

**ANALYSIS OF FACTORS DETERMINING LIVELIHOOD DIVERSIFICATION
AMONG SMALLHOLDER FARMERS IN KWAZULU-NATAL**

BY

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DECLARATION 2 - PUBLICATIONS

The following form part of the research presented in this dissertation.

Manuscript 1

Collin L. Yobe, Maxwell Mudhara and Paramu Mafongoya (2016). Determinants of livelihood strategies among rural households in smallholder farming systems: a case of KwaZulu-Natal, South Africa.

Manuscript 2

Collin L. Yobe, Maxwell Mudhara and Paramu Mafongoya (2016). Analysis of factors determining income diversification among rural households in KwaZulu-Natal province, South Africa.

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LIST OF ACRONYMS

- CA: Cluster Analysis
DA: Discriminant Analysis
DAFF: Department of Agriculture, Forestry and Fisheries
DFID: Department for International Development
DOA: Department of Agriculture
FA: Factor Analysis
GLM: Generalised Linear Model
IFPRI: International Food Policy Research Institute
KMO: Kaiser-Maier-Oklin
KZN: KwaZulu-Natal
LM: Local Municipality
MDS: Multidimensional Scaling
MNL: Multinomial Logistic
NDA: National Department of Agriculture
NPC: National Planning Commission
OLS: Ordinary Least Squares
PC: Principal Component
PCA: Principal Component Analysis
SLF: Sustainable Livelihood Framework
SPSS: Statistical Package for the Social Science
Stats SA: Statistics South Africa

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CHAPTER 1: INTRODUCTION

1.1 Background and justification

South Africa has a dual agricultural economy, consisting of farmers who practise well-developed and capital intensive commercial farming and smallholder and subsistence farmers who are less resourced and poorly developed in their farming practices (Kirsten and van Zyl, 1998). The commercial farming sector occupies over 80% of the agricultural land with an estimated 46 000 farmers. The remaining farmland (14%) is occupied by small-scale communal farmers (NDA, 2005; Vink and van Rooyen, 2009). Smallholder farmers on the communal land, allotments and market gardens number approximately 1.25 million and 64% of them operate on not more than 0.5ha of land (Vink and van Rooyen, 2009).

Poverty exists in South Africa along racial lines and colonialism and apartheid brought about the situation (Shinns and Lyne, 2004). In Bantu homelands established in 1951 were created disparities in terms of access to key resources, especially land (Van der Merwe, 2011; Vorster *et al.*, 1996). At the advent of democracy in 1994, a high percentage of the South African population resided in rural or semi-rural areas (Lahiff and Cousins, 2005). The major part of the lands in these areas were overcrowded and unsuitable for agriculture. As a result, the farming practices in rural communities were on a small scale, making little contribution to income towards rural livelihoods and would mostly be for subsistence purposes. The households in these rural areas relied on the urban-industrial economy (Lahiff and Cousins, 2005) for wage employment and on welfare payments for their livelihoods. Vink and van Rooyen (2009) show that agricultural production among the rural households declined in the period 1994 to 2009, suggesting that these households developed a reliance on non-farm activities. In addition, a comparison between commercial and smallholder agriculture showed that the disparities increased over time due to differences in their respective access to productive resources, resource endowments and infrastructure (Vink and van Rooyen, 2009). Haggblade *et al.* (2007) report that rural households considerably increased their reliance on off-farm income, leading to a situation where the latter makes up a high proportion of the total rural household income. With the decline in farm incomes among the rural households and their desire to cushion themselves against risks associated with agricultural production and markets, rural households tend to diversify their income sources (Reardon, 1997; Ellis, 1998;

Ellis and Freeman, 2004). Although off-farm activities and government transfers are very important sources of income for the rural economy in South Africa, Carter and May (1999) suggest that land-based activities can contribute highly to the overall well-being of the rural population. This is achieved through land-based activities providing alternative livelihood activities to households, as well as goods and services for consumption.

The realization of the significant role that agricultural development can contribute to economic growth is back on the center stage in South Africa. In this regard, the National Development Commission set a national vision for smallholder farmers to participate fully in the economic, social and political life by 2030 (NPC, 2013). It is envisaged that by the target date, a million jobs would be created through agriculture. The NPC vision seeks to achieve economic growth, food security and employment for rural households, whose key constituency are the smallholder farmers. According to the Department of Agriculture, Forestry and Fisheries (DAFF) (2013), supporting smallholder producers is important in order to ensure food security, full utilization of resources (land being key) and job creation. In its pursuit to achieve the set targets, the Department seeks to expand the smallholder sector to 300 000 farmers by 2020, up from 15 000 smallholder producers during 2011/12.

1.2 Problem statement

Rural households depend on agriculture and other strategies for their livelihoods. However, all the strategies pursued by the households may not provide adequate income for household requirements. Different typologies of livelihood strategies are pursued by households. According to Shackleton *et al.* (2001), the diverse multiple livelihood bases of the rural households in South Africa is not well understood. Such an understanding of livelihood diversification strategies among rural households could inform policy formulation. Burch *et al.* (2007) posit that agriculture has been an effective tool for growth and poverty reduction in several countries, but has failed to do so in other countries, due to policy neglect and inappropriate investment by governments and donors towards agriculture.

The work by Camlin *et al.* (2014) highlights migration as one of the factors affecting diversification among rural households in KwaZulu-Natal, suggesting a strong link between the rural and urban economies. This makes this province one of the study areas of interest. the investigation of how these households diversify their incomes and to identify the livelihood choices made beyond migration activities becomes imperative.

Cousins (2013) states that rural poverty in South Africa is similar to that in other countries. However, rural livelihoods in South Africa are unique, in that the contribution of farming to total income is low. In recent years, the proportions of income from wages and remittances have been declining, while the contribution of state transfers increased. A small percentage of smallholder farmers can generate enough income to survive solely from farming (Pauw, 2007). Therefore rural households rarely rely on farming as their main income source but instead derive their livelihoods from a combination of agriculture and non-agricultural opportunities (Baber, 1996; May, 1996; Crookes, 2003; Monde, 2003).

Carter and May (1999) and Leibbrandt *et al.* (2000) used the 1993 Living Standards Survey to study rural households at the national level. In this case, this cannot be taken to be an exhaustive analysis of the situation in South Africa. In addition, their studies were limited due to information on smallholder farmers. However, more recent data is now available for understanding rural households. More recently, Statistics South Africa pointed out that the country has inadequate information on smallholder and subsistence agriculture (Stats SA, 2014). Given this lack of data, there is a need for a study on rural livelihoods which informs policy on the status of smallholder farmers. A good understanding of the diversity of livelihood choices and income sources among rural households would, therefore, inform policy-makers on appropriate policy interventions.

1.3 Objectives

Based on the problems stated above, the general objective of the study is to examine the diversity of livelihoods among rural households. The specific objectives of this study are:

1. To identify the livelihood strategies among rural households in KwaZulu-Natal.
2. To identify the factors influencing the choice of the livelihood strategies in KwaZulu-Natal.
3. To investigate the levels of income diversification among the rural households.
4. To investigate the factors influencing income diversification among rural households.

1.4 Study hypotheses

The hypotheses are as follows:

1. The rural households differ in their livelihood strategies.
2. Capital endowments, education level of the household head, arable land cultivated and financial resources determine the livelihood strategy pursued at the household level.
3. The level of income diversification differs across rural households.
4. The level of income diversification of the rural households varies across households due to household composition, education level of the household head, access to financial resources and satisfaction with infrastructural development.

1.5 Organization of the dissertation

The dissertation was written using the ‘paper’ format. Chapter 1 introduces the study. Chapter 2 extensively reviews the literature. Chapter 3 is a separate paper that identifies the factors influencing the choice of livelihood strategies among rural households in South Africa. Chapter 4 is also another paper that investigates the factors influencing income diversification among the rural households. Chapter 5 is the concluding chapter that summarizes the whole study, provides recommendations and conclusions based on the findings.

CHAPTER 2: LITERATURE REVIEW OF RURAL HOUSEHOLDS, SMALLHOLDER FARMING AND DIVERSIFICATION

2.1 Introduction

This chapter reviews the characteristics of smallholder farmers within rural communities, as well as the terms and definitions that are commonly used. It discusses some of the factors that constrain agricultural production among rural households. The chapter explores the nature and diversity of livelihood choices. This is followed by a review of the livelihood strategies of the rural households.

2.2 The smallholder farmer definition and characteristics

Smallholder farmers are defined in different ways across countries and regions (Dixon *et al.*, 2004; Machingura, 2007). In general, the term ‘smallholder farmer’ is often used to refer to the group of farmers with inadequate resource endowments in comparison to their respective counterparts in the farming sector (Dixon *et al.*, 2005; Barlow and van Dijk, 2013). Narayanan and Gulati (2002) and Lipton (2005) refer to them as farmers characterized by being involved in cropping or livestock farming, commercial and/or subsistence production, relying on family members as the main source of farm labour, and the farming income as the main livelihood source.

Chikazunga and Paradza (2012) point out that defining smallholders in South Africa remains a sticking point in both the political and academic spheres. A review of the literature reveals a number of terms used to refer to the smallholder farmers, as well as to characterize them. In South Africa, the term ‘smallholder’ has been used to denote small-scale farmers (Kirsten and Van Zyl, 1998; Ortmann and King, 2007; Altman *et al.*, 2009; Cousins, 2010). The same term has been used to describe ‘the rural poor’, and ‘emerging commercial farmers’ by Hall (2004) and Wiggins and Keats (2013). The term 'smallholder farmers' is alternatively used to refer to 'communal farmers', 'emerging farmers' and 'black farmers' (Chikazunga and Paradza, 2012).

The literature also reveals that there are competing ways of characterizing smallholder farmers. Kirsten and Van Zyl (1998) reason that land size is not an appropriate indicator to use in determining the status of a farmer, since issues such as productivity and earnings, can potentially distort an understanding of smallholder characteristics. Conversely, the International Food Policy Research Institute (IFPRI) (2005) characterizes small farms on the

basis of the land available for agriculture and/or the number of livestock owned by the household. However, IFPRI (2005) remarks on the inadequacies of their approach, as it fails to take into account issues such as varying resource endowments and the types of crops grown.

This study recognizes the way in which Gradl *et al.* (2012) and Boomsma *et al.* (2013) characterize smallholder farmers, which is accepted as being more recent and flexible. They identify and characterize smallholder farmers as owning small farms with limited land, usually up to two hectares or less; producing either crops and livestock (usually a few animals); engaging in commercial and/or subsistence production, with the majority producing for subsistence; having limited market links and access; producers of one or two cash crops, or those who sell surplus food crops.

2.3 The smallholder farming sector

Globally, it is estimated that smallholder farms are a source of livelihood and homes for two billion people living in rural households (Gradl *et al.*, 2012). Boomsma *et al.* (2013) underscore the importance of the agricultural sector by citing IFAD (2011) which mentions that agriculture has the potential to improve the livelihood of the low income and the vulnerable livelihoods in an agro-based economy. Wiggins and Keats (2013) that improved agricultural production in the smallholder sector improves incomes and consumption for participating households.

According to DAFF (2013), the smallholder farming sector incorporates several types of farmers who are either subsistence or commercial producers, operating at different levels. DAFF (2013) distinguishes the subsistence from smallholder farmers, by indicating that the former produces only for consumption while the latter produces for the market. The smallholder and subsistence farmers produce on 13% of agricultural land in South Africa and are predominantly located in the former homelands and rural reserves (Aliber and Hart, 2009). These farmers in the rural households have different production objectives, face different environments and are involved in varying farm enterprises (Hedden-Dunkhorst and Mollel, 1999). These differences make targeting institutional support difficult, yet DAFF (2013) stresses that such support is vital in improving their agricultural productivity. Improved agricultural productivity enables the smallholder farmers to produce for the market and may be an alternative way to improve rural household welfare (Louw *et al.*, 2008; Ortmann and King, 2010). Darroch and Mushayanyama (2006) reveal that smallholder farmers involved in selling and marketing agricultural produce stand a chance of improving their livelihoods. Barlow and

van Dijk (2013) show that smallholder farmers can sell their produce to fresh produce markets, informal markets and supermarket chains to market their produce.

Generally, agriculture is viewed as important in creating employment, providing labour, providing food supplies and inputs to other economic sectors and generating foreign exchange (Aliber and Hart, 2009; Alemu, 2012). The significance of smallholder farming with respect to income, poverty alleviation and employment creation is further discussed in the following subsections.

2.3.1 Employment creation and providing rural incomes

Several studies concur that in Africa the agricultural sector has the potential to create employment in the form of agricultural labour, thereby making it possible for the rural communities to earn income (Barrett *et al.*, 2001; Aliber and Hart, 2009; Alemu, 2012; Boomsma *et al.*, 2013). In addition, the agricultural sector is recognized by DAFF (2013) as being important in addressing rural poverty issues. Smallholder agricultural production in South Africa is generally labour intensive and DAFF (2013) reasons that, if this sector is well capacitated, it can address rural unemployment in a meaningful way. Altman *et al.* (2009) posit that creating rural employment helps reduce poverty and thereby increases household incomes.

2.3.2 Contribution towards food security and food availability

The smallholder sector is receiving attention around the world since as much as 80% of the food consumed in Asia and sub-Saharan Africa comes from them (Gradl *et al.*, 2012). In South Africa, several households are not food secure, despite the fact that the nation is food secure (Altman *et al.*, 2009; Baiphethi and Jacobs, 2009). Rural households in the poorest areas of the KwaZulu-Natal province fail to have access to sufficient food, indicating the vulnerability of such households (D'Haese *et al.*, 2013).

Smallholder agricultural production has been identified as a way to alleviate food insecurity and reduce vulnerability at the household level (Altman *et al.*, 2009; Aliber and Hart, 2009; Baiphethi and Jacobs, 2009). Baiphethi and Jacobs (2009) point out that households taking up subsistence farming as an extra source of food are increasing, a practice which may be considered as a coping strategy to household food insecurity. With appropriate support to the smallholder sector, smallholder farming could make a meaningful contribution to food production, household food security and livelihoods (Aliber and Hart, 2009; DAFF, 2013).

