

**Land and water use rights in smallholder farming: impacts on productive use of irrigation
water and entrepreneurial spirit in KwaZulu-Natal**

By

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DEDICATION

I dedicate this work to God, my late brother (Dr SR Cele) and my lovely family.

DECLARATION 1 - PLAGIARISM

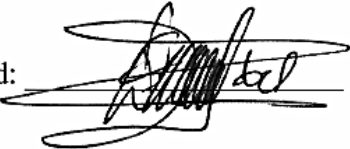
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As the candidate's supervisor, I, **Edilegnaw Wale Zegeye**, agree to the submission of this thesis;

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DECLARATION 2 – PUBLICATIONS AND PRESENTATIONS

Publications

The following publications (work in progress) form part of the research presented in this thesis.

Publication Manuscript 1 (Chapter 4- work in progress)

Cele, L.P. and Wale, E. The role of land and water use rights on smallholders' productive use of irrigation water in KwaZulu-Natal, South Africa. [Target journal: *African Journal of Agricultural and Resource Economics*]

Publication Manuscript 2 (Chapter 5- work in progress)

Cele, L.P. and Wale, E. Determinants of smallholders' entrepreneurial spirit, willingness and ability to expand farming operations in KwaZulu-Natal, South Africa. [Target journal: *Journal of Developing Areas*]

Oral Presentations:

Cele, L.P. 2017. The role of land and water use rights on the productive use of irrigation water and smallholder farmers' entrepreneurial spirit in KwaZulu-Natal, South Africa. Paper presented at the College of Agriculture, Engineering and Science Postgraduate Research Day, 26 October, University of KwaZulu-Natal, Westville Campus, South Africa.

Cele, L.P. 2017. Land and water use rights in smallholder farming: impact on productive use of irrigation water in KwaZulu-Natal, South Africa. Position paper presented at the Department of Agriculture and Rural Development (DARD) Colloquium on Agriculture and Rural Development in KwaZulu-Natal, 16-17 November, Dube Trade port Latitude Conference Centre, Durban.

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I duly acknowledge the smallholder farmers from Msinga, Nongoma and Jozini, KwaZulu-Natal, South Africa, who provided data and information that I used in this research. I am grateful for their willingness to participate despite their frustrations with ‘a lot of research (interviews) and no action’. I would like to extend my thanks to the extension officers in the KwaZulu-Natal Department of Agriculture based at Msinga, Nongoma and Jozini local offices for mobilizing smallholder farmers who were going to take part in data collection for the entire period of the research.

My family and friends, thanks for being always there for me.

All possible shortcomings in this study are my sole responsibility and should not be directed to any acknowledged person or organization.

ABSTRACT

The increasing pressure on land and water resources in developing countries due to population growth has led to the need for improvement of the regulations that control the use of these scarce resources. However, the impact of those regulations and institutional issues therein are little understood, especially in the communal rural areas of South Africa. Recently, entrepreneurship has come to be recognized as a major engine for job creation and economic development in countries around the world. The South African 2012 National Development Plan suggests that agricultural development needs to be based on successful land reform, employment generation through establishment and expansion of agri-businesses, and ensuring strong environmental safeguards. Yet, policy makers have very little information on how the policies they develop and adopt affect smallholder farmers' entrepreneurial spirit. Moreover, very little is understood about whether smallholder farmers are interested in expanding their farming operations or not and if so, what factors influence their willingness and ability to expand. Not much research has empirically analyzed the impact of land use rights and water use rights on the productive use of irrigation water and entrepreneurial spirit of smallholder farmers. Previous studies have mainly focused on the impact of land tenure systems on agriculture investment. This study differs as it classifies customary land tenure system to identify which of the bundle rights have a significant impact on the productive use of irrigation water and entrepreneurial spirit, while taking into account water use rights which have not been accounted for in those studies. Moreover, no research has empirically analyzed the factors that influence the willingness and ability of smallholder farmers to expand their farming operations. Yet, government has been making efforts in trying to move smallholder farmers into commercial farming by expanding existing irrigation schemes and creating new ones.

The study was conducted in three areas, namely, Msinga, Nongoma and Jozini. The data was collected from 242 smallholder farmers using a combination of purposive and stratified random sampling methods. The study purposively selected farmers who are engaged in food crop farming to allow for comparison across different smallholder farmers. A stratified random sampling technique was then employed to select the respondents. Households were categorized into four strata: scheme irrigators (166), non-irrigators (23), community gardeners (27) and home gardeners (26). The study made use of key informant interviews, focus group discussions and household surveys to gather the data. To analyze the data, descriptive statistics, gross margin

analysis, Principal Component Analysis (PCA), Univariate General Linear Model (UGLM), Multivariate General Linear Model (MGLM), ordered probit regression model and Heckman selection model were used. The descriptive analysis was performed to compare socio-economic characteristics of smallholder farmers' typologies. The study made use of the PCA method to develop land use right indices (right to use & exclude others, land transferability and land use decision making), water use right indices (secure access to water, effective scheme management and access to irrigation equipment), psychological capital indices (mainly capturing risk taking, open mindedness, self-confidence and ambition) and entrepreneurial spirit indices (business mindset, self-confidence, innovation and risk taking). The Keiser-Meyer-Olkin and Bartlett's sphericity tests were employed to test the assumptions underlying the use of PCA. The gross margin analysis was used to compare variations among crops and smallholder farmer typologies. The UGLM was used to analyze the factors that influence the gross margin per hectare (proxy for productive use of irrigation water). The MGLM was used to analyze the factors that influence smallholder farmers' entrepreneurial spirit. The oprobit and Heckman model were used to explain the factors affecting smallholder farmers' willingness and ability to expand.

Based on the findings of this study, smallholder farmers face many challenges like drought, pests and crop diseases, scarce arable land with water, market availability, old age, low level of education, availability of quality infrastructure like good roads within the schemes and good cellphone network connections, and access to quality inputs. Due to these challenges, agriculture contribution to total household income is low and social grants are the major contributor. This study found that the existing land tenure system is in line with the communal land tenure policy in the irrigation schemes with land related matters being handled by scheme committees who report to traditional leaders and they, in turn, report to government. The findings indicated that education level hinder productive use of irrigation water, while access to input markets, land transferability and scheme management enhance productive use of irrigation water. To encourage smallholder farmers' entrepreneurial spirit, there is a need to take into account their mode of water supply, output market information, right to use & exclude others from land, land transferability, access to irrigation equipment and on-farm income. To change smallholder farmers' subsistence mindset, investments need to be made in output markets and irrigation equipment. The findings suggest that there are three statistically significant variables that deter

the smallholder farmers' willingness and ability to expand, namely, age, gender and household size.

From this study, it's not clear what benefits privatization of individual land title would bring to improve productivity or investments in land when commons are governed collectively and effectively. This is especially the case as smallholders were not willing to use their land as collateral and also did not have credit records or proof of income which is required by banks to get credit. Therefore, customary tenure system was found to be favorable in this study as it was inclusive, ensured sustainability of land and accountability of leadership. The communal land tenure policy was found to be consistent with what was happening at local level. Therefore, the study recommends that the roles and responsibilities of scheme committees be reflected in both the communal land tenure policy and the national water resource strategy as a body that is responsible for land and water in the irrigation schemes for smallholder farmers. Agency control tenure systems need to be more inclusive in decision making as it affects smallholders' production level. A provincial body of scheme committees is needed whereby smallholders will capacitate each other to collectively address the challenges they face related to water, land and markets. This body would also need to be represented in the policy formulation and can aid in policy implementation. When agriculture and other livelihoods fail, smallholder farmers depend mainly on social grants to survive. Therefore, the study recommends that when developing irrigation projects, departments like social development and economic development should also be part of the consultation to improve smallholder farmers' livelihoods. Moreover, the study recommends that in new irrigation schemes young people must be given priority and there must be proper incentive schemes targeted specifically for them. Furthermore, it must be ensured that they receive necessary training and exposure to be able to participate meaningfully in the whole value chain.

Key words: Customary tenure system, Entrepreneurial spirit, Gross Margin Analysis, Heckman Selection model, KwaZulu-Natal, Land use rights, Ordered Probit model, Principal Component Analysis, Productive use of irrigation water, Smallholder farmers, Univariate and Multivariate General Linear Model, Water use rights, Willingness and ability to expand farming operations

TABLE OF CONTENTS

DEDICATION	ii
DECLARATION 1 - PLAGIARISM	iii
DECLARATION 2 – PUBLICATIONS AND PRESENTATIONS.....	iv
ACKNOWLEDGEMENTS	v
ABSTRACT.....	vi
TABLE OF CONTENTS	ix
LIST OF TABLES	xii
LIST OF FIGURES	xiv
LIST OF ACRONYMS	xv
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Study motivation	5
1.3 Study objectives	7
1.4 Study scope and limitations.....	8
1.5 Organization of the thesis.....	9
CHAPTER 2 LITERATURE REVIEW	10
2.1 Introduction	10
2.2 The water, energy and food nexus	10
2.3 Land reform in South Africa	11
2.4 Water reform in South Africa	13
2.5 The complementarity of land and water policies/strategies	14
2.6 Understanding land and water use rights in the South African context.....	15
2.7 Land/water use rights and agricultural productivity.....	17
2.8 Land/water use rights and on-farm entrepreneurial spirit	19
2.9 Summary	21
CHAPTER 3 RESEARCH METHODOLOGY	22
3.1 Introduction	22
3.2 Study area description.....	22

3.2.1 Tugela Ferry Irrigation scheme	23
3.2.2 Bululwane Irrigation Scheme	25
3.2.3 Makhathini Irrigation Scheme	26
3.3 Justification for the selection of the schemes	28
3.4 Data collection methods	29
3.4.1 Sampling procedure	29
3.4.2 Data collection instruments	30
3.5 Conceptual framework	31
3.6 Empirical methods of data analysis	35
3.6.1 Descriptive statistics	36
3.6.2 Gross Margin Analysis	36
3.6.3 Principal Component Analysis	38
3.6.4 General Linear Model	40
3.6.5 Ordered Probit Model	42
3.7 Summary	45
CHAPTER 4 WATER/LAND USE RIGHTS AND PRODUCTIVE USE OF IRRIGATION	
WATER: RESULTS AND DISCUSSIONS	46
4.1 Introduction	46
4.2 Descriptive analysis: results and discussions	46
4.2.1 Typologies of smallholder farmers in the study	46
4.2.2 Household demographics and socio-economic characteristics	47
4.2.3 Household livelihood influencers	51
4.2.4 Land holdings and land use rights	57
4.2.5 Water access and typologies of water use rights	62
4.2.6 Access to input and output markets	67
4.2.7 Gross Margin Analysis: results and discussions	72
4.2.8 Savings	74
4.2.9 Access to finance	75
4.2.10 Access to human, social and psychological capital	77
4.3 Description of the factors influencing productive use of irrigation water	81
4.4 Further empirical results and discussions	83
4.4.1 Land use rights indices: PCA results	83
4.4.2 Water use rights indices: PCA results	84

4.4.3 Psychological capital indices: PCA results	86
4.4.4 Impacts of land/water use rights on productive use of irrigation water: UGLM results and discussions	87
4.5 Summary	91
CHAPTER 5 WATER/LAND USE RIGHTS AND ON-FARM ENTREPRENEURSHIP: RESULTS AND DISCUSSIONS	93
5.1 Introduction	93
5.2 Descriptive results and description of the variables in the models	93
5.2.1 Smallholder farmers' entrepreneurial spirit	93
5.2.2 Smallholder farmers willingness and ability to expand farming operations	95
5.3 Further empirical results and discussions	97
5.3.1 Entrepreneurial spirit indices: PCA results	97
5.3.2 Impact of land/water use rights on on-farm entrepreneurship spirit: MGLM results and discussions	98
5.3.3 Factors affecting willingness and ability to expand farming operations: Oprobit results and discussions	105
5.4 Summary	108
CHAPTER 6 CONCLUSIONS AND POLICY RECOMMENDATIONS	109
6.1 Recapping the purpose of the research	109
6.2 Conclusions	110
6.3 Policy recommendations	112
6.4 Recommendations for future research	113
REFERENCES	114
APPENDICES	127
Appendix A – Focus group discussion checklist	127
Appendix B – Ethical clearance	129
Appendix C – Questionnaire used for data collection	130
Appendix D - Turn it in originality report	139

LIST OF TABLES

Table 3.1. Specific objectives and the corresponding data analysis methods.....	36
Table 4.1. Typologies of farmers in Jozini, Nongoma and Msinga	46
Table 4.2. Average size of land for smallholder farmers' typologies	47
Table 4.3. Household demographic and smallholder socio-economic characteristics	50
Table 4.4. The average estimated household income (R) of smallholder farmers per year	54
Table 4.5. Satisfaction level of security of land ownership and decision making (%).....	58
Table 4.6. Proportion of smallholders willing to relocate to bigger plots and their reasons (%).....	59
Table 4.7. Proportion of land related issues faced by smallholder farmers (%).....	60
Table 4.8. Smallholder farmers' satisfaction with their land use rights (%)	62
Table 4.9. Smallholder farmers' access to water and satisfaction with scheme committees (%).....	64
Table 4.10. Water use rights of smallholder farmers (%)	66
Table 4.11. Reasons why smallholder farmers chose which crops to plant (%).....	67
Table 4.12. Percentage of farmers growing each crop (%)	68
Table 4.13. Accessibility of inputs to smallholder farmers (%).....	71
Table 4.14. Gross margin (R) estimates per hectare for three major crops in 2016.....	74
Table 4.15. Smallholder farmers' type of saving and average amount being saved	75
Table 4.16. Sources of credit and the importance of credit (%).....	76
Table 4.17. Training received by smallholder farmers (%).....	77
Table 4.18. Sources of information for land and water use rights and rules (%).....	78
Table 4.19. Major reasons for farming by smallholder farmers (%).....	80
Table 4.20. Smallholder farmers' attitudes towards farming (%).....	81
Table 4.21. Description of factors that influence the productive use of irrigation water.....	82
Table 4.22. The dimensions of land use rights for smallholder farmers.....	84
Table 4.23. The dimensions of water use rights for smallholder farmers	85
Table 4.24. The dimensions of psychological capital for smallholder farmers	87
Table 4.25. Factors that influence the productive use of irrigation water.....	89

Table 5.1. Smallholder farmers' entrepreneurial characteristics (%).....	94
Table 5.2. Description of factors that influence smallholder farmers entrepreneurial spirit	95
Table 5.3. Factors affecting smallholder farmers (%) willingness and ability to expand farming operations	96
Table 5.4. Description of factors that influence willingness and ability to expand farming operations	96
Table 5.5. The dimensions of smallholder farmers entrepreneurial spirit.....	98
Table 5.6. Factors that influence smallholder farmers' entrepreneurial spirit components: MGLM results	100
Table 5.7. Factors affecting smallholder farmers entrepreneurial spirit: MANOVA results	105
Table 5.8. Factors that influence the willingness and ability to expand farming operations: Oprobit and Heckman selection model results	106

LIST OF FIGURES

Figure 2.1. Water, energy and food nexus.....	11
Figure 3.1. Map of study locations	22
Figure 3.2. The link between land and water use rights, entrepreneurial spirit, productive use of irrigation water and livelihood assets.....	34
Figure 3.3. Normal distribution of error term.....	44
Figure 4.1. Proportion of smallholder farmers' level of formal schooling (%)	51
Figure 4.2. Percentage of smallholders receiving social grants (%).....	52
Figure 4.3. Average number of livestock owned by smallholder farmers	55
Figure 4.4. Reasons why smallholder farmers keep their livestock	56
Figure 4.5. Communication and production assets owned by individual farmers (%).....	57
Figure 4.6. Smallholder farmers (%) that mostly fail to sell their produce for various crops	71
Figure 4.7. Development programmes awareness, involvement in consultations and benefit (%).....	79
Figure 4.8. Management of farming activities by smallholder farmers (%).....	80

LIST OF ACRONYMS

ANCOVA	Analysis of covariance
ANOVA	Analysis of Variance
CLTP	Communal Land Tenure Policy
DARD	Department of Agriculture and Rural Development (provincial)
DRDLR	Department of Rural Development and Land Reform (national)
DWA	Department of Water Affairs* (national)
DWS	Department of Water and Sanitation* (national)
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
IWMI	International Water Management Institute
KMO	Kaiser-Meyer-Olkin
MGLM	Multivariate General Linear Model
NDP	National Development Plan
NGP	National Growth Plan
NWA	National Water Act (of 1998)
NWRS-2	National Water Resource Strategy-2
PCA	Principal Components Analysis
RSA	Republic of South Africa
UGLM	Univariate General Linear Model
WRC	Water Research Commission
WUAs	Water User Associations

*DWA is now known as DWS

CHAPTER 1 INTRODUCTION

1.1 Background

Land and water resources are essential in agriculture and rural development, as they are interconnected to worldwide issues of poverty and food insecurity that affect 75% of the rural peoples' livelihoods (Bidogeza *et al.*, 2009; FAO, 2011; Ma *et al.*, 2017). In developing nations, land and water policies and institutions have been found to be inadequate to deal with the rising land and water problems (Malzbender *et al.*, 2005; Binswanger-Mkhize *et al.*, 2010). According to FAO (2011), the agricultural sector uses 11% of the world's land surface for crop production and 70% of the world's water. The increasing burden on land and water resources as a result of an increasing population in developing countries has led to the need for improvement of their regulation (Bidogeza *et al.*, 2009; Speelman & Veettil, 2013). Food and Agriculture Organization of the United Nations (FAO), for example, has developed voluntary guidelines on land and water governance that developing countries can follow to improve their policies. As most governments from developing countries are promoting agricultural development, there is an increasing competition from other sectors like mining and manufacturing that also need land and water resources. With this competition that is present, in future land and water could be allocated more towards those sectors if the agricultural sector fails to create job opportunities for people and alleviate poverty.

Smallholder agricultural productivity as a way of poverty reduction amongst rural households in Africa has been given considerable attention (Machethe *et al.*, 2004; Place, 2009; Birner & Resnick, 2010), including the role of land and water reform policies. The state of the political economy has had an influence on how resources are accessed by people. The changing global circumstances have resulted in an increasing concentration on the future of smallholder farmers (Jayne *et al.*, 2010). Today most of the world's poor continue to rely on farming for improvement of their livelihoods and the majority of them are smallholders (Fischer & Qaim, 2012). The South African government has, therefore, prioritized the development of the rural areas where most of the poor people are located with agricultural development as the core focus for their empowerment. Since most of the people residing in the rural areas are women, it is important to study the key challenges that they face which hinder their development. At the core of those challenges are the issues related to access to water and land. Given this reality on the

ground, it remains critical to understand the role that land and water use rights have on the productive use of water. This can help improve government interventions in the smallholder sector and the development of sustainable livelihoods for rural people.

The ways in which land tenure impacts on smallholder incentives is not easily understood and the tenure problems that exist at local level cannot be fixed through policy reform alone (Place, 2009; Cousins, 2016). In rural South Africa, it is essential to recognize the role of local stakeholders as they are key players in the implementation of new policies and their success. The political economy implications and the entrenched nature of the cultural authority make it difficult to disrupt the systems that exist in different areas. Understanding existing local land and water use rights in relation to national policies is critical, especially for ensuring successful implementation of national policies. The Communal Land Tenure Policy (CLTP), for example, strives to deal with the gross distortions on traditional and customary systems in communal areas initiated by apartheid regimes which have caused a lot of socio-economic barriers including land scarcity and tenure insecurity (DRDLR, 2013). The CLTP makes it possible for farmers to hold an institutionalized use right which allows them to legally lease their land and this opens an opportunity for land rental markets which, in turn, create an opportunity for utilization of idle land. However, the role or importance of traditional authorities in the policy formulation and implementation is not clarified.

According to De Lange & Mahumani (2012), South African agriculture accounts for more than 60 percent of water utilization and yet the productive use of water remains a contentious issue in most of its enterprises. The South African government has made considerable investment to support irrigation infrastructure (Van Averbeké *et al.*, 2011) with the hope of boosting agricultural production and productivity in the rural areas. However, Ostrom & Gardner (1993) argue that a lot of emphasis in the development literature has been placed on physical technology that enhances irrigation and farming performance instead of institutions both local and national. Since the introduction of the National Water Act of 1998, government continues to push for the registration of Water User Associations (WUAs) in the smallholder irrigation schemes in the communal areas to improve water use productivity, address water scarcity and improve management (DWA, 2014). However, those WUAs only exist on paper in most smallholder irrigation schemes and instead scheme committees are in charge of scheme management as a whole which includes, amongst other things, dealing with land and water related issues.

According to Meinzen-Dick *et al.* (2004), the failures of community development projects are a result of limited knowledge on how collective action in those communities arise to solve various problems and how they are maintained. The existing water use systems that operate in communal areas are little understood. Policies that do not recognize existing structures have failed and there is a need to change that approach.

Addressing the problems of right to use land and water resources, and capability to utilize them in a lucrative and regenerative way is essential for the rural poor in communal areas (Hodgson, 2004; FAO, 2011; Van Averbek, 2012). Entrepreneurship has been generally accepted as a key strategic solution for creating employment and economic opportunities in developed and developing nations. In recognizing this trend, the South African government has developed and implemented policies that encourage entrepreneurship in the rural areas while ensuring sustainable utilization of limited natural resources. For example, the 2012 National Development Plan indicates that agricultural development needs to be based on successful land reform, employment generation through establishment and expansion of agri-businesses, and ensuring strong environmental safeguards. However, plans on how this vision can be realized remains open to question as there is little research on smallholders as entrepreneurs. Therefore, there is a need evaluate the consequences of the adopted policies on the smallholder farmers' entrepreneurial spirit (Wilson *et al.*, 2013) and aspirations.

According to Ruben & Pender (2004) and FAO (2011), agricultural policies largely benefit smallholders with access to water and productive land, excluding the many smallholders who receive low returns to production factors and have eroding asset base. Therefore, a need exists for enhancing irrigation competence and productivity for those smallholder farmers (FAO, 2011; Van Averbek *et al.*, 2011). According to studies by Ruben & Pender (2004), Cotula (2006), Cousins (2007), Sjaastad & Cousins (2008), Toulmin (2008) and Hodgson (2016), decentralization of decision making responsibilities to the local level where farmers operate has the potential to close the gap concerning legal frameworks and local practices, and therefore permitting land/water users more responsibility.

Therefore, this research seeks to address the following specific problems that currently exist in the rural communal areas of South Africa.

- Secure access to land and water is critical for livelihood improvement, so do advances in institutions (Namara *et al.*, 2010). Land and water are scarce not only because of the physical availability but also due to institutional factors. There is a knowledge gap on the extent to which land and water use rights (and their lack thereof) hinder or promote the productive use of irrigation water in the rural areas. A large body of literature has focused mainly on the impact of land tenure on agricultural productivity in developing countries (Deininger & Jin, 2006; Fenske, 2011), while excluding water use rights. This research will fill that gap and will assist land and water policy makers in drawing up policies that improve smallholders' livelihoods while ensuring the sustainable use of the scarce natural resources.
- According to the author's knowledge, there is currently little research that has analyzed the influence of land and water use rights on smallholder farmers' entrepreneurial spirit. So far, policy makers have very little information on how the policies they adopt affect the entrepreneurial spirit of smallholders in the communal areas. Since the South African government is promoting smallholder agriculture to be practiced mainly as a business, it is essential to have knowledge of how land and water use rights influence smallholder farmers entrepreneurial spirit. As noted by Ligthelm (2013), "the renewed emphasis on entrepreneurship and business development, coupled with South Africa's poor performance in this regard, confirms the need within both the public and private sectors for more information about the drivers of, and the barriers to entrepreneurship development".
- The majority of Africa's smallholder farms are less than 1.2 hectares and with most of them owning less than 0.5 hectares, with little possibility of expansion (Jayne, 2014). Moreover, in South Africa, government has committed in supporting subsistence farmers to be smallholders and smallholders to be commercial farmers (NPC, 2011; DARD, 2015). However, very little is known about whether or not smallholders are interested in expanding their operations and what factors drive that desire. This study will identify and analyze the determinants of willingness and ability of smallholder farmers to expand farming operations in the selected study areas, taking into account the irrigable land scarcity challenge.

1.2 Study motivation

While government develops and adopts policies, management remains in the hands of smallholders who are often using their own rules to govern themselves, their relationships with others and the resources. Government departments usually have primary responsibility for developing policy framework for land and water use. In South Africa, the work of two government departments, namely, the Department of Rural Development and Land Reform (DRDLR) and Department of Water and Sanitation (DWS), has fallen to the Department of Agriculture and Rural Development (DARD) as it is usually the only department that is easily accessible to the farmers at local level. This leads to poor implementation of the policies as the respective mandates for these departments are often contradictory and not easy to synchronize, harmonize and coordinate. For example, agricultural extension officers from DARD are not involved in land and water reform which makes the facilitation of policies difficult as officials from DRDLR and DWS have limited contact with the smallholders. Therefore, the scheme committees are often left by themselves and have to do what will work for them in the absence of guidance from government officials.

In many African countries where agriculture dominates, smallholder farmers' performance is essential for the development of the economy and rural areas (Chancellor, 1999). Development of markets, management and collective governance is essential irrigation schemes in Africa (Backeberg & Groenewald, 1994; Saruchera *et al.*, 2010; FAO, 2011). According to Binswanger-Mkhize *et al.* (2010) and Van Averbeke *et al.* (2011), the adoption of one size fits all models which are reliant on technically demanding and expensive infrastructure exclude black smallholder farmers because they fail to recognize the diverse smallholder groups that exist and do not also take into account historical legacies. This is something that cannot be afforded in South Africa as it could increase the rate of food insecurity in the rural areas where most smallholder farmers are located. In developing countries and economies in transition where state water legislation either does not exist or where it is not yet being fully implemented. Lack of water security with regards to water rights inevitably impacts negatively on the worth and security of land tenure rights (Hodgson, 2004).

The rising interest of water rights from policy makers from developing nations has made it important to expand the knowledge of land and water rights simultaneously as they apply on the

ground (Hodgson, 2004; Meinzen-Dick & Nkonya, 2005; Cotula, 2006; Hodgson, 2016). The dynamic and complexity of cultures, economic activities and environments has complicated how water rights and water allocation institutions can be developed. Therefore, when realigning land and water use rights for smallholders the state regulations and institutions are not good areas of departure (Meinzen-Dick & Nkonya, 2005). Rather, it is best to explore how they are currently linked in different tenure systems that exist at local levels (Lovo, 2016; Hodgson, 2004; Cotula, 2006). The South African National Water Act of 1998 continues to be vague on essential issues relating to local institutions (Perret, 2002), especially in the setting of smallholders in the rural communal areas. One therefore has to ask whether the problem in South Africa is the incompleteness or inappropriateness of the Act or is it a problem of enforcement or implementation?

According to Beckeberg (1997), an intensive research work on property rights based on water institutions is needed. Speelman *et al.* (2009) argue that better water use rights can improve water use productivity. Studying the potential of water rights improvement for smallholders in South Africa is therefore relevant in the light of their poor production performance and of weak cost recovery at smallholder irrigation schemes under a general context of water scarcity (speelman & Veetil, 2013). Moreover, smallholder farmers face various challenges that might threaten the implementation of land and water use policies, namely, lack of equipment and infrastructure maintenance capacity, expensive energy- electricity, saturated markets, lack of extension and farmer training, conflict, and weak local organization (Van Averbeke & Mohamed, 2006). Smallholders react differently to challenges they encounter depending on who they are and the formal and informal rules that govern them. It is, therefore, important to take that into account in the formulation and evaluation of reform policies for smallholders (Ruben & Pender, 2004; Machethe *et al.*, 2004; Van Averbeke & Mohamed, 2006; Hansson *et al.*, 2013; Lovo, 2016).

Efficient land markets improve land issues by giving emerging smallholders an opportunity to combine their land and grow their farming businesses (Huy *et al.*, 2013). However, this hardly ever happen due to the large number of family members who are in need of irrigable land and smallholders rotate plots within the family with payments made in-kind (Cousins, 2013). This then limits the chances of either expansion or rental of land by people who do not have land within their family but short-term rental markets do exist in some places. According to Crookes

& Lyne (2003), active rental markets indicate existence of tenure security which promotes good farming performance and inclusion of disadvantaged groups like youth and single women. In rural communal areas, the customary institutions are dynamic and the property rights evolve according to the local conditions and pressures (Malzbender *et al.*, 2005; Cotula, 2006; Place, 2009; Bainville, 2017). The customary land tenure has become more inclusive of the previously excluded people like women who are widows and single due to the dynamic nature of this tenure system. There are different typologies of land tenure systems in the communal areas and that heterogeneity has to be accounted for and generalization should be avoided in policy making. Moreover, Place (2009) called for more research on the effects of land policy instruments on smallholder farmers and how they can be improved, looking at both formal and informal land and water use rights. This study seeks to contribute to this call.

Most of the literature often seek to analyze agricultural performance besides management traits, but usually constrained by scarcity of information on management behaviors captured as farmers' aims, behaviors and activities (Wilson *et al.*, 2013). However, this study is able to account for this by using qualitative data. Pichardo *et al.* (2012) argue that numerous measurements of viewing smallholders as entrepreneurs needs further research on their business approaches and entrepreneurial dimensions. Smallholder farmers' entrepreneurial spirit is molded and mobilized by socio-economic and institutional developments that exist in rural areas. The dynamic and diverse nature of farmers' reaction to market and policy state of affairs is supported by diverse smallholders (Morgan *et al.*, 2010; Chancellor, 1999). It is, therefore, necessary to understand the influence that land and water use rights have on the smallholder farmers' entrepreneurial spirit. According to Seuneke *et al.* (2013), better knowledge on smallholder farmers' entrepreneurial spirit is needed as agriculture entrepreneurship gains more attention.

1.3 Study objectives

The general objective of the study is to examine the inter-linkages of land and water use rights, productive use of irrigation water, and smallholder entrepreneurial spirit.

The specific empirical objectives of the study are to analyze the:

1. Extent to which land and water use rights (and their lack thereof) enable/deter the productive use of irrigation water;

2. Influence of land and water use rights on smallholder farmers' entrepreneurial spirit;
3. Factors affecting the willingness and ability to expand farming operations.

1.4 Study scope and limitations

i) Self-reported data

The self-reported data is difficult to verify autonomously. Therefore, research assistants recorded what smallholders shared, interviews and focus group discussions. Since farmers do not keep farm records, what they say could not be confirmed with exactly what they do. This is a similar problem like contingent valuation studies as stated preferences (what farmers say) are different from revealed preferences (what farmers do). Therefore, there is a limitation of selective memory, which is, recall problems regarding experiences or events that occurred at some point in the past, such as the previous year's revenue or yield for a particular crop. The farmers were more likely to remember the revenue they received from their produce than the quantity they sold. This was because most of them do not sell all the produce at once. To the extent possible, this limitation was overcome through triangulation of available data in which local and district level records were gathered to verify data collected from respondents. In addition, the local extension officers were also consulted, especially with regards to prices of inputs. Focus group discussions and key informant interviews were used to verify information provided by individual respondents.

ii) Researchers being viewed as government officials

In some cases, researchers were viewed as government officials and decision makers to address their rural development challenges. Hence, respondents frequently requested them to solve a range of local development problems, for example, poor roads, low output prices, limited access to clean and safe water, just to name a few. Moreover, they tended to exaggerate their challenges because they thought they were going to get something from government by taking part in the survey. To overcome this issue, at the beginning of each interview, enumerators and the principal investigator had to explain their role as researchers to farmers and the importance of the research. Moreover, the extension officers, enumerators and scheme committees were also briefed on the importance of the study and were requested to assist in explaining to the farmers. This helped to minimize the expectations that farmers had from the enumerators and researchers.

1.5 Organization of the thesis

The remainder of the thesis is outlined as follows: Chapter 2 will present an overview of the relevant literature on the role of land and water use rights on the productive use of irrigation water and entrepreneurship spirit of smallholder farmers. Chapter 3 presents the research methodology adopted in this study. This chapter provides selected study area description, the justification of the selected schemes, data collection methods of this study, conceptual framework employed and the empirical methods of data analysis. Chapter 4 is the first empirical chapter which descriptively explores the capital endowments of smallholder farmers' typologies, and highlights the challenges and opportunities faced by smallholder farmers. After the descriptive statistics, it provides empirical results and discussion of the impact of land and water use rights on the productive use of irrigation water in smallholder farming. Chapter 5 is the second empirical chapter which also explores descriptive statistics related to entrepreneurship spirit. Moreover, it provides empirical results and discussion of the influence of land and water use rights on smallholder farmers' entrepreneurial spirit. Furthermore, it determines the factors affecting willingness and ability to expand farming operations. Chapter 6 presents the conclusion and policy recommendations. It proposes areas for future research based on the researcher's field experiences and the research gaps identified during the course of undertaking empirical data analysis. The appendices are presented after the references at the end.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Smallholders in South Africa comprise of a large and varied cluster (Van Auerbeke & Mohamed, 2006). Raising agricultural productivity for these smallholder farmers is necessary if African countries are to overcome the problems of unemployment, poverty and food insecurity (Perret, 2002; Hodgson, 2004; Machete *et al.*, 2004). Raising smallholder agricultural productivity involves access to consistent quality support services such as extension, marketing, finance (Chancellor, 1999; Sharma *et al.*, 2010; Fischer & Qaim, 2012; Gatzweiler & Von Braun, 2016), and enhancement of their entrepreneurial spirit (Pichardo *et al.*, 2012). According to Chamberlin & Jayne (2013), farmers in faraway regions encounter greater input costs, inferior output prices as result of small number of traders competing for their produce and poor access to supporting services. All of which leads to impediments to taking on new technologies and being market driven. Therefore, these challenges have to be dealt with simultaneously for smallholder farmers to make progress and improve their livelihoods (Backeberg & Groenewald, 1994). Key to doing this is ensuring that strong government and farmer institutions are in place. This chapter provides an overview of the relevant literature on the study topic.

