were caught by others in the act of committing an offence, that were never brought before the SMC. In such cases, the affected parties settled the matter informally. A common offence involved plot holders blocking the canal to obtain more water and this is regarded as "irrigation water theft". During a transect walk along the canal, at least three instances of this offence were observed on the same day.

Theft of irrigation water occurs at two levels in Dzindi, namely, between blocks and within blocks. The "between blocks theft" is when irrigation water in the main canal is blocked in order for it to proceed to the next block. The implications are that less water, or at times, no irrigation water is delivered to the next block. Indications are that this kind of theft occurs seldom and mainly during extended periods of drought.

The findings are that the behaviours of plot holders in Dzindi are characterised by 5 types of plot holders affected by the transgression of rules. The first group is "*the bullies*" referred to by Ostrom (2002: 464) as "rent seekers" who involve active efforts to obtain disproportionate advantages. The "bullies" disregard the rules and constitute 18% of the irrigating community of Dzindi.

Typical behaviour is drawing irrigation water from the main canal to the extra land acquired as an additional land. This additional parcel is land that was declared waste land when the scheme was established. The rule is that those given extra land still have to irrigate within the allocated period as per the time-table. The SMC seems to be facing an impasse in resolving such cases since the committee approved the addition of land without considering these consequences in irrigation water allocation. An example in this case is a plot holder who happens to have even afforded to secure a petrol water pump engine obtains irrigation water from the main canal. When he pumps water, the plot holders' block down the canal and they cannot get water.

The second group are "*the opportunists*". This is the largest group of irrigating community in Dzindi. They are smooth operators who seek chances of irrigating beyond their allocated periods by arranging to use the allocated irrigation periods with those who did not plough their lands, or those who have ploughed their land. However, for other reasons such as being engaged in other off farm matters, they cannot irrigate. The tendency of this group is to disregard the expiry of the arrangement.

This group is dominated by individuals who go to limits of illegally regulating the irrigation water control gates and blocking the distribution canals in order to "steal" irrigation water, thereby, letting water flow into their plots. This group is invisible for the fear of retribution. The group size increases when irrigation water becomes scarcer due to reduced water levels in the river, especially during winter and droughts.

The third group are those abiding by the set rules. They are the "*righteous*". This group follows the irrigation time-table to the letter. Irrespective of changes in irrigation water flow in the canals, they never irrigate beyond their allocated periods and do not "steal" irrigation water. When the flow is slow, and they cannot irrigate all the beds, this group would rather irrigate at night. Night irrigation is not an offence and is unlimited.

"*The victims*" constitute the fourth group of the irrigation community in Dzindi. The "the bullies" and "the opportunists" take advantage of this group of plot holders. These plot holders irrigate incompletely or cannot irrigate at all because there is no water flowing during their periods of irrigation. They confront the offenders, complain and even report to the bailiffs, the SMC and to the extension officer, but all in vain. They are typical helpless plot holders who are frustrated and distressed without help at all levels.

"Non-conformists" - The last group, the fifth, are those who avoid eminent conflict over irrigation water by either relying on rain for irrigation or leave their plots uncultivated and they are dubbed "*the cowards*". The demand for irrigation water has increased and exceeds the supply in Dzindi. Plot holders are no longer able to irrigate all their beds within the allocated half-a-day and once a week session. Three main reasons have been found to be contributing to the situation: ***a)*** *over time, more waste land that has been turned into irrigated land has increased the size of the irrigated land in the scheme.* This implies that the irrigated land is now more than that initially demarcated irrigation land the irrigation infrastructure was designed for.

There has been an expansion of irrigated land without the expansion of the irrigation infrastructure; ***b)*** *the irrigation water conveyance system has deteriorated to a state of disrepairs and the system has accumulated sediments of silt and plants to the extent that the flow in the canals is negatively affected.* Poor cleaning of the canals is due to the crumbling of collective cleaning actions; ***c)*** *seasonal low and extraordinary drought periods when the supply into river Dzindi runs low.*

Results indicate that the scarcity of irrigation water resource causes a state of dissonance in local institutions in Dzindi. The sharing of irrigation water rules are grossly ignored by role players. The behavioural typology of the affected and effected by the irrigation rules transgression intensifies. According to the plot holders irrigation water theft increases as plot holders compete for limited irrigation water.

The "opportunists" and the "bullies" intensify their behaviour by transgressing the irrigation water sharing rules and procedures and, thereby, increasing the victimisation of law abiders. The number of conflicts over irrigation water access has risen dramatically.

Those who uphold the irrigation water sharing rules, become victims. During their irrigation sessions irrigation water flow is either very slow or at times, there is no water at all. These plot holders follow the complaint procedure by reporting the situation to the bailiffs, the SMC and even the extension officer, but all in vain. The SMC as the ultimate power in scheme matters is aware of the situation of increased conflicts.

The SMC is paralysed. Offenders reported to the SMC are not brought to book and are not punished as required by the contents of the sharing of irrigation water rules. The SMC and the victim plot holders hope that the problem will be resolved when it starts raining since the river will run full again and irrigation water will be enough for everybody.

Table 7: *Offences and conflict resolution in sharing irrigation water in Dzindi*

	Mean	SD
Ignore the irrigation timetable	1.07	0.65
Block the canal in order to irrigate illegally	1.20	0.61
Use more irrigation water	1.24	0.61
Require more days to irrigate	1.28	0.62
Apologise immediately when found caught committing an offence	1.31	0.60
Be reported to SMC for transgressing irrigation rules	1.21	0.56
Refuse to stop breaking the rules until irrigation is completed	1.21	0.56
Breaks the irrigation rules often	1.22	0.58
Get caught breaking the irrigation rules	1.36	0.62

4.4 Participation in collective action activities

Table 8 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 very crucial to water distribution in the scheme and for most farmers to have access to water; these activities have to be carried out. Fischer and Qaim (2012) found that among smallholder banana farmers in Kenya, farmer groups are inclusive of the poor, although 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. Beyond prices, farmer groups function as important catalysts for innovation adoption through promoting efficient information flows.

We discuss the conditions under which collective action is useful, and through what mechanisms the potential benefits emerge. Naziri *et al* (2013) examined conditions and institutions that influence pesticide residues level in vegetables in Vietnam and found that collective action affects safety by providing members with technical assistance, monitoring and certification. The expected increase of free-riding in larger groups is not an issue when members are properly supported and monitored. 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. Furthermore, the results provide supportive evidence that participation in collective action has the potential to strengthen market participation among the poor and marginalized smallholder producers.

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 the free-rider problems exist among irrigators in the scheme. Alboiu, *et al* (2013) found that a small degree of farmers' participation in collective actions in the Romanian supply chains, as influenced by a certain degree of uncertainty among stakeholders in terms of institutional arrangements and participation in collective action.

Devaux, Velasco, López, Bernet, Ordinola, Hernán and Pico, (2007) reported that the use of collective action to reduce poverty in the Andes, by developing market niches and adding value to potatoes, particularly the native potatoes grown by poor farmers. Also, the Participatory Market Chain Approach (PMCA) and Stakeholder Platforms fosters commercial, technological, and institutional innovation through a structured process that builds interest, trust and collaboration among participants.

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. Based on a conceptual framework that uses social capital dimensions to study collective action, trust, cooperation and communication were identified as the key elements responsible for ensuring cohesion in informal groups engaged in mushroom production.

The studies by Mogoi *et al* (2012) on community based management and empowering local communities focus on co-management, using local/indigenous knowledge, recognizing local institutions and the establishment of common property regime.

Table 8: *Dzindi's irrigator's 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
Labour 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

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.

4.5 Dimensions of collectivism and individualism of irrigators

In this section, the dimensions of collectivism and individualism of irrigators was measured based on the scale of Triandis and Gelfland (1998). These dimensions were vertical collectivism (seeing the self as a part of a collective and being willing to accept hierarchy and inequality within that collective), Vertical Individualism (seeing the self as fully autonomous, but recognizing that inequality will exist among individuals and that they will accept this inequality), Horizontal Collectivism (seeing the self as part of a collective but perceiving all the members of that collective as equal) and Horizontal Individualism (seeing the self as fully autonomous, and believing that equality between individuals is the ideal). This is based on the fact that there are two basic ways of understanding the relationship between individuals in a group. The first way is individualism, which states that each individual is acting on his or her own, making their own choices, and to the extent that they interact with the rest of the group, as individuals. Collectivism is the second way, and it views the group as the primary entity, with the individuals lost along the way.