According to Wiggins and Keats (2013), enhancing smallholder sector agriculture production and allowing the farmers to participate in produce markets can improve food security through improved earnings. Van Averbeke and Khosa (2007) state that household income is one of the most important determinants of food security.

Subsistence agriculture is the primary source of food for most rural households and its contribution to rural household food requirements has been on the decline (Aliber and Hart, 2009; Baiphethi and Jacobs, 2009). As a result, rural households have developed a dependence on market purchases and transfers for food provision (Baiphethi and Jacobs, 2009). In addition, poor households are net food buyers and spend a considerably high portion of their earnings on food (Altman *et al.*, 2009; Boomsma *et al.*, 2013; Wiggins and Keats, 2013). Altman *et al.* (2009) identify maize and wheat as the staple food items in the food provisions in South Africa. This reliance by rural households on these food products exposes them to volatile food prices. Increased agricultural production is seen as a way to stabilize food availability for these households (Wiggins and Keats, 2013; Boomsma *et al.*, 2013). Household food production in many rural communities is inadequate for meeting the quantity and the various nutritional needs of households (Altman *et al.*, 2009). Machethe (2004) and Baiphethi and Jacobs (2009) suggest that subsistence food production by smallholder farmers may reduce household food expenditure.

2.4 Factors constraining agricultural production among rural households

There are numerous challenges and varying difficulties in accessing input and product markets, although there are smallholders with the potential to grow high-value crops like vegetables, fruit and cut flowers (Ortmann and King, 2007; Aliber and Hart, 2009; Ortmann and King, 2010). This section examines factors which constrain agricultural production among rural households. These include limited land, household composition, infrastructure, financial resources, extension services and farmer support. The factors are discussed below.

2.4.1 Limited land

Agricultural land is crucial in overcoming rural poverty problems in Africa through agricultural production (Barrett *et al.*, 2001). However, in most cases, available land is limited in size, is unsuitable for agricultural production and farmers have insecure property rights (Ortmann and King, 2007). The redistributive land reform programme by the South African government seeks to address the land distribution imbalances which were a result of the apartheid era (Anseeuw

and Mathebula, 2008; Jayne *et al.*, 2010). Limitations of suitable land for agricultural production has been an area of interest in income diversification and livelihood choices studies such as those of Fabusoro *et al.* (2010), Khatun and Roy (2012), Babulo *et al.* (2008), and Mutenje *et al.* (2010).

2.4.2 Household composition

Household composition among rural households is an important determinant of livelihood strategy choices and its income diversification strategies. The production system of subsistence farming is labour intensive (DAFF, 2013) and the main source of labour is predominantly family labour (Grad *et al.*, 2012). Feynes and Meyer (2003), cited by Altman *et al.* (2009), state that the bulk of those dwelling in the former homelands are the aged and women and children. In some cases, even though such household members are available, they are not able to fully engage in agricultural activities. For example, the elderly household members may be beyond their prime physical and economically active age and, therefore, cannot contribute to subsistence agricultural production. According to Dlova *et al.* (2004), the age of the household head has a strong influence on the choices a household's livelihood activities. Older household heads may make decisions based on maturity and experience, which younger household heads would otherwise not make. This study embraces the view that the age of the head affects the households' responsiveness to certain livelihood strategy and income diversification patterns. Dlova *et al.* (2004) feel that women's household and marital roles such as child rearing and household chores may constrain their labour availability and decision-making process within the household.

In order to gain a further understanding of the household composition, measures such as the dependency ratio have been used in studies, such as those of Khatun and Roy (2012), to predict income diversification. Equally, in livelihood strategy choices, Mutenje *et al.* (2010) predicted the livelihood choices using the same ratio.

2.4.3 Infrastructure

Within rural communities, smallholder agricultural production is constrained by the lack of good roads, access to electricity, sanitation, health care services, water infrastructure and productive assets (Barrett, 2008; Gradl *et al.*, 2012; Sikwela, 2013). The presence of infrastructural developments and technology may improve livelihoods and agricultural production by enabling all-year-round agricultural production, the production of high-value

crops, broadening the range of cultivated products and making smallholders less dependent on rain-fed agriculture (Gradl *et al.*, 2012). Efficient use of, and access, to water resources, is required for improvements in smallholder productivity. Irrigation infrastructure is crucial to achieving this (Boomsma *et al.*, 2013). The intensity of production may be achieved by utilizing machinery which, for instance, can allow the cultivation of larger pieces of land, in addition to performing other activities such as transportation and harvesting (Gradl *et al.*, 2012).

Babulo *et al.* (2008), Stifel (2010), Alemu (2012) and Rahman (2013) investigated the importance of infrastructure with regard to its impact on livelihood strategy choices. Infrastructure has also been identified as determining income diversification (Fabusoro *et al.*, 2010). Infrastructural developments such as roads, piped waters and irrigation facilities have been investigated in income diversification in various studies (Babatunde and Qaim, 2009; Fabusoro *et al.*, 2010; Khatun and Roy, 2012).

2.4.4 Financial resources

Smallholder farmers lack financial resources to boost their productivity (Sikwela (2013). The level of intensification and management of resources required to achieve a good return from production can be achieved when adequate financial resources are available (Hofs *et al.*, 2006). According to Boomsma *et al.* (2013) and Gradl *et al.* (2012) inputs such as fertilizers and improved seeds, improved animal breeds are often inaccessible to the smallholder in sub-Saharan Africa. The proper use of the fertilizers has been shown to improve agricultural output and productivity, especially when combined with improved seeds and soil management techniques (Gradl *et al.*, 2012). These agricultural inputs are not prioritized and make up a small part of smallholder expenditure due to constraints in access to credit and other financial resources (Aliber and Hart, 2009).

Access to credit for crop and livestock production is vital for smallholder farmers to produce a marketable surplus (Barrett, 2008). Access to credit is limited for most smallholder farmers due to the lack of documentation reflecting legal ownership of the land they have access to, which is a usual requirement to access agricultural loans from financial institutions (Gradl *et al.*, 2012).

Access to savings and credit can improve the resource poor base of farmers within the rural communities (Gradl *et al.*, 2012). Babulo *et al.* (2008) examined the importance of financial

resources, such as access to credit, in determining livelihood choices. Babatunde and Qaim (2009), Khatun and Roy (2012) and Demissie and Legesse (2013) identify credit as an important factor in this regard.

2.4.5 Extension services and farmer support

Historically, the rural households in South Africa have been deprived of extension services and this deprivation continues (Akpalu, 2013). Hofs *et al.* (2006) show that unavailability of extension support is likely to lead to poor farmer performance, as it is crucial for improving farm production. Sikwela (2013) highlights the lack of agricultural information as a significant constraint in smallholder farming systems. Through farmer organizations and access to skills, the deficiencies in agricultural production among the rural households can be addressed (Akpalu, 2013; Sikwela, 2013).

Improved access to extension support positively impacts smallholder livelihoods (Baiphethi and Jacobs, 2009). Extension service may also help to:

- i. promote sustainable farming practices (DAFF, 2012)
- ii. promote good agricultural practices such as crop rotation and cultivation methods, which can be used together with the other farming techniques (Gradl *et al.*, 2012)
- iii. protect the health of the users of agrochemicals through proper use of the agrochemicals and promote environmentally friendly use (Bennett *et al.*, 2006; Hofs *et al.*, 2006; Gradl *et al.*, 2012)
- iv. provide market information to farmers (DAFF, 2012; Gradl *et al.*, 2012).

2.5 Risk and diversification of the rural households

Farming is vulnerable to uncertain and adverse weather, pests and diseases, factors which undermine its reliability as a livelihood source (Gradl *et al.*, 2012). Rural households mitigate the risk associated with agricultural production by diversifying their livelihood activities and sources of income. This diversification differs from one region to another across countries and within countries (Boomsma *et al.*, 2013). These are discussed in the following subsections.

2.5.1 Livelihood choices

The diversification livelihood choices of each household are determined by a number of factors such as resource endowment, its assets (mainly availability or lack of land and livestock) and the household members' levels of education. In addition, the composition of the household,

household risk perception and the opportunities accessible from part of the determinants of livelihood choices at the household level (Boomsma *et al.*, 2013). The farmers' ability to take part in the agricultural production and participate in markets is largely determined by assets and resource endowment (Baiphethi and Jacobs, 2009). Thus rural households in the smallholder sector, with varying asset and resource endowment, respond differently to risks. Their diversification depends on their socioeconomic factors and the livelihood options that are available to them. Rural households reliant on one type of livelihood activity (e.g. subsistence farmers) are more likely to be in deep poverty compared to those relying on a variety of sources (Altman *et al.*, 2009; Boomsma *et al.*, 2013).

Although farming is vital for rural households, diverse livelihood opportunities may be found in non-farming opportunities (Baiphethi and Jacobs, 2009). Compared to non-farming income sources, farming income provides less income than remittances, social grants and off-farm employment (Aliber and Hart, 2009). The low agricultural productivity and meager farming incomes are the reasons why rural households are shifting their dependence away from agricultural production towards activities that provide non-farm income (Baiphethi and Jacobs, 2009). This has led rural households to participate in agricultural production as a supplementary livelihood strategy, or even for recreation (Altman *et al.*, 2009).

2.5.2 Income diversification

Development economics literature has established that individuals and households do not depend on a single source of income for their livelihoods, but invest their resources in one asset rural, or use their resources to sustain their livelihoods from one source (Barrett *et al.*, 2001). Reasons for income diversification include increasing earnings to sustain livelihoods when the main activity fails to sufficiently provide household needs (Minot *et al.*, 2006) and reducing income variation (Reardon, 1997). According to Ellis (1998), income diversification patterns vary across regions. However, scant attention has been given to the empirical investigation of income diversification among rural households in South Africa and generally during the past decade.

2.6 Livelihood strategies among rural households

The livelihood choices made by households has recently attracted the attention of Babulo *et al.* (2008), Diniz *et al.* (2013), Mutenje *et al.* (2010), and Siddique *et al.* (2009). While research and the growing body of literature on livelihood strategies and choices have been steadily

increasing elsewhere in the last decade, there seems to be a lack of recent similar work in South Africa. Babatunde and Qaim (2010) identify the main livelihood activities among rural households as farming (cropping and/or livestock), off-farm employment, non-agriculture employment, self-employment and remittances. Ellis (2000) mentions migration as another livelihood activity which household members can be involved in. In South Africa, household members can also be recipients of social grants, which several poor and vulnerable households have their members taking the grants to sustain their livelihoods (Todes *et al.*, 2010). The following sub-section discusses how the livelihood choices have been modelled in some studies.

2.6.1 Measurement of the livelihood choices

This section shows the empirical methods that have been used in analyzing livelihood choices. It identifies the factors that influence the choices. The multinomial logistic regression model has been a dominant analytical tool in analyzing livelihood choices. Babulo *et al.* (2008), Mutenje *et al.* (2010), Stifel (2010) and Alemu (2012) used this tool to analyze livelihood strategies. The multinomial logistic regression model is preferred because of its suitability in modelling dependent variables that are categorical. Other methods used in the measurement of livelihood choices are reviewed in this subsection.

Dossa *et al.* (2011) identify several multivariate techniques that are frequently used for classification purposes and stresses that the use of techniques usually differs across disciplines. The techniques are Discriminant Analysis (DA), Factor Analysis (FA), Multidimensional Scaling (MDS), Cluster Analysis (CA) and Principal Component Analysis (PCA). The latter technique reduces the dimensionality of the data (Jolliffe, 2002). Dossa *et al.* (2011) allude to the fact that PCA is similar to DA, FA, and MDS techniques. According to Everitt *et al.* (2001) and Hair *et al.* (2006), CA is useful in creating sets of objects that are homogeneous from given characteristics of a dataset.

The multivariate analysis approach that uses both PCA and CA to identify typologies of research interest has been widely used in the literature (e.g. Bidogeza *et al.*, 2009; Dossa *et al.*, 2011; Diniz *et al.*, 2013; Nainggolan *et al.*, 2013). Ding and He (2004) provide empirical arguments from a statistical point of view which demonstrate the suitability of this analytical approach. Bidogeza *et al.* (2009) explain that this multivariate analysis approach draws its strength from the understanding that it allows for distinct identification of typologies. The choice of the set of variables which are considered for constructing a typology depends on the

research objective, as the multivariate analysis approach is cross-disciplinary (Nainggolan *et al.*, 2013). For example, a study by Fish *et al.* (2003) focused on the rationale of farmers' decisions, while Bidogeza *et al.* (2009) and Nainggolan *et al.* (2013) identified farm household and farmer typologies, respectively, using this approach. Diniz *et al.* (2013) demonstrate the suitability of the approach in classifying livelihood strategies into typologies.

There is no single method which can objectively identify the suitable number of clusters (Bidogeza *et al.*, 2009). Gelbard *et al.* (2007) point out that due care is needed in choosing the appropriate clustering method for any given application. Hierarchical and K-means clustering are the two most common methods of clustering (Gelbard *et al.*, 2007). These two clustering methods have a caveat in their applicability because, according to Kaur and Kaur (2013), the K-means performs better than the hierarchical clustering with a data set of a sample size greater than 250. A study by Ding and He (2004) pivots on the argument that the principal components generated from PCA are suitable to be retained as inputs for K-means cluster analysis. Bidogeza *et al.* (2009), Dossa *et al.* (2011) and Nainggolan *et al.* (2013) used both Hierarchical and K-means clustering. The purpose of hierarchical clustering was to estimate the suitable number of clusters, while that of K-means clustering is for classification (Bidogeza *et al.*, 2009; Dossa *et al.*, 2011; Diniz *et al.*, 2013; Nainggolan *et al.*, 2013).

Mutenje *et al.* (2010) formulated an econometric model using the multinomial logistic regression model in the study investigating rural livelihood diversity in Zimbabwe. The livelihood strategy of a household was identified by the income proportions of the household, the land allocated for agricultural purposes and the time allocated to activities. K-means cluster analysis was used in grouping the livelihood strategies. The factors which influenced livelihood strategies were household head age, dependency ratio, marital status of the household head, monetary asset value, livestock owned (cattle), livestock income earned, income from non-forestry timber products, HIV/AIDS shock and livestock loss.