2.2 The water, energy and food nexus

Reduced water availability directly impacts the agriculture sector, the energy sector, as well as the rest of the economy (Al-Riffai *et al.*, 2017). Developments in food security need to be addressed within a nexus perspective integrating key linkages within related sectors, including water and energy. Recognizing and embracing this nexus is critically important for holistic future rural development policy strategies. Water, energy and food are inseparably linked as energy is required to yield food and distribute water by pumping water from the ground or surface water sources (WRC, 2017). Water, energy and food nexus is an important instrument to address poverty, unemployment and inequality (Gafy *et al.*, 2017). It also reinforces the need to move towards policy convergence as opposed to the current 'silo' approach. Figure 2.1 below shows the relationship between water, energy and food. This study seeks to identify problems experienced by smallholders when they gain access to land, water, energy to pump water and food.

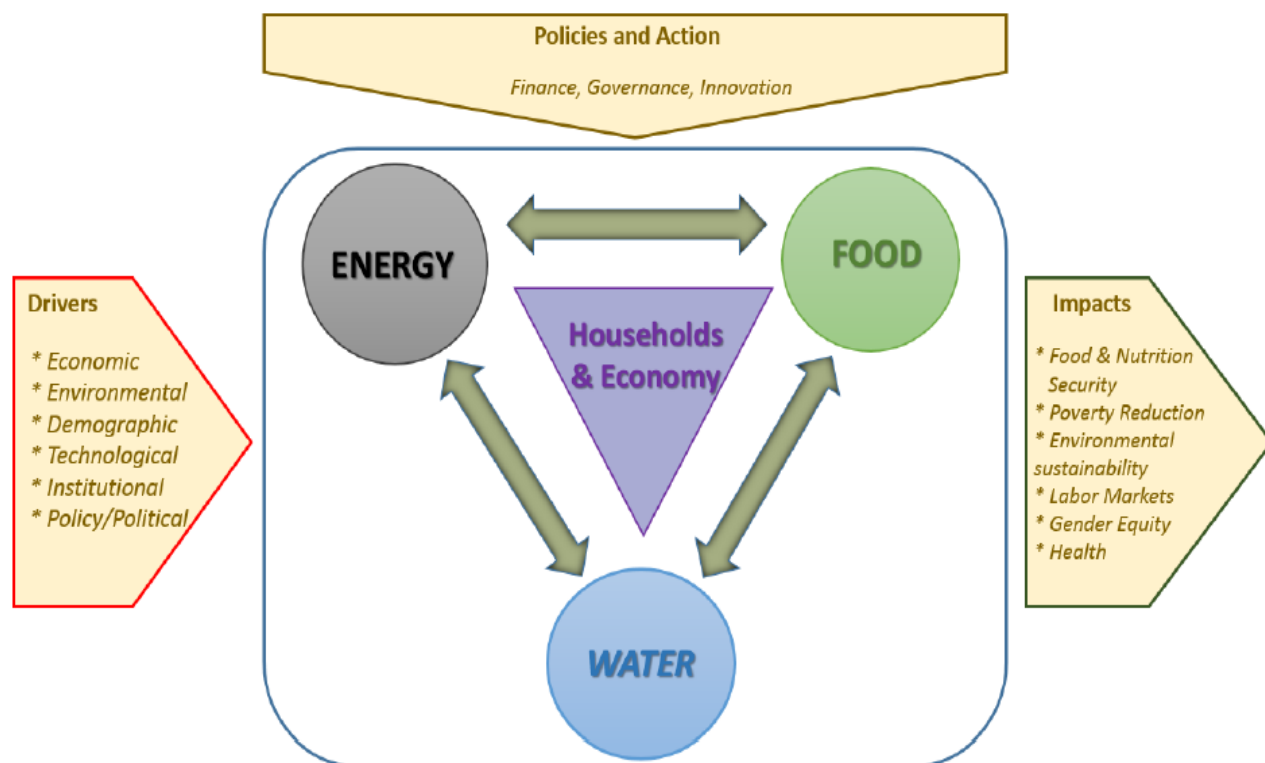


Figure 2.1. Water, energy and food nexus

Source: Al-Riffai *et al.* (2017)

The national government main concern in water resources and agricultural policies is the optimum usage of available water and energy to satisfy agricultural plans and economic sustainability goals (Mohtar & Daher, 2016; Gafy *et al.*, 2017). DWS has committed in their 2nd National Water Resource Strategy (NWRS-2) to working with the DAFF and Department of Energy to pull resources together and avoid duplication of efforts by the departments. Moreover, they will ensure that these resources are allocated where they will yield high impact in terms of job opportunities and improvement of the livelihoods of the majority who are poor.

2.3 Land reform in South Africa

Land tenure systems rules and regulations in South Africa are essential for smallholder irrigation schemes (Jordaan *et al.*, 2014). At the end of the apartheid era, approximately 60 000 white commercial farmers occupied about 86 million hectares (ha) of land, while 14.5 million ha were accessed by around 2 million black farming households in the communal areas (Van Koppen *et*

al., 2009). Hence, land reform in South Africa is broadly critiqued for its speed (about 8 per cent of commercial farmland redistributed over 18 years versus the 30 per cent over 5 years initially targeted) and its performance (Aliber & Cousins, 2012; Woodhouse, 2012). Equity considerations continue to be necessary in South African land reform as the large number of people rely on agriculture to sustain their livelihoods (Zikhali & Chilonda, 2012; Bainville, 2017). The South African government idea of the land reform programme emphasizes numerous intentions, namely, dealing with land deprivation and inequality; supporting economic growth; improving security of tenure (where necessary) and land administration (DRDLR, 2013).

The dispossession of land from black people that took place in the apartheid era has resulted in land redistribution and restitution programmes to be of primary interest for South African land reform policies (Cousins, 2007). As a result most land reform studies in South Africa have focused mainly on commercial farms to evaluate the impact of new policies implemented by government to correct the wrong doings of the apartheid system. This reinforces the need for more research on smallholder tenure systems that currently exist, especially within smallholder irrigation schemes as government has committed to improve them. The ambiguous findings with regard to the impact of land reforms on productivity come as a result of land reform being implemented differently within and across countries, and therefore have a mixed impact across different locations (Zikhali & Chilonda, 2012). Hence, the South African government has developed three programs under land reform which aim to deal with the diversity, namely, (i) restitution and land acquisition, (ii) recapitalization and development, and (iii) land tenure programmes.

The 2012 National Development Plan recognizes customary land tenure system in rural areas as insufficient for the security of credit and investment (DRDLR, 2013). It regards this type of tenure as impediment to land development within the communal areas. However, Aliber & Cousins (2012) raise an argument that policies based on the hypothesis that only large-scale commercial farming is real agriculture, and that land reform projects must follow this model to be successful, contribute to the challenges, and in most cases are the reason for project failures. The other challenges with land reform programmes include lack of farming skills and experience by the land reform beneficiaries (Backeberg & Sanewe, 2010; Aliber & Cousins, 2012). Moreover, small land grants, poor market access, late delivery of inputs, water availability, internal conflicts within beneficiary groups and the acquisition of insufficient land of low

agricultural potential have exacerbated the problems, and made it impossible for many beneficiaries to hope for anything more than a slight improvement in self-provisioning (Andrew *et al.*, 2003; DAFF, 2012; Kirsten *et al.*, 2016; Kepe & Hall, 2017). Taking these challenges into account, putting into practice an inclusive agrarian reform in the communal areas for the majority of the rural people who were dispossessed of their land remains a huge struggle for South Africa (Lahiff & Cousins, 2005; Woodhouse, 2012; DARD, 2015).

There is a necessity for area and intervention specific empirical analyses of land reform, especially at household level. This study focuses on the understanding of the communal land tenure systems which is a component of the land tenure reform programme for smallholder farmers. Existing tenure systems appear reasonably stable in some areas at the same time they are also under tension due to population growth, weak formal administration, misconduct by some traditional leaders, and unclear roles and responsibilities of traditional leaders and local government bodies (Cousins, 2007). For the purpose of this study, tenure systems related to farm workers and labor tenants living on commercial farms are beyond the scope of this study. Cousins (2016) argue that the objectives and strategic push of land tenure reform remains unclear.

2.4 Water reform in South Africa

South Africa is measured amongst the frontrunners in water reform. The NWRS-2 diverges from common notions of international water resource management in at least three ways (DWA, 2014; Van Koppen & Schreiner, 2014). Firstly, according to NWRS-2, water management is meant to contribute to the South African government objectives of social and economic improvement. Secondly, the NWRS-2 highlights the necessity to place water infrastructure and service delivery at the core of its mandate. Thirdly, equity is essentially prioritized. Based on previous experience, DWS made the decision to bring the National Water Act and the Water Services Act into one piece of legislation governing the entire water chain. According to DWA (2014), the implementation challenges arising from the two pieces of legislation do not require policy shifts or elaboration, but simply improved alignment and articulation of the integration of the two separate pieces of legislation. These policies make the assumption that all smallholders are the same and their influence on productive use of water in smallholder agriculture is little understood.

With water reform, the water management decision making process is moving from the state and municipal levels to the river basin or the WUAs in the case of smallholder scheme irrigators. The water reform program makes it possible for an efficient and autonomous arrangement under transfer of rights to users. Moreover, it confines the ability of the new system to react to clear needs as a result of resource shortage. Water reform is likely to be insufficient when it does not adequately consider socio-political matters like equity, institutional situations, power dynamics, and the differentiated socio-economic nature of communal water use systems, and cultural features (Wilder & Lankao, 2006). The regulation of water resources can support agrarian reform by ensuring that these resources are made available in a fair and sustainable manner (Van Koppen *et al.*, 2009). However, the growing stress on agricultural water management is forcing re-allocation of water. That leads to different and improved institutional engagements which allow and discuss that re-allocation reform (Mollinga *et al.*, 2007).

Water governance, management and use can be characterized as follows (Mollinga *et al.*, 2007): (i) several actors and organizations engaged in water decision-making at various levels; (ii) range of rules and procedures relevant to unique problems; and (iii) multi-functionality of water-resources systems and the series of diverse values devoted to these tasks. According to Ostrom (1999), central governments often use smaller set of rules which gives resources to outsiders with no long-term commitment for the resource and may be unwilling to follow the set rules. Without understanding the current water use rights that smallholder farmers have and use in the communal areas, these policies can do more harm than good, especially since water is productive and consumed asset. The questioning of enforcement, implementation and intended impact of irrigation policy brings up issues relevant to sustaining rural livelihoods and development. The goal of restoring previous disparity by South African government implies that water reform is supposed to bring changes in process and in social outcomes (Woodhouse, 2012).

2.5 The complementarity of land and water policies/strategies

Water reform and land reform have hardly been linked (Woodhouse, 2012). There are immediate links between the current land reform and water (Van Koppen *et al.*, 2009): firstly, in the case of irrigated land that is restituted and redistributed, and secondly, in the case of water as one aspect of land tenure reform in communal areas. Agrarian reform holistically regards land and water resources in South Africa as assets for rural redress, higher productivity and improved wellbeing.

According to DAFF (2012) and Denby *et al.* (2016), the insufficient application of policies is a outcome of the misalignment of policies among various government departments, lack of knowledge on the effects of policies at macro and micro levels and lack of engagement among regulators, implementation groups and stakeholders.

This lack of coordination at a policy level between land and water reforms is made worse by the marked lack of sufficient incentives or political will within regional and local institutions to collaborate (Denby *et al.*, 2016). Based on NWRS-2, DWS works with the DRDLR and DAFF (and provincial DARD) to attain a comprehensible programme of land, water and agrarian reform. The NWRS-2 aims to support rural development through a programme of support to smallholder water users. However, despite the progressive reforms, water allocation remain a profoundly political issue due to the historical context of South Africa, the economic importance of water, and the many complex needs of multiple stakeholders from differing departments, socioeconomic classes and political regimes (Denby *et al.*, 2016).

2.6 Understanding land and water use rights in the South African context

Property rights perform a critical role in sustainable irrigation and their reform has to be based on thorough knowledge of the existing rights to land, water, and their primary institutions. Malzbender *et al.* (2005) emphasize the importance of recognizing legal heterogeneity that exists at local level. The typology method proposes a tool for evaluating and developing more distinguished policies taking into account differences in tenure systems. Meinzen-Dick (2014) argues that there is no one optimal property right system that can be applied in all irrigation systems across the developing countries. Instead, more alternatives are required and knowledge of how they can be tailored to an ever changing physical and institutional environment.

Hodgson (2016) summarizes water tenure systems into two groups, namely, tenure arrangements defined by formal law and those not defined by formal law. Tenure arrangements defined by formal law consist of: (i) 'traditional' formal water rights (rights to use water resources derived from land tenure rights), (ii) 'modern' formal water rights (permit-based long-term rights which do not depend on land tenure rights), (iii) regulatory licenses, (iv) agency control (water agency holds legal power to abstract and use water resources) and (v) common-hold water tenure (rights to water held in common by a distinct community of users such as members of a WUA and are highly dependent on effective governance within). Tenure relationships not well-defined by

formal law consist of: (i) customary water tenure (rights to abstract or use water resources based on local law), (ii) informal water tenure (use of water that is not legally recognized but is tolerated by the water administration), (iii) assumed rights (formal water rights are wrongly assumed to exist due to the 'official' nature of the use).

FAO (2016) summarizes three diverse states of commons, namely, (i) commons may be publicly or state-owned land that is collectively used and managed by local groups, (ii) commons may be owned by indigenous peoples or other communities with customary tenure systems and this may be legally recognized, and (iii) commons may be newly established where groups come together to create rules and norms to use, manage and even own a specific natural resource collectively. Using these summaries by Hodgson (2016) and FAO 2016, the tenure systems that currently exist in the selected study areas are different. For example, in Makhathini Irrigation Scheme the tenure system that exists for water is the agency control and the agency is called Mjindi Farming. In Bululwane and Tugela Ferry Irrigation Schemes, the tenure system that dominates is the customary water tenure which is similar to common-hold water tenure but the difference is that water is managed by scheme committees and not WUA. However, for smallholders outside the schemes, the informal water tenure dominates. Similar to all schemes, the commons are state-owned land which are collectively used and managed by local groups or traditional authorities under customary tenure. Therefore, further research is required to find optimum mixed tenure arrangements (Ouedraogo *et al.*, 1996; Holden & Ghebru, 2016).

Hodgson (2004) and Bainville (2017) argue that customary tenure is neither an impediment to investment nor as an absolute safety net for smallholders. The presence of excludability right in African tenure arrangements implies that productive use of land can be attained (Sjaastad & Bromley, 1997; Bugri, 2008). Deininger *et al.* (2008), Place (2009) and Hodgson (2016) argue that in Africa, the lack of individual titles to land or water resources doesn't necessary equate to lack of tenure security. According to Bugri (2008), individual titles to land do not necessarily equate to high agricultural production in agriculture. Furthermore, Hodgson (2004) and Holden & Ghebru (2016) argue that the assumption that customary land tenure systems are insecure is problematic. However, there is an acknowledgement that where insecurity of customary tenure occurs in an agrarian economy it leads to low agricultural production. A study by Fort (2008) found that in customary tenure arrangements, simple land use rights administered by local

authorities appeared to be adequate to encourage land owners to invest and transfer rights (presumed to be conveyed by land title) did not meaningfully advance investment motivations.

Binswanger-Mkhize *et al.* (2010) argue that collective rights with formal and informal rules for access and use are usually more effective than individual private property or any state managed property rights. Unlike urban investors, rural communities believe their rights are better represented in the customary sphere (Cotula, 2006) and trust amongst community members plays a critical role. This raises a concern of whose agenda is being pushed when private individual rights are being enforced. According to Toulmin (2008), one of the key questions for generating growth and reducing poverty is how provision for land titling and registration can yield benefits for the poor. This raises questions like how land registration systems can improve the land use rights of smallholders. Can they improve the existing local systems and institutions that manage common property resources?

2.7 Land/water use rights and agricultural productivity

Securing land and water use rights needs consideration of the broader bundle of rights which include land and water access rights, transfer rights, withdrawal rights, management rights, exclusion rights, alienation rights, operational rights and decision-making rights (Brasselle *et al.*, 2002; Namara *et al.*, 2010). According to Meinzen-Dick (2014), “use rights of access and withdrawal can provide incentives for investing in and maintaining irrigation systems with management and exclusion rights”. People usually exercise their entitlements by using rules and regulations that come from various rights systems that represent best the interests they have as a community. In many irrigation schemes non-payment water (or electricity) fee and non-productive use of land involves forfeiting of land use rights and has consequences for land tenure security. In most publicly funded irrigation schemes, smallholder farmers enjoy land use rights. Therefore, the handling and misuse of the execution of resource rights, and execution of the conditions going along with those rights reduces agricultural investment for smallholder farmers (Cotula, 2006; Sjaastad & Cousins, 2008; Bainville, 2017). Moreover, Deininger *et al.* (2014) argue that land titling programs legitimize and often promote infringement on community land, including areas of great ecological value, unless detailed precautions are put in place.

According to Machete *et al.* (2004) and Fanadzo *et al.* (2010), smallholder agriculture intensification by improving the management and productivity of land and water in a viable way

is a solution for agricultural growth in developing nations. Increasing agricultural productivity is necessary when land and water are scarce and there is a necessity to gain all the benefits of production inputs (Sharma *et al.*, 2010). Some of the common factors contributing to the failure of smallholder irrigation projects in the rural areas include total dependence on government, unproductive water management, rundown irrigation water infrastructure, lack of motivation, limited understanding of irrigation system, poor extension services, absence of markets and credit, challenge of sourcing production inputs, limited mechanization services, broken fences, and poor soils (Machete *et al.*, 2004; Holden & Ghebru, 2016). According to Migot-Adholla *et al.*, (1991), “As new technologies become available, credit, input and product markets improve, and rural infrastructure is developed, then more significant relationships between tenure security and land productivity begins to emerge”. Thus, the aim of this study is to investigate the challenges and opportunities confronted by smallholders.

Empirical studies by Fenske (2011) and Bellemare (2013) have suggested that formal land rights have no influence on productivity and that informal land rights (i.e., landowners’ subjective perceptions of their rights) have mixed effects on productivity. Following these studies, this research investigates the impact of informal or subjective perceptions of land and water use rights on productive use of water in smallholder farming in the selected study areas. Sitko *et al.* (2014) found that assigning land titles to smallholders’ in Zambia did not lead to any sort of advantageous fluctuations in smallholders’ production levels and investment approaches desirable to grow farming-based poverty alleviation. Therefore, understanding the existing land use rights is necessary as it can guide how best land use rights can be formalized in a way that will improve productivity of smallholder farmers. Migot-Adholla *et al.* (1991) argue that land titling is insufficient to improve accessibility to credit if land as insurance is worthless as in places where land transfer to foreigners via sale is not legal. Furthermore, where there is lack of good non-farm and off-farm prospects, people are not willing to mortgage land. Therefore, it is important to investigate whether similar conclusion can be drawn in the South African context.

According to Namara *et al.* (2010), “understanding and enabling changes on how improvements in water management can reduce rural poverty are the most important policy and research challenges for the coming decades”. Sharma *et al.* (2010) argue that instead of attempting to prescribe solutions to water scarcity, policy choices and associated approaches should be grounded on a set of general main beliefs that are effective throughout various socio-economic

situations and should be founded on the good empirical evidence. Meinzen-Dick (2014) and Hodgson (2016) argue that rights that are on paper only are not secure and customary law provides better tenure security in those situations. The development irrigation projects essentially amend prevailing property rights by passing on rights and by making new rules (Meinzen-Dick, 2014). This study investigates whether or not the customary tenure is secure for most smallholder farmers.

According to Hodgson (2004), the impact of land and water use rights on livelihoods has received little research. To close this knowledge gap, Hodgson (2004) suggest the use of livelihoods approach to identify the extent to which land and water use rights, or their absence, constrain poverty alleviation. This study makes an effort to close this information gap and utilizes the suggested method to determine the influence of land and water use rights. Tenure systems consist of bundle of rights. Hence, if low performance is related to a particular tenure system it is difficult to identify which of the bundle rights is causing poor performance. This is an area that most studies have failed to address as land tenure is often run as dummy variable and water use rights effects are normally not accounted for in the land tenure and farm productivity literature. Disaggregating the customary land tenure and water use rights into components will give an opportunity to explore how certain rights impact production behavior instead of tenure types.

2.8 Land/water use rights and on-farm entrepreneurial spirit

The agricultural potential and smallholder farmers' adaptive behavior in South Africa has given rise to more attention on entrepreneurship in agriculture. Ligthelm (2013) argues that in a formal-to-informal dichotomy, the danger of generalization of small businesses develops when a more knowledge of different and multifaceted range of businesses is required, especially in the rural areas. According to Vesala & Vesala (2010), "agriculture has had a distinct position in society by differing from other branches of business and, thus seeing farmers as equal to other entrepreneurs has not been self-evident". The switch of smallholders to start to function as the entrepreneurial model requires a change of mindset, income sources and their business principles (Vesala & Vesala, 2010). Agriculture is now more considered and valued as a business or strategic sector by government which has the potential to enhance the country's economic development, reduce poverty, and create employment as well as ensuring food security (Seuneke

et al., 2013). Therefore, this study makes an attempt to capture the current sources of income for smallholder farmers, their current state of psychological capital, aspirations and entrepreneurial spirit.

Entrepreneurs engage in actions like noticing buyer requirements, casting an eye over the surroundings, articulating tactics, building and utilizing business networks and starting new things (Lans *et al.*, 2014). Smallholders' probability of being an entrepreneur depends on their access and use of sustainable livelihood assets (Cetindamar *et al.*, 2012). Smallholder farmers' entrepreneurial spirit is formed and mobilized by socio-economic developments and institutional support systems that exist in rural areas, and by individual, location and physical features (Morgan *et al.*, 2010; Hansson *et al.*, 2013; Seuneke *et al.*, 2013). The sustainable livelihood assets refer to financial capital, human capital, social capital, natural capital, physical capital (Cetindamar *et al.*, 2012) and psychological capital (self-efficacy/confidence, hope, optimism and resilience) (Luthans & Youssef, 2004; Luthans *et al.*, 2007). The standard sustainable livelihoods framework does not consider psychological capital but is important to consider when assessing smallholder farmers' entrepreneurial spirit and aspirations. All these assets have been evaluated for smallholder farmers in the selected study areas. Highlighting the level of entrepreneurial spirit of different smallholder farmer typologies offers the most important opportunity in agricultural entrepreneurship field. This, therefore, makes it important to also identify factors that influence the entrepreneurial spirit and aspirations of smallholder farmers.

Understanding smallholders' aspirations and/ motives for adopting certain farming methods continues to be of considerable significance to policy makers as they have to design and put into practice policies that yield positive effects on farmer' behaviors and attitudes. Wilson *et al.* (2013) argue that improved insight on the drivers and behavior of smallholders' leads to policy delivery that is directed to specific farmer groups accomplish better improved results. Therefore, it is essential to capture the drivers of smallholder' aspirations through their willingness and ability to expand their farming operations. The levels of smallholders' aspirations reveal their aptitude to react to improvements in agricultural policy and regulation (Morgan *et al.*, 2010). With government initiatives aiming to commercialize smallholder farmers, no empirical research has been conducted to evaluate the willingness and ability of smallholder farmers to expand their farming operations. This study closes this research gap.

2.9 Summary

This chapter highlighted the need or importance of this study using the research gaps in previous studies. For example, the land tenure literature has excluded the influence of water use rights on agricultural productivity. Little or no research has evaluated the impact that land and water use rights have on entrepreneurial spirit, especially the interaction effects. Moreover, policy makers have little understanding of the smallholder farmers' aspirations and the factors that influence them. A glimpse of land and water reform was provided to give a background and foundation of the study. This chapter explained how land use rights, water use rights, agricultural productivity and entrepreneurial spirit are linked or influence each other. In accordance with the characteristics of the target population, this study focuses on the analysis of access rights instead of property ownership. Based on the literature review, this study explores the role that the land and water use rights have on the productive use of irrigation water and entrepreneurial spirit. It identifies the challenges and opportunities smallholder farmers face. Moreover, it investigates the factors affecting smallholder farmers' willingness and ability to expand farming operations and their impact on their aspirations. The results of this study will better inform future land and water reform policies that are targeted at smallholder farmers in the communal areas. The next chapter presents the research methodology adopted in achieving the objectives of this study.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents descriptions of the study areas located in the rural communal areas of KwaZulu-Natal, namely, Msinga, Nongoma and Jozini. KwaZulu-Natal comprises of 9 districts and the selected irrigation schemes are in 3 districts, namely, uMzinyathi, Zululand and uMkhanyakude. The population of KwaZulu-Natal in the rural areas accounts for 54 % of the total provincial population which makes it a rural dominant province (DARD, 2015). This chapter further offers the research design used in this study. The following section describes the geographic location, biophysical features, demographic structure and economic activities in the study areas. Section 3.3 deals with the justification of the selected study areas. Section 3.4 focuses on the data collection procedures. Section 3.5 outlines the conceptual framework of the study. Section 3.6 deals with the empirical data analysis methods applied in this study.

3.2 Study area description

The figure below illustrates the location of the selected study areas in KwaZulu-Natal.

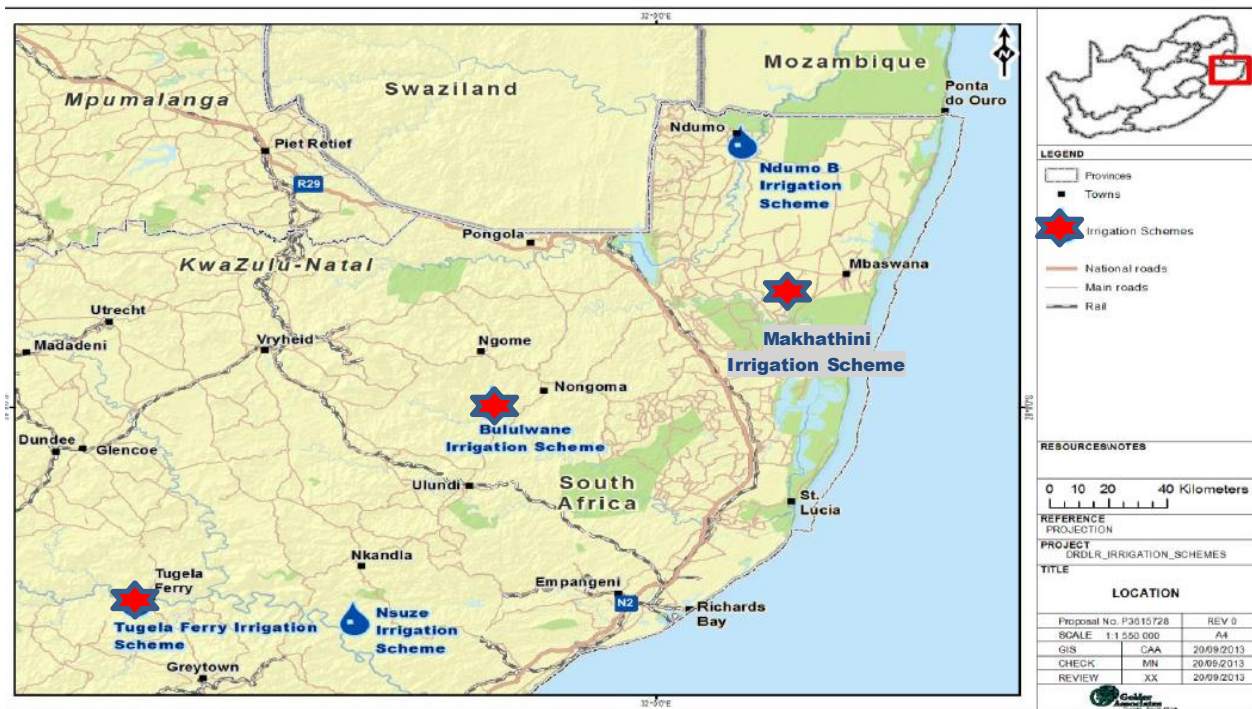


Figure 3.1. Map of study locations

Source: Golder Associates Africa (2015a)

3.2.1 Tugela Ferry Irrigation scheme

Tugela Ferry Irrigation Scheme is situated in Msinga Local Municipality, located within the uMzinyathi District Municipality (MDM). Msinga Local Municipality is part of the most poverty stricken and less developed municipalities in MDM. It has a poor economic base which accounts for the least economic output produced while having the largest inhabitants under MDM. Msinga area is located in the central part of the MDM. Msinga is positioned in a dry to semi-arid zone, with a mean rainfall of 600–700 mm per year (Cousins, 2013). Msinga Local Municipality is located 350 kilometers from Durban and about 400 kilometers from Johannesburg. Msinga has six traditional leaders, namely, Bomvu, Mabaso, Mchunu, Mthembu, Ngome, and Qamu. Land ownership in Msinga is classified into three: state land, traditional authority land (Ingonyama Trust land) and private land (Urban Economists, 2012). Since land is owned by Traditional Council, smallholders do not have formal ownership. The focus of this study is on farmers using the land under the Traditional Council. A key natural asset for Msinga is the Tugela River which provides water for irrigation schemes used for crop farming.

The Tugela Ferry Irrigation Scheme was established in the early 1900 and is situated near the town of Tugela Ferry. The scheme is 726 ha in extent with nine discrete irrigation blocks. Over the last few years, a rehabilitation of bulk scheme infrastructure has been underway. This has involved firstly the installation of buried mainline pipes from the main canal into blocks 1, 2 and 3 and flexible hoses at each plot for controlled flood (furrow) irrigation in these three blocks. The installation of pump stations at blocks 4a, 4b, 5, 6, 7a and 7b has allowed for pumping irrigation water directly from the Tugela River. The nine blocks of the irrigation scheme fall under three traditional authorities and five municipal Wards. This creates a high degree of complexity in terms of governance and dissemination of information from the scheme to the numerous authorities. It is estimated that there are between 1800 and 2000 active farmers involved in the irrigation scheme. Many farmers operate with four plots with an average size of 0.1 ha each which equates to a farm size of 0.4 ha. The mean annual rainfall for the area is between 750 and 850 mm which falls during the summer months mainly between November and March. The main crops grown are a wide range of vegetable crops and field crops such as maize and dry beans (Golder Associates Africa, 2015a).

Farmers who want to be part of this irrigation scheme need to first go to the block committee and then the block committee selects suitable members. The list of selected members is taken by block committee to the traditional authority for approval. Furthermore, farmers that are selected need to be able to pay R200 for joining fee and R50 for renewal every year. Farmers in this scheme do not pay for land and water. However, farmers do pay for electricity (R100 per plot per month) and diesel (R50 per plot per month). Block committees pay for electricity directly to Eskom and monthly payments can range from R18,000 – R35,000 per block, depending on season and crops planted. Members of the scheme make deposits in the post bank since cash collection is no longer safe to do and they have to submit slips to block committee. Members of the scheme have to pay the monthly fee for electricity and diesel even if they are not irrigating so that electricity is not shut down by Eskom. Surplus money is used for emergencies or cost recovery.

Farmers in the scheme are formally not allowed to rent out or borrow land but block committees allow it to happen informally because they want to cover the costs incurred by the scheme. As noted by Cousins (2013), some plot holders lend unused plots to relatives or neighbors so that it seems as if they are using land, thus avoiding reallocation to others, and the borrower of the plot may be required to offer some produce to the holder. Farmers pay about R200 - R250 per 0.1 ha per season to rent land. If a farmer fails to pay for electricity or diesel costs after 2 months, the block committee calls in a meeting to discuss the matter. If the matter is not resolved within a month, the chief is asked to get involved and the farmers' land will be reallocated to another farmer that can pay. However, during the focus group discussions, farmers mentioned that this has never happened so far as block committees are very merciful. This means that if a farmer cannot pay for electricity or diesel, they can lose their land and water use rights in the scheme. Traditional authorities play a big role in the communal rural areas as they provide social security to the farmers. Most farmers in the focus group discussions mentioned that people would be reckless if the land belonged to them and not the traditional authorities. According to the farmers, most traditional authorities are adjusting to the new laws made by government and this can be seen through women who now have land under their names.

3.2.2 Bululwane Irrigation Scheme

Bululwane Irrigation Scheme is situated in Nongoma Local Municipality, located within the Zululand District Municipality. Zululand is one of the poorest districts in South Africa due to its history as a disregarded native land. The high population numbers and livestock concentrations in the freehold settlements highlight the need for additional land, and create possible opportunities for the development of commonage schemes. In addition, tenure upgrade projects could be considered for tenants presently living on portions of the freehold land. A large percentage of the district is communal land (Zululand District Municipality, 2014).

The Bululwane (gravity-fed) Irrigation Scheme draws its water from a dam which draws water on the Bululwane River. The scheme was developed in 1962 and consisted of a main canal of about 3.8 km in length, leading from the weir to storage dams and secondary canals to 11 flood irrigated blocks. The scheme has been rehabilitated to be gravity-fed, sprinkler irrigation system. The irrigable area has been reduced to areas on the scheme with adequate pressure head for sprinkler irrigation. The hydrology of the catchment which feeds the weir dictates that a total of 184 ha can now be irrigated in summer and about 40 ha (part of the 184 ha) in winter during river low-flow periods. Water is stored in two storage dams, one of which was built as part of the rehabilitation process and the other is the original main storage dam. Water is now reticulated from these dams to the irrigation blocks by buried main pipelines. Part of the irrigable area (62 ha) is allocated to the traditional authority for private use and the remaining 122 ha is allocated to 136 farmers with an average plot size of 0.9 ha. The mean annual rainfall for the area is between 750 and 850 mm which falls during the summer months mainly between November and March. The climate is, therefore, well suited to winter production of crops provided irrigation water is available (Golder Associates Africa, 2015b).