Table 9 shows a list of 80 statements about individualism and collectivism in group situations. The scale was sub-divided into 9 sections with 5 and 4 subsections for individualism and collectivism respectively. The sub sections for collectivism were values (3 statements), team- member exchange quality (14 statements), horizontal collectivism (10 statements) and vertical collectivism (8 statements). This section had 35 statements in all. The sub section on individualism consists of self-reliance with competition (12 statements), concern for in group (9 statements), and distance from in groups (7 statements), horizontal individualism (8 statements) and vertical individualism (8 sentences) making a total of 44 statements. These statements were ranked on a five point scale of no (1) through yes indeed (5). The actual mean due to the rating scale is 3; which implies that a mean score above 3 amplifies the manifestation of the behaviour portrayed in the sub scale and a mean score below 3 depicts non manifestation of the behaviour described in the scale.

The results show that from the list of 44 statements on the individualism scale 35 statements were above the actual mean score of 3.0 representing 79% of the total statements. This shows high tendency of individualism and evidence for lack of collective actions among irrigators in the Dzindi scheme. The perceptions and values associated with individualism as against collectivism could have been responsible for their behavioural manifestation towards collective actions. Tekana and Oladele (2014) found that in the absence of collective action among women in irrigation scheme in the North West Province South Africa, lowered their empowerment status. In terms of the use of income, 53% were disempowered, 60.2% were disempowered in terms of access to productive capital and access to credit, while about 50% were empowered in leadership and decision making.

Stofferahn (2004) found that as a result of problems associated with high machinery costs, farmers in the United States are examining group-farming arrangements that permit them to share machinery and labour, while group-farming arrangements are more frequent elsewhere, they are infrequent in the United States of America. Davis (2014) reports that the link between agricultural risk and collective responsibility is formalised in a model of informal risk sharing arrangements that incorporates optimal parental socialisation decisions and that individual responsibility has a large positive effect on economic development.

Conversely, 21 of the 35 statements listed on collectivism were above the actual mean of 3.0 which depicted a high tendency towards collective actions. This proportion represent 60% of the statements and could be attributed to the fact that the Dzindi irrigation scheme is a common pool of water resources which should be shared among initiated the proportion described by irrigators. Davis (2014) found that a taste for collective responsibility was adaptive in preindustrial societies exposed to high levels of agricultural risk, and that these attitudes continue to influence contemporary social norms. Stofferahn (2004) maintain that farmers who rent more land, have more education, are slightly older, and are more involved in cooperatives would be more willing to share machinery or labour.

In a discriminant analysis, only education and cooperative involvement had the power to classify farmers into those willing and not willing to share machinery and labour. However in a logistic regression procedure, only acres rented, education, and cooperative involvement significantly predicted willingness to share labour or machinery.

Talhelm *et al* (2014) indicated that the history of farming rice makes cultures more interdependent, whereas farming wheat makes cultures more independent, and these agricultural legacies continue to affect people in the modern world. Stofferahn (2004) and Harris and Fulton (2000), 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 including: lower costs, greater efficiency, access to new technology, and access to greater pool of knowledge and resources. Overall, the tendency among irrigators for individualism is higher collectivism in the irrigation scheme. This could be responsible for low participation in collective actions among the irrigators.

Table 9: *Individualism and collectivism tendency among irrigators on Dzindi scheme*

COLLECTIVISM SUB SCALES	MEAN	SD	CRONBACH'S
Values subscale (3)			**0.75**
I prefer to work with others in a team rather than to work alone	3.07	1.63	
Given a choice, I would rather do a job where I can work alone. than do a job where I have to work with others (R)	2.89	1.49	
I like it when team members do things on their own, rather than working with others all the time	2.97	1.46	
Team-members exchange quality (14)			**0.96**
Other group members usually let me know what they expected from me	2.80	1.47	
I normally checked with other group members before I did something that might affect them	2.99	1.36	
I usually let other group members know when they did something that affected my work	2.94	1.28	
Other group members usually let me know when I did something that affected their work	2.93	1.42	
I often made suggestions to other group members about better work methods	3.03	1.42	
I had a clear understanding of the problems	2.82	1.37	

associated with the strategy game and the needs of my group members during the game			
Other group members clearly understood my needs and problems related to performance on the strategy game	3.10	1.32	
I got constructive criticism from other group members	2.93	1.41	
I often helped other group members solve problems associated with the strategy game	2.97	1.42	
When I was busy, other group members often volunteered to help me out	3.01	1.48	
When other group members were busy, I often helped them out	3.15	1.45	
Other group members were flexible about switching responsibilities to make things easier for me	3.10	1.50	
I was willing to help finish work that had been given to other group members	3.28	1.48	
Other group members were willing to help finish work that was assigned to me	3.37	1.35	
Horizontal Collectivism			**0.95**
My happiness depends very much on the happiness of those around me	2.97	1.50	
I like sharing little things with my neighbours	3.27	1.37	
The wellbeing of my co-workers is important to me	3.21	1.49	
It is important for me to maintain harmony within my group	3.35	1.44	
If a relative were in financial difficulty, I would help within my means	3.26	1.40	
If a co-worker gets a price I would feel proud	3.32	1.25	
To me pleasure is spending time with others	3.43	1.39	
I feel good when I cooperate with others	3.23	1.55	
I think cooperation in the workplace is more important than competition	3.29	1.49	
I think it is important everyone has equal access to water	3.18	1.58	
Vertical collectivism			**0.90**
I would do what would please my group	3.10	1.50	
I usually sacrifice my self-interest for the benefit of my group	3.08	1.55	
We should keep our aging parents with us at home	3.09	1.60	
Colleagues should feel honoured if their co-worker receive a distinguished award	3.03	1.49	
Colleagues should be taught to place duty before pleasure	2.96	1.58	
I would sacrifice an activity that I enjoy very much if my family did not approve of it	2.68	1.76	
I hate to disagree with others in my group	2.52	1.73	
Before making a major trip, I consult with most members of my family and many friends	2.16	1.66	

INDIVIDUALISM SUB SCALES			
Self-Reliance with competition			**0.91**
If the group is slowing me down, it is better to leave it and work alone.	3.75	1.34	
To be superior a man must stand alone.	3.54	1.53	
Winning is everything.	3.48	1.56	
Only those who depend on themselves get ahead in life	3.49	1.49	
If you want something done right, you've got to do it yourself.	3.61	1.40	
What happens to me is my own doing.	3.29	1.53	
I feel winning is important in both work and games.	3.28	1.48	
Success is the most important thing in life.	3.20	1.52	
It annoys me when other people perform better than I do.	3.02	1.49	
Doing your best isn't enough; it is important to win.	2.96	1.57	
In most cases, to cooperate with someone whose ability is lower than oneself is not as desirable as doing the thing on one's own.	3.12	1.65	
In the long run the only person you can count on is yourself	2.95	1.65	
Concern for in-group			**0.88**
It is foolish to try to preserve resources for future generations. (Reversed)	2.76	1.59	
People should not be expected to do anything for the community unless they are paid for it. (Reversed)	2.64	1.54	
Even if a farmer is prosperous the community should not feel honoured in any way. (Reversed)	2.79	1.57	
I would not let my neighbour use my resources (Reversed)	2.77	1.62	
I would help within my means if a colleague is in financial difficulty.	3.05	1.65	
I like to live close to my friends.	3.15	1.63	
The motto "sharing is both blessing and calamity" is still applicable even if one's friend is clumsy, dumb, and causing a lot of trouble.	3.29	1.47	
When my colleagues tell me personal things about themselves, we are drawn closer together	3.11	1.63	
I would not share my ideas and newly acquired knowledge with my colleague. (Reversed)	3.41	1.48	
Distance from in-groups			**0.93**
I am not to blame if one of my family members fails.	3.46	1.53	
My happiness is unrelated to the well-being of my co-workers	3.38	1.51	
My colleagues' opinions are not important in my choice of a livelihood	3.46	1.66	
I am not to blame when one of my close friends fails.	3.43	1.66	
My co-workers' opinions are not important in my	3.49	1.56	

choice of a what i plant			
When a close friend of mine is successful, it does not really make me look better.	3.54	1.54	
One need not worry about what the neighbours say about whom one should relate with	3.44	1.59	
Horizontal individualism			**0.92**
I prefer to be direct and forthright when I talk with people	3.70	1.49	
One should live one's life independently of others	3.67	1.58	
I often do my own thing	3.61	1.42	
I am a unique individual	3.44	1.45	
I like my privacy	3.54	1.26	
When I succeeded, it is usually because of my abilities	3.37	1.53	
What happens to me is my own doing	3.38	1.45	
I enjoy being unique and different from the others in many ways	3.25	1.49	
Vertical individualism			**0.91**
Winning is everything	3.20	1.57	
It annoys me when others people perform better than I do	2.96	1.59	
It is important for me that I do my job better than the others	2.91	1.58	
I enjoy working in situations involving competition with others	2.81	1.51	
Competition is law of nature	3.09	1.58	
When another person does better than I do, I get tense and aroused	3.05	1.56	
Without competition it is impossible to have a good society	3.19	1.45	
Some people emphasize winning; I am not one of them (reverse)	3.25	1.53	