Babulo *et al.* (2008) in Northern Ethiopia identified the household typologies by grouping them according to total income and forest dependence. The multinomial logistic regression model was used to identify the factors influencing the livelihood strategies. Household size, the gender of the household head, education of the household head, plot size, access to grazing land and access to loans and roads were identified as influencing livelihood strategies.

Stifel (2010) categorized the households based on the combinations of choices among farm and non-farm, and wage and non-wage activities, based on household expenditure data in rural Madagascar. The three broad groupings that were identified as a result of this method comprised activities strictly confined to farming and non-farm only and activities which combined farm and non-farm. The determinants were analyzed with the multinomial logistic model. The significant factors were the age of household head, household size (number of members), education, ownership of radio, land holding, difficulty in accessing formal credit, availability of microfinance institutions in the community, electricity access, piped water access and distance to the nearest city.

Alemu (2012) in rural South Africa identified the dominant livelihood strategies. A household survey was used in which the livelihood strategies were classified into four broad and eight specific livelihood strategy groups. The models used to analyze the socio-economic factors that influenced the household choice of the livelihood strategies were the Multinomial logistic regression and stochastic dominance test. The determinants age, labour endowment, education, and community infrastructure were found to significantly influence the households' ability to penetrate high-return livelihoods.

Rahman (2013) analyzed the factors influencing off-farm activity participation in Bangladesh. The study identified three different off-farm activities in which households were involved, namely participation in business activities, off-farm labour activities and participation in different services. The Probit regression model was used on each of these livelihood activities. The factors regressed on each of the models were education, age, farm size, household workers, dependency ratio, organizational participation and infrastructure development.

Several studies have analyzed livelihood strategies without using econometric modelling. For example, Dovie *et al.* (2005), in Thorndale, Limpopo Province, South Africa, conducted a monetary valuation of livelihoods. The study employed the Chi-square test, T-test, correlation analysis and the Principal component analysis. In rural Pakistan, Siddique *et al.* (2009) evaluated rural women's participation in income-generating activities in the agricultural sector. The determination of participation in their study was based on how involved they were in an activity. The main analytical tool was tests of association. Diniz *et al.* (2013), in the Brazilian Amazon, used cluster analysis for grouping the livelihood strategies in settlement projects. No econometrical procedures were used, but frequencies, Pearson Chi-square test and One-way ANOVA (Tukey's test) were used instead.

2.6.2 Measurement of income diversification

In this section, some of the indices used in determining income diversification are identified. This is followed by a review of models used in analyzing the factors influencing income diversification. Finally, the determinants of income diversification are also identified in this section.

The income diversification indices which have been commonly used in income diversification studies are the Simpson index, Herfindahl index, Ogive index, Entropy index, Modified Entropy index, Composite Entropy index (Shiyani and Pandya, 1998). Fabusoro *et al.* (2010) used the Simpson index of diversity. The two supplementary measures for income diversification are also identified in recent studies. For example, Babatunde and Qaim (2009) used the number of income sources and the proportion of off-farm income to the total income. Olale and Henson (2012) used household income as the response variable.

Demissie and Legesse (2013) used the Tobit regression model to ascertain the determinants of income diversification among rural households in Ethiopia. Olale and Henson (2012) also used econometric analysis (i.e., bivariate probit regression) in order to determine the influence of factors that affected income diversification among fishing communities in Kenya. Khatun and Roy (2012) used multiple regression analysis to analyze the determinants of livelihood diversification in West Bengal. Fabusoro *et al.* (2010) analyzed the determinants of diversification in Nigeria using the Hierarchical regression model. Hierarchical regression is a type of multiple regression analysis where the independent variables are entered into the equation in a particular predetermined manner (Pallant, 2007). Babatunde and Qaim (2009) in Nigeria employed econometric techniques, based on survey data, which utilized the Poisson and the Tobit regression models to analyze the determinants of income diversification.

Kieschnick and McCullough (2003) raised concerns in the specifications used in such empirical models that analyze a response variable that is in interval bound form. Their study takes a specific look at proportions on a closed interval (0, 1). Their criticism focuses on the unsuitability of the Ordinary Least Squares, additive Logistic normal distribution (i.e., the Logit regression model), the censored normal distribution (i.e., the Tobit model), Beta distribution, and the Simplex distribution on fractional response variables. Papke and Wooldridge (1996) discourage the econometric procedure of using a linear model to explain fractional response variables. Nevertheless, Kieschnick and McCullough (2003) and Baum (2008) share the consensus that a linear regression on a Logit transformed response variable is

better than a linear regression on a non-transformed variable. The case of absolute values of 0 and 1 in a fractional response variable is dealt with by coding them with some arbitrary value, such as 0.0001 and 0.9999 before they are logit transformed (Baum, 2008).

Various factors have been found to influence income diversification in several studies. Table 1 shows some of the explanatory variables that have been used in previous studies in analyzing income diversification. These variables will be adapted and adopted in this study, where appropriate.

Table 1. Explanatory variables used in determining the influence of income diversification in recent studies

Study	Factors
Babatunde and Qaim (2009)	Age, sex, household size, education level of the household, household size, access to credit, cultivated land on the farm, the value of assets, electricity access, access to piped water, distance to market, on and off-farm income earned.
Fabusoro et al. (2010)	Age, education, household size, years of experience in farming, size of the farm, income sources (farm income, non-farm income, and remittances), location of the household, infrastructure, distance to urban center, market, major road, natural asset.
Khatun and Roy (2012)	Age of household head, dependency ratio, household average years of education, size of the household, arable land per working member in a household, value of household physical assets, area under irrigation, distance to the nearest town, credit/loan access, membership of a formal social organization, formal training on livelihood skill development, membership to the highly diversified district.
Demissie and Legesse (2013)	Age, sex, household size, education, economically active members, school children living in a household, the amount of credit accessed, cultivated land, livestock holding, the number of crops, distance to market, agroecology, soil fertility.

Source: Author's compilation

2.7 Summary

This chapter has reviewed the literature on the characteristics of smallholder farmers within rural communities. The terms and definitions commonly used to refer to smallholder farmers are part of the review. The factors which constrain agricultural production among the rural households were examined. The chapter explored the nature and diversity of livelihood choices and income sources among rural households.

As a result of the apartheid system in South Africa, the literature review has shown that the smallholder sector in South Africa is largely unfavourable for most rural households which are home to smallholder farmers. The common challenges associated with access to financial resources are adequacy and suitability of agricultural land and farming knowledge. These were recognized to be among the key agriculture production constraints in smallholder farming systems.

Benefits of smallholder farming include food security at household level and income from the sale of surplus agricultural produce. In addition, smallholder farming has linked poverty alleviation and employment creation to rural households. Despite this potential within smallholder farming systems, agriculture falls short in meeting household requirements and has been mainly practised for subsistence purposes.

Rural households, therefore, depend on diverse livelihood choices and income sources, since smallholder agriculture is not adequate in meeting their livelihood needs. Diversification is viewed as an important strategy for managing risks associated with depending on one source of income. Generally, it is regarded as a way to safeguard a household from livelihood failure. Households may diversify to other farm and non-farm enterprises in order to stabilize or increase their earnings. Nevertheless, smallholder farming remains an integral part of rural livelihoods.

Several approaches to analyze livelihood and income diversification were reviewed. The multinomial logistic regression model appeared to be the dominant econometric model used to analyze livelihood choices. From the review, several methods were identified which can be used to construct an income diversification metric. These include the Simpson index of diversity and the Herfindahl index. In choosing the suitable model to analyze income diversification, consideration was given to the model that would be appropriate in dealing with

a response variable in a bound interval. The identification of the factors influencing the livelihood choices and income diversification were guided by previous studies.

CHAPTER 3: DETERMINANTS OF LIVELIHOOD STRATEGIES AMONG HOUSEHOLDS IN SMALLHOLDER FARMING SYSTEMS: A CASE OF KWAZULU-NATAL, SOUTH AFRICA

Abstract

Apart from agriculture, rural people seek diverse opportunities to increase and stabilise their income. Rural dwellers combine farming with other non-farming activities to complement each other. An understanding of rural household's choice of strategies is crucial to develop policy aimed at improving their wellbeing. This paper identified the factors influencing the choice of livelihood strategies among smallholder farmers in South Africa. Four hundred rural households from Umzimkhulu and Ndwedwe local municipalities of KwaZulu-Natal province were randomly selected and interviewed. The multivariate analytical approach which employs the use of Principal Component Analysis (PCA) and K-means cluster analysis was used. PCA was applied on dummy variables of livelihood activity participation. Rotated factor loading from PCA served as input into the K-means cluster analysis. K-means clusters were considered as livelihood strategy choices at the household level. The multinomial logistic (MNL) regression was applied to outcomes of K-means cluster analysis to determine the factors influencing households' livelihood choices. The dominant livelihood strategy which combines 'mixed farming/migration/social grant reliant' represented about 52% of the livelihood choices made by the rural households. The results from the MNL regression model indicate that years of formal education of the household head, household size, dependency ratio, arable dryland area accessed by the household, savings, location of the household and the source of agricultural information are the main determinants of livelihood choice.

Key Words: Rural households, livelihood strategies, multivariate analytical approach, Principal component analysis, K-means cluster analysis, Multinomial logistic regression

3.1 Introduction

Rural households pursue a number of livelihood strategies (Babulo *et al.*, 2008) in order to make income and meet their livelihood objectives, with farming being an integral part (Barrett *et al.*, 2001; Ellis, 2000). Studies reveal a trend where rural households are shifting from farming and moving towards other income-generating activities (Bryceson, 2002; Puttergill *et al.*, 2011; Rigg, 2006).

Many rural communities are exploring alternative means of reinforcing their livelihoods (Andereck and Vogt, 2000; Reeder and Brown, 2005). Rural sectors in other parts of the world have been experiencing de-agrarianisation, which is the economic changes arising from a reduction of rural populations that obtain their livelihoods from the agriculture sector (Bryceson, 2002). This phenomenon is also taking place in South Africa (Daniels *et al.*, 2013). However, Bradstock (2006) points out that de-agrarianisation within South Africa may be a result of the South African colonial history of the apartheid era that did not allow black South Africans to rely on agriculture.

Common livelihood sources among rural households in South Africa are migratory income, social grants, agriculture and pensions (Alemu, 2012; De Cock *et al.*, 2013; D'Haese *et al.*, 2013; Todes *et al.*, 2010). The share of agricultural income to rural household income is very small (van Averbeke and Khosa, 2007; De Cock *et al.*, 2013). Most households practise farming for subsistence (De Cock *et al.*, 2013; D'Haese *et al.*, 2013; Puttergill *et al.*, 2011), food security nutrition (De Cock *et al.*, 2013; D'Haese *et al.*, 2013) and for income purposes (Sikhweni and Hassan, 2013).

Many factors influence the dependence on and the choice of certain livelihood strategies in smallholder farming systems (Ellis, 1998; Alemu, 2012). According to Babulo *et al.* (2008), household assets, demographics, economic characteristics and exogenous factors (e.g. technologies and markets) are some of the examples. It is important to understand the factors influencing the choice of a livelihood strategy among rural households, to allow for improved policy-making for their well-being and for economic growth such as the NPC (2013) and DAFF (2013) targets. This study aims to identify the factors that influence the choice of livelihood strategy.

3.2 Livelihood strategies in rural areas

Livelihood strategies are “an organized set of lifestyle choices, goals, and values, and activities designed to secure an optimum quality of life for individuals and their families or social groups” (Walker *et al.* 2001, p. 298). Rural households engage in many livelihood strategies in an attempt to achieve their household outcomes. Puttergill *et al.* (2011) attribute this to the household preferences which are shifting towards consumer-based lifestyles, which require cash income. Several studies have shown that rural households adopt livelihoods choices by selecting from a range of activities (e.g., Alemu, 2012; Diniz *et al.*, 2013; Fabusoro *et al.*, 2010; Mutenje *et al.*, 2010; Rotich, 2012).

Rural areas are generally characterised by inadequate physical infrastructure and services. These characteristics are responsible for making households rely on off-farm income sources (Tshuma, 2012). Baiphethi and Jacobs (2009) explain that developed and effective input and output markets which farmers can participate in, and reduced transaction costs and risks, could positively stimulate rural farming. Improving extension services boost agricultural productivity, adoption of agricultural technologies and increase in enterprise production (Diiro, 2009; Ndoro *et al.*, 2014). Akpalu (2013) states that, in boosting smallholder farming, it is essential that rural farmers be capacitated in detecting threats such as drought, pests and diseases; access to credit; and access to market prices.

3.3 Materials and methods

This section presents the conceptual framework, a description of study analytical techniques used.

3.3.1 Conceptual framework

The central concept of this study is sustainable livelihoods (SL). A livelihood is sustainable when it can manage shocks and preserve or develop its capabilities and assets (Carney, 1998). The concept of SL has been applied in many studies in developing countries, including African countries (Barrett *et al.*, 2001; Brown *et al.*, 2006; Daniels *et al.*, 2013; Ellis, 1998; Mutenje *et al.*, 2010; Santos and Brannstrom, 2015).

The choice of a livelihood strategy depends on the vulnerability context (i.e., shocks) livelihood assets (human, natural, physical, financial and social capital) and transforming structures and processes (DFID, 2000). Livelihood strategy choice by the household is made with the intention of achieving livelihood outcomes (increased wellbeing, more income and reduced vulnerability) (DFID, 2000). A livelihood strategy consists of a combination of different activities. For example, a household could combine the livelihood activities of crop farming, remittances and social grants.

3.3.2 Study site

The data was collected in KwaZulu-Natal (KZN) province of South Africa, in two local municipalities (LM) (Ndwedwe and Umzimkhulu). These two LMs were randomly selected for the study. KZN is located in the southeast part of South Africa (Figure 3.1. page 36).

Ndwedwe is situated 60 km north of Durban and approximately 20 km west-north-west of Tongaat, in the Ilembe District Municipality (29.531°S 30.934°E). According to Stats SA (2015), Ndwedwe has a population of 140 820 and comprises 29 200 households, of which 13 710 are agricultural based. Cropping activities are mainly maize, beans, madumbes and sweet potatoes. Livestock reared consists mainly of cattle, goats and sheep, but not for commercial purposes (Sotshongaye and Moller, 2000). Non-farming livelihood activities include sewing, candle making and block making, among many others (Sotshongaye and Moller, 2000).