For a farmer to be able to join the irrigation scheme they need to be able to pay a joining fee of R200 or R300 depending on the block and an annual renewal fee of R100. The scheme committee has the power to assess and allocate land to a farmer within the scheme and they report to the traditional authority if they have done so. The traditional authorities have no influence inside the irrigation scheme and they only intervene if there are conflicts between the scheme and the surrounding community. For example, when there was a severe drought in the area, local people were using the scheme dams for domestic and livestock purposes, which

caused a conflict between the scheme and the community because the fencing for the dams was destroyed, traditional leaders had to intervene and facilitate the situation. If a farmer fails to abide by the rules of the scheme, the scheme committee has the power to allocate their land to someone else without first consulting with the traditional authority but they have to inform the traditional authority about that decision, in case that person goes to the chief. When someone passes away, land goes back to the scheme committee and family members get first preference to that land if they are interested in farming. Smallholders in this scheme do not pay for water and they do not use electricity or diesel to pump water.

Farmers in this scheme are not allowed to rent out land but borrowing without payment is allowed for a maximum of a year. However, scheme committee needs to be informed about that transaction and it needs to be between members inside the scheme only. If land is not utilized for a year, it gets reallocated to someone else from the community. Women and youth are allowed to own land in the scheme as long as they can utilize it and pay required fees like joining and annual fees. The scheme committee has introduced a 10% tax on profits for its members in order to cover the cost recovery and maintenance fees. However, there have been challenges in implementing it. There are concerns from the scheme committee that this will not be easy to monitor as some farmers can easily lie about their profits. Farmers also face water conflicts in winter since there are low rainfalls.

3.2.3 Makhathini Irrigation Scheme

Makhathini Irrigation Scheme is positioned in Jozini Local Municipality, located within the uMkhanyakude District Municipality. Jozini covers a land area of 3,082 km², is within the uMkhanyakude District in the far North of KwaZulu-Natal Province (UMkhanyakude District Municipality, 2014). The status and role of traditional leaders has been recognized in terms of sections 211 and 212 of Act 108, of 1996 RSA Constitution. In uMkhanyakude District Municipality, the traditional authorities own about 50% of the land (UMkhanyakude District Municipality, 2014). Therefore, the traditional authorities have a strong control in the way in which land is given to individuals for settlement and economic purposes.

The Makhathini Irrigation Scheme, established in 1985, is reported to be irrigating 4,500 ha, though it was designed to irrigate 12,000 ha. The land is under the Ntenga Trust and it is made up of community members who are claimants. The trust, however, still reports to the traditional

authority. The scheme is part of the government's rural development initiatives. The number of beneficiaries in Makhathini is about 300 farmers. However, some farmers lease out land if they fail to cultivate it for whatever reason. Farmers that want to take part in the scheme must be able to pay for a lease of 11 years which is R1,000 per year per ha. Farmers are allowed to lease up to 10 ha of land per person from the trust. The trust has the power to remove and allocate people land but they have to report to the traditional authority about those decisions. The farmers mentioned that there is sometimes conflict of interest between the traditional authority and the trust. For example, the trust wants to be self-sustainable and they want to make decisions independently but the traditional authority will not allow that because they will lose power or control over land and they will not get benefits that accrue to the trust in various forms of business deals. Some of the business deals that would take place include introduction of private investors who would either farm commercially or build a shopping mall which is a common trend in most rural areas and townships.

Farmers who fail to pay for lease lose their land even if they are part of the trust or are claimants. Farmers are allowed to rent out land but not more than they own, for example, if a farmer has 10 ha they can lease up to 5 ha. However, if you are found renting out more land than you own you stand a risk of being land dispossessed. This is done to prevent exploitation of land by outsiders and land abandonment. If you want to rent land from people who are leasing it, the rent is between R2,500 - R3,000 per ha per year excluding water charges. Mjindi Farming (pty) Ltd is established by the DARD to supply water, extension and advisory services, infrastructure services and links to markets in Makhathini. Mjindi Farming has a water right issued by the Department of Water and Sanitation which they use to supply water to the Makhathini farmers. Farmers pay a fixed rate of R3,000 per month per ha for water directly to Mjindi Farming. The Ntenga Trust and Mjindi Farming have a memorandum of understanding that stipulates that if a farmer fails to pay for water, they are at risk of losing land and if they fail to pay for the lease, they are at risk of not getting water. Mjindi Farming is responsible for the maintenance of the irrigation scheme. However, farmers are responsible for fixing damages that happen in their own individual plots. The scheme committee plays almost no role in the scheme as the trust and Mjindi Farming deal directly with the individual farmers. This puts the farmers at the lower end of bargaining power as they are not united and cannot negotiate the pricing terms of land and water.

3.3 Justification for the selection of the schemes

The purposive selection of the three schemes was done using Water Research Commission's (WRC) project requirements of which this study is a part of and based on the diversity of the land and water use rights in those schemes. The WRC project seeks to find ways of using irrigation water productively and also developing entrepreneurial development pathways that will enable homestead gardeners to transition to smallholder irrigation crop farming and to commercial irrigation crop farming.

Selection of the schemes was based on the following criteria:

- The schemes are located in areas that have high rain-fed agricultural activities outside the schemes,
- The schemes have other non-farm and off-farm economic activities,
- The schemes have few social conflicts, proper infrastructure in place,
- The schemes are big enough in terms of their maximum capacity, land size irrigated, type of irrigation system and number of irrigators benefiting from the scheme,
- The type of land and water use rights that exist within the schemes.

The important factor that was used to select the three irrigation schemes is the diversity amongst them and their potential to expand production. These schemes and the surrounding areas are actively involved in farming activities that serve as demonstrative case studies in the move from home gardening to smallholder farming and then to commercial farming. Home gardening appeared to be crucial to food security in the surrounding areas of the schemes.

Before the study took place, four focus group discussions were conducted in different irrigation schemes, namely, Tugela Ferry Irrigation Scheme, Bululwane Irrigation Scheme and Ndumo B Irrigation Scheme. It was found that Tugela Ferry and Ndumo B Irrigation Schemes were similar to each other as farmers in both schemes were not paying for water but they were paying to Eskom for electricity used to pump water. In both schemes the scheme committee decides who gets land and water but they have to report to the traditional authorities. However, Tugela Ferry Irrigation Scheme is more heterogeneous than Ndumo B since there are farmers that pay for diesel not just electricity and they have 3 traditional authorities. Bululwane Irrigation Scheme is different from other irrigation schemes because farmers do not pay for water and they pump

water without electricity or diesel and also the traditional authority is part of the scheme. Makhathini is different from other schemes because land and water are regulated by external stakeholders, namely, Ntenga Trust and Mjindi Farming, respectively.

Finally, Tugela Ferry, Bululwane and Makhathini Irrigation Schemes were selected because of their diversity, types of farming, agricultural land and water use practices, and demographic structures. The selected study areas are also part of government's strategic plan to eradicate poverty in the rural areas of KwaZulu-Natal. The data collected from these study areas is meant to generate knowledge for a better understanding of the impact of land and water use rights on the productive use of irrigation water and on the entrepreneurial spirit of these smallholder farmers. Since the rights that are put in place by different institutions (both formal and informal) have a long-term effect on people's way of thinking, it is also important to evaluate the psychological capital of the smallholders. Since the rural livelihoods are complex and heterogeneous, evaluating three sites will account for diversity that exists in KwaZulu-Natal rural environment.

3.4 Data collection methods

3.4.1 Sampling procedure

Combination of purposive and stratified random sampling methods was applied in this study. The study purposively selected smallholder farmers who were engaged in food crop farming to allow for comparison across different smallholder farmers. A stratified random sampling technique was then used to select the respondents. Households were categorized into four strata: scheme irrigators, non-irrigators, community gardeners and home gardeners. The reason for stratification according to the farm typology was to capture the developmental paths and constraints or challenges of progressing to the next level in each farm typology. From these sub-strata, a simple random selection was done to obtain a sample of 242 smallholder farmers.

The data was collected over a period of two weeks between February and March 2017 at Tugela Ferry and Nongoma, respectively, and one week in April 2017 at Jozini. Four enumerators in each area who were able to speak fluent isiZulu (since most farmers cannot speak English) and English conducted the interviews, including the principal investigator. Only two enumerators had grade 12 only and the other two had degree qualifications in all study areas. The enumerators were trained in data collection methods and the contents of the questionnaire before going for the

survey. It was also important to train the enumerators on the importance of the study and data quality management prior to the start of data collection. This was important because two of the selected study areas, namely, Tugela Ferry and Makhathini, have been extensively researched and there are farmers that would be less likely to participate if they do not know what the study is about. The training involved going through all the questions in the questionnaire, establishing common understanding of the type of data required by each question and asking the enumerators to share how they would ask the questions in isiZulu to ensure that they will be collecting the correct data. Each day was ended by checking questionnaires to ensure that all the information was captured exhaustively and correctly.

The questionnaires were structured according to the information received in the focus group discussions which took place in December 2016 for all study areas. The questionnaires were pre-tested before being administered to all the farmers. A sample of between 5 to 7 farmers were interviewed in different study areas during questionnaire pre-testing phase. Questions that were not clear during questionnaire pre-testing were modified to make them straight forward. Possible responses that were not captured in the closed ended questions were also added to reduce the number of responses getting to 'other'. Questionnaire pre-testing was also used in improving translation of some of the critical questions in the questionnaire to the local language. Pre-testing was also used to improve the reliability and validity of the questionnaire i.e., ensuring that there was consistency in measurement and ensuring that the instrument measured what it was intended to measure. Questions that were ambiguous and culturally sensitive during questionnaire pre-testing were amended following the pre-test. SPSS 24, STATA IC13 and Excel were used to analyze the data.

3.4.2 Data collection instruments

Primary data was collected using key informant interviews, focus group discussions and structured questionnaires. A checklist covering government and traditional leaders roles in farms, farm enterprise objectives, ownership and access to farm/livelihood assets, capital and labor availability, farm sizes, type of irrigation system, choice of crops, specialization and diversification and key constraints, was used to guide the focus group discussions and key informant interviews. The key purpose for the focus group discussions and key informant

interviews was to gather information that could be used to validate the results found from individual farmers. These took place once, before the pre-testing, in all study areas.

In conducting the field visit investigation or the focus group discussions, information was gathered from farmers who were leaders or members of the executive committees in the irrigation schemes and extension officers from the DARD. The extension officers were responsible for organizing the relevant farmers as per study requirement from different blocks in the schemes to ensure inclusivity. Four irrigation schemes were visited initially, namely, Tugela Ferry, Bululwane, Ndumo B and Makhathini Irrigation Schemes. The discussions consisted of about 5-9 farmers per session in all four study areas and 2 extension officers were interviewed per study area. The focus group discussions and key informant interviews helped to gain a better understanding of land and water use rights in the selected study areas. They also helped to shape or guide the research direction on land and water use rights in the communal rural areas. Furthermore, the focus group discussions assisted in identifying the relevant study areas for further research and also aided in designing of the survey questionnaire.

Questionnaires were tested and modified accordingly before being administered. Information on household members' age, gender, relationship to household head, education level and main occupation of household members was collected using the questionnaire. The questionnaire also included measures of household wealth such as household assets, livestock, agricultural production activities and sources of household income. Furthermore, the questionnaire included capital assets (natural, physical, financial, social, human and psychological), land and irrigation water issues, farming constraints, farmers' attitudes and farmers' entrepreneurial characteristics. The same questionnaire was used for both irrigators and non-irrigators, but with extra sections to cover specific questions related to the irrigation activities. This was done to ensure that the information collected is consistent across all farm typologies for comparison purposes.

3.5 Conceptual framework

Figure 3.2 demonstrates the central role of land and water use rights in improving resource allocation decisions and thereby enhancing productive use of irrigation water in the smallholder irrigation schemes. Securing land and water use rights enhances resource allocation decisions, promotes the land rental markets and incentivizes the formulation of collective action institutions such as water user associations or scheme committees. According to Binswanger-Mkhize *et al.*

(2010), the exact mixture of state, customary and individual rights depends on the historic legacy faced, shortage level, existing economic developments, available technologies and stakeholder capabilities. In this study the focus is to unpack the combination of state, customary and collective action laws/rules that are enforced in schemes. Secure land rights that are simple to transfer are essential for improving investment levels and gaining credit, and enabling economic development (Deininger & Jin, 2006; Fenske, 2011). According to Brasselle *et al.* (2002), “there are two main dimensions along which land tenure security can be assessed, namely, the range of the rights held, distinguishing between rights of use and rights of transfer, and the extent of autonomy afforded by the landholder in exercising these rights, especially transfer rights”.

WUAs play a main role of managing and assisting the water use rights between farmers and the state (Hodgson, 2004). In South Africa, WUAs are not functioning well or often non-existent in the communal rural areas (Meinzen-Dick, 2014; Hodgson, 2016). Farmers’ bad experience with the cooperatives is part of the explanation (Cotula, 2006). However, irrigation schemes have individuals who have been appointed to deal with water related issues within the scheme committees. Even though WUAs as a body or formation were not evident in the schemes, the scheme committees adopted some rules or principles that WUAs have. For example, smallholders elect representatives in the scheme committees, scheme committees function and take decisions autonomously without influence from government (only provide technical and infrastructure support), and scheme committees are responsible for collecting water fees from members based on land size irrigated.

Customary tenure still applies in most rural areas yet the NWA never refers to customary water tenure (Malzbender *et al.*, 2005; Hodgson, 2016). For water use to be productive, land access has to be complemented by land and water use security, and by practical skills/knowledge on farming (Backeberg & Sanewe, 2010). When tenure security is high as a consequence of secure land use rights, smallholders are more likely to increase their willingness to invest (Hodgson, 2016). This will then increase their investment on inputs which will, in turn, be influenced by accessibility of finance and markets (Machethe *et al.*, 2004). Ultimately, farmers will have more incentive to increase their productive use of irrigation water and maximize profits. According to Molden *et al.* (2010), elements that impact the endorsement of activities that improve productive use of irrigation water consist of risks, markets, profitability, education level, motivations and institutional arrangements.

Developing the entrepreneurial spirit goes beyond just simply developing entrepreneurial skills of farmers. In addition to improving their abilities, smallholders have to renew their entrepreneurial characters, break the limitations in agriculture and adapt to shifting surroundings (Knudson *et al.*, 2004; Morgan *et al.*, 2010; Seuneke *et al.*, 2013). In economic concepts of entrepreneurship three characteristics are essential (McElwee & Bosworth, 2010). The first one is risk-taking. The assumption is that an entrepreneur takes calculated economic risks and maximizes profits. The second measurement is growth positioning i.e. increasing profits by expansion of business undertakings. The last characteristic is innovativeness i.e. searching, developing and trying new products, markets and methods. Therefore, aspirations or willingness and ability to expand farming operations can be an indication of having an entrepreneurial spirit.

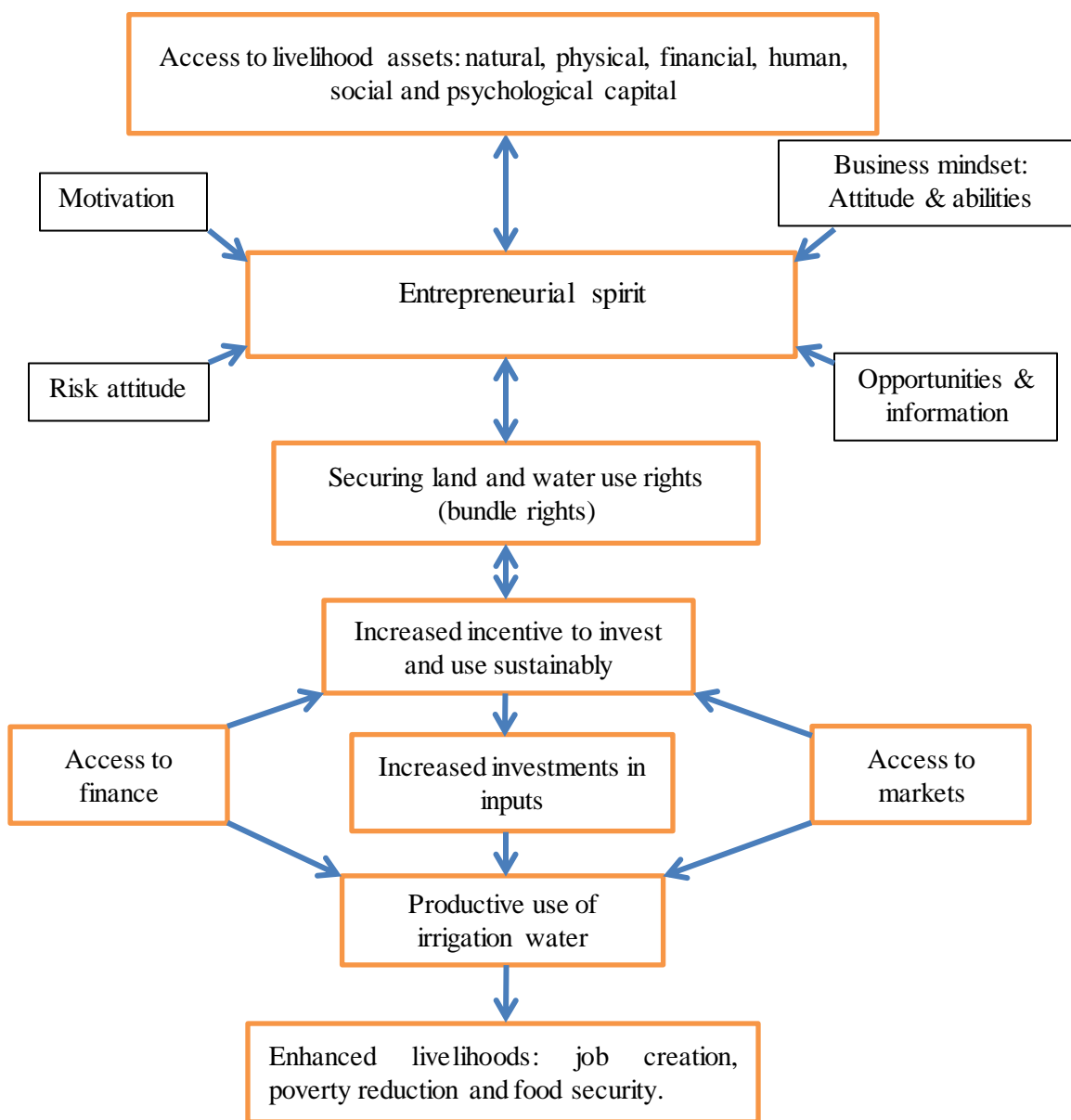


Figure 3.2. The link between land and water use rights, entrepreneurial spirit, productive use of irrigation water and livelihood assets

Source: Adapted from Place (2009); Backeberg (1997); Luthans *et al.* (2006)

Putting into practice new land and water use right policies affects the livelihood of farmers more as critical resources like land and water become scarce (Hodgson, 2004). New policies or improvements of old ones change how the smallholder farmers interact with their sustainable livelihood assets (Cotula, 2006; Namara *et al.*, 2010). As resources become scarce, competition

for them increases and smallholder farmers with an entrepreneurial spirit thrive. Farmers that have access to livelihood assets are usually the ones that are more likely to thrive (Seuneke *et al.*, 2013) because they are motivated, optimistic, self-confident, hopeful and resilient. As highlighted in the previous sections, understanding the implications of land and water use rights is critical as the two resources are scarce. Productive use of irrigation water implies improved food and nutrition for smallholder households, added income and job opportunities (Sharma *et al.*, 2010). Therefore, the significance of taking into account the water, food and energy nexus is critical for the development of smallholder farmers.

3.6 Empirical methods of data analysis

Different econometric models were used to achieve the specific empirical objectives of this study. Table 3.1 gives the specific objectives and the corresponding analytical methods that were used. Descriptive statistics were used to supplement these results and show capital endowment of different smallholder farmers in the rural areas of KwaZulu-Natal. According to Birner & Resnick (2010), a promising research strategy is one that combines qualitative case studies with quantitative modeling in such a way that each informs the other. Case studies can help to discover how policy change actually occurs and to identify the factors that influence processes of change. The emphasis in the fieldwork was mainly on the smallholder farmer's perspective, by studying how they explain their own preferences, decisions, challenges and opportunities. Equally important is analyzing what factors are involved in influencing those processes according to their explanations. An important note to make in analyzing the data is that certain aspects of the variables like land and water use rights, psychological capital and entrepreneurial spirit are perception and behavior based. Therefore, to capture richness of the smallholders' experiences one needs to account for that. This approach is justified by the fact that the farmer is the key actor in the process of smallholder development and so the farmer's viewpoint is crucial in this study (Morgan *et al.*, 2010).

Table 3.1. Specific objectives and the corresponding data analysis methods

Specific Objective	Data analysis method
Challenges and opportunities faced by smallholder farmers	Descriptive statistics (t- test and chi squared-test)
Extent to which land and water use rights enable/deter the productive use of irrigation water	Gross Margin Analysis; Principal Component Analysis (PCA); Univariate General Linear Model (UGLM)
Influence of land and water use rights on smallholder farmers' entrepreneurial spirit	PCA; Multivariate GLM (MGLM)
Factors affecting the willingness and ability to expand farming operations	Ordered Probit Regression and Heckman selection model

3.6.1 Descriptive statistics

The descriptive analysis was performed using averages and mean difference tests, T-test, Chi-square (χ^2) test, percentages to compare socio-economic characteristics of smallholder farmers' typologies. The descriptive analysis involved looking at means, frequencies and standard deviations of the variables. The t-test was used to make comparisons between irrigators, community gardeners, non-irrigators and home gardeners, with respect to relevant continuous variables, and the χ^2 -test was used to test the degree of association between the relevant categorical variables. Some of these variables were then later used as explanatory variables.

3.6.2 Gross Margin Analysis

Agricultural productivity can be well-defined either as total output of a single product per unit of a single input or in terms of an index of multiple outputs relative to an index of multiple inputs. In this study we measure productivity as the value of total agricultural output per ha. According to Dharmasiri (2010), the benefit of the production function estimated in this study is that it allows quantifying the marginal contribution of each input to aggregate production as the response variable is in Rand terms per unit area. The use of production functions to determine farm productivity is limiting because it doesn't consider discrepancies in input and output prices across farms. An analysis of farm gross margins deals with this limitation by including the effect of price of agricultural inputs and outputs. The gross margin was calculated to evaluate economic performance of major crops grown in the selected smallholder farms. Variable costs include

those associated with variable inputs like seeds, fertilizer and pesticides etc. Gross margin does not include overhead (fixed) costs such as the cost of fixed assets.

Gross margin was computed as:

$$GM = \sum_{i=1}^n P_i Y_i - \sum_{k=1}^k P_{ij} X_{ij} \quad (1)$$

Where:

GM = Gross margin per ha,

P_i = price of the i^{th} crop,

Y_i = quantity of the i^{th} crop,

P_{ij} = price of the j^{th} input used in the i^{th} crop, and

X_{ij} = quantity of the j^{th} input in the i^{th} crop.

The gross margin for each irrigated crop (for each year) was calculated as gross income (price multiplied by yield) minus the variable costs of production. Estimation of gross margins (above variable costs) is an accepted method of evaluating the performance of farm enterprises (Van Averbeke & Mohamed, 2006). This method accounts for costs that vary directly with the type and level of production. While overhead (fixed) costs are important for an individual business operator, they are generally excluded from farm enterprise analysis for two reasons. First, they are difficult to allocate among various crops and enterprises on the farm. Second and more importantly, the level of costs of some inputs (especially land) is directly affected by the profitability of the enterprise.

Economic productivity was used in this study instead physical productivity since productive use of irrigation water is based on the amount of quantity produced and sold. Economic productivity enables the researcher to compare returns from different crops planted by smallholder farmers. Households utilize their land by planting various crops at the same time. To compare the productivity of such households, it is better to use economic productivity. Economic productivity was also suitable for this study since the smallholders were more likely to remember the revenue they received from their produce than the quantity they sold. As noted by Grove (2011), optimizing water use based on economic principles implies taking into consideration all the relevant costs and revenues and the opportunity cost of water (scarcity value) while allowing the

crop to sustain some level of water stress, resulting in yield reductions due to deficit irrigation. Scientific irrigation scheduling is done to minimize water applications with the aim of achieving maximum yield but no explicit consideration is given to costs, revenues and the opportunity cost of water.

3.6.3 Principal Component Analysis

Principal Component Analysis (PCA) was used to generate the entrepreneurial spirit indices (Knudson *et al.*, 2004; McElwee & Bosworth, 2010; Sinyolo *et al.*, 2017) which were used as the dependent variables in the second objective (Chapter 5). The PCA was also used to generate the water security indices (Sinyolo *et al.*, 2014) as a proxy for water use rights, land tenure security indices (Brasselle *et al.*, 2002) as a proxy for land use rights and psychological capital indices (Luthans & Youssef, 2004; Luthans *et al.*, 2006; Luthans *et al.*, 2007). By applying the Kaiser criterion, principal components with eigenvalues greater than 1 were retained and were used as independent variables in the UGLM to determine the factors that affect the productive use of irrigation water by smallholder farmers. The principal components, from the entrepreneurial spirit indices with eigenvalues greater than 1 were retained and were used as dependent variables in the MGLM.

The general purpose of this factor analytic technique is to find a way of condensing the information contained in a number of original variables into a smaller set of new composite factors with minimum loss of information. Each principal component is a linear combination of the original variables, with coefficients equal to the eigenvectors of the correlation or covariance matrices. Once the regression coefficients for the reduced set of orthogonal variables are calculated, they are mathematically transformed into a new set of coefficients that correspond to the original or initial correlated set of variables. The implicit form for computing the first principal component (Jolliffe, 2002):

$$PC_n = f(a_{n1}X_1, \dots, a_{nk}X_k) \quad (2)$$

This simply means that, where there are a number of principal components, say n , which represent any number greater than 1, each principal component will be a continuous variable or quantity related to the products of the values of the constituent variables and their respective weightings or component loading (a). The relationship is an additive one and it is conventional to

add up the products to obtain a value for the principal component. This is given by the following expression, for the first PC:

$$PC_1 = a_{11}X_1 + a_{12}X_2 + \dots + a_{1k}X_k \quad (3)$$

Where:

PC_1 is the first principal component,

a_{1k} is the regression coefficient for the k^{th} variable, that is the eigenvector of the covariance matrix between the variables, and X_k is the value of the k^{th} variable.

The indication from equation (3) above is that a linear additive model is required to derive the principal components. Thus, if there are n principal components, then a series of n equations can be written, each of them representing the linear combinations of component loadings and variable values and can be shown as equation (4) below:

$$PC_1 = a_{11}X_1 + a_{12}X_2 + \dots + a_{1k}X_k$$

$$PC_2 = a_{21}X_1 + a_{22}X_2 + \dots + a_{2k}X_k$$

$$\begin{matrix} \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \end{matrix}$$

(4)

$$PC_n = a_{n1}X_1 + a_{n2}X_2 + \dots + a_{nk}X_k$$

Where:

$$n = 1 \dots 4;$$

$$k = 1 \dots 11;$$

$a_{i1} \dots a_{ik}$ = the component loadings; and

$X_1 \dots X_k$ = component variables

The coefficients $a_{i1}, a_{i2}, \dots, a_{ik}$ are chosen such that the first PC (PC_1) will have a large variance as possible, the second PC (PC_2) is chosen to be uncorrelated with the first, and to have as large variance as possible, etc. The rationale for choosing this particular value is that a factor must have variance at least as large as that of a single standardized original variable. The Bartlett's

sphericity test was applied to check if the observed correlation matrix diverges significantly from the identity matrix. Moreover, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was also applied, a value greater than 0.5 indicating PCA could be applied. To interpret the meaning of the components, the factor rotation and interpretation was used. This does not change the outcome but it presents a pattern of loadings that can be easier to interpret by grouping them together. The loadings or correlation coefficients were ordered by size and those below 0.40 were not included in the table for simplification purposes.

3.6.4 General Linear Model

All models are special cases of the general linear model (GLM), including ordinary least squares regression for continuous dependent variables and models for categorical dependent variables (binary logit, multinomial, ordered probit *etc.*). One reason for calling the general linear model “general” is that it can handle an X that is not numerical as well as one that is numerical. GLMs have three components (Hair *et al.*, 2010): the random component, the systematic (or linear) component, and the link. The random component, or dependent variable, assumes a probability distribution; the systematic component specifies explanatory variables used as predictors; and the link describes the functional relationship between the systematic component and the expected value of the random component.

The mean of the dependent variable can be modeled directly or through a monotonic function (function between ordered sets that preserves or reverses the given order) of the mean, and the GLM relates this function of the mean to the explanatory variables through a linear prediction equation. In ordinary regression with continuous response variable, the link function is simply the mean, but other links permit the mean to be nonlinearly related to the predictors. The GLM allows a random component to have a probability distribution other than the normal and a function other than the mean, which is useful for modeling categorical response data. The study utilizes the GLM approach for a number of reasons (Hair *et al.*, 2010). The assumptions about missing data for GLMs are more liberal than those that analyze only the complete cases. The GLMs have a very flexible structure for covariates (quantitative variables), allowing different values over the course of time.

Regression models containing a mixture of quantitative and qualitative variables are called analysis of covariance (ANCOVA) models. An ANCOVA is a GLM with at least one qualitative

and at least one quantitative predictor. Hence, ANCOVA is synonymous with GLM. ANCOVA models are an extension of the ANOVA models in that they provide a method of statistically controlling the effects of quantitative independent variables, called covariates or control variables, in a model that includes both quantitative and dummy, independent variables. ANCOVA models can correct biases due to pre-existing differences between groups and can mostly increase the accuracy of estimation and the statistical power by reducing the error variance, assuming that a linear relationship exists between the covariate and the dependent variable. ANCOVA carries with it the normal assumptions of any ANOVA test, including normal distribution of data and homogeneity of variances. However, ANCOVA also carries a couple of more requirements that are special to the covariate situation.

The general equation for GLM is (Hair *et al.*, 2010):

$$\hat{Y} = \beta + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k \quad (5)$$

The β s in a GLM are coefficients or weights assigned to the predictor variables, i.e. the X 's on the right hand side of the prediction equation. The β_k is a “weight” that determines how much the X_k variable contributes to prediction (\hat{Y}). This scale property of β leads to one of the most important cautions in interpreting the results from a GLM: the β s across variables cannot be compared when determining the importance of the variables in prediction. Technically, a GLM applied to non-experimental observations does not permit inferences about causality. Thus, general linear models are for means and not for individual values. In addition to the Univariate GLM which is a standard GLM, the classical Multivariate GLM is a useful tool for simultaneous inference on many potentially dependent interval-scaled response variables (Zeng *et al.*, 2011). This model subsumes the Univariate and Multivariate Analysis of Variance (ANOVA and MANOVA), analysis of covariance (ANCOVA and MANCOVA), and regression. The flexibility of the GLM makes it suitable for this study.

A similarly useful statistical tool is the *effect size*, which measures the strength of a treatment response or relationship between variables. By quantifying the magnitude of the difference between groups or the relationships among variables, effect size provides a scale-free measure that reflects the practical meaningfulness of the difference or the relationship among variables. It is important to note that effect size and statistical significance testing are complementary analyses, and both should be considered when evaluating quantitative research findings (Maher

et al., 2013). Statistical power is primarily determined by the size of the effect and the size of the sample: as either or both increase, the significance test is said to have greater statistical power to reject the null hypothesis. Thus, metrics of effect size and statistical significance provide complementary information: the effect size indicates the magnitude of the observed effect or relationship between variables, whereas the significance test indicates the likelihood that the effect or relationship is due to chance. Therefore, interpretations derived from statistical significance testing alone have the potential to be flawed, and inclusion of effect size reporting is essential to inform researchers about whether their findings are practically meaningful or important.

$$\text{Partial eta-squared } \eta^2_p = \frac{SS_{\text{between}}}{SS_{\text{between}} + SS_{\text{error}}} \quad (6)$$

Where SS = sum of squares

3.6.5 Ordered Probit Model

Ordered probit (oprobit) regression was applied to assess the determinants of smallholders' willingness and ability to expand farming operations. Smallholders were either willing or not willing to expand farming operations and those that were willing to expand could either be able or not able to expand. Since the outcome or the dependent variable was an ordered binary outcome, oprobit was found to be the right model to use to analyze the data. Oprobit regression analysis readily accepts mixtures of nominal, ordinal, interval, and ratio scaled independent variables. The willingness and ability to expand is an ordered dependent variable and categorically measured as:

Category 0 = Not willing to expand

Category 1 = Willing but not able to expand

Category 2 = Willing and able to expand

The willingness and ability to expand depends on certain measurable factors (X_i) and certain unobservable factors (ε_i). The oprobit model for Y (conditional on explanatory variables X_i) can be derived from a latent variable model as follows:

$$Y_i^* = w_i + \beta X_i' + \varepsilon_i, \text{ where } i = 1, \dots, N \quad (7)$$

Y^* is unobserved, but what are observed are threshold values of Y , which in the present case would be:

$$Y = 0 \quad \text{if } Y^* \leq 0$$

$$Y = 1 \quad \text{if } 0 < Y^* \leq 1$$

$$Y = 2 \quad \text{if } 1 < Y^* \leq 2$$

The vector of independent parameter estimates is embedded in the coefficient vector β , consisting of demographic, institutional and socio-economic factors. The w represents a specific term and ε is a white-noise residual. The model adjusts better to a probability curve by using a normal distribution function to estimate the probability of a certain ranking. The underlying assumption is that there are 3 categories ordered from the lowest to the highest. The implied probabilities are obtained as (Verbeek, 2004):

$$\begin{aligned} P\{Y_i = 1|X_i\} &= P\{Y_i^* \leq 0|X_i\} = \Phi(-X_i'\beta) \\ P\{Y_i = 3|X_i\} &= P\{Y_i^* > Y|X_i\} = 1 - \Phi(Y - X_i'\beta) \\ P\{Y_i = 2|X_i\} &= \Phi(Y - X_i'\beta) - \Phi(-X_i'\beta) \end{aligned} \quad (8)$$

Where Y is an unknown parameter that is estimated jointly with β . Estimation is based upon maximum likelihood, where the above probabilities enter the likelihood function. The interpretation of the β coefficients is in terms of the underlying latent variable model (for example, a positive β means that the corresponding variable increases willingness and ability to expand), or in terms of the effects on the respective probabilities, as we have seen above for the binary choice model. Suppose in the above model that the k^{th} coefficient, β_k , is positive. This means that the latent variable Y_i^* increases if X_{ik} increases. Accordingly, the probability that $Y_i = 3$ will increase, while the probability that $Y_i = 1$ will decrease. The effect on the intermediate categories, however, is ambiguous; the probability that $Y_i = 2$ may increase or decrease.