4.6 Perception of the effect of collective action on livelihood capital among irrigators

Table 10 presents the results on the perception of the effect of collective action on livelihood capital among irrigators in the Dzindi scheme. **Table 10** shows a list of 50 attitudinal statements about effect of collective action on livelihood capital. The respondents were asked to rate the statements using 5 point Likert scale as follows; 1 (Strongly Disagree), 2 (Disagree) 3 (Uncertain) 4 (Agree) and 5 (Strongly Agree).

The actual mean is 3 due to the rating scale and a mean of greater than 3 denoted a positive attitude while a mean less than 3 denoted negative attitude towards effect of collective action on livelihood capital.

The results revealed an overwhelming general negative attitude by farmers towards the effect of collective action on livelihood capital although majority of the means score for the statements were very close to 3 (between 2.5 and 2.9). This might be due to the prevailing individualism among the irrigators. The results also signify a total breakdown of collective action activities among the irrigators. These findings contradict those of many authors on the impact of collective action on livelihood capital.

Limnirankul (2007) found 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. Limnirankul (2007) maintains that in northern Thailand, the varying organisational forms of collective action reveal a hybridity of institutional modalities, by the level of regulation of individual behaviour and the level of absorption of individuals in group memberships. Similarly, the most important institutional and individual mechanisms for collective actions were flexible forms of benefit sharing, recognising and managing common interests, trust building, and finally, joint problem solving and knowledge exchange among farmers themselves and between farmers and external agencies.

Osbahr, Twyman, Adger, and Thomas (2010) stated that some collective adaptation actions enhance livelihood resilience to climate change and variability. Mabuza, Ortmann and Wale (2012) identified the key factors that unify members of informal collective initiatives and stated that members from communities characterised by positive cognitive social capital are most likely to engage in voluntary collective action in an attempt to improve their livelihoods. Fischer and Qaim (2012) stated that collective enterprises can play a role in coordinating activities between different value chain actors and in enabling access to new markets by vulnerable rural dwellers. Nath, Makoto and Pretty (2010) maintain that high social capital was found to be related to better forest condition among forest users.

Table 10: *Perception of the effect of collective action on livelihood capital*

Category of Capital	Mean	SD
Financial Capital		
Collective action improves agricultural wages labour	1.22	1.52
Collective action improves savings	1.56	1.66
Collective action improves self-help groups savings	1.71	1.71
Collective action improves insurance (micro)	1.90	1.65
Collective action improves cash in hand	1.84	1.66
Collective action improves cash in bank	2.24	1.58
Collective action improves credit from relatives	2.21	1.54
Collective action improves government subsidies	2.52	1.42
Collective action improves access to banks	2.66	1.37
Collective action reduced the activities of money lenders	2.61	1.38
Collective action improves credit unions	2.63	1.36
Collective action improves credit from neighbour or associate	2.62	1.42
Collective action improves credit from self –help groups loan (FBOS)	2.72	1.34
Human Capital		
Collective action improves extension services	2.86	1.33
Collective action improves technical training	2.80	1.36
Collective action improves project management training	2.89	1.41
Collective action improves land management training	2.96	1.33

Collective action improves disease treatment	2.94	1.38
Collective action improves water management	2.72	1.26
Collective action improves soil management	2.69	1.29
Collective action improves marketing skills	2.77	1.26
Collective action improves packaging skill	2.88	1.26
Physical Capital		
Collective action improves access to road and transport to the farms	2.67	1.21
Collective action improves access to available agricultural water	2.66	1.33
Collective action improves access to market access	2.61	1.18
Collective action improves access to silos	2.68	1.18
Collective action improves access to agricultural machinery	2.53	1.16
Collective action improves access to houses	2.67	1.21
Collective action improves access to farm sheds	2.79	1.22
Collective action improves access to electricity	2.90	1.19
Natural Capital		
Collective action improves land access	2.68	1.21
Collective action improves land utilization	2.89	1.28
Collective action improves water utilization	2.79	1.25
Collective action improves land tenure arrangement	2.71	1.16
Collective action improves land quality and fertility of soil	2.73	1.13
Collective action improves watershed development and conservation facilities	2.61	1.22
Social Capital		
Collective action improves relationship with relatives / neighbours	2.76	1.23
Collective action improves labour networking (for farm work)	2.58	1.27
Collective action improves community functions and festivals	2.70	1.21
Collective action improves network with financial institutions	2.72	1.16
Collective action improves network with transporters	2.78	1.12
Collective action improves network with processors	2.73	1.22
Collective action improves network with farmers' association	2.59	1.28
Collective action improves network farmers' cooperative (FBOS)	2.58	1.23
Collective action improves network with other production group(NGOS and civic group)	2.73	1.20
Collective action improves network with professional organization	2.59	1.06
Collective action improves network with local trade unions	2.67	1.14
Collective action improves network with village committee	2.73	1.22
Collective action improves network with religious groups	2.75	1.28
Collective action improves network with cultural associations	2.73	1.22

4.7 Collective action behavioural model among irrigators of the Dzindi scheme

Table 11 shows the rating of statements by.irrigators of the Dzindi scheme based on the collective action behavioural model (CAB model). In order to analyse farmers' motivation for collective action, a conceptual model of farmers' collective action behaviour (hereafter CAB model) was applied. According to the CAB model, 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. Deci (1972) defines intrinsic motivation as the performance of an activity for its inherent interest other than the direct economic benefits. PU refers to the users' perception of the extent to which the system will enhance their performance (Phillips *et al.*, 1994). The Perceived Ease of Use refers to the extent to which the user considers the system to be free of efforts (Zhang *et al.*, 2009). The attitude measures a person's perception about an idea or a system (Ajzen and Fishbein, 1980).

Table 11 shows a list of 13 attitudinal statements about collective action behavioural model. The respondents were asked to rate the statements using 5 point Likert scale as follows; 1 (strongly disagree), 2 (Disagree) 3 (Uncertain) 4 (Agree) and 5 (Strongly agree). The actual mean is 3 due to the rating scale and a mean of greater than 3 denoted a positive attitude while a mean less than 3 denoted negative attitude towards collective action behavioural model.

The results revealed an overwhelming general negative behaviour by farmers towards collective action although majority of the means score for the statements were very close to 3 (between 2.5 and 2.9). This might be due to the fact that the components of the behavioural model intrinsic motivation, perceived usefulness, perceived ease of use, and behavioural intent) had been negatively manifested in the Dzindi irrigation scheme. This finding disagrees with the findings of many authors on the collective action behavioural model.

Table 11: *Collective action behavioural model*

	MEAN	SD
Intrinsic Motivation (IM)		
Being part of the group is enjoyable	2.53	1.34
The process of activities is pleasant	2.65	1.32
It is always fun to be part of the group	2.88	1.21
Perceived Usefulness (PU)		
Using the collective action will improve my access to markets	2.87	1.19
Using the collective action will increase the price I receive for my potatoes	2.71	1.23
Collective action enables me to improve my negotiation power	2.78	1.22
With collective action, I am able to sell more potatoes than before	2.79	1.17
Perceived Ease of Use (PEU)		
Collective action makes it easier for me to sell	2.73	1.21
Collective action is more convenient than selling individually	2.66	1.23
It will be easy for me to learn some marketing skills through the collective action	2.60	1.24
Behavioural Intent (BI)		
I intend to be continuously involved in the collective action	2.66	1.24
I intend to advise other producers to join the collective action	2.65	1.16
Even if some buyers offer better terms of trade, I would still want to sell through the group	2.58	1.08

4.8 Irrigators' knowledge of collective action processes

Table 12 shows a list of 38 items on knowledge of collective actions processes among irrigators of the Dzindi Scheme. The respondents were asked to rate the statements using 2- point Likert type scale of: True (2) and False (1). The actual mean is 1.5 due to the rating scale and a mean of greater than 1.5 denoted high Knowledge of collective actions processes while a mean less than 1.5 denoted low knowledge of collective actions processes.