Umzimkhulu falls under Harry Gwala District Municipality. The town is located 105 km from Pietermaritzburg and 18km south-west of Ixopo (30.263°S 29.940°E). Umzimkhulu LM is home to 180 302 people and has 42 909 households (24 538 being agricultural) (Stats SA, 2015). The livelihood activities in this LM include farming (cropping and livestock) and non-farming activities.

3.3.3 Data collection procedure

Data was collected between February and April 2015, through household surveys. The structured questionnaire was pre-tested in February 2015 and a total of 400 questionnaires were administered. The questionnaire was designed to capture demographics, socio-economic factors and livelihood activities of the rural households. The questionnaire presented questions regarding livelihood activities, as adapted from Babatunde and Qaim (2010). First, the respondents were asked to identify activities they were involved in. Secondly, the respondents provided information pertaining to the income received or earned from each of the respective activities that captured household participation in the livelihood activities.

A random sampling technique was used to select the survey respondents and the wards within each local municipality of the study areas where the respondents resided. The interviews were conducted in Zulu by a group of trained enumerators who were fluent in both Zulu and English. The enumerators were familiar with the study areas and were experienced in administering questionnaires. The field work was supervised on a daily basis. The processes of data coding entry and cleaning were carried out. The data was analysed using Statistical Package for Social Science (SPSS) and Stata 13.0. Permission to conduct the interview was obtained ahead of the data collection process from the relevant local authorities within the

respective study areas. Ethical clearance was also sought and granted by the UKZN Research Office to conduct this research using the questionnaire.

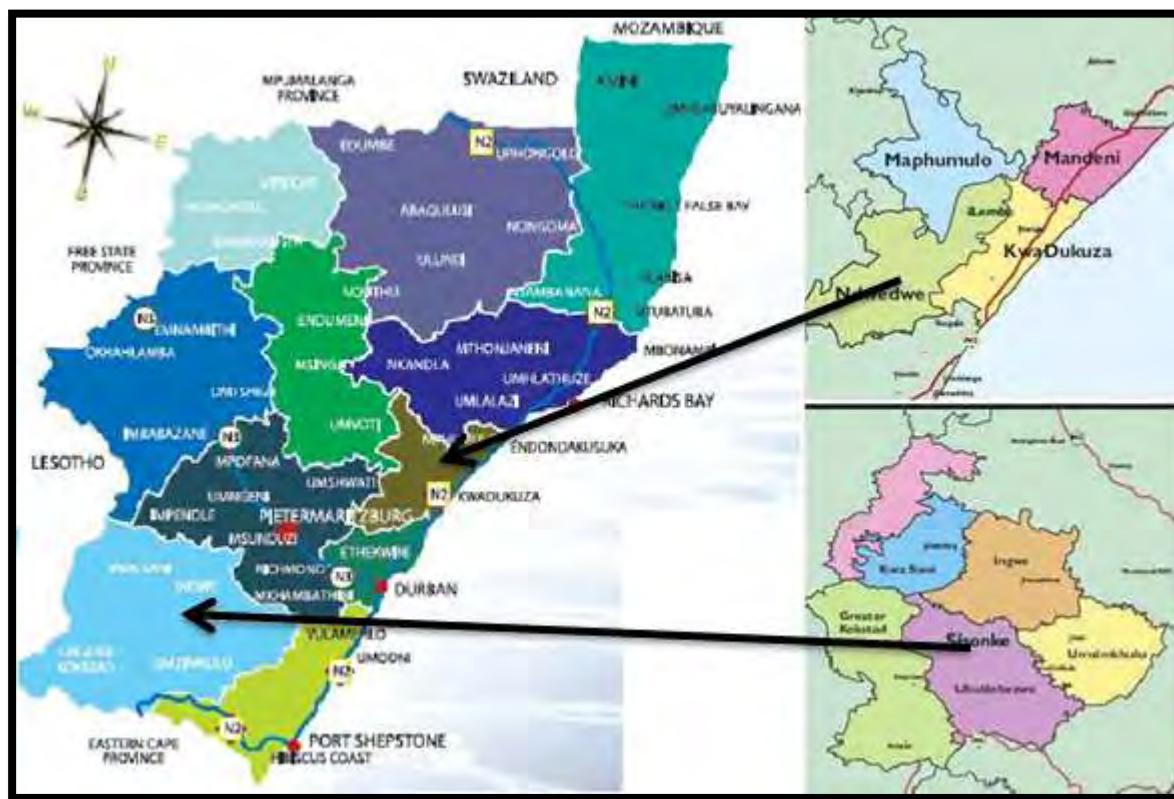


Figure 3.1: Ndwedwe and Umzimkhulu municipalities within KwaZulu-Natal province of South Africa.

Source: www.kzntopbusiness.co.za, 2015

3.3.4 Analytical techniques

In this section, the determinants of the choice of livelihood strategies and the analytical techniques used are discussed.

3.3.4.1 Multivariate approach for classification

The multivariate approach used to develop livelihood strategy typology involved the use of Principal Component Analysis (PCA) and Cluster Analysis (Bidogeza *et al.*, 2009; Dossa *et al.*, 2011; Diniz *et al.*, 2013; Nainggolan *et al.*, 2013). The approach used in this study follows Ding and He (2004), where the retained components from PCA were inputs in K-Means

Clustering technique. Guidelines given by Gelbard *et al.* (2007) were considered and this multivariate approach was appropriate for the type of dataset.

Household participation in livelihood strategies was captured as dichotomous variables, i.e., taking on a value of zero or one. Following Filmer and Pritchett (2001), Vyass and Kumaranayake (2006) and Achia *et al.* (2010), PCA was applied on the dummy variables, in order to identify the dimensionality of the data (Jolliffe, 2002). The eight livelihood activities used in the PCA were household involvement in cropping, livestock, social grants, agricultural wages, non-agricultural wages, self-employment, remittance and migration. PCA is a multivariate statistical method used to reduce the numbers of variables into a smaller number of ‘dimensions’, with minimal loss of information. The first new variables account for as many variations in the original data as possible (Jolliffe, 2002; Manly, 2005). The new variables are linear combinations of the original variables. The suitability of the variables for PCA was checked by the Kaiser-Maier-Olkin (KMO) and the Bartlett’s sphericity tests. According to Hair *et al.* (2006), the variables are considered suitable if the KMO values are greater than 0.5 and Bartlett’s sphericity test is at $p < 0.05$. In choosing the number of PCs to retain the criterion used involved selecting the Eigenvalue that allowed for more sampling variation. The Kaiser’s rule, i.e., Eigenvalue equal to one, would retain too few variables. Therefore, an Eigenvalue equal to 0.7 was used as the cut-off (Jolliffe, 2002).

Chibanda *et al.* (2009) cite Garson (2008), who recommends hierarchical clustering for dummy variables and for data sets with a sample size less than 250. According to Kaur and Kaur (2013), the K-means algorithm performs better than the hierarchical algorithm on a large data set (i.e., greater than 250). K-means analysis was, therefore, appropriate for the sample size of the present study. Principal Component (PC) scores were used for the K-means cluster analysis as the second part of the multivariate approach to classifying the livelihood into typologies. The PC scores are continuous solutions to the discrete cluster membership indicators for K-means cluster analysis (Ding and He, 2004). According to Jolliffe (2002), cluster analysis can be used on data which has no clear group structure.

Based on the objective to identify the factors that influence the choice of a household livelihood strategy among the rural households, cluster analysis was used to group households based on the livelihood activities. The aim of this technique was to identify and classify the respondents into a reasonable number of clusters that best explain the livelihood choices.

3.3.5 Multinomial logistic (MNL) regression

After the multivariate analysis, a multinomial logistic (MNL) model was used to estimate the polytomous response variable (i.e. clusters) to a set of regressor variables determining the household choice of diverse livelihood strategies (see Mutenje *et al.*, 2010; Soltani *et al.*, 2012). The explanatory variables were the livelihood assets and socio-economic factors (e.g. number of household members and income). The goal is then to predict the likelihood of a household, with given characteristics, choosing a cluster representing an identifiable combination of livelihood activities.

The probability associated with choice of a livelihood strategy of a rural household is denoted by P_{nj} ($j = 1-4$), where n represents the household; $j = 1$ represents the rural household in choosing livelihood strategy in cluster 1; $j = 2$ represents the rural household in choosing livelihood strategy in cluster 2, etc. The multinomial logistic model is specified as follows, assuming that the unobserved portion of the utility (ε_n) is identically and independently distributed (iid) across alternatives according to Train (2003), cited by Babulo *et al.* (2008):

$$P_{nj} = \frac{e^{(\beta' X_{nj} + \gamma' H_{nj})}}{\sum_{j=1}^4 e^{(\beta' X_{jj} + \gamma' H_{nj})}} \quad (3.1)$$

If the β s and the γ s are set to zero for one of the activities (for instance cluster 1), the MNL model for each activity ($j \neq$ cluster 1) can be expressed as:

$$P_{nj, j \neq 1} = \frac{e^{(\beta' X_{nj} + \gamma' H_{nj})}}{1 + \sum_{j=2}^4 e^{(\beta' X_{nj} + \gamma' H_{nj})}} \quad (j=2, 3, \text{ and } 4) \text{ and}$$

$$P_{n1} = \frac{1}{1 + \sum_{j=2}^4 e^{(\beta' X_{nj} + \gamma' H_{nj})}} \quad (3.2)$$

Where H_n is a random disturbance and, X_n are the explanatory variables.

3.3.6 Description of the explanatory variables

The explanatory variables selected for the MNL regression and a description of the explanatory variables used are shown in Table 2.

Table 2. Explanatory variables used in the multinomial logistic model (MNL) model

Name of variable	Definition of the variable	Literature
AGE_HEAD	Age of the household head in years	Babulo <i>et al.</i> (2008); Soltani <i>et al.</i> (2012)
EDUCATION_YEARS	Years of formal education of the household head	Babulo <i>et al.</i> (2008); Soltani <i>et al.</i> (2012); Mutenje <i>et al.</i> (2010)
GENDER	Sex of the household head (dummy: GENDER = 1 if the head is male; and 0 otherwise)	Babulo <i>et al.</i> (2008); Soltani <i>et al.</i> (2012)
HHLD_SIZE	The size of the household size represented by the number of household members	Babulo <i>et al.</i> (2008); Soltani <i>et al.</i> (2012)
DPNDCY_RATIO	Dependency ratio of the household	Mutenje <i>et al.</i> (2010);
TOT_ASSETS	The value of household assets (in South African rands)	Mutenje <i>et al.</i> (2010);
TOT_INCM	The total amount of income (in South African rands) earned and/or received by the household unit	Mutenje <i>et al.</i> (2010);
DRYLANDSIZE	The dryland hectarage accessed by the household for crop production	Babulo <i>et al.</i> (2008)
SAVING_DMY	Savings (formal and informal) of the household (dummy: Yes = 1 if the household has savings; and 0 otherwise)	Soltani <i>et al.</i> (2012)
AREA_DMY	Dummy for location (1 = Ndwedwe, 0 = Umzimkhulu)	Babulo <i>et al.</i> (2008)
EXTWORK_EXT	PCA index representing extension workers as information sources for farming activities	
COMMNTY_EXT	PCA index representing the community meetings as information sources for farming activities	
COMMODTY_EXT	PCA index representing the commodity organisation as information sources for farming activities.	

3.4 Results

The results of the household demographics and livelihood strategies and multivariate analysis results are presented in this section.

3.4.1 Household demographics and description of livelihood strategies

Table 3 provides summary statistics of the independent variables used in the study. The averages for the household head age, years of formal education for the household head and

household size had been 57 years, six years, and six members, respectively. Clustering procedure is discussed subsequently in the following subsections.

Table 3. Descriptive statistics of the variables (n=400)

Variable	CLUSTER				Total	F-statistic
	1	2	3	4		
		Mean				
AGE_HEAD	57.42	53.36	56.98	55.76	56.56	NS
EDUCATION_YEARS	5.25	6.70	5.35	5.12	5.51	NS
HHLD_SIZE	6.48	5.92	6.70	5.24	6.40	NS
DPNDCY_RATIO	41.45	27.97	42.99	36.64	39.44	***
DRYLANDSIZE (Ha)	0.73	0.27	0.51	0.29	0.58	***
TOT_INCM (000) (Rands)	53	56	40	46	50	NS
TOT_ASSETS (000) (Rands)	74	128	86	81	87	NS
EXTWORK_EXT	0.04	0.19	-0.21	0.07	0.00	*
COMMNTY_EXT	0.25	-0.12	-0.30	-0.59	0.00	***
COMMODTY_EXT	0.03	0.07	-0.14	0.17	0.00	NS
AREA_DMY (%)						***
Ndwedwe	41.3%	12.8%	19.8%	1.3%	75%	
Umzimkhulu	10.5%	3.8%	7.8%	3.0%	25%	
GENDER (%)						NS
Male	25.5%	9.3%	10.8%	1.8%	47.3%	
Female	26.3%	7.3%	16.8%	2.5%	52.8%	
SAVING_DMY (%)						NS
Yes	19.3%	6.3%	8.3%	0.8%	34.5%	
No	32.5%	10.3%	19.3%	3.5%	65.5%	

Note: * p<0.1; ** p<0.05; *** p<0.01; NS =not significant

Source: Survey data (2015)

The average dependency ratio¹ for this study is 39.44. The dependency ratio varied across the clusters with Cluster 3 having the highest dependency ratio of 42.99. The clusters were examined with analysis of variance (ANOVA), to determine whether or not there was any association between the dependent variables. The variables that represented the location of the household, extension, the arable land used by the household and the dependency ratio of the household showed a statistically significant relationship (Table 3).

¹ The dependency ratio is a measure of the number of dependents in the age category 0-14 and above 65 years to the total population (aged 15-64) (Cohen, 2003). Therefore, if the dependents are more than the rest of the population, the dependency ratio would reflect a large value, and vice-versa.

3.4.2 Multivariate analysis results

The results for the multivariate analytical approach which employed both PCA and K-means analysis are presented below.

3.4.2.1 PCA results

The level of household participation and involvement in each of the livelihood activities are presented in Table 4.