The major underlying assumption of the oprobit model that sets it apart from the ordered logit model is that the unobserved error term follows a normal distribution. Using a graphical method (figure 3.3) to assess residual normality, it can be concluded that the errors have a normal distribution and the oprobit assumption is not violated. According to Glewwe (1997), the

assessment of the appropriate residual plots is sufficient to diagnose deviations from normality. Hence, the use of the oprobit model is validated.

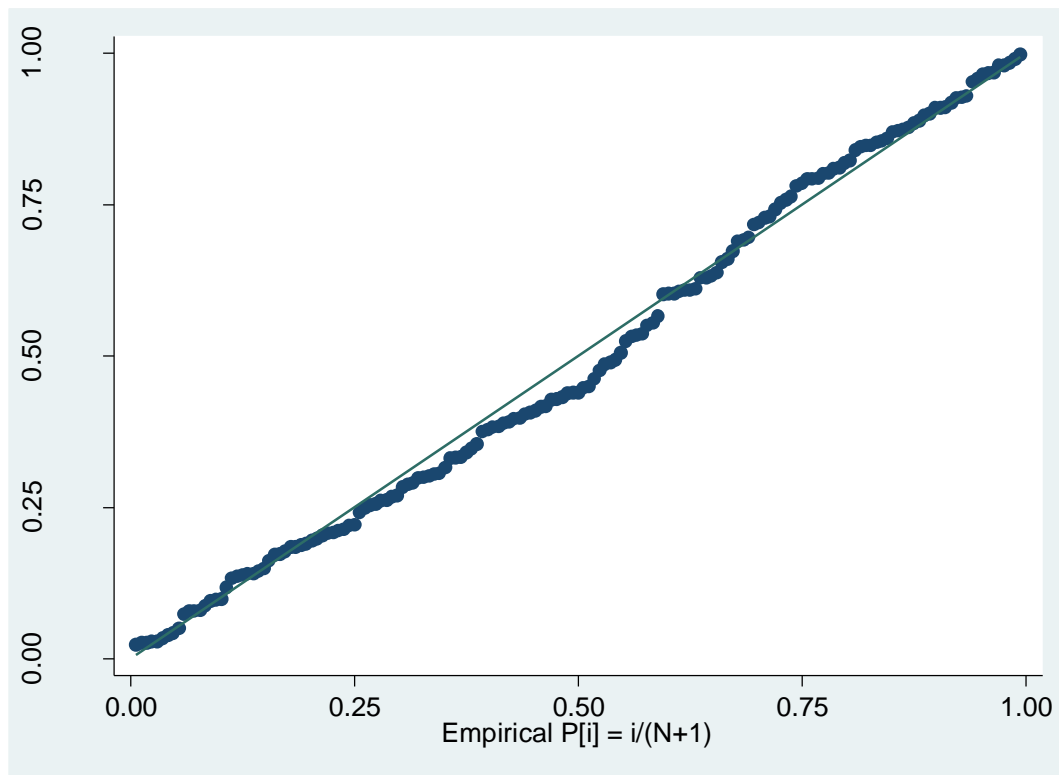


Figure 3.3. Normal distribution of the error term

Source: Survey data (March/April 2017)

However, the problem with oprobit is that it assumes that the willingness and ability are explained by the same set of variables, which is not the case. To remedy this shortfall, the Heckman selection model is also used for comparison purposes as it assumes that the decisions to be willing and able are determined by separate processes (two-step process in this case) (Chiburis & Lokshin, 2007). According to Puhani (2000), the most important difference for the performance of the alternative estimators arises from the existence of exclusion restrictions, i.e. whether there are some variables in the selection equation which are not contained in the outcome equation. The Heckman selection model is used over the double-hurdle model because it assumes that all the zeros are the respondents' deliberate choices.

3.7 Summary

The study was conducted in three areas, namely, Msinga, Nongoma and Jozini. This chapter has provided background information about these areas and gave supporting reasons for their selection. The data was collected from 242 smallholder farmers using a combination of purposive and stratified random sampling methods. The study employed structured questionnaires, focus group discussions and key informant interviews to gather the data. The questions used to collect data were guided by the conceptual framework that was designed for this study to ensure that all the information needed was covered. To analyze the data, descriptive statistics, gross margin analysis, PCA, UGLM, MGLM and oprobit regression models were used. The next two chapters will present the empirical results and discussions for this study.

CHAPTER 4 WATER/LAND USE RIGHTS AND PRODUCTIVE USE OF IRRIGATION

WATER: RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter addresses the second objective of the study which is to determine the extent to which land and water use rights enable/deter the productive use of irrigation water for smallholder farmers. To do that, this chapter first presents the descriptive statistics concerning the capital endowment for different typologies of smallholder farmers surveyed in the selected study areas. These statistics give a background or an overview of the type of smallholder farmers that were part of the study starting from their demographic and socio-economic characteristics to their household livelihood influencers and their land and water use rights. Moreover, a gross margin analysis for smallholder farmers is presented. After the background statistics, this chapter provides an empirical analysis of the impact of land and water use rights on the gross margin per hectare which is a proxy for productive use of irrigation water. The results are analyzed and discussed in comparison to the findings from the previous literature.

4.2 Descriptive analysis: results and discussions

4.2.1 Typologies of smallholder farmers in the study

Four different types of smallholder farmers were surveyed from Jozini, Nongoma and Msinga area. From the total sample of 242 farmers, 68.9% of them were scheme irrigators, 10.7% were home gardeners, 11.1% were community gardeners and 9.4% were non-irrigators or dry land farmers as illustrated in Table 4.1 below. During the time of the survey, there were no independent irrigators that could be identified in the study areas. The scheme irrigators consisted of 73 smallholder farmers from Tugela Ferry, 58 from Makhathini and 35 from Bululwane. In this study, the terms smallholder, farmer and smallholder farmer are used interchangeably.

Table 4.1. Typologies of farmers in Jozini, Nongoma and Msinga

Types of smallholder farmers	Frequency	Percent
Scheme irrigators	166	68.9
Home gardeners	26	10.7
Community gardeners	27	11.1
Non irrigators	23	9.4
Total	242	100.0

Source: Survey data (March/April 2017)

Scheme irrigators have, on average, 0.671 ha of land and total land owned ranges from 0.1 ha to 5 ha. During the focus group discussions in Tugela Ferry, farmers mentioned that it is common that an individual farmer would hold more than 2 plots (0.1 ha each), especially if they have been in the scheme for a very long time or if they had some position in the scheme. A similar observation was made from other irrigation schemes like Bululwane and Makhathini. However, in these two schemes, it was not as common as in Tugela Ferry since they hold bigger land holdings compared to those in Tugela Ferry. For example, in Bululwane, each farmer in the scheme has one plot which is approximately 1 ha. Home gardeners have the smallest land, on average 0.014 ha, compared to other smallholder farmer typologies.

The average size of land had a statistically significant difference ($p = 0.001$) on smallholder farmer typology at 1% significance level. Access to land for smallholder farmers in this study is through permission to occupy land allocated by the traditional authority. Land titles were not used. According to Jayne (2014), once land has been transformed out of customary tenure local people are not able to access it. This was found to be the case in Tugela Ferry where there was a portion of the scheme that was allocated to people not from the local community to operate it as a medium or large-scale farm. However, that scheme is currently not working because of some institutional issues and poor infrastructure. Yet, most farmers have small plots and others cannot access the irrigation schemes because land is limited.

Table 4.2. Average size of land for smallholder farmers' typologies

Smallholder farmers	Average size of land operated (ha)	Standard Deviation	Minimum	Maximum
Scheme irrigators	0.671	0.884	0.100	5.0
Home gardeners	0.014	0.018	0.001	.10
Community gardeners	0.318	0.697	0.005	3.0
Non irrigators	0.690	0.864	0.001	3.0
Total	0.564	0.839	0.001	5.0

Source: Survey data (March/April 2017)

4.2.2 Household demographics and socio-economic characteristics

This section provides description of small scale farmers and their variation. The average age across all types of smallholder farmers was 55 years. Moreover, scheme irrigators in Tugela

Ferry Irrigation Scheme were the oldest at 58 years on average compared to the other irrigation schemes which have farmers with the average age of 51. There is no statistical age difference across types of smallholder farmers and the irrigation schemes. This was expected as there were very few young people that were spotted in the irrigation schemes during the survey and the farmer group discussions. Most of the farmers were not as active as they would like to be because of their age. Some of them are unable to work long hours because they have some illnesses and do not have enough energy. Therefore, there is strong need for young people to be involved not only in irrigation schemes but in the whole agriculture value chain.

According to the focus group discussions held in Nongoma and Tugela Ferry, it was mentioned that it is difficult for young people to gain access to irrigable land because of its scarcity. Those that do have access receive it through their parents or inherit it from their parents. The majority of the farmers further mentioned that their children are not interested in farming because they do not see opportunities in it and they do not see smallholder farming contributing meaningfully to their family livelihoods. This is consistent with the findings by Mkhabela (2005) and Fischer & Qaim (2012) who found that the young people were not much attracted to farming and were looking for work not related to farming. That concerned the farmers involved in the discussions because they are not sure who is going to take over their land from their families once they are unable to work due to old age.

The majority of the farmers in the study areas were females and they constitute 77.9% of the sampled population. There was a statistically significant gender difference across farmer typologies and irrigation schemes at 5% significance level. It is possible that permanent or temporary migration of household members to the urban areas has resulted in a large number of female-headed households (Ruben & Pender, 2004). During the farmer group discussions in Tugela Ferry, it was mentioned that most men still see farming as a women's job. This is further demonstrated by the male participation in Tugela Ferry which is the lowest (14.7%) compared to other irrigation schemes where male participation is 37.1% and 27.6% in Bululwane and Makhathini, respectively. In Tugela Ferry, there were female farmers inside the irrigation scheme that mentioned that their husbands only come to the gardens when the produce is ready to be harvested. Women dominate in all smallholder typologies and men only assist women when the need arises (i.e. when preparing the land, weeding and harvesting). Similar to the

findings by Fischer & Qaim (2012), there was no gender bias in group/scheme membership in the study areas.

Household size was statistically significant only amongst the scheme irrigators at 10% significance level. Across the irrigation schemes, there is a notable difference in household size i.e. farmers in Makhathini have a smaller household size of 3.36 compared to farmers in Tugela Ferry and Bululwane with an average household size of 5.28 and 6.61, respectively. The dependency ratio is very high amongst the home gardeners and non-irrigators, 77.1% and 61.6%, respectively, and lowest amongst the community gardeners and scheme irrigators, 43.02% and 43.38%, respectively. The dependency ratio in this study has to be taken cautiously as most of the people in the rural areas between the ages of 15 to 64 are usually unemployed and families depend on the social grants and not the incomes of the “working group”.

Most smallholder farmers (77.3%) consider themselves as fulltime farmers. About 53.8% of home gardeners consider themselves as unemployed. There is a very small portion of farmers that are self-employed (2.9%) in the selected population. In Bululwane and Tugela Ferry there are farmers who do other jobs besides farming to sustain their livelihoods. Occupation status is significantly different across type of smallholder farmers and the irrigation schemes at 1% significance level. This, therefore, indicates the need to promote off-farm job opportunities for rural people and encourage those who have taken the initiative to diversify their income sources by starting small businesses.

Table 4.3 shows the poverty level of formal education of smallholder farmers. Kisaka-Lwayo & Obi (2012) also found that farming in rural KwaZulu-Natal is generally done by older female smallholders with low literacy levels. Most home gardeners and non-irrigators ended their schooling in grade 5 while the scheme irrigators and the community gardeners ended their schooling in grade 4 on average. However, across the irrigation schemes the farmers who attained the highest level of education (grade 6) are located in Makhathini and the farmers who attained the lowest level of education (grade 2) are located in Tugela Ferry.

Table 4.3. Household demographic and smallholder socio-economic characteristics

Household characters		Scheme irrigators (n=168)	Home gardeners (n=26)	Community gardeners (n=27)	Non-irrigators (n=23)	Total (n=244)	T test	Bululwane (n=35)	Tugela Ferry (n=73)	Makhathini (n=58)	Out of scheme (n=76)	T test
Size of household		4.88	5.31	5.59	5.39	5.05	1.58	6.51	5.28	3.36	5.43	1.78*
Age of farmer		54	55	57	54	55	0.63	51	58	51	55	0.67
Level of education of farmer		4	5	4	5	4	0.45	5	2	6	5	1.78
Dependency ratio (%)		43.38	77.1	43.02	61.6	48.65	0.32	69.67	53.08	14.98	60.3	1.71*
							χ-value					χ-value
Gender of farmer (%)	Male	23.8	7.7	11.1	39.1	22.1	9.18**	37.1	14.7	27.6	18.4	8.61**
	Female	76.2	92.3	88.9	60.9	77.9		62.9	85.3	72.4	81.6	
Main occupation (%)	Fulltime farmer	88.0	23.1	74.1	65.2	77.3	67.38***	71.4	89	96.6	53.9	60.57**
	Regular salaried job	1.2	7.7	0	0	1.7		0	2.7	0	2.6	
	Temporary job	1.8	3.8	0	0	1.7		0	4.1	0	1.3	
	Self-employed	1.2	11.5	3.7	4.3	2.9		2.9	1.4	0	6.6	
	Student	1.2	0	0	0	0.8		2.9	1.4	0	0	
	Unemployed	6.6	53.8	22.2	30.4	15.7		22.9	1.4	3.4	35.5	

Note: *, **, *** indicate significance level at 10%, 5% and 1%, respectively.

Source: Survey data (March/April 2017)

Figure 4.1 below demonstrates the proportion of farmers who never went to school, those that dropped out and those that completed grade 12. The majority (55.7%) of the farmers dropped out of school before they reached grade 12. While 36.1% of the farmers never even went to school. Only 8.2% of the farmers finished high school but none of them went to higher education institutions to further their studies. Some of the reasons that were mentioned by farmers for not attending school or dropping out were poverty, political conditions that existed before 1994 and traditional or customary beliefs against schooling of women that existed in the past. According to Jayne *et al.* (2010), education contributes to enabling the acceptance of new technology and broader public liberation by allowing people to articulate their demands and holding political leaders to account.

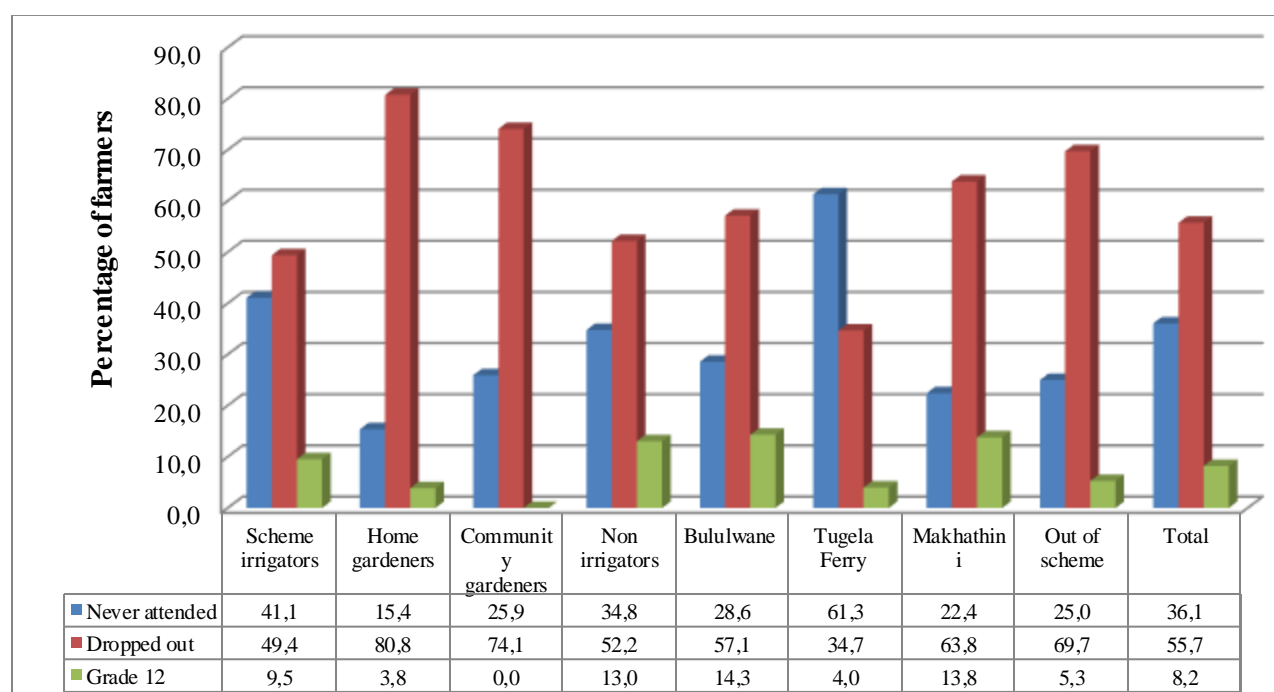


Figure 4.1. Proportion of smallholder farmers' level of formal schooling (%)

Source: Survey data (March/April 2017)

4.2.3 Household livelihood influencers

4.2.3.1 Sources of income

In the selected study areas and the selected population, almost all the households receive social grants from government. A large number of non-irrigators and community gardeners receive social grants compared to scheme irrigators and home gardeners. On average, 87% of the

sampled households receive one or more types of social grants. These social grants serve as an important source of income for most smallholder farmers in times of drought and meager job opportunities (Hendriks, 2013). In some parts of Nongoma and Msinga, for example, there are many smallholder farmers who have plots out of scheme that were no longer used as a result of drought and the only source of income that was coming in for them was the social grant income.

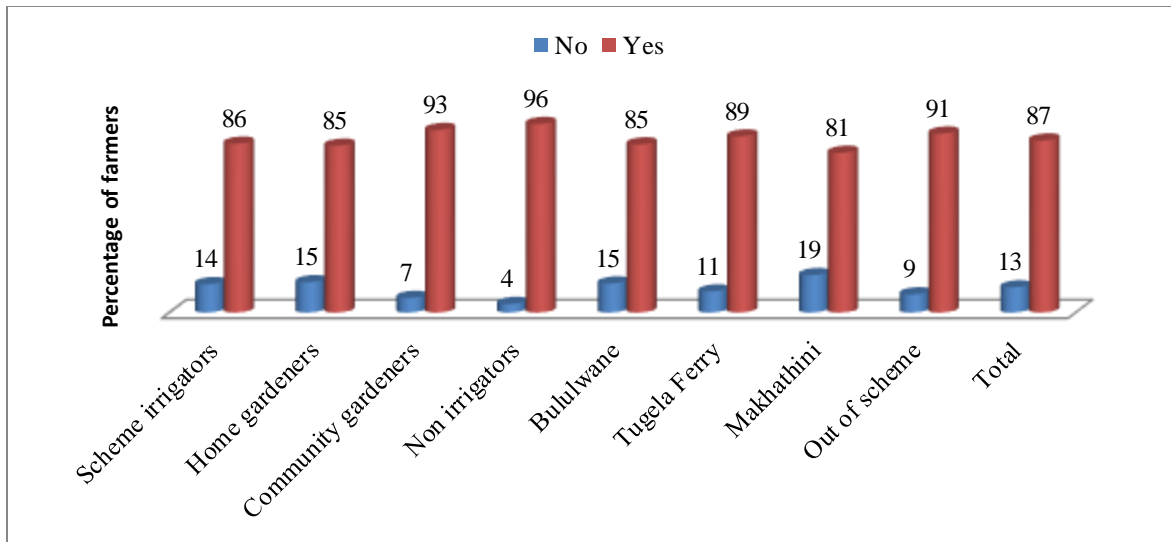


Figure 4.2. Percentage of smallholders receiving social grants (%)

Source: Survey data (March/April 2017)

The social grant beneficiaries as a group are most vulnerable to food price fluctuations (Hendriks, 2013). In the selected study areas, non-irrigators and community gardeners receive more social grant income on average at R28,827 and R26,074 per annum, respectively, compared to scheme irrigators and home gardeners who receive an average of R22,768 and R22,309 per annum, respectively. As noted by Cousins (2013), small-scale farming contributes very little to the total household income and social grants have the highest contribution. On average, 64% of household income comes from social grants. The non-irrigators also receive the highest amount of remittances of R10,240 per year from either their children or spouses and scheme irrigators. According to Hassan *et al.* (2017), remittances are an essential source of household income for most smallholders and their contribution has been growing over the years. On average, remittances contribute 6% to the household income.

In the study areas, there were farmers who went beyond just farming and had other small businesses on the side in the form of art and crafts. Community gardeners invest more in art and

craft businesses and they receive the largest average income of R6,767 per year. This form of income plays an important role to farmers whenever there is crop failure and farmers need to complement their household income over time. Where narrow markets constraint the possibilities for specialization, diversification is vital to lessen helplessness (Ruben & Pender, 2004). Therefore, the potential of the art and crafts needs to be also looked at when thinking of new ways to improve the livelihoods of smallholder farmers.

Although there are a few farmers and family members that are employed either part-time or full-time, most of them are not. According to Niehof (2004), the poor are excluded in the more favorable labor markets because of their low education level. Home gardeners receive more income of R113,400 per year from permanent employment and the second group of farmers that receive an amount close to that are the scheme irrigators who receive R61,920 per year. However, it should be noted that this consists of very few individuals (1.7% of the total population) in those farmer typologies and the same applies with temporary employment. Scheme irrigators and non-irrigators have a higher average income of R18,900 and R18,000 per year, respectively, compared to other farmer typologies.

Livestock contributes to supporting means of living in various ways like providing foodstuff, draught power, bride wealth and savings (Lahiff & Cousins, 2005). About 5% of household income comes from livestock income. Most farmers sell their livestock in times of emergencies and non-irrigators obtained the highest average income of R8,268 per year from livestock sales. Scheme irrigators were the second group to obtain a higher average income of R6,370 per year from livestock sales compared to other farmer typologies. This shows that smallholder farmers actually use the integrated crop-livestock system to sustain their livelihoods. As noted by Hendriks (2013), “agriculture is not only a source of food, underpinning national food security but it also plays an important role in rural livelihoods”.

Looking at the overall total household income, home gardeners obtain a higher average income per year (R44,438) compared to other farmer typologies. However, whether home gardeners are generally better off outside the irrigation schemes is something that would need further investigation over time and also accounting for shocks (i.e. drought) that affect smallholders frequently. As noted by Niehof (2004), smallholders that have poor access to resources depend on their own labor which they use to find work off-farm and as result on-farm contribution

declines. According to Andrew *et al.* (2003) and Lahiff & Cousins (2005), the low influence of agriculture on total household income is a result of poor access to assets, support services and market arrangement.

Table 4.4. The average estimated household income (R) of smallholder farmers per year

Total income	Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total	Proportions
Social Grant	22,768	22,309	26,074	28,827	23,735	64%
	58%	63%	90%	85%		
Remittances	8,664	5,225	3,667	10,240	7,998	6%
	6%	8%	2%	5%		
Art and Craft	2,586	4,250	6,767	19,000	3,331	1%
	1%	2%	3%	1%		
Permanent Employment	61,920	113,400	9,600	0	74,738	4%
	3%	14%	1%	0%		
Temporary Employment	18,900	7,000	0	18,000	14,325	2%
	1%	6%	0%	2%		
Crop Sales	9,212	300	2,448	0	8,819	18%
	26%	0%	3%	0%		
Livestock Sales	6,370	2,917	990	8,268	5,983	5%
	5%	6%	1%	7%		
Total Household Head Income	36,393	44,438	28,651	33,706	35,769	100%

Source: Survey data (March/April 2017)

4.2.3.2 Livestock ownership

The common animals that are owned by smallholder farmers in the selected study areas were domestic chickens, goats and cattle. On average, non-irrigators and scheme irrigators own more domestic chicken at 10.7 and 10.4, respectively, compared to other farmer typologies. Home gardeners have the highest number of goats owned (11) on average and community gardeners have the lowest number of goats owned (6.3) on average. Non-irrigators own about 4.7 cattle, on average, which is the highest compared to other farmer typologies and home gardeners own about 0.7 cattle, on average, which is the lowest. Most of the cattle died from drought and most farmers were severely affected as a result. Hence, most farmers own more domestic chickens and goats because of their adaptability to harsh environments and also the ease with which they can

be converted into cash. In this regard, World Bank (2005) also noted that smallholders with access to saleable assets improve their households' capability to access credit and buy inputs.

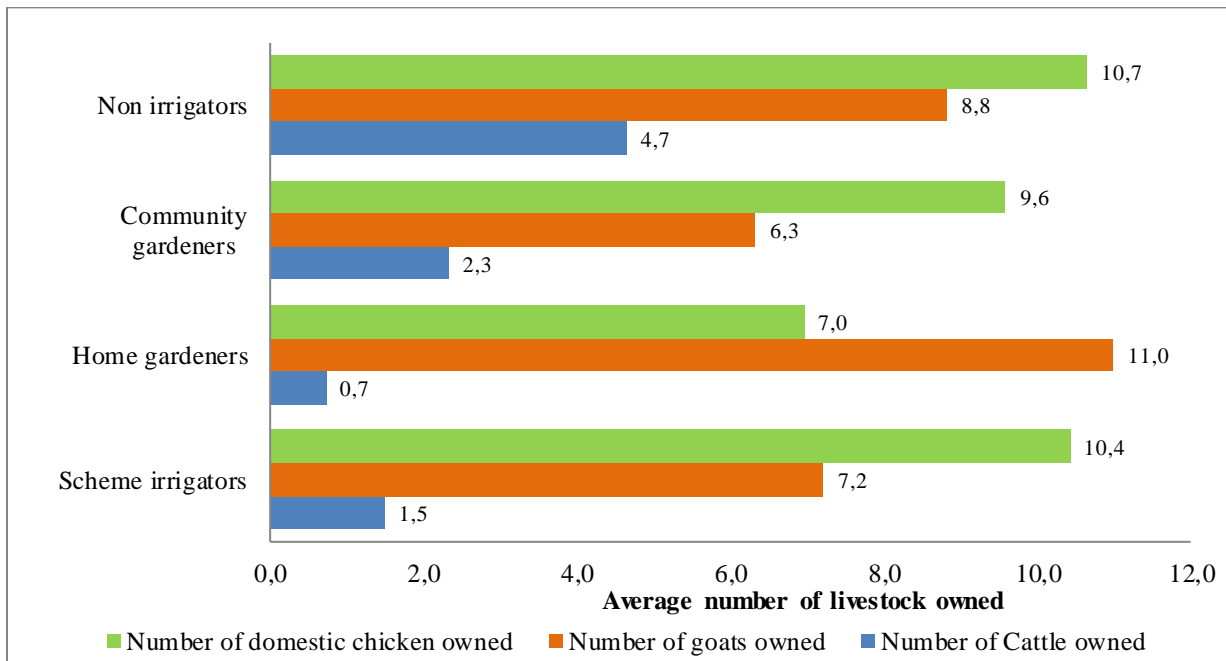


Figure 4.3. Average number of livestock owned by smallholder farmers

Source: Survey data (March/April 2017)

Smallholder farmers keep livestock for various reasons including household consumption, sales, cultural reasons and wealth. The majority of the smallholder farmers (52%) keep livestock mainly for household consumption and these farmers mostly sell their livestock in emergencies. The farmers that keep livestock for selling constitute 21% of the sampled farmers. When farmers sell their livestock, on average, they would sell their cattle for about R7,000 each, goats go for about R1,000 each and domestic chickens are sold for R60 each. They usually sell them mostly to their neighbors and very few to hawkers. These statistics indicate that there is actually an opportunity to improve the livestock sector for smallholder farmers, especially for goats and domestic chicken.

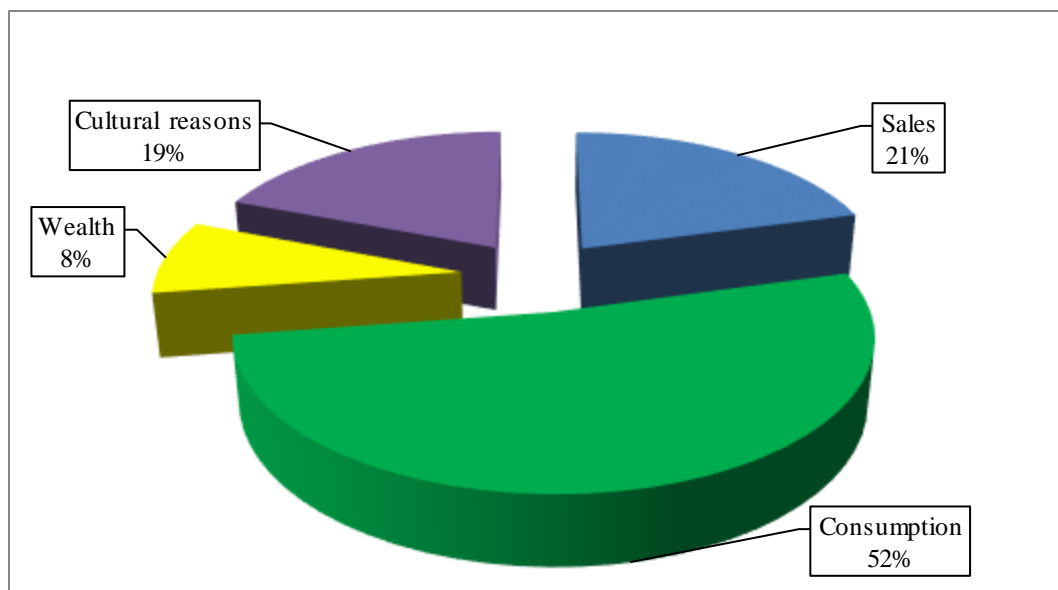


Figure 4.4. Reasons why smallholder farmers keep their livestock

Source: Survey data (March/April 2017)

4.2.3.3 Communication and working assets ownership

There are high transaction costs for buyers/consumers that are normally associated with reaching out to smallholder farmers in the rural areas and also the other way around where farmers find it difficult to reach out to extension officers or services from where they are. However, almost all the smallholder farmers (93.9%) own cellphones but currently this technology is not being fully utilized to reach out to the farmers. It was also noted that most smallholders make use of cell phones to communicate with their customers (Van Averbek & Mohamed, 2006). As noted by Chamberlin & Jayne (2013), communication tools are efficiently dropping selling expenses. For example, cell phones save expenses that might have been experienced if smallholders had to travel to sell produce to the markets in urban areas.

On average, the market value of cellphones owned by smallholder farmers is about R283. Most of the cellphones have internet access capabilities which farmers can be taught to utilize for their benefit i.e. for mobile banking and/or market information provision. Other communication assets like radio and TV are owned by 79.4% of the smallholder farmers and they are common avenues used by government to communicate with the smallholder farmers. There are only 5.8% of the smallholder farmers that own a car and the majority of the farmers have to rent neighbor vehicles

if they need transport for their produce, for example. There are other smallholder farmers that depend on extension officers for transport to go and buy inputs or to sell their produce. The statistics also indicate that there are still smallholder farmers (32.8%) that do not own hoes to farm and they have to borrow them.

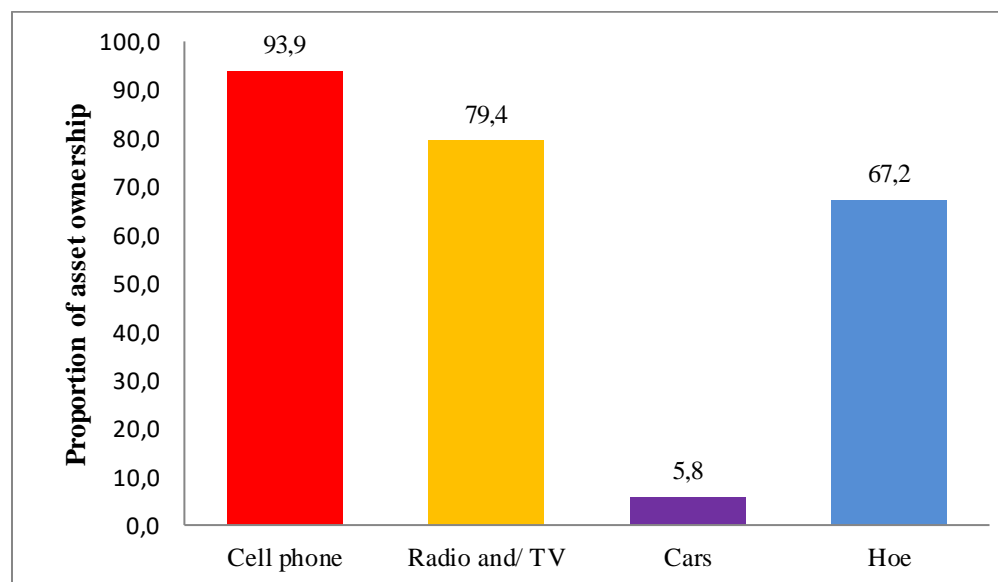


Figure 4.5. Communication and production assets owned by individual farmers (%)

Source: Survey data (March/April 2017)

4.2.4 Land holdings and land use rights

Smallholder farmers' access land differently, namely, the land could be borrowed or rented and it could be owned via land use right under the traditional authority rules. There is a difference between borrowing and renting in this study. Borrowing often happens between family members and there is no payment involved. Renting can happen between friends or strangers and there is normally a payment involved in renting land. For non-irrigators, home gardeners and community gardeners, the land belonged to them and there were no renters or borrowers of land. The rental prices of land ranged from R200 per plot per season in Tugela Ferry (0.1 ha) and Bululwane (1 ha) to R2,500 per ha per year in Makhathini. Land tenure systems play an important role on how farmers use the land. On average, scheme irrigators (97.1%) in Bululwane are more satisfied with their present security of ownership.