The results revealed an overwhelming general high knowledge by farmers on knowledge of collective actions processes as only 8 out of the 38 items on knowledge of collective actions processes recorded means less than 1.5 (actual mean). This may be attributed to the fact that the benefits derived from collective action processes in the scheme do not match the expectation or the input by farmers. Thus, the emotion that is attached to collective process is greater than knowledge. Though knowledgeable about collective action processes the actions do not match the knowledge level as revealed in the results presented in **Tables 9, 10** and **11**.

Limnirankul (2007) found 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 and that the most important institutional and individual mechanisms for collective actions were flexible forms of benefit sharing, recognizing and managing common interests, trust

building, and finally, joint problem solving and knowledge exchange among farmers themselves and between farmers and external agencies.

Brown and Muchagata (2004) maintain that collective action promoted ecological knowledge among colonist or migrant farmers in the frontier environment of eastern Amazonia on taxonomic knowledge, by examining soil types identified by smallholder farmers; systems knowledge, by examining nutrient flows on individual farms; and social institutionalisation of knowledge and that collective action institutions reflect the diverse knowledge of different farmers and institutionalise knowledge within different production, exchange and management systems.

Limnirankul (2007) further argues that collective knowledge made important contribution to technology development and innovation and people with long experiential learning from trial and error in rice farming are able to integrate their own knowledge with outside knowledge in developing technology among rice farmers groups in northern Thailand. Devaux, *et al* (2007) reported that Stakeholder Platforms of Participatory Market Chain Approach provide a space for potato producers, other market chain actors, and service providers to come together to identify their common interests, share knowledge, and develop joint activities.

Table 12: *Knowledge of collective actions processes among irrigators of the Dzindi Scheme*

Collective actions processes	Mean	SD	True	False
Collective action expands the understanding of problems and solutions	1.42	0.59	46(47.42)	51(52.57)
Collective action enhances joint learning, understanding, and support	1.45	0.56	47(48.45)	50(51.54)
Collective action enables well-informed decision making,	1.46	0.58	49(50.52)	48(49.48)
Collective action enables identifying innovative ideas	1.44	0.56	46(47.42)	51(52.57)
Collective action enhances responsive to the interests of the full community	1.43	0.58	47(48.45)	51(52.57)
Collective action enhances responsive to the needs, of the full community	1.48	0.58	51(52.58)	46(44.42)
Collective action enhances responsive to the values of the full community	1.44	0.56	46(47.42)	51(52.57)
Collective action expands the availability of resources for needed change	1.43	0.58	46(47.42)	51(52.57)
Collective action increases the capacity to enable resources for needed change	1.53	0.56	54(55.67)	43(44.33)
Collective action generates momentum for needed change	1.61	0.55	62(63.92)	35(36.80)
Collective action generates robust support for needed change	1.63	0.56	65(67.01)	32(34.09)
Collective action establishes willingness to support	1.60	0.57	62(63.92)	34(35.08)
Collective action establishes willingness to engage in implementation,	1.61	0.55	62(63.92)	35(36.08)
Collective action establishes willingness for monitoring, or evaluation	1.60	0.55	61(62.89)	39(37.01)
Collective action establishes willingness to support implementation,	1.59	0.55	60(61.86)	37(35.14)
Collective action establishes willingness to support, monitoring, or evaluation	1.63	0.55	64(65.98)	33(33.12)
Collective action establishes lasting trust-based relationships	1.61	0.57	63(64.95)	34(35.05)
Collective action builds overall social capital	1.67	0.53	68(70.10)	29(29.89)
Social approval increases in a person's own level of contribution to the group.	1.64	0.54	65(67.01)	32(32.99)
Marginal approval gains are increasing in others' level of contribution.	1.68	0.53	69(71.13)	28(28.87)
Social approval decreases in the average level of contributions of other subjects.	1.61	0.59	64(65.98)	33(34.02)
Social heterogeneity lowers cooperative	1.69	0.53		27(27.83)

effort.			70(72.16)	
Economic inequality lowers cooperative effort.	1.66	0.54	67(69.07)	30(30.93)
Higher wages reduce the level of infrastructure maintenance	1.64	0.54	65(67.01)	32(32.99)
The largest quantitative determinant of cooperative effort is the distributive rule in place at the irrigation system.	1.61	0.59	65(67.01)	32(32.99)
Credibility enhances cooperative effort.	1.59	0.59	62(63.92)	35(36.08)
Trust enhances cooperative effort	1.67	0.53	68(70.10)	29(29.89)
Closeness enhances cooperative effort	1.67	0.53	68(70.10)	29(29.89)
Solidarity enhances cooperative effort	1.59	0.59	62(63.92)	35(36.08)
Reciprocity enhances cooperative effort	1.53	0.58	55(56.70)	42(43.30)
Completed collective projects enhances cooperative effort	1.55	0.58	57(58.76)	40(41.33)
Collective representation enhances cooperative effort	1.57	0.56	58(59.79)	39(40.20)
Satisfaction with group actions enhances cooperative effort	1.63	0.55	64(65.98)	33(34.02)
Expectations about future cooperation enhances cooperative effort	1.62	0.57	64(65.98)	33(35.02)
Concern for future generations enhances cooperative effort	1.64	0.54	65(67.01)	32(32.99)
Volunteerism enhances cooperative effort	1.60	0.55	61(62.89)	36(37.11)
Boundedness / closeness enhances cooperative effort	1.57	0.58	59(60.82)	37(39.17)
Members sharing things beyond their group activities enhances cooperative effort	1.61	0.55	62(63.92)	35(35.08)

4.9 Factors determining collective action among irrigators

Table 13 presents the results of the multiple regression analysis to isolate the determinants of collective action among irrigators. Participation in collective action was regressed against socio-economic characteristics, tendency on individualism and collectivism, knowledge of collective action and the perception on the effect of livelihood capital. 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 $F = 3.86$, $p < 0.05$. 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 50 percent of the variation in participation in collective action processes by the irrigators. The Durbin Watson Coefficient is 1.98. Significant determinants of participation in collective action process were perceived effect on natural capital ($t = 3.36$, $p < 0.05$), perceived effect on social capital ($t = 2.33$, $p < 0.05$), perceived usefulness of collective action ($t = 2.40$, $p < 0.05$), perceived ease of use of collective action ($t = 2.07$, $p < 0.05$), knowledge of collective action ($t = 1.96$, $p < 0.05$), age ($t = -3.99$, $p < 0.05$), farming experience ($t = 2.08$, $p < 0.05$), educational level ($t = 2.06$, $p < 0.05$), religious belief ($t = 3.45$, $p < 0.05$), land ownership ($t = 1.81$, $p < 0.10$) and distance to market ($t = 3.83$, $p < 0.05$). 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.

Fischer and Qaim (2013) found that collective action has become an important strategy for smallholders in developing countries to remain competitive in rapidly changing markets. However, within farmer groups, the commitment of individual members can vary, as the expected net benefits are not the same for all individuals, and opportunities to free-ride exist.

Willy and Holm-Müller (2013) analysed the effects of social influence and participation in collective action initiatives on soil conservation effort among smallholder farmers in Lake Naivasha basin, Kenya and found 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 previous benefits that members received through the groups positively influence their intensity of participation in group meetings and 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, Bett, and Kabuage (2014) found that group activity, age of group, access to market information, sex of household head, education of household head, land size, off farm income and distance to the nearest market had a significant effect on joining groups. Fischer and Qaim (2013) reported that free-riding can mostly be attributed to structural and institutional conditions, such as group size and the timing of payments. More diversified farmers are less likely to sell collectively. Kola *et al* (2014) investigated the determinants of collective action in a strategic and fast growing sector of the 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 indicated that trust is positively influenced by gender, age and religion, while cooperation was found to be influenced by members' dependence on mushrooms for food. Communication, on the other hand, was found to be positively influenced by the level of trust and members' cooperation and that member from communities characterised by positive cognitive social capital are most likely to engage in voluntary collective action in an attempt to improve their livelihoods.