Table 4. Household participation in livelihoods strategies

Variable	Frequency	Percent
P_CROP_DMY	383	95.8
P_GRANT_DMY	365	91.3
P_LVSTK_DMY	281	70.3
P_NONAGRWAGE_DMY	110	27.5
P_REMITNC_DMY	68	17.0
P_SELF_EMP_DMY	48	12.0
P_MIGRAT_DMY	43	10.8
P_AGRWAGE_DMY	35	8.8

P_CROP_DMY=dummy variable of household member participating in cropping activities; P_LVSTK_DMY=dummy variable of household member participating in livestock activities; P_GRANT_DMY=dummy variable of household member receiving social grants; P_AGRWAGE_DMY=dummy variable of household member participating in agricultural wage activities; P_NONAGRWAGE_DMY=dummy variable of household participating in non-agricultural activities; P_SELF_EMP_DMY=dummy variable of household participating in self-employment activities; P_REMITNC_DMY=dummy variable of household receiving remittances; P_MIGRAT_DMY=dummy variable of household participating in migratory activities.

Source: Survey data (2015)

The participation was captured by soliciting a ‘yes’ or ‘no’ response in respect of whether any of the household members was involved in any of the activities. From this study, the results reveal that 95.8% and 70.3% of the households reported participating in cropping and livestock activity, respectively. Social grants are an important means of livelihood for the rural households and the results show that 91.3% of the rural households were receiving social grants.

Application of PCA to the eight livelihood strategies produced seven PCs that explained 91.82% of the variance in the dummy variables (Table 5). In order to determine whether or not the dataset of 400 households could be factored, the KMO and the Bartlett’s sphericity tests were performed. The KMO measure was 0.543 and the Bartlett’s test was significant ($p < 0.001$).

This suggests that the variables had some form of relation and could thus be factored. Varimax with the Kaiser Normalization rotation method was used to improve interpretation of the PCs.

Table 5. Principal component loadings estimated scores for participation in livelihood activities

Component	PC1	PC 2	PC 3	PC 4	PC 5	PC 6	PC7
Eigenvalues	1.27	1.19	1.14	1.06	0.94	0.91	0.83
% of Variance	15.93	14.88	14.23	13.31	11.75	11.32	10.42
Cumulative %	15.93	30.80	45.03	58.34	70.08	81.41	91.82
Household participation dummy in:							
Cropping	0.013	0.019	0.044	-0.074	0.061	0.976	0.029
Livestock	0.084	0.145	0.075	0.924	0.071	-0.088	0.013
Social grant	-0.094	0.938	-0.029	0.148	-0.021	0.033	-0.042
Agricultural wage	-0.096	-0.009	-0.064	0.060	0.959	0.063	-0.042
Non-agricultural wage	-0.499	-0.403	-0.369	0.375	-0.278	0.235	-0.057
Self-employment	-0.033	-0.035	0.024	0.008	-0.040	0.027	0.995
Remittance	0.896	-0.127	-0.134	0.120	-0.143	0.047	-0.047
Migration	-0.093	-0.024	0.951	0.072	-0.073	0.054	0.021

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.543

Bartlett's Test of Sphericity: df = 63.123; Approx. Chi-Square = 28; Sig. = 0.000

Source: Survey data (2015)

The first component (PC1) explained 15.93% of the variance in the rural households' scores for participation in livelihood activities, with one of the estimated component loading above 0.3 being positive and the other negative. The PC show rural households receiving more remittances and participating less in non-agricultural wage as an activity. This PC was therefore named 'Remittance'.

Component PC2 explained 14.88% of the variance. The PC shows households that participate in social grants and less in non-agricultural wage participation. According to Todes *et al.* (2010), social grants are a common livelihoods source of income among rural households in South Africa. This PC was named 'Social grants'.

Component PC3 accounted for 14.23% of the variance in the rural households which strongly participate in migration and participate less in non-agricultural wage. This PC was identified as 'Migration'. Camlin (2013) reports high levels of mobility of adults, especially women, in the KZN area of South Africa. The migrants remain attached to their homes and send

remittances (Camlin, 2013). In South Africa, migratory income is one of the most common sources of livelihoods among rural households (Todes *et al.*, 2010).

The dimension which reflects a strong participation in livestock and moderate non-agricultural wage participation is PC4 and was therefore named ‘Livestock and non-agricultural wage’. This principal component explained 13.31% of the variance in rural household participation in the livelihood activities. The fifth component, PC5, explained 11.75% of the variance in constraint scores. This represents households that strongly participated in agricultural wages and was thus called ‘Agricultural wage’. PC6 accounts for 11.32% of the variation and represents the dimension of rural households that participate in cropping activity. This PC was called ‘Cropping’. The PC7 displayed the last least amount of variation (10.42%) in the rural household participation scores and represents self-employment activities.

3.4.2.2 K-means clustering results

Subsequently, the K-means clustering was used on the PC scores to obtain grouping of the variables into distinct clusters. Table 6 shows PC dimensions of livelihood activities across the four clusters. The clusters were named based on the way in which they related the PC dimensions of livelihood activities.

Table 6. Participation of households in combination of livelihood activities across clusters

PC dimensions of livelihood activities	Cluster			
	1	2	3	4
‘Mixed farming/migration/social grant reliant’	‘Agricultural wage/cropping reliant’	‘Cropping and non-agriculture’	‘Livestock reliant’	
NON AGRIC AND REMMITANCE	-0.36511	-0.07388	0.74059	-0.05952
SOCIAL GRANTS	0.26030	-1.44353	0.38989	-0.08800
MIGRATION	0.20484	-0.05674	-0.31925	-0.20821
LIVESTOCK	0.39407	-0.08796	-0.74270	0.34882
AGRICULTURAL WAGE	-0.35281	1.61645	-0.26156	-0.28718
CROPPING	0.23381	0.12944	0.19722	-4.62563
SELF-EMPLOYMENT	-0.16846	-0.12181	0.41106	-0.13568
Number of households	207	66	110	17

Source: Survey data (2015)

Cluster 1 represents the households whose dominant livelihood choices were mixed farming (i.e., cropping and livestock), social grants and migration. This cluster was named ‘Mixed farming/migration/social grant reliant’. The households in Cluster 2 represented those households which mainly participated in agricultural wage and cropping activities as their livelihood choice. This cluster was therefore named ‘Agricultural wage/cropping’. The cluster that was named ‘Cropping and non-agriculture’, i.e., Cluster 3, represented those households with a livelihood choice that combined more activities compared to other household clusters. The households received social grants and the activities which made up the livelihood choice are cropping, self-employment, non-agricultural wage and remittances. Finally, Cluster 4 represented households whose livelihood activity was livestock farming and was therefore called ‘Livestock reliant’.

Table 7 presents the ANOVA results for K-means clusters. The table shows that the method was suitable for classifying the retained PCs into distinct clusters. The number of clusters predetermined was also suitable.

Table 7. ANOVA results for K-means clusters

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
NON AGRIC AND REMMITANCE	29.449	3	0.784	396	37.540	***
SOCIAL GRANTS	56.136	3	0.582	396	96.403	***
MIGRATION	6.949	3	0.955	396	7.277	***
LIVESTOCK	31.801	3	0.767	396	41.479	***
AGRICULTURAL WAGE	69.048	3	0.484	396	142.520	***
CROPPING	126.814	3	0.047	396	2705.812	***
SELF EMPLOYMENT	8.584	3	0.943	396	9.108	***

Note: *** p<0.01

Source: Survey data (2015)

3.5 Multinomial logistic model results

Results of the MNL to examine the factors influencing rural households to choose certain livelihood strategies are presented in Table 8. Cluster 1 (‘Mixed farming/migration/social grant reliant’ livelihood strategy) was used as the base category in the MNL regression. This cluster accounted for the most common livelihood choice among rural households in the survey.

The coefficients of the explanatory variables measure the influence of the variables on the comparative likelihood of a household selecting a certain livelihood strategy, in comparison to choosing the ‘Mixed farming/migration/social grant reliant’ livelihood strategy. The estimated model shows that households with access to large, arable dry-land areas are less likely to engage in ‘agricultural wage/cropping reliant’ livelihood choice. The Chi-square results show that the likelihood ratio statistics are statistically significant (see statistics below Table 8).

In comparison to the ‘Mixed farming/migration/social grant reliant’ livelihood strategy, households that rely on commodity organisations and extension workers as sources of farming information are associated with a higher likelihood of a household choosing ‘livestock-reliant’ livelihood strategy. The estimated model shows that households with high dependency ratios and access to large dryland area are less likely to choose the ‘agricultural wage/cropping reliant’ livelihood strategy.

Households are less likely to choose ‘Cropping and non-agriculture’ livelihood strategy in preference to ‘Mixed farming/migration/social grant reliant’ livelihood strategy, if they have access to a large dryland area, have no savings and rely on extension workers and community meetings as sources of farming information. Households in Umzimkhulu are more likely to choose the ‘Cropping and non-agriculture’ livelihood strategy as their dominant strategy, rather than ‘Mixed farming/migration/social grant reliant’ livelihood strategy. The likelihood of choosing ‘livestock-reliant’ livelihood strategy, rather than ‘Mixed farming/migration/social grant reliant’ livelihood strategy, is greater for households in Umzimkhulu whereas, those household heads with more years of formal education are less likely to do so.

3.6 Discussion

The regression results reveal that the choice of a livelihood strategy was influenced by the years of formal schooling, household size, the dependency ratio, arable dryland cultivated, extension, location of the household and household savings.

Table 8. MNL regression results (Cluster 1 is the base category)

	2		3		4	
	B	Exp(B)	B	Exp(B)	B	Exp(B)
Intercept	5.298**		-0.351		-29.050***	
AGE_HEAD	-0.036	0.965	0.014	1.014	0.042	1.043
EDUCATION_YEARS	-0.127	0.881	-0.003	0.997	-0.462**	0.630
HHLD_SIZE	0.111**	1.118	-0.094	0.910	-0.130	0.878
DPNDCY_RATIO	-0.070***	0.933	0.019	1.019	-0.008	0.992
DRYLANDSIZE	-2.833**	0.059	-0.685*	0.504	0.785	2.192
TOT_INCM	0.000	1.000	0.000	1.000	0.000	1.000
TOT_ASSETS	0.000	1.000	0.000	1.000	0.000	1.000
EXTWORK_EXT	0.846**	2.330	-0.884**	0.413	1.143	3.137
COMMNTY_EXT	-0.072	0.930	-0.629**	0.533	-2.455	0.086
COMMODTY_EXT	0.371*	1.449	0.079	1.083	0.582	1.789
[AREA_DMY=0]	0.161	1.175	1.394**	4.031	2.898**	18.137
[GENDER=0]	-0.681	0.506	0.477	1.611	0.433	1.543
[SAVING_DMY=0]	-0.976	0.377	-1.888**	0.151	22.941	9183426944.793

The reference category is 1

Likelihood ratio test: Chi-Square = 123.242; df = 39; p-value = 0.001

*, **, and *** significant at 10, 5, and 1% respectively

Overall % households correctly classified = 70.1%

Source: Survey data (2015)

According to Khatun and Roy (2012), educated household members can diversify their livelihood options by securing salaried jobs, while those with low education levels and the illiterate are involved in wage-earning occupations. Gordon and Craig (2001) state that household members who are educated with high skill levels are able to take part in non-farm livelihood activities. Camlin *et al.* (2014) note that rural areas of South Africa, such as the KZN province, are experiencing developments tantamount to a modernized economy, which are responsible for driving migration. The significance of formal education was observed in this study as the households with more years of formal learning were less likely to choose ‘Livestock reliant’ as their dominant strategy. Instead, their livelihood choice would combine activities such as mixed farming and migration, as well as the household members receiving social grants. Therefore, investment in education allows the rural household members to have more livelihood activities, as they construct their livelihood choices.

In previous studies, it is fairly common to find large households in rural communities of South Africa (e.g. Ortmann and King, 2007; Ortmann and King, 2010; Sikhweni and Hassan, 2013). The effect of household size shows that rural households are less likely to receive social grants, are less likely to select a livelihood choice comprising migration, cropping and livestock farming activities, but rather rely on agricultural wage employment and crop farming as a livelihood choice. This is contrary to Fabusoro *et al.* (2010), who observed that larger households influence access to migration, an activity which is a part of the cluster ‘Mixed farming/migration/social grant reliant’. Reardon (1997) feels that household size is an important factor influencing livelihood diversification, as the household members are critical in the supply of labour required for non-farm livelihood activities.

Dependency ratios increase for several reasons. Fostering of grandchildren by their grandmothers (Thurlow *et al.*, 2009), multiple conjugal units (Reardon, 1997) and the effects of HIV/AIDS could be responsible for reducing the proportion of the working population (Hosegood and Ford, 2003). Fabusoro *et al.* (2010) observe that the extended family structure is responsible for household members to access migration as one migrant can facilitate the movement of the other household members. Circular migration remains a key manner in which rural households survive in South Africa, where both men and women leave the rural areas in search of employment (Todes *et al.*, 2010). In this case, children remain in rural homes, thereby increasing the dependency ratio. Reardon (1997) explains that larger households have more members available to participate in non-farm activities, as well as having the remainder available at home to supply family labour required for subsistence production. In South Africa,

such rural households with high dependency ratios frequently have members who receive social grants (Todes *et al.*, 2010). The results obtained largely confirm the observations made above. An increase in the dependency ratio is associated with a higher likelihood of rural households selecting the ‘Mixed farming/migration/social grant reliant’ strategy, rather than choosing a livelihood construct made up of cropping and agricultural wage activities.

Nagayets (2005) cites the World Bank (2003) which defines the smallholder farmer as having a low asset base, operating less than two hectares of cropland. Several rural households fit into this category, as they have limited access to agricultural land. According to Shackleton *et al.* (2001), dryland farming within the rural economy forms part of diverse and multiple livelihood strategies among these households. In addition, the farming activities rely on income from the government and urban areas. As part of the diverse and multiple livelihood strategies, the migrants participate in employment in neighbouring or distant communities and send part of their earnings to the rural households (Barrett *et al.*, 2001; IFPRI, 2005; Fabusoro *et al.*, 2010). In this case, these household members are identified as the link between rural households and urban areas, through which income transfers from migratory wage occur (Camlin *et al.*, 2014). This may suggest that household members who have migrated to urban areas are more likely to be involved in farming, or involved in some form of investment into agricultural activities with rural households. The increase in the arable land was associated with a higher likelihood of households choosing the ‘Mixed farming/migration/social grant reliant’ strategy. However, the results also show that an increase in the dryland area for rural households is associated with a lower likelihood of pursuing ‘Agricultural wage/cropping reliant’ livelihood strategy and ‘Cropping and non-agriculture’ livelihood strategy. These dominant strategies do not capture participation in livestock and migration as part of livelihood choices, suggesting a link between these two activities.