As noted by Bugri (2008) and Van Averbek *et al.* (2011), many scheme irrigators tend to be secure about their tenure rights. However, scheme irrigators (55.2%) in Makhathini are the least

satisfied with their present security of ownership. This notable difference might be the result of land being under a trust in Makhathini and soon farmers are expected to pay a land fee in addition to a water fee that they currently pay. The dissatisfaction of the land tenure system was not linked to gender discrimination because women have equal rights to their male counterparts. The percentage of smallholder farmers that find it difficult to make land use decisions because of the land tenure system is generally low among smallholder farmers. This can be attributed to the people who are renting land because they are not certain of when the land owner might take their land back.

Table 4.5. Satisfaction level of security of land ownership and decision making (%)

	Bululwane	Tugela Ferry	Makhathini	Out of scheme	Total
Satisfied with the present security of ownership	97.1	93.3	55.2	92.1	84.4
Find it difficult to make land use decisions due to the land tenure system	11.4	8.0	10.3	2.6	7.4

Source: Survey data (March/April 2017)

Irrigable land is scarce in the selected irrigation schemes and few farmers can enter or expand in the irrigation schemes. There is, therefore, limited potential for expanding farming operations within the schemes. With developments happening in land reform and some commercial farmers selling their farms, it is important to understand whether smallholder farmers are willing to relocate to other areas to utilize bigger plots and also to understand their reasons for those decisions. The scheme irrigators (65.5%) in Makhathini are willing to relocate to bigger plots in other areas and the major reason for wanting to relocate is to increase production and improve their income. The majority of the smallholder farmers in Bululwane (80%), Tugela Ferry (74.7%) and out of scheme (73.7%) are not willing to relocate to occupy bigger plots in other areas. For scheme irrigators in Bululwane, the two major reasons for not wanting to relocate are old age and access to adequate land. Scheme irrigators in Tugela Ferry are not keen to relocate because they are too old and they cannot leave their families or homestead. For farmers out of the scheme, they do not want to relocate because they are too old. This means that government must give people land that is closer to them as they are not willing to leave where they have settled.

Table 4.6. Proportion of smallholders willing to relocate to bigger plots and their reasons (%)

		Bululwane	Tugela Ferry	Makhathini	Out of scheme	Total
Willingness to relocate to bigger plots		20.0	25.3	65.5	26.3	34.4
Reasons against relocating	Have enough land	31.3	12.5	6.9	17.1	15.1
	I am too old to relocate	34.4	31.9	13.8	34.2	28.6
	I cannot leave my family and/house	9.4	20.8	0.0	11.8	11.3
	I do not have money to relocate	3.1	6.9	15.5	13.2	10.5
Reason for	I want to increase production & income	21.9	27.8	63.8	23.7	34.5

Source: Survey data (March/April 2017)

The majority of the smallholder farmers (86.5%) face no challenges that are related to land. This finding is consistent with the findings by Bugri (2008). However, there are a few smallholder farmers that still face some challenges. For example, 3.4% of the scheme irrigators in Makhathini are concerned about having to pay for a lease from the trust, 8.6% indicated that the rent price for land was too high and 1.7% indicated that it is difficult for young people to acquire irrigable land as it is scarce. A common land issue for scheme irrigators in Makhathini (1.7%) and Tugela Ferry (1.3%) is that when the husband in the household dies, his relatives want to take over the farming land and exclude the wife. Another common land issue from renting scheme irrigators in Tugela Ferry (1.3%) and Bululwane (2.9%) is that land owners take their land back, usually after one or two production seasons and they would have to look for another land plot. According to Jayne *et al.* (2010), for most landless smallholders, education is the only way to a better life. In areas where the irrigable land limit has been reached as in the selected study areas and new people coming in gain access to small size of irrigable land due to the high demand for it (Jayne, 2014). The increasing irrigable landlessness is unavoidable and development of livelihood opportunities in other sectors is essential (Holden & Otsuka, 2014).

Table 4.7. Proportion of land related issues faced by smallholder farmers (%)

Challenges faced in relation to land	Bululwane	Tugela Ferry	Makhathini	Out of scheme	Total
No challenges related to land	82.9	88.0	81.0	90.8	86.5
We have to pay lease now	0.0	0.0	3.4	0.0	0.8
Irrigable land is far, we need transport	0.0	8.0	0.0	0.0	2.5
Small plots	2.9	1.3	1.7	0.0	1.2
Rental price is too high	0.0	0.0	8.6	0.0	2.0
When husband dies, his family members want to take the farming land	0.0	1.3	1.7	0.0	0.8
Hard for youth to get irrigable land	0.0	0.0	1.7	0.0	0.4
Land owners take their land back before agreed time	2.9	1.3	0.0	2.6	1.6
Fencing	11.4	0.0	1.7	6.6	4.1

Source: Survey data (March/April 2017)

Customary tenure systems react to stresses to be inclusive of new demands (Place, 2009). Due to this flexibility there is currently no approved method to accurately capture tenure security of smallholders. Different researchers have used different measures to capture use rights. According to Deininger & Jin (2006), household prospects influence their investment actions. This makes it important to understand the perceptions that smallholders have with regards to their land use rights. Following Brasselle *et al.* (2002) and Bugri (2008), households were requested to express themselves on the character of each of the five use rights considered, namely, (i) the right to choose which crop to grow, (ii) the right to put one's land into fallow and to re-cultivate it, (iii) the right to bring improvements to the land, (iv) the right to freely dispose crop output, and (v) the right to prevent the grazing of others' livestock. In addition, households were questioned about whether they need any approval in order to exercise each of the four transfer rights considered, viz. the right to (vi) lend the land along traditional lines, (vii) give it, (viii) bequeath it, and (ix) rent it against cash. The right to sell land has been omitted because land sales are not considered legitimate and do not exist in the selected study areas. This approach explains the level of security as experienced by smallholders in societies pervaded by highly personalized networks of social relationships.

In order to get accurate responses from smallholders and to avoid strategic responses they were told that their identity will be anonymous. The results showed that, compared to other farmer typologies, non-irrigators (56.5%) had the lowest number of farmers who are confidently aware of their legal rights to land. Most smallholder farmers (78.9%) are able to exercise their rights over land. Almost all the smallholder farmers (92.6%) are free to choose what they produce in their plots, as long as it is a legal crop. Most of the smallholder farmers (87.2%) can use their land for more than 10 years if they want to, which indicates the durability of their land use rights. The majority of the smallholder farmers (81.8%) do not face threats of eviction from their land by either the chiefs or government. About 78.1% of the smallholder farmers believe that they can transfer their land to family members if they want to. However, about 42.6% of smallholder farmers believe that they can transfer land to people not related to them. Based on the focus group discussions, it was revealed that this is actually not allowed and only a chief can do that. This is done to avoid exploitation of local people by people from the cities and to ensure that land reaches poor deserving people that are going to utilize the land and that are from the community.

These statistics are interesting as one would expect that most women would not be comfortable with traditional courts because of the cultural reasons in the past whereby only men were allowed to go there. The focus group discussions and key informant interviews also confirmed these findings. It shows how local institutional arrangements are evolving and how traditional leaders are adapting to the changes that are taking place in the country to promote gender equity. Therefore, the idea of not recognizing the role played by traditional leaders in the rural areas has a serious potential miscalculation in it. Moreover, from a practical perspective, development models that work/are preferred are those that build on what already exists unlike implementing entirely new models which have high transaction costs (i.e. capacity building programs, new organizational structures and more government expertise/man power required). According to Deininger *et al.* (2014), “good land governance can be defined as encompassing laws and institutions that recognize existing rights and allow users to exercise them at low cost, in line with their aspiration, and in ways that benefit society as a whole and that policy is equitable, clear, derived in a participatory manner, implementation monitored”. Hence, based on this definition, these results suggest that there is good land governance in the smallholder sector.

Table 4.8. Smallholder farmers' satisfaction with their land use rights (%)

	Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total
I know my legal rights (i.e., guaranteed power)	68.5	64.0	74.1	56.5	67.5
I am able to exercise my rights over land (i.e., the rights to use and exclude others from land)	79.2	83.3	81.5	78.3	79.8
I am free to choose what to produce on my plot	90.5	95.8	96.3	100.0	92.6
I can use this land for more than 10 years	85.7	83.3	92.6	95.7	87.2
There are no threats of eviction from my land	81.5	75.0	81.5	91.3	81.8
I can transfer land to family members if I want to	76.2	70.8	88.9	87.0	78.1
I can transfer land to people not related to me	42.9	29.2	51.9	43.5	42.6
I always find it easy to approach the police if there is land conflict	74.4	70.8	66.7	60.9	71.9
I always find it easy to approach the traditional (informal) courts	74.4	95.8	77.8	87.0	78.1
I believe I will be treated fairly by the police	75.0	75.0	74.1	73.9	74.8
I believe I will be treated fairly by the traditional courts in any given court case	79.8	95.8	85.2	91.3	83.1

Source: Survey data (March/April 2017)

For the scheme irrigators, the requirements in the CLTP are met by the scheme committees. The scheme committees assign land use rights, keep records of rights and dealings between smallholder farmers, help in disagreement resolution (if any), and communicate with traditional authorities. However, CLTP requires that these committees should communicate with local government bodies with regards to planning, development and other land administration functions. This function is performed by the traditional leaders as the middle men. In the schemes, with assistance from the traditional authorities, the land use right enquiries are open and transparent to the users, and the decisions are informed and democratic. This supports a conclusion by Cousins & Claassens (2006) which stated that in African tenure systems the rights of individuals and families are often solid and secure, originating from accepted membership of a group.

4.2.5 Water access and typologies of water use rights

Most of the scheme irrigators (53.6%) are in the middle from the water source. The most common water pumping system amongst the scheme irrigators (60.5%) is the electric pumping

system and the amount that farmers pay varies with the scheme. During the focus group discussions in Tugela Ferry, for example, farmers complained about the high cost of electricity and they mentioned that the charges by Eskom are higher in summer than winter because that is when more water is required. They suggested that they need to have meters so that they can be able to monitor and control their electricity use based on what they can afford. Wilder & Lankao (2006) noted in their study the challenge of absence of suitable metering tools. This also makes it difficult for government to monitor and evaluate the amount of water used by scheme irrigators. However, Backeberg (2004) argues that installation of meters in schemes would be expensive and proposes that further research is required to demonstrate that water metering is economically justified.

Most of the scheme irrigators (53.9%) use sprinklers to irrigate their plots and the other common irrigation system is the flood irrigation (45.5%). Most community gardeners use the bucket system to irrigate their plots. The proportion of scheme irrigators that often fail to receive water on their irrigation day is 45.8%. From those, most of them (52.7%) would respond by reporting the matter to the scheme committee or others would do nothing (40.7%). The responses are similar with the community gardeners. In the focus group discussions, farmers indicated that when water sources are running low, few people would irrigate on the days not allocated to them and that would cause conflict. As noted by Ostrom (1999) and Mollinga (2016) fixed time slot rules permit smallholders' safe bet as to when they will receive water. However, once water reaches the schemes, it is retrieved on a first come first take basis (Muchara *et al.*, 2014).

The majority of the scheme irrigators (78.3%) are satisfied with how the schemes are managed and 59.3% of the scheme irrigators believe that the scheme water committees are effective in ensuring compliance to regulations. Effectiveness of collective action refers to the capability of scheme members to meet their instant purpose i.e. management of natural resources (Pandolfelli *et al.*, 2008) and dealing with internal issues. However, this does not imply that all the individuals follow or respect their instruction even though the majority does. There are still a few farmers that free ride intentionally because they know powerful people in the community or unintentionally because they do not have money sometimes, even with the strong institutions in place. It is difficult to always monitor water users at all times as the schemes are big and have a lot of water users. As much as farmers monitor each other, there are a few people whom they fear and cannot report if they are using water without paying. In cases where such individuals

exist, the system must not be blamed as the problem is with the individuals and not the system. Therefore, the system must be improved to deal with those individuals in a manner that is acceptable by the community.

According to Ostrom (1999), reducing the number of users failing to pay by opening the resource to outsiders shrinks the level of trust and consequently escalates prosecution costs. This view was supported by farmers in the focus group discussion in Tugela Ferry who indicated that in the past they allowed strangers to get plots in the scheme but those people ended up wanting to control them. As a result they only prefer people they know or recognize.

Table 4.9. Smallholder farmers’ access to water and satisfaction with scheme committees (%)

		Scheme irrigators	Community gardeners	Total
Position along the water source	Head	23.2	14.3	22.9
	Middle	53.6	85.7	54.9
	Tail	23.2	0.0	22.3
How is water pumped to reach your plot?	Gravity	37.7	14.3	36.8
	Electric pump	60.5	0.0	58
	Diesel pump	1.8	85.7	5.2
Type of irrigation system	Sprinkler	53.9	5.3	47.2
	Flood irrigation	45.5	5.3	39.9
	Bucket system	0.0	63.2	8.8
	Hosepipe	0.6	26.3	4.1
Often fail to receive water on my allocated irrigation day		45.8		45.8
Reaction to not receiving water on allocated irrigation day	Nothing	40.7	44.4	40.9
	Report to the irrigation committee	52.7	44.4	52.3
	Talk to farmers upstream myself	6.6	11.1	6.8
Satisfied with overall scheme management		78.3		78.3
Effectiveness of committees in ensuring water users comply with scheme regulations		59.3		59.3

Source: Survey data (March/April 2017)

A good strategy to influence institutional change is to begin with smallholders’ experiences with water (Ostrom, 2002; Meinzen-Dick, 2014). This approach helps to recognize the appropriate legal frameworks to deal with challenges smallholders face and that’s why it was adopted in this study. According to Ostrom & Basurto (2011), “lessons coming out of institutional analyses in

Nepal and elsewhere show that resource users who have relative autonomy to design their own rules for governing and managing common-pool resources frequently achieve better economic (as well as more equitable) outcomes than when experts do this for them”. The consultation or involvement of scheme irrigators in water related decision making process is mostly common in Bululwane (94.3%) and less common in Makhathini (29.3%) since Mjindi is responsible for making water decisions.

Most of the community gardeners (78.9%) have a water source that is reliable because they draw water directly from the big rivers. While scheme irrigators draw their water from dams, home gardeners use municipality taps which are not reliable and sometimes not allowed. While the water source is reliable for most community gardeners, water accessibility is not that good for most community gardeners as only 42.1% have good access to water. This is because community gardeners do not have equipment to draw water from the river to their plots. These findings are consistent with the findings by Sinyolo *et al.* (2014) who found that water supply for most scheme irrigators in Tugela Ferry is reliable and this was attributed to the introduction of pumps which were found to be more efficient than the previous system. Even though the majority of the farmers interviewed believe they are water secure, those that are not water secure end up drawing water illegally as it is unaffordable for them. These findings differ from the findings by Muchara *et al.* (2014) who found that the general perception among most farmers in Mooi River Irrigation Scheme was that irrigation water supply was inadequate and unfairly distributed, as reported by 79.2% and 65.8% of the irrigators, respectively.

The conflict resolution mechanisms are mostly effective for most smallholder farmers (84.7%). According to Ostrom (1999), physical violence is an indication of poor conflict-resolution mechanisms. In the selected study areas, there was no physical violence over resources which indicate that there are good conflict resolution mechanisms in place by both the scheme committees and the traditional authorities. Moreover, there were few cases where there were conflicts between scheme irrigators and the communities when there was drought but those were handled according to customary rules avoiding potential physical fights. As noted by Sinyolo *et al.* (2014), the institutional and organizational structures include respected power relations, rules and regulations that ensure water use rights. Most scheme irrigators (83.3%) are satisfied with the maintenance of the canal. Even though farmers faced challenges of bursting pipes, they indicated that government does respond in dealing with those kinds of issues. In future, farmers

will have to pay for maintenance of the scheme. As noted by Ostrom & Basurto (2011), offerings to maintenance are done by smallholders who partake in the making of the rules of their system.

Ostrom (2002) argues that policy makers must create or establish secondary organizations or institutions that will ensure proper management of natural resources. From the discussions with farmers and from literature (Ostrom & Basurto, 2011), what is clear is that when new rules are introduced, farmers take time to adjust to them and they sometimes manipulate them to fit in to their way of life. These rules are adjusted overtime until they are adopted by many. When these adjustments happen, they do not happen on paper but they happen based on the general understanding of the community members involved. However, this does not imply that perfect rules that are followed by everyone can be crafted but the aim is always to make the rules acceptable to the majority. Whatever allocation rules that officials and/or farmers establish for an irrigation system, there are always those that are tempted to cheat by taking water at an unauthorized time and by contributing less inputs than required for provision of one's given water allocation. Moreover, Ostrom & Gardner (1993) caution policy makers about developing policies without local consultation because those policies might do more harm than good.

Table 4.10. Water use rights of smallholder farmers (%)

	Scheme irrigators	Home gardeners	Community gardeners	Bulul wane	Tugela Ferry	Makh athini	Total
Water source reliable	56.3	40.0	78.9	58.8	54.7	56.9	58.1
Water accessibility is good	69.6	60.0	42.1	85.7	70.7	58.6	66.7
Water quality is good in my plot	82.1	100.0	73.7	97.1	86.7	67.2	81.7
My right to water is secure	77.4	100.0	78.9	85.7	85.3	62.1	78.0
Involved in water use decision making process	57.7			94.3	62.7	29.3	58.6
Have adequate access to irrigation equipment	69.6	60.0	22.2	88.6	68.0	60.3	64.9
Conflict resolution mechanisms are effective	86.2		60.0	70.6	94.7	84.5	84.7
Satisfied with the maintenance of the canal	83.8			97.1	89.3	69.0	83.3

Source: Survey data (March/April 2017)

4.2.6 Access to input and output markets

Most of the scheme irrigators (33.3%) chose their crops based on the availability of markets and the availability of seeds from government (24.7%). The majority of the home gardeners (60%) and non-irrigators (66.7%) make this decision mainly based on the availability of seeds from government. Community gardeners base their decisions on the availability of seeds from government (36.4%) and crop season (31.8%). These results suggest that most smallholder farmers are not thinking about the markets as the main priority for choosing their crops. As a result their produce is mostly bought by the van traders who have been very little researched (Cousins, 2016). Smallholder farmers need to be encouraged to shift this mindset and be market-driven. For this to happen, they must have adequate marketable surplus and smallholder farming has to be their main source of income.

Table 4.11. Reasons why smallholder farmers chose which crops to plant (%)

	Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total
Availability of markets	33.3	0.0	13.6	0.0	29.2
Availability of free seeds from government	24.7	60.0	36.4	66.7	28.2
Crop suitable based on soil sample	19.8	20.0	18.2	33.3	20.0
Crop season	22.2	20.0	31.8	0.0	22.6

Source: Survey data (March/April 2017)

Smallholder farmers plant a variety of crops, some of which for household consumption and the rest for sale. Most of the home gardeners (88.5%) were severely affected by drought and also non-irrigators (47.8%). The three top crops planted by most scheme irrigators are maize, cabbage and tomatoes. These are crops that smallholder farmers have been used to selling over the years and they know that most people want them. For home gardeners it was spinach, onions and cabbage. For community gardeners, it was cabbage, spinach and tomatoes. These are the crops that are easily accessible or provided by government to home and community gardeners. For non-irrigators, the focus was on maize, beans and sweet potatoes. The non-irrigators prefer these crops because they consume less water.

Table 4.12. Percentage of farmers growing each crop (%)

	Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total	Rank
Nothing planted	3.6	88.5	11.1	47.8	17.6	0
Maize	75.0	0.0	25.9	39.1	58.2	1
Beans	15.5	0.0	3.7	13.0	12.3	5
Cabbage	27.4	3.8	70.4	0.0	27.0	2
Spinach	2.4	7.7	40.7	0.0	7.0	7
Butternut	6.0	0.0	0.0	0.0	4.1	8
Potatoes	17.9	0.0	14.8	0.0	13.9	4
Sweet potato	11.3	0.0	11.1	4.3	9.4	6
Tomato	20.8	0.0	40.7	0.0	18.9	3
Yams	3.0	0.0	0.0	0.0	2.0	11
Onion	1.2	7.7	7.4	0.0	2.5	10
Beetroot	0.0	0.0	14.8	0.0	1.6	12
Carrot	0.0	0.0	7.4	0.0	0.8	13
Pepper	2.4	0.0	11.1	0.0	2.9	9
Chilies	4.2	0.0	0.0	0.0	2.9	9

Source: Survey data (March/April 2017)

Very few smallholders plant their crops with the consumers and competitors in mind. This then leads to smallholder farmers produce not being able to sell because the market is not able to absorb all their produce. Most of them usually plant and harvest the same thing at the same time. In the study areas, there are three major crops that do not get fully absorbed by the market, namely, cabbage, tomatoes and maize. Moreover, in Bululwane farmers were planting chilies for the first time as they were instructed by the DRDLR but were rejected by the markets as it was not the type of chilies they were looking for. During the focus group discussions, farmers mentioned that it is not that there is no market for these crops but rather there is no coordination amongst them. For example, they do not plant at different times so that they can harvest at different times of the year and allow for supplying throughout the year. The reason that was mentioned for that was that they receive the inputs and seedlings together from government at the same time. Cousins (2013) also noted the same thing in Tugela Ferry and further mentioned that this challenge is further exacerbated by competition from commercial farmers.

Most of the farmers sell their produce at farm-gate to van traders. During the focus group discussions farmers indicated that they need more van traders who are going to buy from them when their produce is ready. According to the farmers, the van traders are better than supermarkets because they pay instant cash and they are not strict on the quality of the produce as supermarkets. Even if a farmer cannot fill the whole van alone, the van trader can easily move around to find other farmers that have produce ready to be harvested. Van traders are not all perfect according to the farmers as they sometimes promise to come and never come because they find cheaper produce somewhere else. Nonetheless, most farmers still prefer them. Jordaan *et al.* (2014) validate the importance of informal institutions as value chain influencers when considering the behavior of smallholder farmers from South Africa.

A study by Murugani & Thamaga-Chitja (2017) found that price fluctuations due to market forces leave farmers uncertain about what price their batch of produce would fetch at the fresh produce markets, and leaving farmers vulnerable to relatively huge losses if the prices fall in response to national and global market dynamics. In the focus group discussions, farmers mentioned that they have had bad experiences with fresh produce markets because they would send about 10 cases of tomatoes and be told that only about 4 or 5 cases were sold. This was another reason why they preferred the van traders because with them, that would never happen and they also feel in control of the price negotiation of their produce. However, this is contrary to the findings by Murugani & Thamaga-Chitja (2017) who found that despite the uncertainty in fresh produce market prices, the farmers in their study thought it was better to keep sending their produce to the fresh produce market rather than relying on farm-gate sales. This once again highlights the risk of “one size fits all” approach.

It is often assumed that supermarkets are the only market that smallholder farmers should be targeting (Mkhabela, 2005). Yet, experience shows that these assumptions do not always hold as these formal institutions are not always accommodative or the smallholder farmers are not always able to meet the standards they set and in some cases are compared to commercial farmers (Baiphethi & Jacobs, 2009; Rao & Qaim, 2011; Chamberlin & Jayne, 2013). Even though they behave differently in terms of how they choose crops and how they make decisions. There is currently a concern among researchers that smallholder farmers may be increasingly marginalized with the modernization of the global retail food system taking place in the world and in the country as well (Jayne *et al.*, 2010; Rao & Qaim, 2011). Studies by Chamberlin &

Jayne (2013) and Okunlola *et al.* (2016) argue that the point is often missed in policy debates about smallholder farmers, which tend to conceive of markets in a somewhat undifferentiated, homogenous way or imposes very narrow assumptions about what constitutes a desirable market for such farmers. According to Okunlola *et al.* (2016), subjective evidence from areas such as Nwanedi in Limpopo and Pongola in KwaZulu-Natal suggest that many small-scale farmers who supply agro-processors, such as Tiger Brands, or large retailers, such as Massmart (with formal contracts and in ‘tight value chains’) also tend to supply van traders purchasing vegetables at the farm-gate (i.e. in ‘loose value chains’).

A study by Elder & Dauvergne (2015), for example, has found that supermarket chains like Walmart have motives that are not fundamentally about improving food security and agricultural sustainability, but are about securing high quality and inexpensive food from dependable sources, especially when global value chains are becoming more competitive. This study further noted that farmers with contracts to sell to Walmart exited the Walmart supply chain to sell to the local market looking for a higher price, and they exited the local supply chain to sell to Walmart when Walmart offered a better price. This phenomenon can also be expected with smallholder farmers from the selected study areas, taking into account the convenience of payment mechanism and producing standards. Often a smallholder farmer will utilize a variety of markets in different ways at different times, and some farmers sell their produce in formal and informal markets concurrently (Chamberlin & Jayne, 2013; Okunlola *et al.*, 2016). Therefore, research is needed to find out whether there is significant difference in wealth or income and productivity between farmers selling to retailers or supermarkets (i.e. contract farming) and those selling to van traders or informal markets (Nguyen *et al.*, 2015; Rao & Qaim, 2011). Moreover, ways that smallholder farmers can be assisted in reaching out to these markets simultaneously as they use them remains an area of future research. Better information is needed on trader concentrations and competition in rural markets, and important dimensions of rural markets that are not necessarily correlated with typical distance variables (Chamberlin & Jayne, 2013).

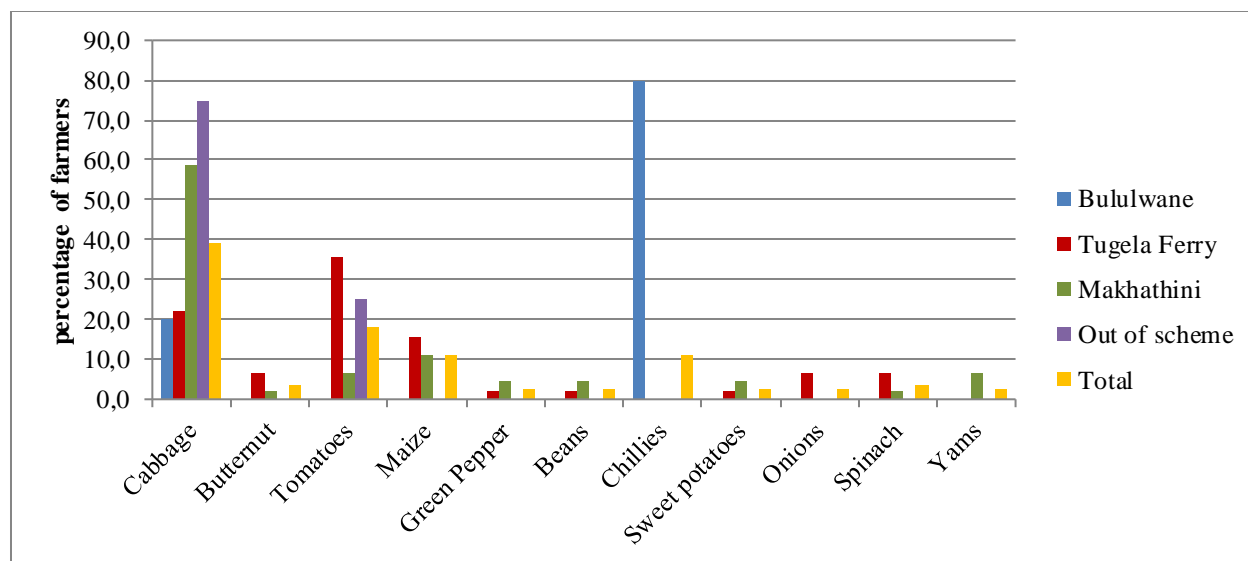


Figure 4.6. Smallholder farmers (%) that mostly fail to sell their produce for various crops

Source: Survey data (March/April 2017)

Before smallholder farmers start production, they encounter many constraints that limit them to produce to their optimum. Most of the smallholder farmers (83.5%) face a challenge of accessing inputs like seeds, fertilizer and chemicals. While it is difficult to reach input markets for smallholder farmers, most of them (85.2%) then face the challenge of large increase in input prices. According to Jayne (2014), the tendency to produce little surplus on very small farms leads to problems in buying required inputs. The issue of lacking financial resources was raised by most smallholder farmers (74.9%). There are smallholder farmers (62.6%) that still find it difficult to access farming knowledge and skills.

Table 4.13. Accessibility of inputs to smallholder farmers (%)

Farming constraints	Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total
Lack of access to inputs	82.6	76.0	85.2	95.7	83.5
Large increase in input prices	85.0	73.1	92.6	91.3	85.2
Lack of farming knowledge and skills	58.7	57.7	74.1	82.6	62.6
Lack of financial resources	75.4	61.5	77.8	82.6	74.9
Unaffordable hired labor cost	52.7	38.9	39.1	31.8	48.2

Source: Survey data (March/April 2017)

4.2.7 Gross Margin Analysis: results and discussions

The three major crops that were planted by most smallholder farmers in large quantities are maize, cabbage and tomatoes. The gross margins per hectare for these three major crops are indicated in Table 4.14 below and are inclusive of the yield sold and consumed by smallholder farmers. The market prices varied depending on the time of the year, place of sale and negotiations between the farmer and the client but there were standard prices that were charged. For example, for maize smallholder farmers charged a standard price of R1,500 to fill a van (approximately 1 ton) and van traders could negotiate with a farmer up to a price of R1,300. A standard price for cabbage was R5 per head (approximately 1-2 kg) and for tomatoes it was between R100-R130 per crate (approximately 25 kg). This was all accounted for in the computation of the gross margins including the number of times the farmer sold their produce.

Home gardeners and non-irrigators were not included in Table 4.14 because the majority of them did not plant and those that did plant didn't harvest anything because of the drought. For scheme irrigators in Tugela Ferry, the average gross margin for all three major crops is + R21,049/ha which is similar to findings by Cousins (2013) in Tugela Ferry which is + R25,461/ha. Looking at maize productivity, scheme irrigators had, on average, a high positive gross margin of + R12,027/ha compared to community gardeners who had a gross margin of - R6,988/ha. Community gardeners suffered more from the drought and maize crop diseases/pests, and they could only harvest very little produce. Scheme irrigators that were doing very well had a gross margin of + R55,800/ha and those not performing well had a gross margin of - R12,300/ha. Amongst the scheme irrigators, on average, scheme irrigators in Tugela Ferry are more productive (+ R15,448/ha) compared to other scheme irrigators. This could be as a result of being close to the markets or shopping center compared to their counterparts in other schemes.

Compared to other crops, cabbage had the highest gross margin (+ R11,803/ha), on average, for both the scheme irrigators and community gardeners. This finding is consistent with the findings by Phakathi (2016) who found that cabbages had a high gross margin compared to maize and tomatoes. Scheme irrigators had, on average, a higher gross margin (+ R12 303/ha) than of community gardeners. Scheme irrigators in Makhathini had a higher average gross margin of + R17,323/ha compared to other scheme irrigators. Tomatoes, on the other hand, had the lowest average gross margin (+ R8,034/ha) compared to other selected crops. This is very similar with

the findings by Phakathi (2016) who also found that tomatoes had an average gross margin of +R8,004/ha. This can be attributed to the high costs involved in growing this crop, especially for scheme irrigators (R24,738/ha). However, tomatoes generate a higher average total revenue amongst the scheme irrigators (R41,700/ha), especially those in Tugela Ferry (R48,113/ha). Scheme irrigators have a big market when it comes to tomatoes and there are many van traders that come to buy in bulk so that they can sell at the local town market. The challenge currently is that most farmers' plant at the same time and the market gets flooded with the same produce. Tomato disease is a common problem that reduces yield. In conclusion, the income variances among the smallholders cannot be credited entirely to water access alone but other sources of variation like farmer training, access to land and institutional aspects that need to also be considered (Muchara *et al.*, 2014).

Table 4.14. Gross margin (R) estimates per hectare for three major crops in 2016

Crop Productivity	Scheme Irrigators	Community gardeners	Bululwane	Tugela Ferry	Makhathini	Total
Maize						
Total revenue	21,043	1,250	7,170	27,849	17,229	20,867
Total cost	8,618	7,613	1,055	10,092	8,061	8,531
Gross Margin	12,027	-6,988	6,388	15,448	8,552	11,611
Minimum	-12,300	-15,000	-800	-12,300	-8,200	-15,000
Maximum	55,800	1,025	21,600	55,800	3,3380	55,800
Cabbage						
Total revenue	27,838	23,429	2,499	28,533	32,889	27,136
Total cost	13,830	8,538	3,078	15,090	13,835	12,848
Gross Margin	12,303	11,963	768	10,086	17,323	11,803
Minimum	-24,600	-13,000	-800	-24,600	-14,200	-24,600
Maximum	66,760	40,600	2,000	39,550	66,760	66,760
Tomato						
Total revenue	41,700	16,950	6,000	48,113	16,333	37,333
Total cost	24,738	8,289	1,860	27,804	9,333	21,996
Gross Margin	8,383	6,240	4,140	8,790	7,000	8,034
Minimum	-34,900	-6,500	3,300	-34,900	-2,500	-34,900
Maximum	67,320	16,680	4,980	67,320	18,800	67,320
Gross Margin for 3 crops						
Gross Margin	15,841	13,934	6,127	21,049	13,400	15,449
Minimum	-14,200	-19,500	-800	-12,700	-14,200	-19,500
Maximum	80,900	57,280	21,600	80,900	78,992	80,900

Source: Survey data (March/April 2017)

4.2.8 Savings

The culture of saving is relatively high amongst scheme irrigators in Makhathini (56.9%) and is lowest in Tugela Ferry (26.7%). Most scheme irrigators in Bululwane (45.5%) save their money in a bank. Scheme irrigators (86.4%) in Tugela Ferry and Makhathini, and out of scheme smallholder farmers save their money mostly in stokvels and/or burial societies. On average, smallholder farmers save about R315 per month. According to World Bank (2005), accessibility to financial assets is measured by participation savings organizations. However, in rural areas

included in this study, entrepreneurial investment is grossly dependent on entrepreneurial wealth as credit is not easily available (Dutta, 2007).