Table 13: *Determinants of collective action among irrigators*

	Unstandardized coefficients		**Standardized coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	83.00	14.10		5.89	0.00
Perceived effect on financial capital	0.26	0.16	0.18	1.61	0.11
Perceived effect on human capital	-0.38	0.26	-0.19	-1.46	0.15
Perceived effect on physical capital	0.03	0.44	0.01	0.06	0.95
Perceived effect on natural capital	**3.11**	**0.93**	**0.96**	**3.36**	**0.00**
Perceived effect on social capital	**-1.01**	**0.43**	**-0.73**	**-2.33**	**0.02**
Intrinsic motivation for collective action	-1.52	1.05	-0.26	-1.45	0.15
Perceived usefulness of collective action	**2.63**	**1.09**	**0.56**	**2.40**	**0.02**
Perceived ease of use of collective action	**-3.16**	**1.53**	**-0.53**	**-2.07**	**0.04**
Behavioural intent on collective action	0.22	1.35	0.04	0.17	0.87
Knowledge of collective action	0.23	0.12	0.18	1.96	0.05
Gender	3.23	3.56	0.08	0.91	0.37

Age	**-1.14**	**0.28**	**-0.72**	**-3.99**	**0.00**
Farming experience	**0.61**	**0.29**	**0.36**	**2.08**	**0.04**
Marital status	2.88	2.00	0.14	1.44	0.15
Educational level	**-3.32**	**1.61**	**-0.21**	**-2.06**	**0.04**
Religious belief	**8.48**	**2.46**	**0.35**	**3.45**	**0.00**
Land ownership	**4.88**	**2.69**	**0.21**	**1.81**	**0.07**
Land allocation process	-1.79	1.58	-0.11	-1.14	0.26
Distance to market	**-0.50**	**0.13**	**-0.42**	**-3.83**	**0.00**
Types of markets used	0.00	0.00	-0.06	-0.50	0.62
F	3.86				
p	0.00				
R	0.71				
R Square	0.50				
DW	1.98				

4.10 Chapter summary

This chapter has presented results of the study and the detailed findings on personal characteristics of irrigators, households characteristics among irrigators of the Dzindi scheme, crop production and marketing activities among irrigators, farm characteristics among irrigators, use of information sources among irrigators, irrigators' participation in social organisations, offences and conflict resolution in sharing irrigation water and collective action activities in the irrigation scheme. Others aspects covered are dimensions of collectivism and individualism among irrigators, perceived effect of collective action on livelihood capital among irrigators of the Dzindi scheme, collective action behavioural model among irrigators, irrigators' knowledge of collective actions processes in the Dzindi scheme and multiple regression analysis to isolate the determinants of collective action among irrigators.

CHAPTER FIVE

SUMMARY CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, conclusion and recommendations of the study. The summary focuses an overview of the research problems, objectives and the methodology used in conducting the study. The conclusion highlights the salient findings from the results and discussion while the recommendations are drawn from the major findings of the study.

5.2 Summary

Farming has many dimensions such as the 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. Examples of arenas in which the social dimension of agriculture is important are the homestead as a social unit, agricultural projects that involve groups of farmers, organised agriculture and the market place. This study is concerned with the social dimension of farming in the context of smallholder irrigation.

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 a plot will affect the neighbouring plots in harbouring pests. The attainment of common goals of these groups depends on the effectiveness of collective action. Although collective action in small holder 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 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 farmers' perceptions and attitudes are very important for the adoption of techniques and practices. Lin (2007) maintains that motivation is a key factor determining human behaviour and action. Therefore, by understanding farmers' attitudes, 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 examined the characteristics and assets of farmer 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).

The main objective of the study was to analyse the determinants of collective action among farmers in the Dzindi communal irrigation scheme, Limpopo Province, South. The specific objectives were to describe the socio-economic profiles of farmers of the irrigation scheme, assess livelihood strategies pursued by farmers of the irrigation scheme, determine farmers' participation in collective action activities on the irrigation scheme, analyse the determinants of farmers' participation in collective action activities, examine farmers' perceptions of the effect of collective action on livelihood capital, ascertain farmers' knowledge about collective action processes and determine the dimensions of collectivism and individualism among farmers of the irrigation scheme.

The study was conducted in Dzindi, a smallholder irrigation scheme was established in 1954 which forms part of the Thulamela Municipality, with Thohoyandou as its administrative capital. Dzindi was chosen as a case because the project has been able to survive the on-going process of state withdrawal from black irrigation projects

and has contributed to the collapse of many similar projects. The population of this study included all the 106 plot holders in Dzindi smallholder 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 namely, personal characteristics and socio-economic factors of irrigators, offences and conflict resolution in the sharing irrigation water on the irrigation scheme, collective action activities, scale on individualism versus collectivism, livelihood strategies among the irrigators, perception of the effect of collective action on livelihood capital and irrigators' knowledge of collective actions processes. The questionnaire was face validated by a panel of experts on agricultural extension, collective action and research and a split half technique was used to determine the reliability coefficient.

Data was analysed using the Statistical Package for the Social Sciences (SPSS) 18.0 with standard deviation, mean and frequency distribution were used to describe the personal characteristics; multiple regression analysis was used to determine the effect of predictors on dependent variables of the study.

5.3 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. Maize, lentils and Kale are the most prominent crops of the irrigation scheme. 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.

Most common offences and conflict resolution techniques were: caught breaking the irrigation rules, Apologise immediately when found caught committing an offence; use more days to irrigate and Use more irrigation water. The results revealed that only three out of a list of 25 collective action activities commonly participated. These were replacement of damaged concrete slabs, weed control in joints and participation in meetings.

The results show that from the list of 44 statements on the individualism scale, 35 statements were above the actual mean score of 3.0. Conversely, 21 of the 35 listed statements on collectivism were above the actual mean of 3.0 which depicted a high tendency towards collective actions. Overall, the tendency among irrigators for individualism is higher than collectivism in the irrigation scheme.

The results on the perception of the effect of collective action on livelihood capital among irrigators of the Dzindi scheme revealed an overwhelming general negative attitude by farmers towards the effect of collective action on livelihood capital. 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. This may be attributed to the fact that the benefits derived from collective action processes in the scheme do not match the expectations or input by farmers. Significant determinants of participation in collective action processes were perceived effect on natural capital, perceived effect on social capital, perceived usefulness of collective action, and perceived ease of use of collective action, knowledge of collective action, age, farming experience, educational level, religious belief, land ownership and distance to market.

5.4 Recommendations

Based on the findings of this study, it is recommended that:

a) There is a need to improve on the diversification of personal and social characteristics of irrigators.

b) There is a need to improve on the production of prominent crops other than maize, lentils and kale .

c) There is a need to improve irrigation and cropping systems and information dissemination should explore more Information Communication Technologies.

d) There is a need to improve conflict resolution techniques in order to be able to sustain collective actions even after conflicts.

e) There is a need to improve on the mechanisms that will reduce the tendency among irrigators for individualism which was found to be higher than collectivism.

f) There is a need to improve on the perception of the effect of collective action on livelihood capital among irrigators of the Dzindi scheme.

g) There is a need to improve on mechanism in order to reduce the overwhelming general negative behaviour by farmers towards collective action.

h) There is a need for farmers to translate their high knowledge on collective actions processes to actions.

i) There is a need to properly consider the significant variables for effective policy and mechanisms to support collective actions.

5.5 Chapter summary

This chapter has presented the summary, conclusion and recommendations of the study. The summary reviewed the research problems, objectives and the methodology used in the study. The salient findings from the results and discussion were highlighted in the conclusion while the recommendations emanated from the major findings of the research.

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APPENDIX 1

AN ORAL HISTORY OF DZINDI

The transcription of the timeline constructed in January 2002 by the Dzindi community is presented below.

1940s Talks about the establishment of an irrigation scheme using water from Dzindi River start but Chief Tshivhase does not accept the idea. Personnel of the Department of Agriculture play a prominent role in the negotiations.

1951 Personnel of the Department of Agriculture finally convince Chief Tshivhase to agree to the idea of establishing an irrigation scheme in the area where Dzindi is now located. Surveying of land commences. The first piece of land to be surveyed is the land that was under Headman Makumbane.

1952 Chief Tshivhase calls a meeting with Headmen Tshikororo and Mawasane to discuss the scheme issue. This meeting resolves to fully endorse the establishment of the scheme.