Khatun and Roy (2012) observed that households in separate locations have different livelihood diversification, due to variability in location specific agro-climatic and socio-economic factors. Based on the 2011 Census, a comparison of the unemployment rate (46.6% vs. 48.7%) and non-income earning households (15.6% vs. 33.0%) between Umzimkhulu and Ndwedwe, respectively, reveals variability in these factors (Stats SA, 2015). The MNL regression results reveal that the livelihood choice of rural households located in Umzimkhulu was more likely to choose either ‘Livestock reliant’ or ‘Cropping and non-agriculture’ clusters as their dominant activities, rather than ‘Mixed farming/migration/social grant reliant’. A recap of the ‘Cropping and non-agriculture’ strategy shows that rural households in this cluster

combine non-agricultural, remittances, self-employment and cropping activities. These households also have some of their members who receive social grants. Therefore, the choice of this cluster as a dominant livelihood strategy could be supported by the argument that Umzimkhulu may have better livelihood choices than Ndwedwe, due to favourable socio-economic factors such as a low unemployment rate and a lower proportion of households who do not earn income (Stats SA, 2015). There are two activities in this cluster, namely non-agricultural activities and self-employment, which are specific to this livelihood choice. It may be inferred that the reason for the low proportion of households which do not earn income may be the availability of such livelihood choices. However, not all the households have access to such livelihood choices. ‘Livestock reliant’ livelihood strategy represents rural households in Umzimkhulu which had livestock as their main activity. According to the Burch et al. (2007), the dietary patterns in developing countries are shifting towards products such as livestock. These changes in consumer diets and the demand for products in emerging markets are indicative of emerging opportunities and should provide a positive stimulus for market-driven agricultural production among smallholder farmers. Therefore, the choice of formulating a livelihood strategy based on the livestock activities in Umzimkhulu may be in response to a particular niche in livestock activities, a change in consumer preferences and/or a higher proportion of income-earning households stimulating demand.

Rural households generally have limited access to services from financial institutions, including savings (Chisasa and Makina, 2012). As a result, informal savings are common among rural households and they are thought to improve informal lending, which then helps strengthen the social capital of the rural households (Irving, 2005; Mashigo, 2008). The results show that households with savings were less likely to select ‘Cropping and non-agriculture’ livelihood strategy, but were more likely to select the ‘Mixed farming/migration/social grant reliant’ livelihood strategy. This may be due to the fact that savings may be important in the determining the choice of this livelihood strategy.

The three PCA indices for information sources for agricultural production were observed to significantly influence the choice of livelihood strategy. It is important to understand that the changes in diets, which are being experienced in developing countries, have resulted in an increase in the demand for products like vegetable oils, fruit, and vegetables, to the detriment of cereals, roots and tubers (Burch et al. 2007). In addition, the demand for livestock products has also increased. Generally, rural households are subsistence producers, mainly producing staple crops such as cereals, roots and tubers (De Cock *et al.*, 2013; D’Hease *et al.*, 2013). The

information disseminated to the smallholder farmers may likely orientate them to produce agricultural products to align with the changes in diets and emerging markets. Fabusoro *et al.* (2010) state that training provides links to useful networks. Such is the case with emerging farmers involved in the production of horticultural produce (Barlow and van Dijk, 2013). The indices representing extension workers (EXTWORK_EXT) and community meetings (COMMNTY_EXT) as a sources of agricultural information had the effect that households are more likely to make a livelihood strategy that combines both cropping and livestock farming (i.e., ‘Mixed farming/migration/social grant reliant’ livelihood strategy), compared with the ‘Agricultural wage/cropping reliant’ livelihood strategy. The rural households which relied on agricultural information of the PCA indices representing extension workers (EXTWORK_EXT) and commodity organizations (COMMODTY_EXT) were more likely to choose the livelihood strategy that most likely emphasizes crop production (i.e., ‘Agricultural wage/cropping reliant’), compared to choosing ‘Mixed farming/migration/social grant reliant’ livelihood strategy. The emphasis of the information sources provided by the agents of extension services influences the choice of the livelihood strategies among rural households. The households combine cropping and livestock farming differently with other livelihood activities, thereby giving rise to the diversity of livelihood choices.

3.7 Conclusion

The study utilised data from 400 sampled rural households in the KwaZulu-Natal province of South Africa. This study explored the determinants of livelihood strategies among rural households in smallholder farming systems. Rural households are involved in several activities, of which cropping and livestock activities, as well as receiving social grants are dominant.

The four livelihood patterns that dominate rural livelihoods choices were identified in the study by a using a multivariate analytical technique that included the use of PCA, K-means cluster analysis and MNL regression. Socioeconomic factors that comprise household size, the household head’s years of formal years of education, the size of arable dryland accessed the location of the household and savings of the household were the main determinants of the choice of the livelihood strategy. The PCA dimension of the sources of information for farming activities that were significant predictors in the MNL regression model was an index representing extension workers as information sources for farming activities, community meetings as information sources for farming activities and commodity organisation as information sources for farming activities.

On the basis of these findings, it is recommended policy interventions should target removing bottlenecks at household level for members to improve human capital. Providing education to household members may provide an opportunity to diversify their livelihood activities. The contribution of this study suggests that policy efforts should be directed towards stimulating accessible savings. Savings were found to provide the opportunity for households to make other livelihood choices. Informal savings groups could be more appropriate for rural dwellers who would not normally meet the requirements of formal lending institutions. Policy-makers need to be sensitive to the different livelihood choices taking place at the household level, craft inclusive policy interventions which cater for diverse livelihoods and respond with suitable and appropriate policy.

CHAPTER 4: ANALYSIS OF FACTORS DETERMINING INCOME DIVERSIFICATION AMONG RURAL HOUSEHOLDS IN KWAZULU-NATAL PROVINCE, SOUTH AFRICA.

Abstract

Agriculture as a development strategy in most developing countries is unable to single-handedly eradicate poverty. Income diversification is a risk mitigation strategy used to bear and cope with difficult circumstances confronting rural households. An understanding of such diversification strategies would allow policy-makers to develop more appropriate development interventions. This study examined the factors influencing the extent of income diversification from randomly sampled 400 rural households in two local municipalities of Ndawedwe and Umzimkhulu in KwaZulu-Natal province of South Africa. Income diversification measured by the Simpson index of diversity (SID) was 0.22, which indicates low levels of income diversification. The analysis indicated that 34% of the households did not diversify their income. The Fractional Logit Generalized Linear Model (GLM) was used to analyze the factors influencing levels of income diversification. The model revealed significant predictors of income diversification to be the household head gender, household head's years of formal education, marital status, total household assets owned by the household and access to credit, savings, infrastructure and agricultural training. The policy should focus on agricultural training needs in the rural communities, gender bias and other forms of discrimination within communities. Promotion of access to financial products such as savings and credit also needs to be considered.

Keywords: income diversification, Simpson index of diversification, risk mitigation strategy, Fractional Logit Generalized Linear Model, South Africa

4.1 Introduction

Rural households are a vulnerable group of people and their livelihoods² revolve around farming activities. The rural communities include smallholder farmers who are commonly poor

² Ellis 2000 defines a livelihood as the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household.

and earn a little income from agriculture production (Godfray *et al.*, 2010). Agriculture as a development strategy in most developing countries is unable to single-handedly eradicate poverty, but it is nonetheless very important (Burch *et al.* 2007). The rapid income growth in developing countries and increasing urbanization gives the rural households the opportunity to diversify farm production into high-value horticultural crops and livestock husbandry. It is notable that dietary patterns in developing countries are shifting towards livestock products, vegetable oils, fruit, and vegetables at the expense of cereals, roots and tubers. These changes in consumer diets and the demand for products in emerging markets are indicative of emerging opportunities and should provide a positive stimulus for market-driven agricultural production among smallholder farmers (Burch *et al.* 2007).

The risks among rural households are ubiquitous and are manifest in a variety of forms. They may present themselves as a disease, political instability, economic changes and environmental damage. The ability to manage risk can be considered a very useful means for development. These risks can deteriorate into a crisis if left unattended, with the potential of reversing substantially the development gains already achieved. Risks that are specific to individuals or households, i.e., idiosyncratic risks, may include loss of a livelihood, loss of a family member to disease, or nursing a chronically ill family member, can be overwhelming, especially for vulnerable families and individuals. It is estimated that over 20% of the population in developing countries survive on less than \$1.25³ a day, suggesting that people around the world are poor or live very close to poverty; they are more likely to fall deeper into poverty if confronted with negative shocks (World Bank, 2013).

At the household level, income diversification is a risk mitigation strategy used to cope with difficult circumstances. Rural households create portfolios consisting of a number of activities and assets with the aim of surviving and improving their standard of living (Ellis, 2000). Households aim to have numerous activities to offset potential effects of risk associated with relying on a single income source. Those that focus on producing agricultural commodities for income may diversify production in an effort to reduce dependence on a single income source (e.g. a single crop) (Barry *et al.*, 2000; Nhemachena and Hassan, 2007).

Rural households are often faced with the decision to either specialize or diversify their income sources. Warren (2002) posits that each of the decisions is influenced or caused by the other.

³ Note: \$1.25 per day is a widely used measure of extreme poverty (World Bank, 2013). ZAR/USD = 13.57/1.00 on 14 September 2015.

There are usually some elements of specialization or diversification with movements from one decision to another among the households. Guèye (2014) states that households prefer to diversify rather than specialize, despite the availability of capital and other resources to specialize. Warren (2002) argues that intensification is usually a move by rural households to replace a lower returns income source with one which yields relatively more returns. If the move proves to be more rewarding, a household usually allocates more resources to the new niche. Guèye (2014) points out that diversification is at the center of most rural households' strategies.

Ellis (1998) opines that patterns of diversification are likely to vary greatly across countries and regions. Babatunde and Qaim (2009) show that income diversification in the rural areas is greater among richer households in Indonesia (Schwarze and Zeller, 2005), whereas in Ethiopia and Mali the opposite effect is observed (Abudulai and Crolerees, 2001; Block and Webb, 2001). Babatunde and Qaim (2009) add that the role of farmland in income diversification serves different purposes and influences income diversification differently (e.g. Minot *et al.*, 2006 vs. Canagarajah *et al.*, 2001; Lanjouw *et al.*, 2001).

Factors influencing income diversification are not well established. Therefore, the objective of this study is to analyze the factors that influence income diversification among rural households.

4.2 Methodology

This section presents analytical techniques that were used in assessing the factors influencing the extent of household income diversification. It presents the income diversification index (SID), econometric analytical model and the independent variables used in regression analysis.

4.2.1 Study site

The data collection was conducted in KwaZulu-Natal (KZN) province of South Africa in two local municipalities (LM), namely Ndwedwe and Umzimkhulu. KZN is located in the southeast part of South Africa (Figure 3.1, page 36).

Ndwedwe is situated 60 km north of Durban and approximately 20 km west-north-west of Tongaat, in the Ilembe District Municipality (29.531°S 30.934°E). According to Stats SA (2015), Ndwedwe has a population of 140 820 and comprises 29 200 households, of which 13 710 are agriculturally based. Cropping activities are mainly maize, beans, taro and sweet

potatoes. Livestock reared consists of cattle, goats and sheep, but not for commercial purposes (Sotshongaye and Moller, 2000). Non-farming livelihood activities include sewing, candle-making and block-making among many others (Sotshongaye and Moller, 2000).

Umzimkhulu falls under the Harry Gwala District Municipality. The town is located 105 km from Pietermaritzburg and 18km south-west of Ixopo (30.263°S 29.940°E). Umzimkhulu LM is home to 180 302 people and has 42 909 households (24 538 being agricultural) (Stats SA, 2015).

The sample size was determined from the guidelines provided by Israel (1992). Given that the total number of households from the two LMs was 72 109, the guidelines provide that sample sizes of 370, 383, and 384 would have a 5% margin of error on a 95% confidence level of population sizes of 10 000, 100 000, and 500 000 respectively. Therefore, a sample of 400 was considered adequate to meet the two requirements.

4.2.2 Data collection procedure

The data collection for this chapter was similar to the procedure which was described in section 3.3.3 on page 35.

4.2.3 Analytical techniques

Descriptive statistics were used to summarize the dependent and independent variables. The Fractional Logit Generalized Linear Model (GLM) was identified as a suitable model to analyze the relationship between the SID and its determinants. The following subsections describe the income diversification index and the regression model used.

4.2.3.1 The Income Diversification Index

The SID generates a measure of the extent of income diversification, which is shown by the proportion of the households' income. The SID is an applied diversification index adapted from biodiversity studies (Fabusoro, 2010).

Some studies have included income sources such as remittances in the computation of the SID measure (e.g. Nguyen *et al.*, 2011). The present study includes remittances as well as social grants in the computation of the SID. These income sources make up a substantial contribution to household incomes in South Africa.

The index is computed as follows:

$$D = 1 - \frac{\sum_{i=1}^R n_i(n_i - 1)}{N(N-1)} \quad (4.1)$$

Where:

D = Simpson Index of Diversity

R = number of activities for household “*i*”

N = total income of a household

n = Income generated from the *i*th activity in the total income.

The dependent variable obtained from the SID will be a proportion with non-integer values and will be bound in an interval between 0 and 1. The SID measures the dispersion of income made from livelihood activities. The SID value of 1 represents complete income diversification, and 0 represents perfect income non-diversification (Fabusoro, 2010).

4.2.3.2 The Econometric Model

The Fractional Logit Generalized Linear Model (GLM) was used to analyze the factors affecting the income diversification. This model has proved more reliable in modelling proportions rather than the Ordinary Least Squares (OLS) and Tobit regression models (Papke and Wooldridge, 1996; Baum, 2008). According to Wooldridge and Papke (1996), the Fractional Logit Generalized Linear Model (GLM) is a quasi-likelihood method of estimating regression models with a fractional dependant variable.