Table 4.15. Smallholder farmers' type of saving and average amount being saved

		Bululwane	Tugela Ferry	Makhathini	Out of scheme	Total
Saving cash (%)		34.3	26.7	56.9	34.2	37.3
Type of savings (%)	Formal	45.5	25.0	39.4	7.7	27.8
	Informal	36.4	55.0	51.5	84.6	60.0
	Both	18.2	20.0	9.1	7.7	12.2
Saving per month (R)		493	387	321	176	315

Source: Survey data (March/April 2017)

4.2.9 Access to finance

Credit plays an important role for a small proportion of smallholder farmers. About 22.9% of the smallholder farmers borrowed money in the past 12 months before the study was conducted. The three major reasons why most smallholder farmers do not want to take credit are that they do not want to be indebted (43.5%), the interest rate is high (30.6%) and that they have their own sufficient money (18.3%). As noted by Hassan *et al.* (2017), for those not borrowing, remittances and social grants are credited with easing of credit limitation. Those that were borrowing were borrowing from saving clubs or stokvels (38.2%), relatives or friends (16.4%), money lenders (14.5%) and government pension points (14.5%). Almost all the smallholder farmers reported that they were able to pay back the money they borrowed on time. The major reason for borrowing money is because of family emergencies which include school fees and health care.

Sources of micro-finance like saving groups for smallholder farmers are often undermined when discussing the financing options for smallholder farmers' farming operations. Mostly the focus is on linking smallholder farmers with formal banks. In the focus group discussions, few farmers mentioned that collateral is not the only issue why they cannot get access to finance from banks but there are also issues of not having a consistent monthly income and formal credit history. Murugani & Thamaga-Chitja (2017) also found that smallholder farmers in their study had the same challenges. During the survey, a hypothetical question was asked to smallholder farmers to find out whether they would be willing to use land as collateral (assuming they could) and none of them said that they would be willing to use land as collateral. Therefore, there is no evidence

that suggests that indicated that offering private title deeds alone would increase their borrowing capacity from the lending institutions. A study by Deininger *et al.* (2008) also supported this notion.

At low levels of development, land is not only a productive asset but also performs important functions as a social safety net and old-age insurance (Deininger *et al.*, 2014). Therefore, land cannot just be viewed as a mere commodity, especially for smallholder farmers in the rural areas. Since formal credit and land sale markets do not exist in the survey areas, one of the three presumed effects of individualized tenure on investment incentives, namely, the collateralization effect is prevented from operating. As noted by Brasselle *et al.* (2002), the realizability effect may come into play in so far as the enhanced value of the land resulting from new investments susceptible of being realized through rental transactions rather than through a land sale.

Table 4.16. Sources of credit and the importance of credit (%)

		Bululwane	Tugela Ferry	Makhathini	Out of scheme	Total
Have taken credit in the past 12 months		18.2	21.9	20.7	27.6	22.9
Reason for not taking credit or loan facility	Interest rate is high	23.1	32.8	36.2	27.3	30.6
	No collateral	0	0	23.4	0	5.9
	Got my own sufficient money	38.5	8.6	12.8	23.6	18.3
	It isn't easily accessible	0	1.7	2.1	1.8	1.6
	I do not want to be indebted	38.5	56.9	25.5	47.3	43.5
Main source of credit/loan	Relative or friend	0	37.5	8.3	9.5	16.4
	Money lender	50	18.8	0	9.5	14.5
	Savings club	50	25	50	38.1	38.2
	Input supplier	0	0	8.3	0	1.8
	Commercial Banks	0	0	8.3	0	1.8
	Government	0	6.3	25	19	14.5
	Microfinance institutions	0	6.3	0	19	9.1
	Furniture shop	0	6.3	0	4.8	3.6
Purpose of credit/loan	Family emergency	100	53.3	41.7	80	70
	Consumption	0	6.7	8.3	10	6.7
	Agricultural purposes	0	40	50	10	23.3

Source: Survey data (March/April 2017)

4.2.10 Access to human, social and psychological capital

Most smallholder farmers have over 16 years of crop farming experience on average. Nevertheless, they still need training in order to be able to improve their production and be able to move from subsistence farming to commercial farming. Before any training is provided, there is a need to undertake needs assessment study to identify the areas on which farmers need to be trained. Otherwise, it will raise issues of relevance. Furthermore, Kraay & McKenzie (2013) have argued that regardless of the amount of financing available, individuals with poor skills and facing other constraints may be unable to produce at more than a subsistence level. Compared to scheme irrigators, most out of scheme farmers have received less formal training. Scheme irrigators in Bululwane are well trained compared to other scheme irrigators in Tugela Ferry and Makhathini. More smallholder farmers need to be trained in budgeting/bookkeeping (74.2%), business planning (78.6%), pricing of produce (61.3%) and processing of farm produce (35.7%). Therefore, smallholder farmers need to be trained in processing of farm produce so that they can be involved in the agricultural value chain. These trainings were mainly provided by extension officers from government and non-governmental organizations like Lima.

Table 4.17. Training received by smallholder farmers (%)

Training received	Bululwane	Tugela Ferry	Makhathini	Out of scheme	Total
Vegetable production	100.0	76.7	77.6	71.1	78.5
Land preparation	100.0	66.7	75.9	65.8	73.4
Fertilizer application	100.0	79.5	81.0	56.6	75.6
Herbicide application	97.1	80.8	84.5	43.4	72.3
Irrigation scheduling and water management	91.4	62.3	55.2	14.5	49.6
Processing of farm produce	64.3	43.2	39.7	14.7	35.7
Pricing of produce	82.8	54.8	36.2	8.0	38.7
Business planning	74.1	4.7	32.8	8.0	21.4
Budgeting/ bookkeeping	77.8	9.2	43.1	8.0	25.8

Source: Survey data (March/April 2017)

Smallholder farmers' depend on their social capital to gain access to important information. Depending on where the farmer is located and is farming, their source of information in relation to land and water use rights differs. The majority of scheme irrigators get information related to land and water use rights from fellow farmers. Very few scheme irrigators use ward councilors

and chiefs to get information on land and water use rights. For most home gardeners, the major source of information for land and water use rights is the ward councilors. For most community gardeners, the two major sources of information for land and water use rights are the fellow farmers and the extension officers. Similar to home gardeners, most non-irrigators get their information from the ward councilors. The findings highlight the importance of farmer to farmer information sharing systems as they are the most effective and have a wider reach.

Table 4.18. Sources of information for land and water use rights and rules (%)

Information source		Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total
Fellow farmers	Water	36.9	11.5	40.7	14.3	32.6
	Land	37.1	11.5	40.7	14.3	32.8
Extension officers	Water	17.9	3.8	40.7	9.5	18.2
	Land	26.3	0	37	4.8	22.8
Scheme committee	Water	20.2				14
	Land	18				12.4
Ward councilors	Water	0	80.8	18.5	76.2	17.4
	Land	2.4	76.9	18.5	76.2	18.7
Chief	Water	0.6	3.8	0	0	0.8
	Land	1.2	11.5	3.7	4.8	2.9
Mjindi	Water	24.4				16.9
	Land	15				10.4

Source: Survey data (March/April 2017)

In the rural areas, development programmes take place in areas that have the most political influence and people who are able make their voices heard are the ones that benefit. According to Birner & Resnick (2010) and Cousins (2013), efforts to improve agriculture have often benefited politically connected people and political supporters, including retired civil servants and soldiers, who do not necessarily have any background in farming. In the study areas, only 24% of the smallholder farmers were aware of the development programs that were taking place in their area. Among the 24% that are aware of the development programs, 71.7% of them were consulted before those projects were implemented and 62.3% benefited from those projects. The imbalance between the smallholder farmers that are consulted and the smallholder farmers that benefit is high in home gardeners. One of the possible reasons for this is that home gardeners do

not have an organized body that represents them and they are hard to coordinate because of their geographical locations.

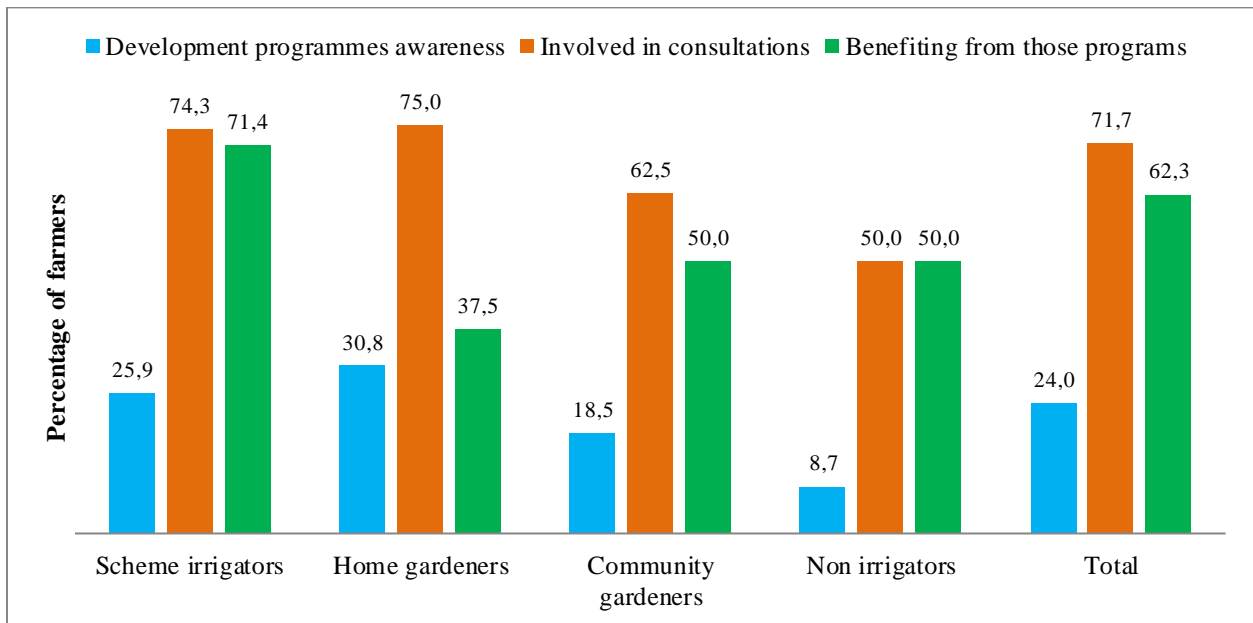


Figure 4.7. Development programmes awareness, involvement in consultations and benefit (%)

Source: Survey data (March/April 2017)

Smallholder farmers farm for different reasons based on their family needs. In South Africa, an estimated 4 million people engage in smallholder agriculture for various reasons, and the majority of these people are in the former homeland areas (Baiphethi & Jacobs, 2009). Subsistence producers consist of approximately 2, 8 million households who practice agriculture mainly for the purposes of own consumption, largely by means of gardening and small-scale animal husbandry (DAFF, 2012). The majority of the scheme irrigators’ farm for two major reasons, namely, to have sufficient food to eat and to earn an income from the sale of crops. These reasons for farming are consistent with those found by Baiphethi & Jacobs (2009) and Cousins (2013). Unlike scheme irrigators, most home gardeners, community gardeners and non-irrigators farm to have sufficient food to feed their families. Generally, economic insecurity tends to motivate less wealthy people to opt for entrepreneurship (Dutta, 2007).

Table 4.19. Major reasons for farming by smallholder farmers (%)

	Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total
Sufficient food	13.7	69.2	63.0	65.2	29.9
Sufficient food and Income	53.0	7.7	25.9	13.0	41.4
Sufficient food and Leisure	7.1	23.1	7.4	17.4	9.8
Income	20.2	0.0	3.7	0.0	14.3
Income and Employment	6.0	0.0	0.0	4.3	4.5

Source: Survey data (March/April 2017)

Since the reasons for farming amongst smallholder farmers vary, the way they manage their farming is also likely to vary. Most of the smallholder farmers (74.6%) do not distinguish their farming operations from family operations. This can be explained by the fact that most smallholder farmers farm to consume and make an income only with the surplus. A small proportion of smallholder farmers (15%) keep records of their farming activities. This is often due to lack of knowledge or lack of interest from the smallholder farmers. About 56.4% of the smallholder farmers are able to see if they are making a profit or loss from farming, even though most of them do not keep any farming activity records. Most smallholder business planning is constructed on responsive opportunism (Morgan *et al.*, 2010).

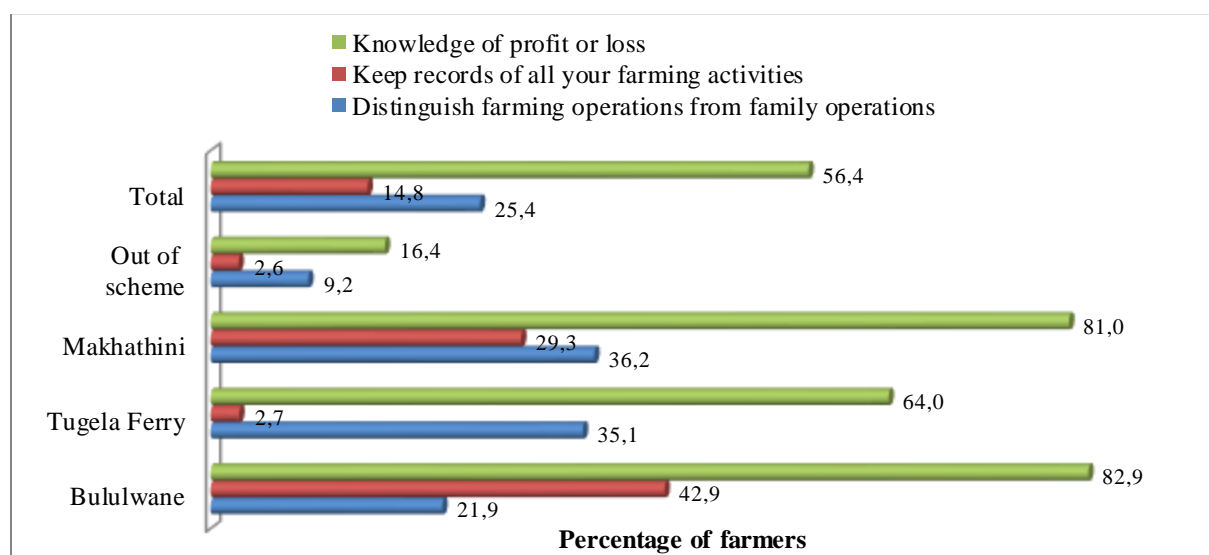


Figure 4.8. Management of farming activities by smallholder farmers (%)

Source: Survey data (March/April 2017)

Farmers were asked questions aimed at capturing the dimensions of positive psychological capital (Luthans & Youssef, 2004), namely, confidence, hope (having the willpower and pathways to attain one’s goals), optimism and resiliency (having the capacity to bounce back from failure). Most of the smallholder farmers (89.8%) are optimistic about the future of agriculture. Even though the majority of smallholder farmers (90.6%) do not give up easily, very few of them are able to cope with natural disasters like droughts and hail storms (47.1%) which are common in the study areas. Out of all the smallholder farmers, 48% would not be farming if there were other good alternative sources of income and 49.2% are willing to take a job or start a business not related to farming. The majority of the smallholder farmers (70.4%) consider themselves as risk takers.

Table 4.20. Smallholder farmers’ attitudes towards farming (%)

Farmer attitudes	Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total
Optimistic about the future of agriculture	92.3	69.2	92.6	91.3	89.8
Able to cope with natural disasters	54.2	19.2	48.1	26.1	47.1
Do not give up easily	89.9	84.6	100.0	91.3	90.6
Would not be farming if there was an alternative source of income	47.6	38.5	63.0	43.5	48.0
Would take a job or start a business not related to farming	48.2	57.7	44.4	52.2	49.2
Willing to take more risks than other farmers	72.6	48.0	77.8	69.6	70.4

Source: Survey data (March/April 2017)

4.3 Description of the factors influencing productive use of irrigation water

Table 4.21 outlines the variables that were included in the model for productive use of irrigation water.

Table 4.21. Description of factors that influence the productive use of irrigation water

Variables	Description of variables
<i>Dependent variable</i>	
Gross margin (R/ha)	Gross margin per hectare for all the produce (consumed and sold) - a proxy for productive use of irrigation water
<i>Independent variables</i>	
Age	Age of household head (in years)
Age square	Age square of household head (in years)
Sex	Gender of household head (1=Male)
Household size	The total number of productive members in each household
Education	Household head education level (in years)
Experience	Number of years involved in farming
Right to use & exclude others (PC _{L1})	Land use rights indices
Land transferability (PC _{L2})	
Land use decision making (PC _{L3})	
Secure access to water (PC _{W1})	Water use rights indices
Effective scheme committees (PC _{W2})	
Access to irrigation equipment (PC _{W3})	
Risk taker (PC _{P1})	Psychological capital indices
Open minded (PC _{P2})	
Input	Access to input markets (1=Yes)
Output market information [#]	Access to output market information (1=Yes)
Extension service [*]	Access to extension services (1=Yes)

#Output market information. Since most of the farmers sell their produce to van traders who buy produce at farm-gate, market distance was not used in this study (Chamberlin & Jayne, 2013). Instead, farmers were asked to rate their satisfaction with their access to market information. As noted by Chamberlin & Jayne (2013), in rural areas a large numbers of traders buy directly from smallholders. Market information aids and places the producer and buyer on more equal bargaining basis and enables exchange of information. Poor access to market information leads the smallholder farmers to sell their produce at low farm-gate prices.

***Extension service.** Extension services are an important source of farming information and advice to smallholder farmers. Smallholder farmers depend heavily on government extension officers who are very few and each has too large coverage area to manage, and therefore do not reach as many farmers as possible. In addition, the extension services are demand driven.

4.4 Further empirical results and discussions

4.4.1 Land use rights indices: PCA results

In Table 4.22, Bartlett's test was statistically significant at 1% significance level and therefore the null hypothesis that variables are not inter-correlated was rejected. Moreover, the KMO measure (0.68) was greater than 0.5 which indicated that PCA could be applied to the dataset. The variables of land use rights that were used to extract the land use rights indices were 11 and only 3 principal components (PCs) were extracted with Eigen values greater than 1 as per Kaiser Criterion. The three extracted PCs contribute 61% of the total variation of the variables used. The three PCs were named based on the dominant variables. The first component (PC_{L1}) explained 34% of the variation and was found to be closely related to the right to use the land and exclude others. The second component (PC_{L2}) explained 15% of the variation and was found to be closely related to land transferability. According to Deininger & Ali (2007), transferability is a precondition for bringing land to more efficient users and thus maximizing output. The third component (PC_{L3}) explained 12% of the variation and was found to be closely related to freedom in land use decision making.

Table 4.22. The dimensions of land use rights for smallholder farmers

Variables	Principal Components			
	PC _{L1} - Right to use & exclude others	PC _{L2} - Land transferability	PC _{L3} – Land use decision making	
I believe I will be treated fairly by the police	0.820			
I always find it easy to approach the traditional courts	0.786			
I always find it easy to approach the police	0.775			
I believe I will be treated fairly by the traditional courts	0.750			
I know my legal rights and responsibilities	0.584		0.418	
I am able to exercise my rights over land	0.566		0.476	
I can transfer land to people not related to me if I want to		0.666		
I can transfer land to family members if I want to		0.646		
I can use this land for more than 10 years if I want to	0.463	0.517		
There are no threats of eviction from my land		0.400		
I am free to choose what to produce on my plot			0.576	
Eigen value	3.7	1.6	1.3	
Variance explained (%)	34	15	12	
Cumulative % of variance explained	34	49	61	
Keiser-Meyer-Olkin (KMO)	0.682			
Measure of sampling adequacy	Bartlett test of sphericity	Chi- square	Sig	Df
		958.05	0.000	55

Notes: Component loadings less than |0.40| are not included in the table. The variables in the first column are captured as 5 point Likert scale in terms of farmers’ agreement/disagreement.

Source: Survey data (March/April 2017)

4.4.2 Water use rights indices: PCA results

In Table 4.23, the significance of Bartlett’s test (1%) suggests that variables are inter-correlated. Moreover, the KMO measure (0.8) was greater than 0.5 which indicated that PCA could be applied to the dataset. The components of water use rights that were used to extract the water use rights indices were 11 and only 3 principal components (PCs) were extracted with Eigen values greater than 1 as per Kaiser Criterion. The three extracted PCs contribute 58% of the total variation of the variables used. The first component (PC_{w1}) explained 34% of the variation and was found to be closely related to secure access to water. According to Namara *et al.* (2010),

access to agricultural water decreases temporary poverty at the farm level. The second component (PC_{w2}) explained 13% of the variation and was found to be closely related to effective scheme committees. Zhang *et al.* (2013) noted that prevention of illegal abstraction of water results in successful collective action. The third component (PC_{w3}) explained 11% of the variation and was found to be closely related to access to irrigation equipment. According to Faysse (2004) and Mollinga (2016), getting access to water requires that two types of access rights to be met at the same time: (i) a legal water access and (ii) a technical access, i.e. the availability of equipment.

Table 4.23. The dimensions of water use rights for smallholder farmers

Variables	Principal Components			
	PC _{w1} – Secure access to water	PC _{w2} - Effective scheme committees	PC _{w3} – Access to irrigation equipment	
My right or claim to water is secure	0.782			
Farmers’ rating of water accessibility to their plot	0.745			
I am satisfied with the maintenance of the canal	0.725			
Farmers’ rating of water quality coming to their plot	0.690			
Farmers’ rating of the overall scheme management	0.620			
Involved in the water use decision making process	0.552			-0.432
Conflict resolution mechanisms are effective	0.540	0.461		
Water source is reliable (never dries up)	0.427			
Farmers’ rating of the effectiveness of committees to ensure compliance to regulations on water users		0.751		
I have adequate access to irrigation equipment				0.703
The frequency of farmers’ failure to receive water on their allocated irrigation day	-0.486			0.560
Eigen value	3.7	1.4		1.2
Variance explained (%)	34	13		11
Cumulative % of variance explained	34	47		58
Keiser-Meyer-Olkin (KMO)	0.795			
Measure of sampling adequacy	Bartlett test of sphericity	Chi- square	sig	Df
		475.85	0.000	55

Notes: Component loadings less than |0.40| are not included in the table. The variables in the first column are captured as 5 point Likert scale in terms of farmers’ agreement/disagreement.

Source: Survey data (March/April 2017)

4.4.3 Psychological capital indices: PCA results

In Table 4.24, the significance of Bartlett's test (1%) suggests that variables are inter-correlated. Moreover, the KMO measure (0.7) was greater than 0.5 which indicated that PCA could be applied to the dataset. The components of psychological capital that were used to extract the psychological capital indices were 11 and only 4 principal components (PCs) were extracted with Eigen values greater than 1. The four extracted PCs contribute 59% of the total variation of the variables used. The first component (PC_{P1}) explained 26% of the variation and was found to be closely related to being a risk taker. The second component (PC_{P2}) explained 12% of the variation and was found to be closely related to being open minded. According to Niehof (2004), McElwee & Bosworth (2010) and Kisaka-Lwayo & Obi (2012), diversification is a risk management strategy. The third component (PC_{P3}) explained 11% of the variation and was found to be closely related to self-confidence. The fourth component (PC_{P4}) explained 10% of the variation and was found to be closely related to being ambitious.

Table 4.24. The dimensions of psychological capital for smallholder farmers

Variable	Principal Components			
	PC _{P1} - Risk taker	PC _{P2} - Open minded	PC _{P3} - Self- confident	PC _{P4} - Ambitious
I am willing to take more risks than other farmers	0.781			
I am willing to forgo a profit opportunity in the short-run to benefit from potential profits in the long-run	0.725			
I trust other farmers	0.596			
I am optimistic about the future of agriculture in my area	0.575		0.514	
I enjoy new challenges and opportunities	0.453			
I am able to cope with shocks or natural disasters	0.434			
I would take a job or start a business not related to farming		0.718		
I would not be farming if I had an alternative source of income		0.662		
I am confident in myself as a farmer			0.766	
I am interested in expanding farming operations				0.690
I do not give up easily	0.463			0.586
Eigen value	2.8	1.4	1.2	1.1
Variance explained (%)	26	12	11	10
Cumulative % of variance explained	26	38	49	59
Keiser-Meyer-Olkin (KMO)	0.718			
Measure of sampling adequacy	Bartlett test	Chi- square	Sig	Df
	of sphericity	383.92	0.000	55

Note: Component loadings less than |0.40| are not included in the table. The variables in the first column are captured as 5 point Likert scale in terms of farmers' agreement/disagreement.

Source: Survey data (March/April 2017)

4.4.4 Impacts of land/water use rights on productive use of irrigation water: UGLM results and discussions

Table 4.25 below presents the results of the factors that influence the productive use of irrigation water. The use of Type III sums of squares option tests the unique contribution of each independent variable by removing effects of all other independent variables (no Multicollinearity). Furthermore, Type III sums of squares of the UGLM ensure that both continuous and categorical variables from either balanced or unbalanced samples are not

problematic, hence its adoption in this analysis (Hair *et al.*, 2010). Partial eta squared was used to determine how big the effect of an independent variable is, controlling for all the other independent variables. Partial eta squared values are preferred since they represent the variation attributable to an effect after correcting for any other effects in the model. Levene's Test of homogeneity-of-variance, less dependent on the assumption of normality than most tests, is employed to test the assumption of homogenous variance (Hair *et al.*, 2010). The test result (p-value of 0.559) was greater than 0.05, suggesting that the variances are homogenous. The independent variables included in the UGLM model explained 19.6% of the variability in gross margin per hectare which is acceptable for cross-sectional data. The corrected model was statistically significant at 5% significance level with a p-value of 0.027 ($F=1.86$). According to the regression results, variation of gross margin per hectare in the selected study areas is mainly influenced by access to input markets, education level, land transferability and effective scheme committees.

Table 4.25. Factors that influence the productive use of irrigation water

Parameter	Coefficients	Std. Error	t	Sig.	Partial Eta Squared
Intercept	56,617.87	28,387.45	1.99	0.048	0.030
Input	10,479.11*	6,106.41	1.72	0.089	0.022
Output market information	160.75	5,457.69	0.03	0.977	0.000
Extension service	-2,882.96	4,698.61	-0.61	0.541	0.003
Sex	-2,274.43	5,478.31	-0.42	0.679	0.001
Age	-751.24	1,013.30	-0.74	0.460	0.004
Age square	3.94	9.07	0.43	0.665	0.001
Experience	232.79	179.43	1.30	0.197	0.013
Education	-1,197.15**	595.47	-2.01	0.046	0.030
Household size	-1,150.16	1,004.27	-1.15	0.254	0.010
Right to use & exclude others (PC _{L1})	-1,897.77	2,393.24	-0.79	0.429	0.005
Land transferability (PC _{L2})	4,197.29**	2,111.80	1.99	0.049	0.029
Land use decision making (PC _{L3})	-1,521.15	2,305.95	-0.66	0.511	0.003
Secure access to water (PC _{W1})	3,637.30	2,669.31	1.36	0.175	0.014
Effective scheme committees (PC _{W2})	5,885.94**	2,534.11	2.32	0.022	0.040
Access to irrigation equipment (PC _{W3})	2,002.26	2,514.42	0.80	0.427	0.005
Risk taker (PC _{P1})	2,068.31	2,687.71	0.77	0.443	0.005
Open minded (PC _{P2})	-2,625.01	2,222.03	-1.18	0.240	0.011
R Squared = 0.196 (Adjusted R Squared = 0.100)					
Corrected Model	df = 17		F= 1.859	0.027	0.196
Levene's Test	df1 = 13	df2 = 134	F= 0.896	0.559	

Notes: ***, ** and * mean statistically significant at 1%, 5% and 10% levels, respectively.

Source: Survey data (March/April 2017)

Access to input markets was statistically significant at 10% significance level and had an influence of 2.2% on the productive use of irrigation water. Smallholder farmers with access to input markets have a higher productive use of irrigation water by R10,479.11 compared to those that do not have it, *ceteris paribus*. This finding was expected as the major crops planted by smallholders require fertilizers and chemicals in order to yield meaningful produce and income. For example, most smallholders lost a lot of produce as a result pests in cabbages and maize, and diseases in tomatoes. Andrew *et al.* (2003) found that difficulty in obtaining local sources of agricultural inputs and tractor services often associated with the withdrawal of white traders and

poor service delivery on the part of government departments of agriculture leads to underutilization of arable land. A study by Mkhabela (2005) also found that if the government can provide fertilizer at a subsidized price, most smallholders would use it. This is an idea that smallholders welcomed in this study during the focus group discussions because free inputs are not tailored to their fields and weather conditions.

The level of education was statistically significant at 5% significance level and had a 3% influence on the productive use of irrigation water. Increasing level of education by 1 year decreases the productive use of irrigation water by R1,197.15, *ceteris paribus*. An explanation for these results could be that as smallholder farmers get more educated, they are more likely to spend more time off-farm than on-farm. Hence, they are not as productive as those who are less educated and spend more time on the farm (Mkhabela, 2005). The results are in line with the findings by Jayne *et al.* (2010) who found that education played an important role in Asia by allowing households to exit agriculture into more lucrative off-farm jobs. A study by World Bank (2005) also confirmed these results. Therefore, even though education level improves chances of being employed off-farm and diversifying sources of income, it can lead to smallholders reducing the time spent in farming as most of them farm to supplement their food consumption. If most smallholders viewed farming as a business, then increasing education level would be more likely to increase the productive use of irrigation water.

Out of three land use right components, only land transferability was found to be statistically significant at 5% significance level and had an influence of 2.9% on the productive use of irrigation water. Improving land transferability increases the productive use of irrigation water by R4,197.29, *ceteris paribus*. The results are consistent with the findings by Brasselle *et al.* (2002) and Deininger & Jin (2006). Clear and enforceable rules for transferring land are significant to smallholders' investment choices (Deininger & Jin, 2006; Ma *et al.*, 2017). When land use rights are transferable, it makes it easy for land to be cultivated by the best user. Since smallholder farmers know that their plot will be passed to their children when they can no longer work on it, they invest more in it and they make sure that the soils remain in a good condition for their children. According to Deininger *et al.* (2014), land registration operation is economically necessary when the cost of creating and sustaining these institutions is complemented by increasing productivity. Therefore, it is expected that formalization of this process will not have that much economic impact since farmers are already enjoying the benefits of transferring land to

others within the family or relatives. Smallholders' investments decisions are subject to the expected economic return (Bainville, 2017). A study by Fort (2008) also finds that in customary land areas, basic land rights are sufficient to induce land holders to invest.

The effectiveness of scheme committees was found to be statistically significant at 5% significance level and had a 4% contribution to the productive use of irrigation water. Improving effectiveness of scheme committees increases the productive use of irrigation water by R5,885.94, *ceteris paribus*. When scheme committees ensure compliance to rules and have strong conflict resolution mechanisms, farmers are able to be more productive as they are able to get water on their irrigation days. As noted by Wilder & Lankao (2006), the major problem facing scheme committees is the lack of resources caused by the withdrawal of government in supporting irrigation projects. This will remain a problem since most of these irrigation projects by government are established as development programmes with the main objective of increasing food security (selling left overs) and not building sustainable businesses (consuming left overs). The moment scheme committees are left to operate on their own when they are not yet ready to take over by themselves, they are left vulnerable and their effectiveness gets threatened by challenges they cannot afford to solve by themselves like dealing with broken engines or other technical issues. Moreover, Mollinga (2016) noted that it is not easy to see how strengthening the legal status of individual water entitlements to explicit water rights might do much to make water distribution less unequal. As formalization of rights usually involves more administrative work with little or no new practical benefits that were not there before in the previous tenure system. The common challenge that scheme committees have to deal with relates to people using water on the days not allocated to them (Ostrom & Gardner, 1993) and the challenge of broken pumps/pipes.

4.5 Summary

This chapter started off by breaking down smallholder farmer typologies, gross margins, human, social and psychological capital, and their socioeconomic characteristics using descriptive statistics. This chapter further categorized land use rights, water use rights and psychological capital into indices using the principal components. Land use rights indices comprised of the right to use the land and exclude others, land transferability and land use decision making. Water use rights indices comprised of secure access to water, effective scheme committees and access

to irrigation equipment. Lastly, psychological capital indices comprised of being a risk taker, being open minded, being self-confident and being ambitious. This chapter addressed the first objective of the study which was to determine the influence of land and water use right on the productive use of irrigation water. The results indicated that only four independent variables, namely, education level, access to inputs, land transferability and effective scheme committees had a significant impact on the productive use of irrigation water. The next chapter addressed the remaining objectives of the study.

CHAPTER 5 WATER/LAND USE RIGHTS AND ON-FARM ENTREPRENEURSHIP: RESULTS AND DISCUSSIONS

5.1 Introduction

This chapter addresses the second objective which is to analyze the influence of land and water use rights on smallholder farmers' entrepreneurial spirit. Using the PCA, the entrepreneurial spirit was broken down into four components or characteristics, namely, business mindset, self-confidence, innovation and risk taking. Since there were multiple dependent variables, the MGLM was used in this study to test the extent of influence of independent variables including land and water use right indices on the entrepreneurial spirit. It also addresses the third objective of the study which is to analyze factors affecting the willingness and ability to expand farming operations by smallholder farmers. The oprobit and Heckman selection model were adopted to test the impact of factors affecting the willingness and ability to expand. The results are presented and discussed subsequently.