1953 Sotho-speaking workers are employed to construct the first canals at block 4. That same year the workers go on strike complaining about low wages. The workers decide to abandon the site and leave, creating employment opportunities for the local people who get hired to replace them.

1954 Allocation of plots is carried out in the Mugumo and Tshivhuyuni sections of Itsani (**Figure 3**). Pieces of paper with numbers of plots are put in a container and people draw their lot from the container. The number that is picked represents the plot number allocated to that individual. The community of Tshisaulu, which contributed the biggest piece of land (**Figure 3**), was absent when plots were allocated, because they were under the impression that the scheme was for the "Italians" who were coming to occupy the land. The source of this rumour was not known.

Plot 1 is allocated to Headman Makumbane, who refuses it, stating that he has enough land already. As a result, plot 1 is not allocated to anybody and later on it becomes the research plot. People whose land is incorporated into the scheme get allocated a plot first. For the others a waiting list of people wanting a plot is drawn up. The list is short. People do not seem ready to start farming in the scheme.

Removal of the natural vegetation starts in Block 1. Plots in this block are measured and demarcated. An earth dam is constructed.

Government tractors arrive at the scheme and farming starts. Plot holders pay for the services rendered by tractors. Many plot holders continue to make use of animal draught, using cattle or donkeys. The first black agricultural technician, Mr Thelele from Middleburg, arrives at Dzindi.

Whilst farming at Block 1 proceeds the clearing of the natural vegetation in Blocks 2 and 3 starts. Conditions for plot occupation are laid down as follows: (a) plot-holders must be full-time farmers; (b) plot-holders will be replaced if found not utilizing the plot; (c) plot holders shall pay a rental fee of £3 per annum; (d) one family shall hold one plot; (e) plot-holders are prohibited to hold any land other than the irrigation plot; and (f) the rearing of goats is prohibited because goats destroy crops, but the rearing of large stock, for which grazing is available in the scheme, is allowed. Farmers make use of kraal manure to increase the fertility of their land. They have long known the positive effect of kraal manure on maize yield, from observations that old kraal sites produce persistently high yields. Kraal manure is bought collectively and trucked to the scheme.

1957 Departure of the first black agricultural technician, and arrival of the second, Mr David Nesengani.

1958 Encouraged by the extension officer plot holders at Dzindi form a farmers' association. The first year or two the association is involved in planning. No real activities occur.

1961 Commissioner Potgieter and personnel of the Department of Agriculture visit Dzindi to inspect the scheme. Plot holders who fail to pay the annual rent and those who do not utilize their plot appropriately are identified.

Chemical fertilizers are used at the scheme for the first time. A white man sells bags of fertilizers (the type could not be identified) at R1 per bag. Later on the purchase of chemical fertilisers becomes a collective action arranged through the farmers' association.

1962 Non-payment of rent or under-utilisation of plots causes many plot holders to lose their right to a plot, and since plot allocation is linked to residential land, they also have to vacate their residential sites and their houses.

Agricultural technicians instruct farmers to plant *ndozi* (pigeon peas) instead of the maize, bambara groundnuts and vegetables they are used to plant.

The farming community asks the government for an extension of the term of service of the extension officer, because he is a good man. The request is granted.

1963 Personnel of the Department of Agriculture search for suitable replacements by identifying farmers who utilise river water for irrigation, and invite them to join the scheme, because in many cases farmers entering the scheme as replacements are as poor as the evicted farmers they replace.

The Department abandons the growing of pigeon peas and reintroduces the planting of vegetables.

A white pastor introduces maize hybrid seed to farmers who immediately started using it.

The introduced hybrid seed fails as farmers discover that cobs get rotten at the top. As a result, farmers revert to using their own seed.

Farmers are instructed to plant cotton, but cotton turns out not to be profitable.

1964 Farmers are instructed to plant tomatoes. The marketing agent discriminates against Dzindi farmers by allocating a very small portion of his loading space to them, whilst reserving the rest for white farmers, who are also farming tomatoes. Many of the tomatoes produced by Dzindi farmers end up rotting away in the office of extension officer.

1966 Farmers are instructed to plant wheat and cotton, but this is not a success. Marketing is the main problem.

1967 Farmers continue planting wheat and cotton. Marketing is still problematic.

1968 Farmers continue planting wheat and cotton. Market problems persist

1969 Starting in 1969 and lasting until 1974, there is reallocation of plots that become vacant as Venda is being prepared for self-government. Plot holders who are Shangaan (Tsonga-speaking) and not Venda are forced to vacate their plots and move to Gazankulu, a homeland created for Tsonga-speaking people. Four Venda farmers who government regards as progressive are allocated multiple plots. One person is even allocated four plots. Other vacated plots are allocated to new arrivals at Itsani. To obtain a plot one approaches Headman Makumbane who allocates residential sites and irrigation plots. For that people pay R3.00 to the Headman. . At the end of 1974, when all vacated plots have been reallocated, holders of multiple plots have to return these for allocation to landless people.

During the Venda homeland era the supply of soil preparation services is superior. Government tractors are available whenever farmers need them. Bookings are made with the resident extension officer of that time, Mr. Nesengani. Farmers recall this period as a time during which they built or expanded their dwellings, but farming was not particularly intensive.

1970 Plot holders not utilizing their farms continue to be expelled from the scheme but now they retain their residential sites and their houses.

A dairy project is started at Dzindi.

1971 The era of the Venda homeland administration starts.

1972 The commissioner stops visiting the scheme. Farmers miss his personal attention, because the high-powered representatives of the Venda homeland, who replaced him, never show up.

Farmers are informed that they may plant the crops of their choice. That year Chinese cabbage dominates winter production.

1976 Members of dairy project start taking their cattle from the project.

Drought causes yields to be very low. The Venda homeland government donates fertilizers to farmers. Each plot holder of Dzindi receives six bags of 50 kg fertilizer.

1977: A flood prevents farmers from cultivating their lands from February to June. The river is very full and a hippopotamus roams around the plots. At Itsani many of the huts made of wattle and daub collapse.

1979: The central government of South Africa totally stops its involvement in Venda irrigation schemes.

1980: A conflict between Headman Makumbane and Tshikororo arises because Headman Tshikororo starts allocating residential sites to new households arriving at Itsani. The sites are close to the main canal, which breaches an arrangement reached between Headman Makumbane and the Dzindi plot holders. This arrangement prevents people from residing close to the canals to avoid them polluting the water or damaging the canal. The process of settling people near the canals results in people polluting the irrigation water by washing clothes or themselves in the canals. Theft of the produce and wood from the rangeland belonging to the scheme also occurs. The new people destroy parts of the scheme fence.

A land reclamation and fruit campaign project is launched at the scheme and a committee of nine is formed to oversee the project.

Rules governing the use of irrigation water are written down in a mass meeting.

1981: The dairy project that was started in 1970 collapses.

1983: A drought kills livestock and limits the area of land farmers are able to irrigate. Some can only irrigate one bed, and the irrigation timetable is changed from once per week to once per fortnight. Yields of crops are very low.

1984: Dzindi farmers enter into a contract with a company in Phalaborwa. The contract involves the supply of cabbages, carrots and beetroots. The contract looks very good, but the Department of Agriculture interfered. When the client comes to collect the vegetables, the Department brings produce from elsewhere, and gives it priority. The result is that only small amounts of produce supplied by Dzindi farmers are bought. Farmers are upset and terminate the contract.

1985: The existing farmers' association is transformed into a registered cooperative.

1986: Agriven (ARDC) arranges a tomato production contract for farmers with a processing company based at Tzaneen. The ARDC convinces farmers to sign contracts. Farmers who enter contracts are given production loans by the ARDC. Large quantities of tomatoes are produced, but the tomato processing company only buys a very small portion. Large amounts of tomatoes are left to rot in the plots because of a lack of market.

Farmers earn very little from their consignments and most farmers are unable to repay their production loans to the ARDC. Some farmers end up in court for failing to repay their loans.

1989: Farmers who are considered progressive obtain permission by the scheme management committee (SMC) to utilize non-scheduled land.

1990: The political uprising that affects the entire country also arrives at Itsani. The youth of Itsani revolt against the SMC, accusing the committee of forcing their parents, who are also plot holders, to work in other plots without reward. The youth fails to understand that plot holders usually assist each other with certain production activities (cooperative work or *davha* in Tshivenda).