In order to deal with multicollinearity, the Variance Inflation Factors (VIF) were reviewed for Fractional Logit GLM. However, the literature does not provide a clear guide to an acceptable VIF value. For instance, Glavin *et al.* (2011) consider VIF values which are above 2.50 as problematic, whereas Pan and Jackson (2008) consider those below 4 as acceptable. The maximum level of VIF value of 10 has also been considered acceptable in some studies (e.g. Hair *et al.*, 1995; Arimond, and Ruel, 2004). The use of squares of covariates such as age squared has been known to be a source of multicollinearity. In some cases, such squared covariates have resulted in models with a high VIF, often above 10 (Arimond, and Ruel, 2004; Calafat *et al.*, 2008).

The Fractional logit GLM uses robust estimates in order to deal with heteroscedasticity and was followed by a specification test to determine the suitability of the model (Hardin *et al.*, 2007). Generally, the specification test involves regressing the response variable on the predicted values and their squares. A correct specification would result in the squares of the predicted value not being statistically significant (Hardin *et al.*, 2007). The procedure was carried out using Stata Software.

According to Papke and Wooldridge (1996), the Fractional Response Regression Model (i.e., a Generalized Linear Model with a binomial distribution and a logit link function) may be presented as follows:

$$g\{E(y)\} = x\beta, y \sim F \quad (4.2)$$

Where $g(\cdot)$ is the link function and F is the distributional family. This becomes

$$\text{Logit}\{E(y)\} = x\beta, y \sim \text{Bernoulli} \quad (4.3)$$

4.3 The independent variables used in the regression analysis

The variables which were hypothesized to influence the level income diversification are presented in Table 9. The choice of these variables was based on previous studies, theory and the available data. From the factors known to affect income diversification, this study considers age of the household head, number of household members residing in the household, education, size of the arable land accessed, gender of household, marital status, savings, household access to credit, location of the household, agricultural training and infrastructure of amenities in the analysis (Babatunde and Qaim, 2009; Fabusoro *et al.*, 2010; Khatun and Roy, 2012; Demissie and Legesse, 2013). These determinants are important, as they can influence household income diversification. The explanatory variables and the hypotheses of how these and other variables influence income diversification are shown in Table 9.

Table 9. A Priori expectation of the description of explanatory variables used in regression analysis

Variable name	Definition	Hypothesized direction of sign
SID	Simpson index of income diversity	
AGE_HEAD	Age of the household head	+
AGE_SQRD	Square of the age of the household head	-
HHLD_SIZE	Number of household members residing in the household	+
EDUCATION	Years of formal education of the household head	+
ARA_LAND	Size of the dryland accessed by the household	+
GENDER	Dummy for gender of household is head (male = 1, female = 0)	+
MARRIED	Marital status of the household head (married = 1, otherwise = 0)	+
SAVING_DMY	Dummy for savings (yes = 1, no =0)	+
CREDIT	Household access to credit	+
AREA_DMY	Dummy for location of household (Ndwedwe = 1, Umzimkhulu =0)	+/-
AGRI_TRAIN	Dummy for having received agricultural training (yes = 1, no = 0)	+
INFRAST	Principal component analysis (PCA) index representing the satisfaction with infrastructure of amenities	+

Source: Author

An increase in the age of the household head is expected to positively influence income diversification. Including the age-squared covariate allows for more accurate modelling and determining the influence of age in the regression model. The influence of age is expected to be positive up to a certain point, beyond which the relationship is assumed to wear off. Intuitively, the square of the age of the household head is therefore expected to negatively affect income diversification. As the household heads advanced in age, the influence of age is expected to have a different effect to that of age squared (Drukker, 2003; Gelman, 2008).

A large family has more household members available to participate in several economic activities. This might help prevent livelihood failure (Reardon, 1997; Khatun and Roy, 2012). A larger household has more members who may be able to take advantage of opportunities

compared to smaller households. Larger households are therefore more likely to have a greater measure of income diversification than smaller households (Olale and Spencer, 2012). More household members are expected to be able to contribute income from diverse sources. The covariate for the household members is expected to positively influence income diversification.

Farming at rural household level is usually not very specialized and is often practised as subsistence farming. Dryland farming is generally associated with several risks. For example, crop failure as a result of drought, pests and the general failure of credit markets and product markets (Akpalu, 2013). With such a risk, households turn to non-farming income sources in order to sustain their livelihoods. However, households are also likely to increase income-earning opportunities as they increase the size of their arable land under cultivation. It is hypothesized that such households would produce a marketable surplus which they can sell to boost their income. Thus, the area of arable dryland accessed by the household is expected to positively influence income diversification.

Patterns of gender bias and discrimination have been reported in several studies and have been known to affect the livelihoods (Arizpe, 2014; Bishokarma and Amir, 2014). This selective discrimination towards female-headed households is expected to affect income diversification among rural households. Recent studies analyzing income diversification have also captured the gender variable, in order to relate it to income diversification (Babatunde and Qaim, 2009; Demissie and Legesse, 2013). It is hypothesized that male-headed households are more income diversified compared to female-headed households.

4.4 Results

This section presents the results of the study. Descriptive statistics, frequencies and percentages, as well as empirical analysis using regression models, are presented below.

4.4.1 Socio-economic characteristics of the rural households

Table 10 shows the results of the socioeconomic characteristics of the rural households. On average, the household heads were 57 years old. Each household had an average of seven members and household heads had an average of six years of formal education. The other variables are presented in Table 12.

Table 10. Socioeconomic characteristics of the rural households (n = 400)

Variable	Mean	Std. Deviation
Age of household head in years	56.56	13.72
Number of household members	6.40	3.80
Number of schooling years of household head	5.51	4.49
Area of arable dryland land accessed (ha)	0.58	0.70
Value of total assets ('000) in rands	86.70	187.09

Source: Survey data (2015)

4.4.2 Extent of income diversification

Table 11 shows the extent of income diversification for the rural household, with frequencies and percentages. The SID values were categorized in order to present the distribution of the SID based on percentages. An analysis of the fragmented SID categories reveals how the households diversified at different SID categories. The average value of SID was 0.22, which indicates low levels of income diversification. There was evidence of households with no income diversification (i.e., SID = 0) and these accounted for 34% of the sample. The next predominant category after the non-income diversified category is the 0.41 to 0.50 range which accounted for 17.75% of the households. This accounts for 17.75 percent of the diversified households. However, only a few households (3%) were in the category 0.61 to 0.70 which represented the highest diversification category.

Table 11. Distribution of respondents by the extent of diversification (SID)

SID categories	Frequency	Percentage
0.00	136	34.00
0.01-0.10	37	9.25
0.11-0.20	32	8.00
0.21-0.30	42	10.50
0.31-0.40	40	10.00
0.41-0.50	71	17.75
0.51-0.60	30	7.50
0.61-0.70	12	3.00

Mean = 0.22; Min= 0.00; Max = 0.69; SD = 0.21

Source: Survey data (2015)

4.4.3 Income diversification characteristics of the categorical independent variables

This subsection focuses on comparing income diversification across the categorical variables (Table 12).

Table 12. Comparison of the means for nominal variables

Variable	Response	Mean SID	N	t-test
Household savings	No	0.20	262	***
	Yes	0.27	138	
Household location	Umzimkhulu	0.26	100	**
	Ndwedwe	0.21	300	
Agricultural training received by household	No	0.21	89	NS
	Yes	0.22	311	
Access to credit	No	0.22	313	NS
	Yes	0.23	87	
Household head marital status	Otherwise	0.21	215	NS
	Married	0.23	185	
Gender of household head	Male	0.23	189	NS
	Female	0.21	211	

Note: ** p<0.05; *** p<0.01; NS = not significant

Source: Survey data (2015)

The households that reported having savings were associated with higher means for the SID (0.27), in comparison to those which did not have savings (0.20). The independent sample *t-test* was associated with a statistically significant effect on households with savings. The results also indicate that, on average, rural households in Umzimkhulu were relatively more income diversified than those in Ndwedwe. An independent sample *t-test* shows that the mean for the income diversification measure differs significantly for the households in Umzimkhulu and Ndwedwe. The mean SID values for the other variables were not significantly different among their options.

4.4.4 The Regression results

Heteroskedasticity was dealt with by using robust estimates in the model. A specification test was used in order to ascertain the appropriateness of the logit link function. The square of the predicted value had no statistical significance as shown in Table 13. This means that the link test accepts its null hypothesis and, therefore, the Fractional Logit GLM is accepted. There were no multicollinearity problems identified in the model, but the age and age squared covariates were sources of high VIF values.

Table 13: Specification test: regression of the dependent variable on the predicted values and their squares

SID	Coef.	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
<u>hat</u>	0.1813424	0.1244632	1.46	0.145	-0.062601	0.4252858
<u>hatsq</u>	0.006316	0.0417795	0.15	0.880	-0.0755702	0.0882023
<u>cons</u>	0.452154	0.0858365	5.27	0.000	0.2839176	0.6203904

The results of the Fractional logit GLM are shown in Table 14. The results reveal that the years of formal education for the household head (EDUCATION), marital status (MARRIED) and access to formal and informal credit (CREDIT) were found to negatively affect income diversification among the households. The level of rural households satisfaction with amenities (road accessibility, markets, electricity, agricultural water supply and drinking water supply) (INFRAST), gender of the household head (GENDER), the value of the total household assets (TOT_ASSETS), household savings (SAVING_DMY) and agricultural training (AGRI_TRAIN) were found to positively influence income diversification.

The regression analysis showed that the years of formal education (EDUCATION) was a statistically significant predictor of income diversification ($p<0.01$). This was contrary to expectations. The model predicts that, for a unit increase in the years of formal education for the household head, income diversification decreases by 0.070. Marital status (MARRIED) was found to influence income diversification and the variable was statistically significant at $p<0.05$. The sign for the coefficient for the variable was not as expected. Households with married heads were less likely to diversify their income than the base category, by an income diversification measure of 0.458. The married household heads were less likely to diversify their income, compared to those that were not married. Access to credit (CREDIT) was statistically significant ($p<0.05$). The households with access to credit were less likely to diversify their income, compared to households with no access to credit. This contradicts the *a priori* expectation.

Table 14. Estimates of the Fractional Logit GLM

SID	Coef.	Robust Std. Err.	P>z	VIF
AGEHHLD	0.212	2.89E-01	0.464	5.61
AGE_SQRD	-0.000	0.000	0.273	5.31
EDUCATION	-0.070***	2.58E-02	0.006	1.75
HHLD_SIZE	0.010	1.95E-02	0.589	1.65
GENDER	0.527**	0.228	0.021	1.56
TOT_ASSETS	1.076e-06**	4.38E-07	0.014	1.33
ARA_LAND	0.059	0.173	0.730	1.28
MARRIED	-0.458**	0.217	0.035	1.28
INFRAST	0.269***	0.101	0.008	1.24
SAVING_DMY	0.498**	0.209	0.017	1.24
AREA_DMY	0.333	0.281	0.236	1.24
AGRI_TRAIN	0.475**	0.241	0.049	1.16
CREDIT	-0.549**	0.252	0.030	1.14
_cons	-2.071***	0.730	0.005	
No. of obs			171	
AIC			0.878148	
BIC			-768.0156	

Note: * p<0.1; ** p<0.05; *** p<0.01

Source: Survey data (2015)

The level of rural households' satisfaction to infrastructure amenities (INFRAST) positively influenced income diversification. The model predicts that male-headed households diversify their incomes more than female-headed households. The results show that a unit increase in the value of the total household assets (TOT_ASSETS) owned by a household leads to an increase in income diversification (p<0.05). The household savings (SAVING_DMY) variable was found to significantly affect income diversification (p<0.05). The specified model reveals that households with savings diversified their incomes more than households with no savings by a measure of 0.498 on the diversification index. In comparison to the households that reported not having received agricultural training (AGRI_TRAIN), the households that had received such training were found to be more likely to diversify their income by an extent of 0.475 on the index of income diversification. This variable positively influenced income diversification.

The estimates of the OLS and the Tobit regression models are presented in Table 15. In comparison to Fractional logit GLM, the models show large standard errors. The fractional

logit GLM seems to fit the data well since it has robust standard errors to deal with heteroskedasticity. According to Kieschnick and McCullough (2003) several regression models overlook the fact that since these response variables are bounded, their error distributions must be heteroskedastic. A post estimation test after estimating the OLS using the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity suggests evidence of heteroskedasticity. The null hypothesis of constant variance revealed Chi-squared value of 0.1604.

Table 15. Estimates of the OLS and Tobit models

	OLS Estimates			Tobit Estimates		
SID	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
AGEHHLD	0.008333	0.007023	0.237	0.014532	0.009977	0.147
AGE_SQRD	-8.7E-05	5.98E-05	0.15	-0.00014	8.47E-05	0.089
EDUCATION	-0.00919	0.004175	0.029	-0.01321	0.005714	0.022
HHLD_SIZE	0.000042	0.003283	0.99	0.00075	0.004436	0.866
GENDER	0.068019	0.035612	0.058	0.083446	0.048852	0.09
TOT_ASSETS	1.94E-07	9.48E-08	0.043	2.41E-07	1.26E-07	0.057
ARA_LAND	0.038242	0.021519	0.077	0.045438	0.028817	0.117
MARRIED	-0.07138	0.035574	0.046	-0.08206	0.049176	0.097
INFRAST	0.035208	0.015978	0.029	0.048083	0.02162	0.028
SAVING_DMY	0.079092	0.033284	0.019	0.116492	0.045231	0.011
AREA_DMY	0.030244	0.039941	0.45	0.045846	0.055154	0.407
AGRI_TRAIN	0.073689	0.036202	0.043	0.082578	0.049622	0.098
CREDIT	-0.06075	0.037851	0.11	-0.09284	0.052492	0.079
cons	-0.04965	0.214716	0.817	-0.27115	0.303185	0.372
Number of obs	174			Number of obs		174
F(13, 160)	3.4			LR chi ² (13)		39.92
Prob > F	0.0001			Prob > chi2		0.0001
R-squared	0.2165			Pseudo R ²		0.3052
Adj R-squared	0.1529					

Source: Survey data (2015)

4.5 Discussion

Socio-economic factors and households demographic characteristics are important in determining income diversification of rural households. Olale and Spencer (2012) identified

the age of the household head, education and household size as some of the important characteristics that influence income diversification. Older household heads are generally associated with a wealth of experience, asset accumulation and social networks. The average age of the household head is 57 years.