5.2 Descriptive results and description of the variables in the models

5.2.1 Smallholder farmers' entrepreneurial spirit

According to Knudson *et al.* (2004), McElwee & Bosworth (2010) and Sinyolo *et al.* (2017), entrepreneurs are those people who exhibit common traits such as single-mindedness, creative, problem solving, persistence, honesty, strong drive to achieve, goal oriented, independent, self-confident, disciplined, strong management and organizational skills, tolerance for failure, positive attitude and seeing opportunities where others see problems. This study follows this approach to estimate smallholder farmers' entrepreneurial spirit. Most of the smallholder farmers (67.8%) like to deal with problems as they arise rather than spend time anticipating them. Being able to speak in public and voicing challenges is very important because it allows farmers to be heard by government or politicians. The majority of smallholder farmers (63.9%) are able to confidently speak in the public meetings or gatherings.

The ability of smallholder farmers to inspire each other, to network and to be able to communicate is very critical for their success as it allows them to mobilize scarce resources. Almost all the smallholder farmers (90.2%) have the will to cooperate and network with other smallholder farmers. Most smallholder farmers have the ability to inspire and energize others

(75.4%) who might be discouraged when things get difficult. The percentage of smallholder farmers that possess persuasive communication and negotiation skills which is important in produce marketing is 64.3%. Another important skill that most smallholder farmers (85.7%) possess is the ability to set new goals once old ones have been achieved. However, smallholder farmers normally set short-term goals only. Trainings to smallholder farmers are normally provided by government and NGOs for free. Therefore, smallholders who are willing to pay for trainings show a level of eagerness to learn and grow themselves. About 57.8% of the smallholder farmers are willing to pay for any farm related trainings and see value in them. There is a high number of risk takers (73.4%), smallholder farmers that are willing to try new ideas even without full knowledge about the possible outcome.

Table 5.1. Smallholder farmers’ entrepreneurial characteristics (%)

	Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total
I always look for better and profitable ways to run farm operations	89.9	44.0	74.1	73.9	81.9
I deal with problems as they arise rather than spend time to anticipate them	67.3	48.0	80.8	78.3	67.8
I am confident to speak in public	66.1	53.9	59.3	65.2	63.9
I have the ability to inspire and energize others	76.2	65.4	85.2	69.6	75.4
I am willing to cooperate with others and network	92.9	61.5	96.3	95.7	90.2
I possess persuasive communication and negotiation skills	66.7	50.0	55.6	73.9	64.3
I have the ability to set goals and set new ones once attained	86.3	80.8	85.2	87.0	85.7
I am very competitive in nature	76.2	34.6	81.5	73.9	72.1
I am willing to pay for any farm related trainings	60.7	50.0	55.6	47.8	57.8
I am willing to try new ideas even without full knowledge about the possible outcome	72.0	65.4	77.8	87.0	73.4
If one problem is persistent, I try alternative approaches to address it	81.0	92.3	92.6	91.3	84.4

Source: Survey data (March/April 2017)

Table 5.2 below indicates the variables that are included in the MGLM to determine which factors influence smallholder farmers’ entrepreneurial spirit.

Table 5.2. Description of factors that influence smallholder farmers entrepreneurial spirit

Variables		Description of variable	
<i>Dependent variables</i>			
Business mindset	Self-confidence	Innovation	Risk taking
<i>Independent variables</i>			
Mode of water supply	Type of water supply system(1=gravity)		
Age	Age of the household head (in years)		
Household size	The total number of productive members in each household		
Total land	Land size utilized (in hectares)		
Education level	Household head education level (in years)		
Off-farm income	Total income derived from off-farm activities per year (in Rands)		
On-farm income	Total income derived from on-farm activities per year (in Rands)		
Experience	Household head farming experience (in years)		
TLU	Livestock size in Tropical Livestock Units (TLU)		
Assets	Assets value of household head (in Rands)		
Right to use & exclude others (PC _{L1})	Land use rights indices		
Land transferability (PC _{L2})			
Land use decision making (PC _{L3})			
Secure access to water (PC _{W1})	Water use rights indices		
Effective scheme committees (PC _{W2})			
Access to irrigation equipment (PC _{W3})			
Inputs	Access to inputs (1=Yes)		
Output market information	Access to market information (1=Yes)		
Extension service	Access to extension services (1=Yes)		

Source: Survey data (March/April 2017)

5.2.2 Smallholder farmers willingness and ability to expand farming operations

According to DAFF (2012), “1,5 million ha of land under irrigation can be expanded by at least 500 000 ha through the better use of existing water resources and developing new water schemes”. About 41.6% of the smallholder farmers are willing and able to expand their farming operations if an opportunity would present itself. There are 19.3% smallholders that are willing to expand but are not able due to lack of resources. There are three major factors that prevent smallholders from expansion, namely, irrigable land availability constraints (47.4%), financial constraints (40.3%) and lack of access to inputs (35.4%). Moreover, there were two major

reasons why other smallholders were not willing to expand their farming operations, namely, they have enough land (51.2%) and they are too old to expand their farming operations (47.7%).

Table 5.3. Factors affecting smallholder farmers (%) willingness and ability to expand farming operations

		Scheme irrigators	Home gardeners	Community gardeners	Non-irrigators	Total
Not willing to expand (n=95)		38.1	44.0	37.0	43.5	39.1
Willing but not able to expand (n=47)		18.5	32.0	14.8	17.4	19.3
Willing and able to expand (n=101)		43.5	24.0	48.1	39.1	41.6
Factors preventing expansion ability (more than one reason)	Financial constraints	40.7	26.7	38.9	53.8	40.3
	Land availability constraints	50.0	46.7	44.4	30.8	47.4
	Lack of access to inputs	45.8	18.2	30.0	10.0	35.4
	Water availability constraints	4.2	45.5	0.0	90.0	20.3
Reasons for not wanting to expand	I have enough space	47.4	60.0	55.6	60.0	51.2
	I am too old	50.9	40.0	44.4	40.0	47.7

Source: Survey data (March/April 2017)

Table 5.4 below shows the variables that were included in the oprobit and Hackman selection model to analyze the factors influencing the willingness and ability to expand farming operations among smallholder farmers.

Table 5.4. Description of factors that influence willingness and ability to expand farming operations

Variables	Description of variables
<i>Dependent</i>	
Willingness and Ability to Expand	Willingness and ability to expand farming operations (2= Willing and able, 1= Willing but not able, 0= Not willing to expand)
<i>Independent</i>	
Age	Age of household head (in years)
Sex	Gender of household head (1=Male)
Household Size	The total number of productive members in each household
Total land	Land size utilized (in hectares)
Total income	Total income received by household head both from off-farm and on-farm activities (in Rands)
Inputs	Access to inputs (1=Yes)
Assets	Asset value of household head (in Rands)
Access to irrigation equipment	Water use right index

Source: Survey data (March/April 2017)

5.3 Further empirical results and discussions

5.3.1 Entrepreneurial spirit indices: PCA results

In Table 5.5, the significance of Bartlett's test (at 1%) suggests that variables are inter-correlated. Moreover, the KMO measure (0.836) was greater than 0.5 which indicated that PCA could be applied to the dataset. The components of entrepreneurial spirit that were used to extract the entrepreneurial spirit indices were 12 and only 4 principal components (PCs) were extracted with Eigen values greater than 1. The four extracted PCs contribute 55.8% of the total variation of the variables used. The first component (PC_{E1}) explained 30.7% of the variation and was found to be closely related to business mindset. The second component (PC_{E2}) explained 9.5% of the variation and was found to be closely related to self-confidence. According to McElwee & Bosworth (2010), leadership is essential for smallholders to enhance their business. The third component (PC_{E3}) explained 8.4% of the variation and it was named innovation. The fourth component (PC_{E4}) explained 7.1% of the variation and was found to be closely related to risk taking.

Table 5.5. The dimensions of smallholder farmers entrepreneurial spirit

Variable	Principal Component			
	PC _{E1} – Business mindset	PC _{E2} – Self- confidence	PC _{E3} – Innovative	PC _{E4} – Risk taking
I am very competitive in nature	0.706			
I always look for better and profitable ways to run farm operations	0.674	-0.524		
I possess persuasive communication and negotiation skills	0.631			
I have the ability to set goals	0.596			
I produce mainly for the market	0.570			
I have the ability to inspire and energize others	0.565			
I deal with problems as they arise	0.540			0.488
I am willing to cooperate with others and network	0.511			
I am confident to speak in public	0.547	0.550		
If one problem is persistent, I try alternative approaches	0.518		-0.631	
I am willing to pay for any farm related trainings			0.544	
I am willing to try new ideas even without full knowledge about the possible outcome	0.545			0.559
Eigen value	4.6	1.4	1.3	1.1
Variance explained (%)	30.7	9.5	8.4	7.1
Cumulative % of variance explained	30.7	40.2	48.6	55.8
Keiser-Meyer-Olkin (KMO)	0.836			
Measure of sampling adequacy	Bartlett test	Chi- square	Df	sig
	of sphericity	920.390	105	0.000

Notes: Component loadings less than |0.40| are not included in the table. The variables in the first column are captured as 5 point Likert scale in terms of farmers' agreement/disagreement.

Source: Survey data (March/April 2017)

5.3.2 Impact of land/water use rights on on-farm entrepreneurship spirit: MGLM results and discussions

Similar to UGLM, MGLM uses Type III sums of squares option which tests the unique contribution of each independent variable by removing effects of all other independent variables and therefore, there is no Multicollinearity problem. The Box's M test of equality of covariance matrices was used to check the assumption of homogeneity of covariance across the groups using $p < .001$ as a criterion. The Box's M test was statistically significant and therefore must reject the

hypothesis that the variance-covariance matrix for the dependent variables is equal across groups. Since the assumption of homogeneity of variance-covariance is violated, the Pillai's Trace test which is a test statistic that is very robust and not highly linked to assumptions about the normality of the distribution of the data is used in Table 5.7 for MANOVA instead of Wilk's Lambda. Levene's Test result had insignificant F-values of 0.98, 1.52, 1.28 and 0.75 at 10% significance level for business mindset, self-confidence, innovation and risk taking characteristic, respectively, suggesting that the variances are homogenous for all four equations. The independent variables included in the MGLM model explained 25.9% of the variability in business mindset, explained 31.1% of the variability in self-confidence, explained 24.1% of the variability in innovation and explained 35.5% of the variability in risk taking. Considering that the data is cross sectional, the R^2 values are acceptable. The corrected models were statistically significant at 1% significance level with F-value of 2.76, 2.1, 2.39 and 4.15 for business mindset, self-confidence, innovation and risk taking, respectively.

The partial eta squared values included in the table indicate the contribution (effect size) of each factor, independent of the number of variables included in the model. Following Cohen's effect sizes, a cutoff point of 0.06 (medium effect) was used to report on the practical significance of the results. Effectiveness of scheme committees had the highest impact on business mindset, on-farm income had the highest impact on self-confidence and land transferability had the highest impact on risk taking. Table 5.6 displays the results of the impact of independent variables on the components of smallholder farmers' entrepreneurial spirit. Using the variables that were statistically significant in Table 5.6, a MANOVA regression is used to determine whether these variables have a statistical significance on smallholder farmers' entrepreneurial spirit. The results are shown in Table 5.7 below.

Table 5.6. Factors that influence smallholder farmers' entrepreneurial spirit components: MGLM results

Variables	Business mindset		Self-confidence		Innovative		Risk taking	
	Coeff.	Partial Eta Squared	Coeff.	Partial Eta Squared	Coeff.	Partial Eta Squared	Coeff.	Partial Eta Squared
Intercept	-0.17	0.001	0.45	0.006	0.00	0.000	-0.48	0.007
Mode of water supply	-0.09	0.003	-0.51***	0.053	-0.22	0.008	0.13	0.004
Input	0.16	0.006	0.11	0.002	0.18	0.004	0.00	0.000
Output market information	0.11	0.004	-0.02	0.000	-0.13	0.003	-0.31*	0.021
Extension service	-0.24*	0.026	-0.03	0.000	0.18	0.008	-0.16	0.008
Age	0.00	0.004	-0.01	0.003	0.01	0.006	0.01	0.004
Experience	-0.01	0.008	-0.01	0.019	0.01	0.005	-0.01	0.017
Education	0.03	0.018	0.04*	0.020	-0.01	0.001	0.02	0.010
Household size	0.04	0.014	-0.01	0.001	-0.07	0.018	0.05	0.011
Total land	-0.14	0.013	-0.27**	0.032	-0.06	0.001	0.13	0.008
Right to use & exclude others (PC _{L1})	0.02	0.001	0.05	0.003	-0.19**	0.029	0.32***	0.102
Land transferability (PC _{L2})	-0.01	0.000	0.17**	0.038	0.06	0.004	0.23***	0.070
Land use decision making (PC _{L3})	0.11	0.019	0.02	0.000	-0.07	0.005	0.02	0.001
Secure access to water (PC _{W1})	-0.03	0.001	-0.01	0.000	0.02	0.000	-0.02	0.000
Effective scheme committees (PC _{W2})	0.22***	0.067	0.14*	0.020	-0.20**	0.030	-0.05	0.003
Access to irrigation equipment (PC _{W3})	0.12*	0.022	0.16*	0.027	-0.14	0.016	0.17**	0.032
TLU	0.00	0.002	0.00	0.002	0.01	0.015	-5.086E-05	0.000
Assets	0.00*	0.023	7.621E-05	0.008	0.00	0.014	4.202E-05	0.003
Off-farm income	3.710E-06	0.006	5.952E-06	0.010	-1.527E-06	0.001	2.460E-06	0.002
On-farm income	1.392E-06	0.000	2.1E-05***	0.063	8.192E-06	0.008	-7.441E-06	0.008
Boxe's Test	Box's M = 172.00		F = 1.96***					
Levene's Test	F= 0.98		F= 1.52		F= 1.28		F= 0.75	
Corrected Model	F= 2.54***		F= 3.27***		F= 2.31***		F= 3.99***	
R Squared	0.26		0.31		0.24		0.36	
Adjusted R Squared	0.16		0.22		0.14		0.27	

Notes: ***, ** and * mean statistically significant at 1%, 5% and 10% levels, respectively.

Source: Survey data (March/April 2017)

Business mindset

The results indicate that effectiveness of scheme committees, irrigation equipment and assets enhance smallholders' business mindset, and extension services hinder it. The more effective the scheme committees are in managing the scheme, the more smallholders are encouraged to be more business minded, *ceteris paribus*. When scheme committees are effective, there are fewer conflicts and smallholders are able to plan better as there are less water disturbances by other farmers that affect how they receive water in their plots. Better access to irrigation equipment like sprinklers encourages smallholders to be more business minded in how they farm, *ceteris paribus*. Irrigation equipment enables smallholder farmers to cover more surface area in less time and they are able to use the extra time for other businesses that they might want to start. Improving access to communication and working assets enhances smallholders' business mindset, *ceteris paribus*. Smallholders with communication assets are able to contact potential clients and are able to use their working assets to meet the demand of their clients. Access to assets also means better access to information and opportunities.

Smallholders with access to extension services were less likely to be business minded compared to those that do not have access, *ceteris paribus*. This finding is contrary to the findings by Sinyolo *et al.* (2017) who found that smallholders that have contact with extension officers gain access to information on new technologies or markets, which is important in successful farm entrepreneurship. However, the possible reason for this finding is that, most smallholders with access to extension services receive free inputs and have an expectation that government has to do everything for them which reduces their business mindset. Those that do not have access extension services have to depend on themselves and be business minded in order for them to be able to acquire inputs. Most smallholder farmers sell their produce to van traders and extension officers are not involved in the coordination of those trades.

Self-confidence

Smallholder self-confidence was found to be enhanced by education level, land transferability, effectiveness of scheme committees, access to irrigation equipment and on-farm income, and was hindered by mode of water supply and total land size. The more educated a smallholder farmer is, the more confident they are in communicating and networking which is critical in getting information and gaining access to opportunities, *ceteris paribus*. Farmers who are

educated are more likely to look for and take new opportunities. They are usually outspoken. Farmers who are educated are more likely to hold leadership positions in the scheme they work in because of their self-confidence (Backeberg & Sanewe, 2010; Muchara *et al.*, 2014). This was seen to be the case for most irrigation schemes. The transferability of land increases the smallholder self-confidence, *ceteris paribus*. Smallholder farmers have pride in themselves when they own land which they know they can transfer to their children. Effectiveness of scheme committee increases the self-confidence of smallholders, *ceteris paribus*. Inclusive scheme committees encourage participation of members and provide them a space where their voices can be heard irrespective of gender. As highlighted by Luthans & Youssef (2004), leadership clarity improves insights of authenticity, enabling leaders to draw the support and buy-in that are crucial for guiding their units to accomplish their targets and goals.

Improving access to irrigation equipment of smallholders increases their self-confidence, *ceteris paribus*. When smallholders have their own irrigation equipment, they become more independent and are able to better compete with their counterparts. Increasing on-farm income increases self-confidence of smallholders, *ceteris paribus*. When smallholders receive good returns from the work that they do, they are able contribute meaningfully in their households and in the scheme which gives them a sense of pride. Moreover, Muchara *et al.* (2014) noted that income generated in irrigation farming can be an indicator of the incentives available for farmers to participate in irrigation activities. The decision of a rural household whether or not to start a household enterprise depends on the expected profits in comparison to agricultural wages (Naude, 2016). The findings indicate that smallholders who use gravity irrigation system have less self-confidence compared to those using pumps, *ceteris paribus*. According to Luthans & Youssef (2004), people who are self-confident choose challenging tasks and endeavors, extend motivation and effort to successfully accomplish their goals, and persevere when faced with obstacles. Therefore, the findings are consistent with that notion, that smallholders using pumps face more challenges compared to those not using pumps (Muchara *et al.*, 2014) and as a result they are more confident because they have overcome a lot challenges.

As land size increases, self-confidence decreases, *ceteris paribus*. This finding is contrary to the findings by Sinyolo *et al.* (2017) who found that land size was positively associated with entrepreneurship because farmers with bigger land sizes have more risk-bearing ability compared to farmers with smaller pieces of land. However, a possible reason for this finding is that more

land size comes with more expenses needed to work on that land. Since most smallholders struggle to buy inputs, sell their produce and also pay for water. It is likely that given those constraints more land will cause stress to smallholders and reduce their self-confidence especially since most of them are old. As noted by Van Averbeké & Mohamed (2006), one of the risk minimizing strategies that smallholders use is to utilize small portions of their plots and restraining their expenditure on total variable costs which eliminates the risk of losing money.

Innovative

The right to use and exclude others from land and the effectiveness of scheme committees hinder smallholders' innovativeness. The possible reasons for these findings is that when smallholders have the right to use and exclude others from land, they do not have much pressure to try new crops that can yield them high income which they can use to cover their expenses. Moreover, effective scheme committees are able to mobilize farmers to work as a team and they often encourage their members to plant same crops so that they are able to attract big clients. This then leads to smallholders not being interested in trying new crops when others are not growing that crop, especially since they face the challenge of markets which makes them skeptical about what they grow. Hence, effective scheme committees encourage group innovation but not individual innovation.

Risk taking

The capacity to take risks is enhanced by the right to use and exclude others from land, land transferability and access to irrigation equipment. Access to output market information is one factor that hinders smallholder desire to take risks. When smallholders know they can exclude others from their land, they are happy to try something new because they know that no one will interfere with their land and all the benefits of that will come to them. This finding is consistent with the findings by Ma *et al.* (2017) who found that secure property rights may reduce the risks involved in making long-term investments. The more confident smallholders are in their land transferability rights, the more risk they are willing to take, *ceteris paribus*. As noted by Ma *et al.* (2017), increased land tenure security stimulates land market development. The land market effect refers to transferring land to more efficient farmers. Moreover, Sinyolo *et al.* (2017) also noted that smallholders with secure land tenure had higher entrepreneurship levels because of their greater incentive to undertake risky investments in productive inputs and technology as

secure tenure ensures their ability to maintain long-term use over their land. Improving access to irrigation equipment enables smallholders to consider taking the risks of trying new crops in their plots as they are able to irrigate more land. The more information smallholders get about the markets, the less likely they will want to take risks with crops they know nothing about or selling in markets with high uncertainty. This is expected as access to information reduces the risk of doing something. According to Sinyolo *et al.* (2017), access to market information implies less transaction costs (including risk) and speaks of opportunities of making good profits out of farming activities. Hence, those with access to market information take fewer risks compared to those without.

Entrepreneurial spirit: MANOVA results

The test for the overall MANOVA model indicates that the model is statistically significant at 1% significance level. In the overall model in Table 5.7 the Pillai's Trace multivariate test is used for each of the predictor variables. Other tests like Wilks' lambda, Lawley-Hotelling trace and Roy's largest root indicated the same F and P values for all predictors in the model and were not included in Table 5.7. Since the Box's M test was statistically significant, the Pillai's Trace test was the most suitable in this case. The null hypothesis for all the independent variables is that the coefficient for each variable is equal to 0 in all four equations. Based on the results of this test we reject the null hypothesis that the coefficients for mode of water supply, output market information, the right to use & exclude others from land, land transferability, access to irrigation equipment and on-farm income across the four equations are simultaneously equal to 0. In other words, the coefficients for mode of water supply, output market information, the right to use & exclude others from land, land transferability (Ma *et al.*, 2017; Sinyolo *et al.*, 2017), access to irrigation equipment and on-farm income (Muchara *et al.*, 2014; Naude, 2016), taken for all four outcomes together, are statistically significant. Therefore, they influence smallholder farmers' entrepreneurial spirit. Similar to the findings by Sinyolo *et al.* (2017), education level was insignificant in explaining smallholder farmers' entrepreneurial spirit.

Table 5.7. Factors affecting smallholder farmers entrepreneurial spirit: MANOVA results

Source	Pillai's Trace Statistic	F
Model	0.954	3.07***
Mode of water supply	0.087	3.19**
Output market information	0.144	1.85**
Extension service	0.07	0.87
Education	0.054	1.97
Total land	0.045	1.78
Right to use & exclude others (PC _{L1})	0.128	5.2***
Land transferability (PC _{L2})	0.063	2.2*
Effective scheme committees (PC _{W2})	0.073	1.78
Access to irrigation equipment (PC _{W3})	0.072	2.87**
Assets	0.025	0.51
On-farm income	0.124	4.56***

Notes: ***, ** and * mean statistically significant at 1%, 5% and 10% levels, respectively.

Source: Survey data (March/April 2017)

5.3.3 Factors affecting willingness and ability to expand farming operations: Oprobit results and discussions

DAFF is in the process of implementing an irrigation policy which aims to expand the irrigation schemes in the country. This then raises the question of whether or not smallholders are willing and able to expand. If so, what could be the factors that influence such decisions? This section seeks to make a contribution in that regard. The smallholder farmers that are willing and able to expand can be viewed as entrepreneurs. Before interpreting the results of the model, tests for model fitness were done. Since the residual errors were normally distributed as shown in chapter 3- figure 3.3, the use of the oprobit model instead of ordered logit was justified. The mean VIF was 1.19 indicating that multicollinearity is not an issue in the model. Even though the pseudo R² is low, the results confirm and reinforce the descriptive results. According to Meinzen-Dick *et al.* (2004), quantitative and qualitative analysis can be used in an iterative way to cross-validate empirical results. The Mills lambda was statistically significant at 5% significance level in the Heckman model. This indicates that there is little collinearity in the Heckman model and the two-step process is appropriate (Puhani, 2000).

The results of the oprobit and Heckman model indicate that age, sex and household size have a statistically significant influence on willingness and ability to expand. The marginal effects were included in Table 5.8 below to determine the influences of the variance of the independent variable per unit on the dependent variable in order to provide a better interpretation of the coefficients with random effects. However, regardless of the quantitative values, the oprobit model with random effect was applied to examine the actual pattern of responses on willingness and ability to expand levels in each category. The Heckman results were presented for comparison purposes and were close to the oprobit results. Therefore, results discussions focus on the oprobit results, although similar explanations apply to the Heckman results.

Table 5.8. Factors that influence the willingness and ability to expand farming operations: Oprobit and Heckman selection model results

Variables	Estimated coefficients (Est. Co.)	Marginal Effects (dy/dx)			Heckman	
		0	1	2	probit	oprobit
					Est. Co.	Est. Co.
Age	-0.186**	0.0069	0.0004	-0.0073	0.01***	-0.0174*
Sex	-0.405*	0.1511	0.0078	-0.1590	0.3238***	-0.5901**
Household Size	-0.085*	0.0316	0.0016	-0.0333	0.0493	-0.1385***
Total land	-0.008	0.0028	0.0001	-0.003	0.0335	0.0236
Total Farm Income	3.88E-06	-1.45E-06	-7.51E-08	1.52E-06		3.40E-06
Input	-0.308	0.1103	0.0118	-0.1222		-0.3927
Assets	-8.91E-05	0.00003	1.73E-06	-0.00004		-9.7E-05
Access to irrigation equipment (PC _{w3})	-0.149	0.0557	0.0029	-0.0586		-0.1823
/cut1	-2.6607				Mills Lambda	-0.6454**
/cut2	-2.1237				Rho	-1
Number of observations	167	Pseudo R2	0.0668		sigma	0.6454
Wald Chi-square (8)	23.04	Log pseudo likelihood	-163.05		Wald chi2(4)	62.66
Prob > Chi-square	0.006	Mean VIF	1.19		Prob > chi2	0.0

Notes: ***, ** and * mean statistically significant at 1%, 5% and 10% levels, respectively.

Source: Survey data (March/April 2017)

Age of the farmer was statistically significant at 5% significance level. As age increases, smallholders will less likely be willing and able to expand farming operations, *ceteris paribus*.

This finding is consistent with findings by Sinyolo *et al.* (2017) who found a negative association between entrepreneurship/aspirations and age. With an aging smallholder farmer population in the study areas, these results indicate that old smallholder farmers are less interested or capable of expanding their farming operations and viewing farming as a business. Fischer & Qaim (2012) and Xaba & Masuku (2013) also noted that the aspirations of the entrepreneur as well as his mental capacity to cope with the challenges of his business activities and his mental and physical abilities to do manual work decreases with age. Among those older smallholder farmers, who are approaching the time of retirement due to age, other goals might be more important than farming in an entrepreneurial way (Vesala & Vesala, 2010) or expanding farming operations. Therefore, in order for government to get a return on their investment in irrigation scheme expansion, they must carefully consider the age of the people that will participate in those schemes.

The sex of the farmer was statistically significant at 10% significance level and had a negative sign. This means that males were less likely to be willing and able to expand compared to females, *ceteris paribus*. This is consistent with the findings by Sinyolo *et al.* (2017) who found that female-headed households were more entrepreneurial or had higher aspirations in agriculture than male-headed households as a result of the lack of options for women outside farming. This means that women are more committed to farming than their male counterparts. This can also be explained by the fact that males are considered to be mobile and spend more time looking for non-farm work than farm work. There are also cultural reasons that can explain these results. For example, in Msinga farming is still considered as a woman's duty and during focus group discussions some farmers indicated that males are sometimes verbally bullied by women in the schemes since it is considered as something for women only. More women are found to be the household heads in the rural areas and high unemployment forces them to work harder so that they can be able to feed their families. These findings are contrary to the findings by Pandolfelli *et al.* (2008) who found that men are more involved in groups related to income generation (e.g. productive groups) whereas women are more involved in home and child related groups. In the selected study areas, women participate in all groups as most households do not have male heads.

The household size was statistically significant at 10% significance level and had a negative sign. This implies that household heads with many household members are less likely to be

willing and able to expand, *ceteris paribus*. This finding is consistent with the findings by Sinyolo *et al.* (2017) who found that bigger households are less likely to be entrepreneurial or have less farming aspirations compared to smaller households. According to World Bank (2005) and Sinyolo *et al.* (2014), large household size may lead to lower income per capita if there are diminishing returns to additional labor in the household and larger households tend to have a higher share of dependents. Therefore, this finding is due to the fact that most family members are either working off-farm or are looking for employment off-farm and have little interest to work on-farm. Moreover, kinship links play an important part at every stage and in every aspect of entrepreneurial activity and farming aspirations. The farmer who has greater financial family support has a higher probability of becoming an off-farm entrepreneur and as a result work less on the farm (Dutta, 2007). This finding is also an indication that smallholders do not operate in a vacuum when developing their businesses or making decisions about their next move. Seuneke *et al.* (2013) noted that farming families are less driven by ideas of growth and profit maximization but instead, higher priority is given to survival, maintaining a rural life-style and passing a healthy farm on to the next generation.

5.4 Summary

To recap, understanding the factors influencing smallholder farmers' entrepreneurial spirit and aspirations informs agricultural development policy interventions targeted at harnessing entrepreneurial activities in agriculture. This chapter concludes that, to encourage smallholder farmers' entrepreneurial spirit, there is a need to take into account the impact of mode of water supply, output market information, right to use & exclude others from land, land transferability, access to irrigation equipment and on-farm income. Hence, the existing land and water use rights enhanced smallholder farmers' entrepreneurial spirit. In addition, factors that were found to have a statistically significant effect on smallholder farmers' willingness and ability to expand were age, sex and household size. Age and household size were found to hinder willingness and ability to expand while males were less likely to be willing and able to expand compared to females. The following chapter provides the conclusions, recommendations and areas of future research based on the outcomes of this study.

CHAPTER 6 CONCLUSIONS AND POLICY RECOMMENDATIONS

6.1 Recapping the purpose of the research

In South Africa, agricultural development has been placed at the core for rural development and smallholder development in particular. However, the role of smallholder agriculture to poverty reduction has been by and large negligible. Smallholder farmers' face a variety of challenges with land and water, and the institutions governing them being amongst those challenges. However, the land and water use rights and the institutions that govern them are little understood at local levels in the rural areas and also their impact on productivity and entrepreneurial spirit. Hence, the general objective of this study was to examine the influence of land and water use rights on the productive use of irrigation water and smallholder farmers' entrepreneurial spirit, and to further determine factors affecting willingness and ability to expand farm operations. The study had three specific objectives, namely, to analyze the extent to which land and water use rights enable/deter the productive use of irrigation water; to analyze the influence of land and water use rights on smallholder farmers' entrepreneurial spirit; and to investigate the factors affecting the willingness and ability to expand farming operations. Since the development of smallholder farmers does not rely on land and water policy reform alone, this study further investigated other challenges related to access to input and output markets that hinder smallholder development.

This study was different compared to other studies analyzing the impact of land tenure on agricultural productivity. Most studies in the past do not include the role of water use rights and they consider land tenure as a dummy variable which makes it difficult to determine which of the bundle of rights have or do not have an impact on agricultural productivity. This study took a bundle of rights approach to measure both land and water use rights and also taking into account smallholder farmers' perceptions of their use rights at local level which gives a broader and comprehensive set of rights. That is the contribution of this study to the existing literature. With more focus on entrepreneurship for smallholder farmers in South Africa, this study made an empirical contribution to the limited and scarce literature on smallholder agriculture entrepreneurship. Moreover, the study provided more information about the drivers of, and/ the barriers to entrepreneurship development for smallholder farmers. This further includes factors that drive smallholder farmers' aspirations to expand their farming operations.

6.2 Conclusions

Based on the findings of this study, smallholder farmers face many challenges like drought, pests and crop diseases, scarce land with water, market availability, old age, low levels of education, availability of quality infrastructure like good roads within the schemes and good cellphone network connections, lack of affordable finance and access to quality inputs. Due to these challenges, the contribution of smallholder agriculture to total family income is low and the major contributor to smallholder farmers' total income is social grant. There is, therefore, a strong need to promote entrepreneurship among smallholders so that they do not depend mainly from government social grants to sustain their livelihoods. This can be done mainly by focusing on coordinating the production schedule of smallholders and broadening markets available for smallholder produce. Moreover, exposing smallholders to business opportunities they can pursue both on and off-farm which will help supplement crop farming income, starting with those whose main aim for farming is to make money. This will then encourage those who are only farming for subsistence purposes to also engage in business activities.

Smallholder farmers considered their land and water use rights to be secure. Different types of tenure systems exist for smallholders in KwaZulu-Natal. For example, it was found that in Makhathini Irrigation Scheme, the tenure system that exists for water is the agency control tenure system. This tenure system was criticized by smallholders as it is not inclusive in water use decision making. In Bululwane and Tugela Ferry Irrigation Schemes, the tenure system that was used is the customary water tenure system and water is managed by scheme committees and not WUAs. Similar in all schemes, the commons are state-owned land which is collectively used and managed by local groups or traditional authorities under customary tenure. This study found that the existing land tenure system is in line with the communal land tenure policy in the irrigation schemes with land related matters being handled by scheme committees who report to the traditional leaders and they report to government. The results indicate that land and water use rights have a positive impact on the productive use of irrigation water. Moreover, traditional leaders that do not adhere to the constitution or the rules that have been adopted in parliament must be dealt with as individuals within the system. Hence, going forward, scheme committees should be empowered with knowledge of their rights and be urged to encourage young people to participate in farming. Scheme committees should also be involved in decision making of new

policies as they are the first point of contact for many smallholders when it comes to land and water related issues which affect them directly.

Understanding the factors influencing smallholder farmers' entrepreneurial spirit gives an idea of how they are likely to respond to developments in agricultural policy and regulation. Therefore, in order to change smallholder farmers' subsistence mindset, investments need to be made in output markets and irrigation equipment as most of them have secure land tenure. When smallholder farmers have secure markets and water, they are able to improve their incomes and be more independent. The policy by government to expand irrigation schemes has made it necessary to understand the factors that influence smallholder farmers' willingness and ability to expand farming operations. However, government goals to commercialize smallholders cannot be achieved at the current state and if forced would yield little return both socially and economically. More young people, both male and female, are needed in the agricultural sector to transform subsistence smallholder farming into commercial smallholder farming. Young people are more suitable because they have fewer dependents and have the capacity to participate within the value chain. The lack of farming interest by young people as expressed by smallholder farmers can potentially hinder the transition from subsistence farming to commercial farming in smallholder agriculture.