1991: The dairy project is restarted. It is no longer a collective project that belongs to all plot holders, as was the case previously. The new project is only for farmers who have contributed the R700 joining fee that is used to purchase dairy cattle.

1994: A new extension officer, Mr. Netshithuthuni, replaces Mr. Nesengani.

The Republic of Venda is re-incorporated into South Africa, and the African National Congress government comes into power.

1995: Farmers receive donations of fertilizers from the government.

The flow in Dzindi River is low. People lower the top of the weir by hacking away part of the top to prevent all river water from entering the main canal of Dzindi. They need the river to run to get at water below the weir to wash cars. This does not affect the farmers much, because the damage is limited.

1996: Farmers receive vouchers from government with which they can purchase agricultural inputs and farming equipment, such as hand hoes, rakes, and garden forks.

The Department of Agriculture tells the scheme committee to apply for grants of R15000 per plot, but farmers do not succeed in acquiring the grants.

1998: The organisation of the co-operative changes, and the leaders employ people to work in a store built by government.

The government withdraws its tractors and workers who maintained the infrastructure. Many state tractors are sold by public auction, whilst others are taken to Polokwane. Maintenance of canals becomes a serious problem since the engineers of the state no longer come to the scheme.

Shayandima Township takes part of the land belonging to the irrigation scheme in block 1 for the development of residential sites. The scheme committee (SMC) negotiates the return of that that piece of land with the Thulamele Local Municipality, a process that is ongoing.

1999: Plot holders of Dzindi collectively purchase a tractor.

2000: A flood destroys fences and the pipe that conveys water to the Dam in Block 1.

Plot holders throw a party using the money that was generated from operating the tractor.

The Dzindi Co-operative ceases to function.

The Dairy project collapses following the death of all cattle.

2001: Researchers from Technikon Pretoria and Ghent University in Belgium visit Dzindi for the first time.

2002: Students from Reunion and Technikon Pretoria conduct a socio-economic survey and investigate damage to the canals and concrete furrows.

People trying to catch fish destroy canals.

People not participating in the scheme divert water from the canals to irrigate their maize.

Technikon Pretoria brings a two-wheel tractor to Dzindi. Experiments with Chinese cabbage start at the demonstration plot.

2003: The Dzindi-Technikon Pretoria project is launched officially at the extension officer's house.

Students from Reunion and Technikon Pretoria conduct research on maize and vegetables.

Two representatives of farmers attend the official launch of the Dzindi-Technikon Pretoria project at the WRC offices in Rietfontein, Pretoria.

Farmers introduce the system of collecting money for jobs that they are supposed to do collectively. This money is used to hire people. The gate of the canal from the dam is repaired.

2004: The plot holder collective obtains a "Permission To Occupy" certificate for the scheme as a whole.

APPENDIX 2

QUESTIONNAIRE ON THE EFFECT OF COLLECTIVE ACTION ON LIVELIHOOD STRATEGIES AMONG SMALL HOLDER FARMERS ON DZINDI IRRIGATION SCHEME, LIMPOPO PROVINCE SOUTH AFRICA

Questionnaire identification number	
Study area	
Interviewer's name	
Date of the interview	

Personal characteristics and socio-economic factors

Gender (**Tick**)	Male	
	Female	

Age	
Farming experience	

Marital status (**Tick**)	Single	
	Married	
	Divorced	
	Widowed	

Highest educational level (**Tick**)	Abet	
	Primary	
	Secondary	
	Tertiary	
	None	

Religious belief

Category	**Tick**
Christian	
Traditional	
Muslim	
Other (specify)	

Household size

Category	**Number**
Adult	
Children	
Male	
Female	
Total	

Number of dependents .....

Location of plots along the canal

Upper		Middle		Lower	

Number of plots along the canal

Upper		Middle		Lower	

Size of plots along the canal

Upper		Middle		Lower	

Crops produced on the plots

Crops grown last season?	**Area of production (Ha)**	**Quantity harvested? (kg)**	**Quantity sold**
Maize			
Sunflower			
Spinach			
Cabbage			
Carrots			
Beetroot			
Tomatoes			
Potatoes			
Butternut			

Onion			
Lettuce			
Cauliflower			
Green beans			
Lucerne			
Green Pepper			
Lentils			
Kale			

Type of land ownership **(Make a tick in the right block)**

1. Own land ☐
2. Communal land ☐
3. Leased land ☐
4. Land reform ☐
5. Rent ☐

Land allocation process

Acquired the preferred area without process	
Lottery within or outside the claimed area	

First come, first served basis	
Negotiation among the resettlers	
No formal permission regarding land use	

Distance to market.....km

Type of market used

Farm gate		High value		Others	

Costs	Amount
Transaction cost	
Transport cost	
Storage cost	
Levy costs	
Handling cost	

Type of irrigation systems

Central pivots irrigation systems	
Flood irrigation systems	

Sprinkler irrigation systems	
Micro irrigation systems	
Drip irrigation systems	
Other:	

Source of water for the irrigation scheme

Dam	
River	
Reservoir	
Bore hole	
Fountain	

Irrigation is owned by

Privately owned		
Community		
Government department		
Private stakeholders		

What type of cropping system do you follow?

Mono cropping system	
Double cropping system	
Multiple cropping system	
Mixed cropping	
Crop livestock integration	

Do you have contact with the extension officer? Yes..... No.....

What is the frequency of contact with extension officer?

Regularly		Occasionally		Rarely	

Please indicate your sources of information

	Yes	No
Television		
Radio		
Phone		
Extension officer		
University		
Internet		
ARC		
News paper		
Magazine		
Computer		

Farmers' participation in agricultural or social organizations

Organization	**Organizational activities**			**Extent of participation**		
	Meetings	Conferences	Workshops	Regular	Occasional	Never
AFASA						
Water user association						
Agricultural cooperatives						
Scheme management committee						
Canal management committee						
YARD/BAYOFA						
Local community clubs						

OFFENCES and CONFLICT RESOLUTION IN THE SHARING IRRIGATION WATER AT DZINDI

	Yes	NO
Ignore the irrigation timetable?		
Block the canal in order to irrigate illegally?		
Use more irrigation water?		
Require more days to irrigate?		
Apologise immediately when found caught committing an offence?		
Be reported to SMC for transgressing the irrigation rules?		
Refuse to stop breaking the rules until irrigation is completed?		
Breaks the irrigation rules often?		
Get caught breaking the irrigation rules?		

Collective Action activities

Please indicate if you participate in the following activities in the last growing season

	Yes	No	Regularly	Occasionally	Rarely
Replacement of joints					
Replacement of damaged concrete slabs					
Weed control in joints					
Weed control on surface of concrete slabs					

Control and removal of silt					
Maintenance of roadways					
Consultation with scheme management committee					
Participation in meetings					
Membership of groups					
Division of work activities					
Monitoring of irrigation at night					
Greasing of the control gates					
Greasing of the valves					
Detection of leakages					
Detection of seepages					
Detection of canal cracks					
Detection of leaking aqueduct					
Detection of leaking subsidence of sections of main canal					
Fees for maintenance					
Adherence to water rosters					
Consultation before plot transfer					
Expenses for irrigation maintenance					
Expenses for ceremonial events					
Labour participation in irrigation maintenance					
Labour participation in community work					

Scale on individualism vs collectivism

Please indicate on a scale of 1= no, not at all to 5= yes, indeed your disposition towards these statements with respect to collective activities on this irrigation scheme

	1	2	3	4	5
Values subscale (3)					
I prefer to work with others in a team rather than to work alone					
Given a choice, I would rather do a job where I can work alone rather than do a job where I have to work with others (R)					
I like it when team members do things on their own, rather than working with others all the time (R					
Team-member exchange quality (14)					
Other group members usually let me know what they expected from me					
I normally checked with other group members before I did something that might affect them					
I usually let other group members know when they did something that affected my work					
Other group members usually let me know when I did something that affected their work					
I often made suggestions to other group members about better work methods					
I had a clear understanding of the problems associated with the strategy game and the needs					

of my group members during the game					
Other group members clearly understood my needs and problems related to performance on the strategy game					
I got constructive criticism from other group members					
I often helped other group members solve problems associated with the strategy game					
When I was busy, other group members often volunteered to help me out					
When other group members were busy, I often helped them out					
Other group members were flexible about switching responsibilities to make things easier for me					
I was willing to help finish work that had been given to other group members					
Other group members were willing to help finish work that was assigned to me					
Self-Reliance With Competition					
If the group is slowing me down, it is better to leave it and work alone.					
To be superior a man must stand alone.					
Winning is everything.					
Only those who depend on themselves get ahead in life					
If you want something done right, you've got to do it yourself.					
What happens to me is my own doing.					