To conclude based on the findings in this study, it is not clear what benefits privatization of individual land title would bring to improve productivity or investments in land when commons are governed collectively and effectively. Also, considering the fact that the commons are inclusive of gender and in decision making of who may utilize the resources available to the community. The results indicate that land titling alone will not be sufficient to increase access to formal credit as smallholder farmers indicated that collateral is not the only limitation but issues of not having a consistent monthly income and formal credit history are also hurdles as most of them do not keep records even though they have been trained how. In the absence of better off-farm opportunities, smallholder farmers are not likely to use their land as collateral so long as the previously mentioned challenges are not addressed. Hence, customary tenure system was found to be favorable in this study as it is inclusive, ensures sustainability of land and accountability of leadership.

6.3 Policy recommendations

Based on the empirical results, the study makes the following recommendations:

- The major challenge for smallholder farmers was irrigable land availability and land that was available had no infrastructure and water access. There is a need for land assessment and whether the land that is not utilized has water access including underground water. Smallholder farmers already know where unutilized land is but they do not know whether it has access to water.
- In the future new irrigation schemes, young people and women must be given priority. There must be proper incentive schemes targeted specifically for them so that they get interested to be in this sector. Furthermore, it must be ensured that they receive necessary training and exposure to be able to participate meaningfully in the whole value chain.
- In order to deal with the market challenge that smallholder farmers face. Government must give seeds to irrigating farmers in intervals or in a coordinated manner so that they do not all harvest at the same time and flood the market with the same produce.
- There must be a database of van traders that smallholder farmers can use to call them when their produce is ready. By increasing competition among van traders farmers can receive better prices for their produce.
- There is a need to improve the cellphone connection in the rural areas which could enable farmers to be able to regularly contact their customers/clients and the extension officers for information. They can also be able to share information among themselves. Unlocking or expanding the market base of smallholder farmers enables the transition from subsistence farming to commercial farming as it improves smallholder farmers' entrepreneurial spirit.
- With most clients being van traders for smallholder farmers, there is a need to improve the roads within the scheme.
- When markets fail, smallholder farmers depend mainly on social grants to survive. Therefore, it is recommended that when developing irrigation projects, departments like social development and economic development should also be part of the consultation to improve smallholder farmers' livelihoods.

- Most smallholder farmers are satisfied with the current land tenure system and it was found that it has a positive contribution towards productive use of irrigation water and enhancing entrepreneurial spirit. Therefore, it is recommended that the roles and responsibilities of scheme committees be reflected in the policy as a body that reports to the traditional authorities with regards to land matters.
- It is recommended that affordable irrigation equipment needs to be made accessible to smallholder farmers to boost their entrepreneurial spirit.
- Agency control tenure systems need to be more inclusive in decision making as it affects smallholders' production.
- A provincial body of scheme committees is needed whereby smallholders will capacitate each other based on the challenges they face related to water, land and markets. This body would also need to be represented in the policy formulation and can aid in policy implementation.

6.4 Recommendations for future research

Due to time and resource constraints, this study could only collect data for one season and three irrigation schemes in one province. The results would have been more robust if the study was conducted in more than one season in order to compare the productive use of irrigation water in a different season with different crops. Moreover, future research should also include smallholder farmers from different provinces in assessing and comparing the impact of land and water use rights on the productive use of irrigation water and entrepreneurial spirit. Research is needed to test young people's attitude towards farming and their level of entrepreneurial spirit to ensure that irrigation expansion programs by government become a success. Research is needed to find out whether there is significant difference in wealth or income and productivity between farmers selling to retailers or supermarkets (i.e. contract farming) and those selling to van traders or informal markets (Nguyen *et al.*, 2015). Moreover, it is important to explore more on how they can be assisted in reaching these markets simultaneously, taking into account the potential of using communication devices to link smallholders with clients.

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APPENDICES

Appendix A – Focus group discussion checklist



University of KwaZulu-Natal & WRC



The information to be captured from this discussion is strictly confidential and will be used for research purposes by staff and students at the University of KwaZulu-Natal to examine **the impact of land and water use rights on the productive use of irrigation water in KwaZulu-Natal.**

FOCUS GROUP DISCUSSION AND KEY INFORMANT CHECKLIST QUESTIONS

Department of Agriculture/ Department of Rural Development and Land Reform

1. What are the key problems that face farmers when it comes to land and water?
2. What strategies have been implemented to allow small-scale farmers to retain more ownership and management of the schemes? Including cost recovery?
3. What kinds of support is given to small-scale farmers in the schemes? Any differences between the 4 schemes in terms of support? Why?
4. How are small-scale farmers organized? Which farmer associations (ie. WUA and coops etc) are available and how have farmers been mobilizing their efforts through those associations?
5. Which structures are involved in the management of water issues particularly irrigation water in the district (Department of Water Affairs, municipality)? What role does each structure play?
6. How important are land and water conflicts in your district?
7. How effective are traditional authorities in settling disputes? What are the common mechanisms?
8. What and how is the relationship between traditional leaders and the Department?
9. How does land tenure legislation distinguish between irrigated land and non-irrigated land?
10. What do you think needs to be done to ensure that small-scale irrigation is successful in achieving set objectives of increasing food security, income and employment creation?

Department of Water Affairs/Irrigation Action Committees/ Water User Associations

1. What do you think are the key challenges play in the management of irrigation water in the communal small-scale irrigation schemes?
2. What other structures/ institutions are involved in the management of irrigation water in the province?
3. What are the roles of each and every structure/ institution and how effective have they been in delivering their mandate?

4. What challenges are being faced by these structures/ institution and how can these be addressed?
5. Are small-scale irrigation farmers in irrigation schemes charged for use of water? If so, at what rate?
6. To what extent does government subsidize water use in irrigation schemes?
7. What strategies, if any, have been put in place to ensure use of irrigation water on cost recovery basis in small-scale irrigation schemes?
8. Do you think that there is a link between land and water rights administration? How?
9. In light of effects of climate change and the role of small-scale irrigation as a solution to the global food crisis, what needs to be done to improve productive use of irrigation water in the schemes and ensure that adequate water will be available for future irrigation use?

Community leaders/Progressive farmers/other actors

1. What are the key problems that face farmers when it comes to land and water?
2. What is the role of community leadership in ensuring proper use and management of water resources in the community? How have community leadership been playing this role?
3. What is the role of community leadership in land and water management or distribution in the schemes?
4. How are decisions by traditional leaders about land and water made and implemented?
5. Are the practices of land renting or leasing and borrowing allowed in the irrigation schemes?
Please explain your answer
6. What are the traditional values as regards ownership of land by women? Do women own land? What happens if their husband passes away?
7. Do these values apply in the irrigation schemes?
8. What happens to the land if a plot holder in the scheme passes away?
9. Can land be permanently transferred within the family and/or with outsiders?
10. Are there restrictions on what people can do with their land?
11. In the past 5 years, have there been disputes over grazing land?
12. What are the differences in rules between grazing land and farming plots?
13. Does the state respect customary law?
14. What needs to be done to improve the performance of farmers in irrigation schemes?
15. Are Stokvels registered? How big are they? Who initiates them?

Appendix B – Ethical clearance



31 January 2017

Mr Lungelo Cele 210590080
School of Agricultural, Earth and Environmental Sciences
Pietermaritzburg Campus

Dear Mr Cele

Protocol Reference Number: HSS/0108/017M

Project title: Typologies of land and water use rights and the productive use of irrigation water in KZN: How far do these rights nurture smallholder farmers' entrepreneurial spirit?

Full Approval – Expedited Application

In response to your application received 23 January 2017, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted FULL APPROVAL.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully



.....
Dr Shenika Singh (Chair)
Humanities & Social Sciences Research Ethics Committee

/jpm

cc Supervisor: Professor Wale Edilegnaw
cc Academic Leader Research: Professor Onesimo Mutanga
cc School Administrator: Ms Marsha Manjoo

Appendix C – Questionnaire used for data collection



University of KwaZulu- Natal



The information to be captured in this questionnaire is strictly confidential and will be used for research purposes by staff and students at the University of KwaZulu-Natal. It is meant to address an MSc study entitled "Typologies of land and water use rights and the productive use of irrigation water in KZN: how far do these rights nurture smallholder farmers' entrepreneurial spirit?". This study is part of a Water Research Commission (WRC) research project entitled "Water use productivity associated with appropriate entrepreneurial development paths in the transition from homestead food gardening to smallholder irrigation crop farming in KwaZulu-Natal". You are free to be part or not of this survey and you can withdraw from the survey anytime you feel like doing so. However, your cooperation is greatly appreciated.

Date		Respondent Name	
Village name		Ward No.	
Type of farmer*		Irrigation scheme and Block No.	
Questionnaire No.		Enumerator Name	
Cell No		Age	

*Farmer type: 1-Scheme irrigator 2-independent irrigator 3-homestead gardener 4-community gardener 5- Non-irrigator

A. HOUSEHOLD DEMOGRAPHICS

Household Member Name	Age	Sex (M/F)	Relationship to Household Head*	Main Occupation**	Level of Education
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					

*1=Head 2=Wife 3=Husband 4=Son 5=Daughter 6=Father 7=Mother 8=Relative 9=Other (specify) _____

** 1=fulltime farmer 2=Regular salaried job 3=Temporary job 4=Self-employed 5=Student 6=Off-farm job 7=Other (specify)

B. Natural Capital

Land ownership and tenure issues

Land type	B1. Type of ownership (area under use)				B2. Total area (ha)	B3. Amount paid* for land (if rented or borrowed)
	Traditional	Rented	Borrowing	Other (Specify)		
a. Homestead garden					
b. Dry land (field crops)						
c. Community garden (your portion)						
d. Irrigation plots (inside the scheme)						
e. Irrigation plots (outside the scheme)						

f. Total						
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* If the payment is in kind, present the crop type and quantity per hectare

B4. Generally, are you satisfied with the present security of ownership (indlela umhlaba ophethwe ngayo) of the land you are using? *1=Very satisfied 2=Satisfied 3=Neutral 4=Unsatisfied 5=Very unsatisfied*

B5. Ngabe kunzima yini ukuthatha izinqumo eziphathelele nomhlaba ngenxa yendlela umhlaba ophethwe ngayo? *1= Yes 0= No*

B6. If Yes to **B5**, why? please give details _____

B7. Are you looking for another plot to rent or borrow? *1= Yes 0= No*

B8. If Yes to **B7**, what amount would you be willing to pay for 0.25 hectare of?

a) good quality plot in the scheme? _____ c) rain-fed good quality plot? _____

b) poor quality plot in the scheme? _____ d) rain-fed poor quality plot? _____

B9. To what extent do you agree or disagree with the following? *1=Strongly agree 2=Agree 3=Neutral 4=Disagree 5=Strongly disagree*

Indicator	Response
a. I know my legal rights (i.e., guaranteed power/claims)	
b. I am able to exercise my rights over land (i.e., the rights to use and exclude others from land)	
c. I am free to choose what to produce on my plot	
d. I can use this land for more than 10 years if I want to	
e. There are no threats of eviction (ubungozi bokuxoshwa) from my land	
f. I can transfer land to family members if I want to	
g. I can transfer land to people not related to me if I want to	
h. I always find it easy to approach the police if there is conflict on land	
i. I always find it easy to approach the traditional (informal) courts	
j. I believe I will be treated fairly by the police at any given moment	
k. I believe I will be treated fairly by the traditional courts in any given court case	

B10. Are you willing to relocate to a different area or community to utilize bigger plots of land? *1=Yes 0=No*

B11. Please support your answer in **B10**. _____

B12. What are the key challenges you are facing in relation to land? _____

B13. How far away is your household from the irrigation scheme? (walking minutes) _____

	Questions	Response
B14.	What is your position along the main distributary canal? <i>1= Head 2= Middle 3= Tail</i>	
B15.	On average, how many days per week do you irrigate your crops? (indicate number)	
B16.	On average, how many irrigation hours do you do per day (when you are irrigating)?	
B17.	Water source reliable (never dries up) <i>1= Strongly agree 2= Agree 3= Neutral 4= Disagree 5= Strongly disagree</i>	
B18.	How do you rate water accessibility (indlela othola ngayo amanzi) to your plot(s)? <i>1= Very good 2=Good 3=Neutral 4=Bad 5= Very bad</i>	
B19.	How do you rate water quality to your plot(s)? <i>1= Very good 2=Good 3=Neutral 4=Bad 5= Very bad</i>	
B20.	My right or claim to water is secure. <i>1= Strongly agree 2= Agree 3= Neutral 4= Disagree 5= Strongly disagree</i>	
B21.	I am involved in the decision making process related to water use in the scheme. <i>1= Strongly agree 2= Agree 3= Neutral 4= Disagree 5= Strongly disagree</i>	
B22.	I have adequate access to equipment that draws water to my plot. <i>1= Strongly agree 2= Agree 3= Neutral 4= Disagree</i>	

	5= Strongly disagree	
B23.	How often do you fail to receive water on your allocated irrigation day? 1=Never happens 2=Very rare 3=Rare 4=Often 5=Very often	
B24.	What do you do if you do not receive water on your irrigating day? 1= Nothing 2=Report to the irrigation committee 3=Talk to farmers upstream myself 4= other(specify)	
B25.	Conflict resolution instruments are effective. 1= Strongly agree 2= Agree 3= Neutral 4= Disagree 5= Strongly disagree	
B26.	Amount paid for water fee during this season (Rand /ha/ per month)? (only for people with formal water rights)	
B27.	How is water pumped to reach your irrigation plot (s)? 1=Gravity 2=Electric pump 3=Diesel pump 4= other (specify)	
B28.	How much do you pay to pump water per month per plot irrigated?	
B29.	What type of irrigation system are you using for the crop grow n? 1=Sprinkler (izinyoni) 2=flood irrigation (imisele) 3=Bucket system 4=Center pivot 5=other (specify)	
B30.	I am satisfied with the maintenance of the canal. 1=Strongly agree 2=Agree 3=Neutral 4=Disagree 5=Strongly disagree	
B31.	How would you rate the overall scheme management? 1= Very good 2=Good 3=Neutral 4=Bad 5= Very bad	
B32.	Do you see existing committees as effective to ensure compliance to regulations (ukulandelw a kw emthetha) on water users? 1= Do not know 2=Not effective 3=Neutral 4=Effective 5=Very effective	

B33. I find it difficult to pay for water/electricity/diesel. 1=Strongly agree 2=Agree 3=Neutral 4=Disagree 5=Strongly disagree

B34. What is the maximum amount of money you are willing to pay for water per hectare of irrigated land? _____ (Rand/ha/month)

B35. If maximum amount is zero, why do not you want to pay anything? *1= Irrigation water should be provided free of charge 2= I am not satisfied with the existing irrigation service 3= I do not have enough money 4= I know that the money will not be used properly 5= It is the responsibility of the government to provide 6= Only those irrigating a lot should pay 7= Only those that are making more money should pay 8= Other reasons, specify _____*

B36. How often do disputes (conflicts) occur among farmers or between blocks on water issues?

1= Never 2= Occasionally 3= I do not know 4= Often 5= Very Often

B37. If your answer is 4 or 5, what are the main reasons for water-related disputes? _____

B38. Mention challenges faced with irrigation: a) Hard to operate b) Poor management c) Underutilized d) Inadequate water e) Not profitable f) Not productive g) High costs of repairing and rehabilitation g) Others **(Multiple answers possible)**

B39. What do you think are the possible solutions for the above mentioned challenges? _____

B40. Is there any other issue you would like to inform us about on water use in agriculture? _____

C. PHYSICAL CAPITAL

C1. Are you satisfied with the state of the following infrastructure in your farming area? Please specify on a scale from 1 to 5.

1= Strongly satisfied 2= Satisfied 3= Neutral 4= Dissatisfied 5= Strongly dissatisfied

a) Road accessibility	
b) Electricity	
c) Agricultural water supply	
d) Drinking water supply	

C2. What equipment do you think would improve your production and access to markets? _____

Complete the following table on ownership and access to assets

Assets	C3. Number of assets	C4. Current market value of asset (s)(Rand)
a. Cell phone		
b. Radio and television		
c. Trailer/cart		
d. Motor vehicle in running order		
e. Plough (igeja)		
f. Planter, harrow or cultivator		
g. Tractor		
h. Other (please specify)		

Complete the table below on livestock ownership

Livestock type	C5. Cattles	C6. Goats	C7. Sheep	C8. Domestic Chicken	C9. Other
Number owned currently					
Number sold					
Price of each					
Main market outlet*					

* Main market codes: 1=Local butchery 2=Supermarket 3=Neighbors 4=Hawkers 5=Other (specify) _____

C11. What is the main purpose of keeping livestock for the House Hold?

1=Sales 2=Consumption 3=Wealth 4=Draught power (ukulima) 5=Cultural reasons 6=Other

D. FINANCIAL CAPITAL

D1. Are any of your household members receiving a government social grant? 1=Yes 0= No

If yes to D1, complete the table below

Grant	D2. Number of people receiving	D3. Number of years receiving grant/ since w hich year (oldest to youngest)
a. Child grant		
b. Old persons grant		
c. Disability grant		
d. Foster child grant*		
e. Care dependency grant		

*foster grant is support given to a family that is looking after a child not theirs, in their home

D4. Do you use some of your grant money to buy agricultural inputs? 1=Always 2=Sometimes 3=Never

Complete the table below on sources of household income

Source of household income	D5. Average income each time (Rands)	D6. How many times do you receive this income per year? E.g. once, 2, 3 or 4 times, per year, etc.	D7. Major uses of income (indicate at most two)*
a. Remittances (imali ethunyelwe)			
b. Arts and craft			
c. Permanent employment			
d. Temporary employment			

* 1=Food and groceries 2=Agricultural inputs 3=School fees and supplies 4=Health-related expenses 5=Transport 6=Other (specify)

D8. Do you have any form of savings? 1=Yes 0=No

D9. If yes to D8, how much (Rands)? _____

D10. If Yes to D8, which type of saving? 1=Formal 2=informal (e.g. stokvel) 3=both

D11. Have you ever taken credit or asked for a loan/credit in the past 12 months? 1=Yes 0=No

D12. If yes to D11, what was the main source of credit/loan? 1= Relative or friend 2= Money Lender 3= Savings club (e.g. stokvel or Internal savings and lending schemes) 4= Input supplier 5=Output buyer 6= Banks 7=Government 8= Microfinance institutions 9=Others (please specify).....

D13. If No to D11, please specify the reason(s) for not taking and/or using credit (multiple answers possible)

1= The interest rate is high 2= I couldn't secure the collateral (isibambiso) 3= I have got my own sufficient money 4= It isn't easily accessible 5= I do not want to be indebted 6=Other, please specify.....

D14. If you took credit or loan what was the purpose of the loan/credit? (multiple answers possible) 1= family emergency 2= Consumption 3= Agricultural purposes 4= Other (specify).....

D15. Were you able to pay back the loan/credit in time? 1=Yes 0=No

D16. Assuming it was possible; would you be willing to use your land as collateral at the banks? 1=Yes 0=No

Complete table for crops grown in 2016 (Please indicate units of produce for each crop)

Crop	D17. Water source 1=irrigation 2=rain-fed	D18. Area under production (ha)	D19. Quantity harvested (units/ha)	D20. Quantity sold	D21. How many times did you sell?	D22. Total amount received?	D23. Market outlet*	D24. Market distance from farm

* 1= farm gate 2= Hawkers 3= Local shops 4= Shops in town 5= Roadside 6= Others (Please specify).....

D25. Do you sell some of your produce as a group? 1=Yes 0=No

D26. What is the walking distance to the nearest (a) road (minutes) _____ (b) town (minutes) _____

Complete the following table for production inputs used for each crop in 2016

Crop	Inputs	Unit	D27. Quantity/Number	D28. Cost per unit (R)	D29. Total Cost (R)
	a. Seeds				
	b. Basal fertilizer				
	c. Top fertilizer				
	d. Manure (umquba)				
	e. Herbicides (ukhula)				
	f. Pesticides				
	g. Tractor/ox				
	h. Transport cost				
	a. Seeds/ seedlings				
	b. Basal fertilizer				
	c. Top fertilizer				
	d. Manure				
	e. Herbicides				
	f. Pesticides				
	g. Tractor/ox				

Crop	Inputs	Unit	D27. Quantity/Number	D28. Cost per unit (R)	D29. Total Cost (R)
	h. Transport cost				

D30. Which crop do you mostly fail to sell due to lack of market? _____

D31. Do you know the market requirements for your produce? 1=Yes 0=No

D32. What mostly dictates your choice of crop to be planted? 1= Availability of market access 2= Availability of free seeds from government 3= Crop suitable based on soil samples 4= Other (please specify) _____

D33. Distance to input markets in (hours) _____

Complete the following table for **hired labor** for each operation per crop (whenever applicable)

D Complete table for HIRED LABOUR for all crops produced in 2016

Crop grown	Land preparation			Planting and fertiliser application			Weeding			Crop spraying			Harvesting			Other		
	No of people	Number of days	Cost per day (Rands)	No of people	Number of days	Cost per day (Rands)	No of people	Number of days	Cost per day (Rands)	No of people	Number of days	Cost per day (Rands)	No of people	Number of days	Cost per day (Rands)	No of people	Number of days	Cost per day (Rands)
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51

Complete the following table for **family labor** for each operation per crop (whenever applicable)

Crop	D52. Ploughing/ Land preparation		D53. Planting and fertiliser application		D54. Weeding		D55. Watering		D56. Crop spraying		D57. Harvesting		D58. Other	
	days	people	days	people	days	people	days	people	days	people	days	people	days	people

D59. What are your average working times in hours for family labor in the field per day? _____ hours per day

To what extent do you agree or disagree with the following?

1= Strongly agree 2= Agree 3= Neutral 4= Disagree 5= Strongly disagree

Farming constraints	D60. Response
a. Lack of access to inputs (seeds, fertilizer and chemicals etc) is a constraint	
b. Large (unaffordable) increase in input prices is a constraint	
c. Limited or lack of farming knowledge and skills is a constraint	
d. Lack of access to adequate land is a constraint	
e. Insecure land ownership is a constraint	

f.	Lack of financial resources is a constraint	
g.	Too high labor cost is a constraint	
h.	High pump and maintenance cost is a constraint	
i.	Unavailability or lack of access to adequate water is a constraint	
j.	Water distribution network is a constraint, hindering access to irrigation water	
k.	Lack of adequate storage facilities for vegetables or fresh produce is a constraint	
l.	Poor output price is a frequent challenge	
m.	Limited access to market information is a constraint	
n.	Lack of access to transport services for marketing agricultural produce is a constraint	
o.	Access to the agricultural extension service is a major constraint	
p.	Local or social conflict- resource use related - is a major constraint	
q.	Political conflict - local government and traditional leadership-related - is a major issue	
r.	Irrigation scheme is far away from my home	
s.	Stray animals destroy my crops in the field	
t.	Any other (specify):	

D61. What are the possible solutions to the above mentioned problems? _____

D62. To what extent are you satisfied with your current level of crop production/productivity in your plot(s)? *1=Very satisfied*
2=Satisfied 3=Neutral 4=Unsatisfied 5=Very unsatisfied

D63. To what extent are you satisfied with your current level of income earned from farming operations? *1= Very satisfied 2=*
Satisfied 3= Neutral 4= Unsatisfied 5= Very unsatisfied

D64. Do you obtain livestock feed from crop residues (izinsalela)? *1=Yes 0=No*

D65. Which crops do you mostly use as livestock feed and in what quantity? _____

E HUMAN CAPITAL

E1. Number of years the farmer has been involved in crop farming? _____

E2. How difficult is it to access agricultural information? *1. Very easy 2. Easy 3. Neutral 4. Difficult 5. Very difficult*

E3. Do you have a business plan for your farm? *1= do not have (never developed one) 2= do not have (tried to develop one but could not)*
3= have a written business plan 4= have a business plan conceptualized in my mind 5= Do not know what a business plan is

E4. If **E3** is 4, what stops you from having written business plan? _____

Complete table on your skills rating and training in the following areas

Skills	E5. Have you ever been trained <i>1=Yes 0=No</i>	E6. If Yes to E5, who offered the training?*
a. General crop/vegetable production		
b. Land preparation		
c. Fertiliser application		
d. Herbicide application		
e. Irrigation and water management		
f. Processing (ukuguqulwa) of farm produce		
g. Pricing of products		
h. Business planning		
i. Budgeting/ Bookkeeping		
j. If other (please specify)		

*1= Extension Officer 2= Private Company 3= NGO 4= Fellow Farmers 5= Self-taught 6= Indigenous Knowledge 7= Other

- E7.** Were most of the training(s) relevant? 1=Yes 0=No
- E8.** Are you able to utilize any of the skills learnt from above training (If any) or any other irrigation production related training you have received before? 1=Yes 0=No
- E9.** If you are not able to utilize any of the skills learnt, Why? _____

F. SOCIAL CAPITAL

- F1.** Do you have any responsibilities in the scheme or community? 1=Yes 0=No
- F2.** If yes to **F1**, what is your position and/ what are you responsible for? _____
- F3.** If yes in **F1**, what benefits do you receive from doing what you do? _____
- F4.** Where do you get information related to: (multiple answers are possible)
- a) Water use rights and rules? _____
 - b) Land use rights and rules? _____
 - c) Input and output markets? _____
- F5.** Are you aware of any development programs (by NGOs or government) that are taking place in your community? 1=Yes 0=No
- F6.** If yes to **F5**, were you involved in the community consultation of any of them? 1=Yes 0=No
- F7.** If yes to **F5**, are you benefiting from those programs? 1=Yes 0=No
- F8.** If yes in **F7**, How? _____

G. PSYCHOLOGICAL CAPITAL

- G1.** What are your main reasons for farming? 1=Have sufficient food to feed my family 2=Earn an income from sale of crops 3= Create employment for myself and family members 4= Create employment for people in the community 5= Leisure 6=Other (specify) _____
(multiple answers possible)
- G2.** Do you separate your farming operations from family operations? 1=Always 2=Often 3= Sometimes 4= Rarely 5= Not at all
- G3.** Do you keep records of your farming activities? 1=Always 2= Often 3= Sometimes 4= Rarely 5= Not at all
- G4.** Do you know whether you are making a profit or loss from your farming operations? 1=Yes 0=No
- G5.** In what form do you practice farming? 1= As an individual OR household 2= As member of informal group 3= As member of cooperative 4= other (please specify) _____

Complete the table on selected farmer attitudes 1= Strongly agree 2= Agree 3=Neutral 4= Disagree 5= Strongly disagree

Farmer attitudes	G6. Response
a. I am confident in myself as a farmer	
b. I am optimistic (nginethemba lokuhle) about the future of agriculture in my area	
c. I am able to cope with shocks such as drought and other natural disasters	
d. I enjoy new challenges and opportunities	
e. I do not give up easily	
f. I would not be farming if there was another means of maintaining family livelihoods (indlela yokuziphilisa)	
g. I would take a job or start a business not related to farming	
h. I am willing to take more risk than other farmers in my community	
i. I am willing to forgo a profit opportunity in the short-run to benefit from potential profits in the long-run	
j. I trust other farmers	

Complete the following questions regarding interest to expand irrigation farming operations

G7. If an opportunity arises, are you interested in expanding your farming operations, i.e. moving into small-scale irrigation (including increasing plots in the irrigation schemes) *1= Very interested 2= Interested 3= Neutral 4= Disinterested 5= Not interested at all*

If answer is 4 and 5 please go to G11, otherwise continue

G8. How much would you want to expand your farming operations (size of land) _____ hectares

G9. If you are interested in expanding your farming operations, do you have the capacity to do so? *1=Yes 0=No*

G10. If you are interested and willing in expanding farming operations but not able to make it happen, what are the factors holding you up? *1=financial constraints 2=land availability constraints 3=Lack of access to inputs and machinery 4= Water availability constraints 5= Market constraints 6= Local and political constraints 7= Other (specify) _____ (multiple answers possible)*

G11. If you are not interested at all, answer to **G7** is **4** or **5**, why? _____

G12. How interested are you in being part of a water committee governing irrigation water use? *1= Very interested 2= Interested 3=Neutral 4= Disinterested 5= Not interested at all*

G13. If the answer is 4 or 5 to **G12**, why? _____

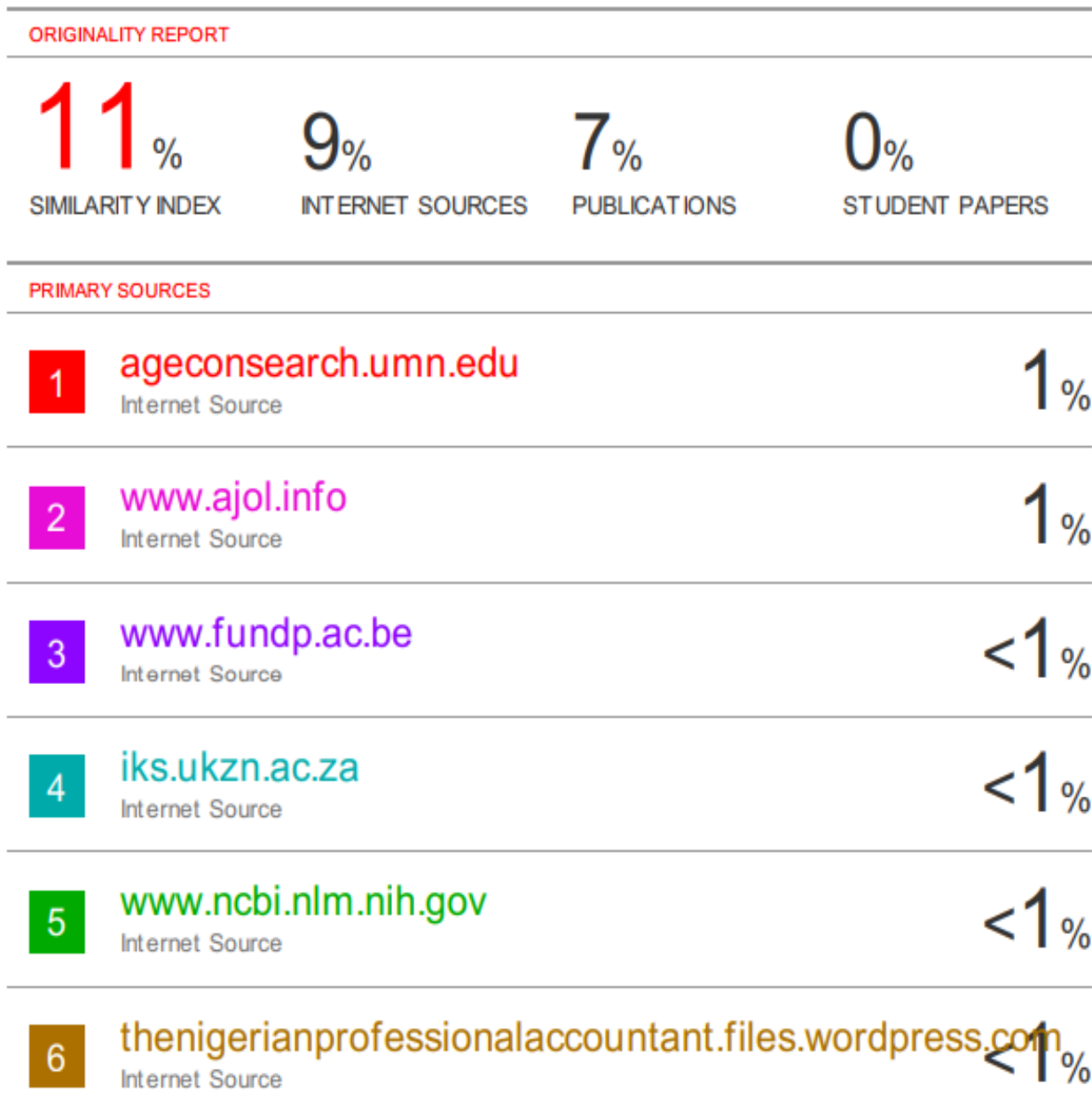
Complete the following table. *1=Strongly agree 2= Agree 3=Neutral 4= Disagree 5= Strongly disagree*

Entrepreneurial Characteristics	G14. Response
a. I like being my own boss	
b. I produce mainly for the market	
c. I view my farm as a profit making business	
d. I am passionate about my farm business	
e. I always look for better and profitable ways to run my farm operations	
f. I deal with problems as they arise rather than spend time to think about them in advance	
g. I am confident to speak in public	
h. I have the ability to inspire and energize others	
i. I am willing to cooperate with others and network (ngiyathanda ukusebenzisana nabantu)	
j. I possess persuasive communication and negotiation skills (ngiyakwazi ukushintsha izinqondo zabantu)	
k. I have the ability to set goals and set new ones once attained	
l. I am very competitive in nature (ngiyawuthanda umqhudelwano)	
m. I am always willing to learn new things	
n. I am willing to pay for any farm related trainings	
o. I am willing to try new ideas even without full knowledge about the possible outcome	
p. If one problem is persistent, I try alternative approaches to address it	
q. I am keen to take advantage of new farm business opportunities	
r. I am able to emotionally (ngokwemizwa) cope when faced with a problem	

H. If there are any further details that you wish to share with us regarding land and water, please feel free to do so. _____

T H A N K Y O U . S I Y A B O N G A

Appendix D - Turn it in originality report



157

Sinyolo, S, M Mudhara, and E Wale. "The impact of smallholder irrigation on household welfare: The case of Tugela Ferry irrigation scheme in KwaZulu-Natal, South Africa", Water SA, 2014.

Publication

<1%

158

Guangming Yu, Xiaoxu Chen, Zhenfa Tu, Qiwu Yu, Yu'an Liu, Hailong Yu. "Modeling Water Accessibility of Natural River Networks Using the Fine-Grained Physical Watershed Characteristics at the Grid Scale", Water Resources Management, 2017

Publication

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