I feel winning is important in both work and games.					
Success is the most important thing in life.					
It annoys me when other people perform better than I do.					
Doing your best is not enough; it is important to win.					
In most cases, to cooperate with someone whose ability is lower than oneself is not as desirable as doing the thing on one's own.					
. In the long run the only person you can count on is yourself					
Concern for In group					
It is foolish to try to preserve resources for future generations. (Reversed)					
People should not be expected to do anything for the community unless they are paid for it. (Reversed)					
Even if a farmer is prosperous the community should not feel honoured in any way. (Reversed)					
I would not let my neighbour use my resources (Reversed)					
I would help within my means if a colleague is in financial difficulty.					
I like to live close to my friends.					
The motto "sharing is both blessing and calamity" is still applicable even if one's friend is clumsy, dumb, and causing a lot of trouble.					
When my colleagues tell me personal things about themselves, we are drawn closer together					
I would not share my ideas and newly acquired knowledge with my colleague. (Reversed)					
Distance From In groups					

I am not to blame if one of my family members fails.					
My happiness is unrelated to the well-being of my co-workers					
My colleagues' opinions are not important in my choice of a livelihood					
I am not to blame when one of my close friends fails.					
My co-workers' opinions are not important in my choice of a what i plant					
When a close friend of mine is successful, it does not really make me look better.					
One need not worry about what the neighbours say about whom one should relate with					
Horizontal Individualism					
I prefer to be direct and forthright when I talk with people					
One should live one's life independently of others					
I often do my own thing					
I am a unique individual					
I like my privacy					
When I succeeded, it is usually because of my abilities					
What happens to me is my own doing					
I enjoy being unique and different from the others in many ways					
Vertical Individualism					
Winning is everything					
It annoys me when others people perform better than I do					
It is important for me that I do my job better than the others					

I enjoy working in situations involving competition with others					
Competition is law of nature					
When another person does better than I do, I get tense and aroused					
Without competition it is impossible to have a good society					
Some people emphasize winning; I am not one of them (reverse)					
Horizontal Collectivism					
My happiness depends very much on the happiness of those around me					
. I like sharing little things with my neighbours					
The wellbeing of my co-workers is important to me					
It is important for me to maintain harmony within my group					
If a relative were in financial difficulty, I would help within my means					
If a co-worker gets a price I would feel proud					
To me pleasure is spending time with others					
I feel good when I cooperate with others					
I think cooperation in workplace is more important than competition					
I think it is important everyone has equal access to water					
Vertical Collectivism					
I would do what would please my group					
I usually sacrifice my self-interest for the benefit of my group					
We should keep our aging parents with us at home					
Colleagues should feel honoured if their co-worker receive a distinguished award					
Colleagues should be taught to place duty before pleasure					

I would sacrifice an activity that I enjoy very much if my family did not approve of it					
I hate to disagree with others in my group					
Before making a major trip, I consult with most members of my family and many friends					

Livelihood strategies

	Yes	No	Amount
Agriculture sources			
Livestock			
Crop			
Non-farm sources			
Petty trade6			
Remittance			
Rural craft			
Family business			
Off-farm sources			
Gathering			
Wage			
Hire/rent			
Pension			
Remittances			

Perception of the effect of collective action on livelihood capital

Please indicate your perception towards the effect of collective action on livelihood capital

Category of Capital	SA	A	U	D	SD
Financial Capital					
Collective actions improves Agricultural wages labour					
Collective action improves Savings					
Collective action improves Self-help groups savings					
Collective action improves Insurance (micro)					
Collective action improves Cash in hand					
Collective action improves Cash in Bank					
Collective action improves Credit from Relatives					
Collective action improves Government subsidies					
Collective action improves Access to banks					
Collective action reduced the activities of Money lenders					
Collective action improves Credit Unions					
Collective action improves Credit from Neighbour or associate					
Collective actions improves Credit from Self –help groups loan (FBOs)					
Human Capital					
Collective action improves Extension services					
Collective action improves Technical training					
Collective action improves Project management training					

Collective action improves Land management training					
Collective action improves Disease treatment					
Collective action improves Water management					
Collective action improves Soil management					
Collective action improves Marketing skills					
Collective action improves Packaging skill					
Physical Capital					
Collective action improves access to Road and Transport to the farms					
Collective action improves access to available agricultural water					
Collective action improves access to Market access					
Collective action improves access to Silos					
Collective action improves access to Agricultural Machinery					
Collective action improves access to Houses					
Collective action improves access to Farm sheds					
Collective action improves access to Electricity					
Natural Capital					
Collective action improves Land access					
Collective action improves Land utilization					
Collective action improves Water utilization					
Collective action improves Land tenure arrangement					
Collective action improves Land quality and fertility of					

soil					
Collective action improves Watershed development and conservation facilities					
Social Capital					
Collective action improves Relationship with relatives / neighbours					
Collective action improves Labour networking (for farm work)					
Collective action improves Community functions and festivals					
Collective action improves Network with financial institutions					
Collective action improves Network with transporters					
Collective action improves Network with processors					
Collective action improves Network with farmers association					
Collective action improves Network Farmers' cooperative (FBOs)					
Collective action improves Network with other production group(NGOs and civic group)					
Collective action improves Network with professional organization					
Collective action improves Network with local Trade unions					

Collective action improves Network with Village committee					
Collective action improves Network with Religious groups					
Collective action improves Network with Cultural associations					
Collective action behavioural model					
Intrinsic Motivation (IM)					
Being part of the group in enjoyable					
The process of activities is pleasant					
It's always fun to be part of the group					
Perceived Usefulness (PU)					
Using the collective action will improve my access to markets					
Using the collective action will increase the price I receive for my potatoes					
Collective action enables me to improve my negotiation power					
With collective action, I am able to sell more potatoes than before					
Perceived Ease of Use (PEU)					
Collective action makes it easier for me to sell					
Collective action is more convenient than selling individually					

It will be easy for me to learn some marketing skills through the collective action					
Behavioural Intent (BI)					
I intend to be continuously involved in the collective action					
I intend to advise other producers to join the collective action					
Even if some buyers offer better terms of trade, I would still want to sell through the group					

Knowledge of collective actions processes

Please indicate True of false based on the following statements about collective action

Collective actions processes	True	False
Collective Action expand the understanding of problems and solutions		
Collective Action enhances joint learning, understanding, and support		
Collective Action enables well-informed decision making,		
Collective Action enables identifying innovative ideas		
Collective Action enhances responsive to the interests of the full		

community		
Collective Action enhances responsive to the needs, of the full community		
Collective Action enhances responsive to the values of the full community		
Collective Action expands the availability of resources for needed change		
Collective Action increases the capacity to enable resources for needed change		
Collective Action generates momentum for needed change		
Collective Action generates robust support for needed change		
Collective Action establishes willingness to support		
Collective Action establishes willingness to engage in implementation,		
Collective Action establishes willingness for monitoring, or evaluation		
Collective Action establishes willingness to support implementation,		
Collective Action establishes willingness to support, monitoring, or evaluation		
Collective Action establishes lasting trust-based relationships		
Collective Action builds overall social capital		
Social approval increases in a person's own level of contribution to the group.		
Marginal approval gains are increasing in others' level of contribution.		
Social approval decreases in the average level of contributions of		

other subjects.		
Social heterogeneity lowers cooperative effort.		
Economic inequality lowers cooperative effort.		
Higher wages reduce the level of infrastructure maintenance		
The largest quantitative determinant of cooperative effort is the distributive rule in place at the irrigation system.		
Credibility enhances cooperative effort.		
Trust enhances cooperative effort		
Closeness enhances cooperative effort		
Solidarity enhances cooperative effort		
Reciprocity enhances cooperative effort		
Completed collective projects enhances cooperative effort		
Collective representation enhances cooperative effort		
Satisfaction with group actions enhances cooperative effort		
Expectations about future cooperation enhances cooperative effort		
Concern for future generations enhances cooperative effort		
Volunteerism enhances cooperative effort		
Boundedness / closeness enhances cooperative effort		
Members sharing things beyond their group activities enhances cooperative effort		