The result presented in Table 14 show that male-headed households were more income diversified than female-headed households. Gender discrimination and bias has been shown to exist in developing countries. Men generally have better access to human, physical and financial capital in comparison to women (De Janvry and Sadoulet, 2001; Lanjouw and Lanjouw, 2001; Villarreal, 2006; Olale and Spencer, 2012). Women are most marginalized in their access to resources and opportunities. It is argued that if women were to access comparable levels of resources as their male counterparts, agricultural productivity among women, for instance, could lead to 20 to 30% increase in productivity, which would be adequate to take approximately 100 million out of poverty through improved income and food supply (Godfray *et al.*, 2010). With better capital access male-headed households are more likely to access resources for income-generation better than women and, therefore, become more income diversified.

Education has been identified as a key in the reduction of transaction costs associated with the access and interpretation of information in general (Pingali *et al.*, 2005). Because of this, the household heads with more years of formal education were anticipated to lead their households into various income diversifying strategies. Education is also viewed as a means through which households members are able to compete in formal labour markets and thus potentially increase their earnings. Fabusoro *et al.* (2010) argue that education brings with it increased skills levels, provides opportunities for non-farm income and increased productivity. According to Jacobs and Makaudze (2012), in a rapidly modernizing economy, considerably higher levels of education are essential for rural households relying on human capital, i.e., education of household members, for sustainable livelihood. A low level of education translates to a weaker human capital base, with fewer income-earning opportunities in an economy that requires certain skills from formal education. As the results show, an increase in the years of formal education for the household head leads to a decrease in income diversification. This is probably because the increased chances of engaging in gainful employment provide stable income. With such income stability, households are more likely to intensify than diversify their income sources. However, Babatunde and Qaim (2009), Khatun and Roy (2012) and Demissie and

Legesse (2013) provide the evidence that education can positively affect income diversification.

Access to credit was identified as another factor that influences income diversification. Table 14 shows that households with no access to credit were more income diversified than those with access. Credit is potentially used in cushioning the lives of rural households by stabilizing income demands for household needs when income is variable and helps cope with unexpected expenditure (Okten and Osili, 2004). The greatest challenges that rural households face in accessing credit includes, but is not limited to, lack of collateral security, high-interest rates, default risks, and lack of suitable loans (Diagne *et al.*, 2000). Therefore, households without access to credit turn to alternative sources of income when excluded from credit markets. With the same argument, households with access to credit are less likely to diversify their income due to their reliance on credit which they can use to cushion themselves.

The regression results show that household assets are a statistically significant predictor which positively influences income diversification. Households that have more assets are in a better position to buffer them from adversity, particularly if they are productive assets (Kochhar, 1995). Mutenje *et al.* (2010) showed that households which accumulate and invest their wealth as livestock could use the livestock as a buffer in difficult circumstances. The household asset variable also captured assets that could be productive. This finding supports that by Babatunde and Qaim (2009), who believe that assets are useful in establishing self-employment activities, therefore enabling households to diversify their income.

The results in Table 14 provide the evidence that the married households were less likely to diversify their income compared to the households in the “otherwise” category, which was made up of the other marital statuses (i.e., single, widowed and divorced). This was not expected since more adult members would mean the household would be able to engage in more income-generating activities and thereby diversify the household incomes. It is probable that the family structure in households with married couples allows one of the household members to be the breadwinner while the other one is left to support the family with household activities. According to Dlova *et al.* (2004), married women are often limited to taking part in other livelihood activities due to household and marital roles (e.g., child rearing and household chores). Grad *et al.* (2012) state that the main source of labour in rural communities is family labour. Therefore, in married households, one of the partners is most likely to attend to

household subsistence production. Thus, married households are less likely to diversify their income.

Agricultural training assists the rural households by possibly offering knowledge of opportunities related to income-generating farming ventures and building their capacity towards income-earning farming. With appropriate agricultural training, farm productivity and the farming income could possibly be improved (Ndoro *et al.*, 2014). Diiro (2009) found that the farmer contact with extension service providers is associated with increased agricultural production. Results from the Fractional Logit GLM showed that agricultural training increased the likelihood of a household diversifying its income. This finding is supported by Khatun and Roy (2012). Fabusoro *et al.* (2010) reasons that training increases confidence and enables the establishment of networks that can be used in allowing household members to diversify their incomes.

The PCA dimension representing the level of satisfaction with infrastructure and amenities (road accessibility, markets, electricity, agricultural water supply and drinking water supply) of rural households positively influenced income diversification. The results may be useful in understanding the relationship between income diversification of the rural households and their level of satisfaction with amenities. According to Tshuma (2012), rural areas are generally characterized by inadequate physical infrastructure and services, elements which are responsible for pushing households away from agriculture to off-farm income sources. Rural households that were more satisfied with infrastructure were more likely to diversify their income, as they may realize more opportunities that are available in their community by making use of the infrastructural developments.

4.6 Conclusion

The present study analyzed the factors influencing income diversification in rural South Africa among 400 randomly selected households in KZN province. The findings reveal that a high proportion of households were not responsive to income diversification.

The analysis indicated that income diversification was low, that is, SID = 0.22, as an average. Up to 34% of the households showed no income diversification (i.e., SID = 0). The maximum income diversification measure was 0.69. The Fractional Logit GLM was used to analyze the factors influencing income diversification. Determinants which negatively affected income diversification were found to be the years of formal education for the household head, marital

status and access to credit. The level of rural households' satisfaction with amenities, the gender of the household head, the value of the total household assets, household savings and agricultural training were found to positively influence income diversification.

Policy needs to be geared to capacitate rural households with agricultural training so that they may be able to diversify their income. These agricultural training services allow for increased agricultural land use and the production of high-value agricultural commodities. Management of the risks linked to farming, in general (e.g. crop failure), may be appropriately disseminated through such services. Policy needs to align the introduction of interventions such as irrigation schemes within the community with the appropriate extension service.

Development interventions need to pay attention to a policy that would promote gender sensitive opportunities and remove gender bias and discrimination within communities. Policies that work towards promoting the availability of financial services by encouraging savings should be considered. An inclusive financial system should aim towards improving rural livelihoods. Wider interventions should focus on providing adequate infrastructure to the rural communities and promoting education.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Smallholder and subsistence farmers in South Africa are poorly resourced and developed in their farming practices. Rural households are home to smallholder farmers, mainly located in the former homeland areas, which are largely unsuitable for agriculture. For their livelihoods, rural households diversify their livelihood choices and incomes between farming and non-farming activities. Farming in the rural communities is on a small scale, mostly being for subsistence purposes and contributing little income to rural livelihoods. Rural households diversify their income and choice of livelihood strategies. An understanding of the nature of livelihoods and income diversification among rural households would allow appropriate policy formulation.

This study analysed the contribution of farming to the livelihoods of rural households, using Ndawedwe and Umzimkhulu Local Municipalities of KwaZulu-Natal province, South Africa, as case studies. Four hundred rural households were randomly selected and interviewed, using a structured questionnaire. The objectives of the study were to identify rural livelihood strategies, the factors that influence the choice of the livelihood strategies and to investigate the factors influencing income diversification among rural households in KZN.

5.2 Summary of results

Rural households participated in activities such as cropping, livestock, agricultural wage-earning, non-agricultural, self-employment, remittances and migratory activities. Household members also received social grants. Most of the households in the study participated in crop farming and/or livestock farming as integral parts of their livelihood strategies. Combinations of these activities formed household livelihoods. From the 400 households interviewed, the four dominant livelihood strategies identified were:

- ‘Mixed farming/migration/social grant reliant’ (representing 51.27% of the households)
- ‘Agricultural wage/cropping reliant’ (representing 16.50% of the households)
- ‘Cropping and non-agriculture’ (representing 27.50% of the households)
- ‘Livestock reliant’ (representing 4.25% of the households)

The factors influencing the choice of these activities were the years of formal education of the household head, household size, dependency ratio, dryland area accessed by the household, savings, location of the household and the source of agricultural information.

Determinants of income diversification were the years of formal education for the household head, marital status and access to formal and informal credit. The level of rural households satisfaction with amenities, the gender of the household head, the value of the total household assets, household savings and agricultural training were found to positively influence income diversification.

5.3 Policy recommendations

From the findings of this study, policy-makers should consider the following interventions:

- In order to allow for desirable livelihood choices, which allow households to diversify farming (cropping and farming) and non-farming livelihood strategies, policy needs to focus on access to arable land, savings and extension support targeted at rural households.
- Promotion of extension services, to allow households to make choices of livelihood activities that include cropping and livestock farming, as these are the policy thrust of interventions under DAFF.
- Removal of bottlenecks at household level for members to improve human capital. Provision of education to other household members may improve human capital of the household concerned, thereby providing an opportunity to participate in other livelihood choices.
- Promotion of the availability of financial services by encouraging savings. Removing the bottlenecks associated with credit access should be considered. Informal savings groups could be more appropriate for rural dwellers who would not normally meet the requirements of formal lending institutions. Policy efforts should be directed towards stimulating accessible savings for rural communities.
- Capacitation of rural households through agricultural training so that they can diversify their income. These agricultural training services may allow for increased agricultural land use and the production of high-value agricultural commodities.

- Paying attention to the creation of gender-sensitive opportunities and removal of gender bias and discrimination within communities, to allow households to diversify their income.
- Provision of adequate infrastructure to the rural communities to enable income diversification among rural households.

5.4 Areas for future research

- The determinants of farming activities (cropping and/or livestock) for the households were not investigated in this study. This suggests a need to conduct a further study investigating the factors which affect households' participation in these farming activities.
- Unlike the Simpson index of diversity used in this study, income diversification could be examined by the Herfindahl and Ogive indices. A study comparing these and/or other such indices could provide more insight into the factors influencing income diversification.
- Income inequality was not examined in this study. Examining the income equality that exists among rural households could provide further insight into the welfare of the rural households.
- An examination of rural households' market participation in agricultural produce markets could provide more understanding of the welfare impacts of such activities on smallholder farmers in South Africa.
- It is anticipated that households that do not have a reliable (urban economy based) source of income diversify into more petty activities to augment their incomes. An examination of income diversification among the segment of rural households that do not have strong links to urban economies may need to be investigated in order to see how the results would differ from the present study.

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APPENDICES

APPENDIX A: Principal component analysis: total variance explained for livelihood activities and KMO and Bartlett's Test

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.274	15.928	15.928	1.274	15.928	15.928	1.086	13.578	13.578
2	1.190	14.875	30.803	1.190	14.875	30.803	1.082	13.520	27.098
3	1.138	14.231	45.034	1.138	14.231	45.034	1.072	13.396	40.494
4	1.064	13.305	58.340	1.064	13.305	58.340	1.046	13.071	53.565
5	.940	11.745	70.085	.940	11.745	70.085	1.034	12.924	66.489
6	.906	11.321	81.406	.906	11.321	81.406	1.026	12.826	79.315
7	.833	10.419	91.824	.833	10.419	91.824	1.001	12.509	91.824
8	.654	8.176	100.000						

Extraction Method: Principal Component Analysis.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.543
Bartlett's Test of Sphericity	Approx. Chi-Square
df	63.123
Sig.	.000

APPENDIX B: Principal component analysis: component matrix, final cluster centers and ANOVA for livelihood activities

Component Matrix^a

	Component						
	1	2	3	4	5	6	7
P_CROP_DMY	-.231	.530	-.006	-.211	.734	-.196	-.091
P_LVSTK_DMY	.487	-.151	-.212	.615	.303	.060	.349
P_GRANT_DMY	.724	.068	-.095	.084	.165	-.039	-.584
P_AGRWAGE_DMY	.288	.407	-.467	-.385	-.009	.407	.403
P_NONAGRWAGE_DM Y	-.475	.234	-.397	.587	.006	-.200	.028
P_SELF_EMP_DMY	-.166	.261	.523	.335	.104	.701	-.113
P_REMITNC_DMY	-.133	-.720	.076	-.166	.520	.110	.153
P_MIGRAT_DMY	.325	.273	.655	.042	-.018	-.391	.404

Extraction Method: Principal Component Analysis.

a. 7 components extracted.

Final Cluster Centers

	Cluster			
	1	2	3	4
NON AGRIC AND REMITTANCE	-.36511	-.07388	.74059	-.05952
SOCIAL GRANTS	.26030	-1.44353	.38989	-.08800
MIGRATION	.20484	-.05674	-.31925	-.20821
LIVESTOCK	.39407	-.08796	-.74270	.34882
AGRICULTURAL WAGE	-.35281	1.61645	-.26156	-.28718
CROPPING	.23381	.12944	.19722	-4.62563
SELF EMPLOYMENT	-.16846	-.12181	.41106	-.13568

ANOVA

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
NON AGRIC AND REMITTANCE	29.449	3	.784	396	37.540	.000
SOCIAL GRANTS	56.136	3	.582	396	96.403	.000
MIGRATION	6.949	3	.955	396	7.277	.000
LIVESTOCK	31.801	3	.767	396	41.479	.000
AGRICULTURAL WAGE	69.048	3	.484	396	142.520	.000
CROPPING	126.814	3	.047	396	2705.812	.000
SELF EMPLOYMENT	8.584	3	.943	396	9.108	.000

APPENDIX C: Model fitting information, Goodness-of-fit, Pseudo R-square, Likelihood ratio tests for multinomial logit regression

Model Fitting Information

Model	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	379.938	389.292	373.938			
Final	334.696	465.652	250.696	123.242	39	.000

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	376.127	456	.997
Deviance	250.696	456	1.000

Pseudo R-Square

Cox and Snell	.522
Nagelkerke	.584
McFadden	.330

Likelihood Ratio Tests

Effect	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC of Reduced Model	BIC of Reduced Model	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	334.696	465.652	250.696 ^a	.000	0	.
age_head	332.660	454.261	254.660	3.964	3	.265
education_years	336.961	458.563	258.961	8.265	3	.041
HHLD_SIZE	336.534	458.136	258.534	7.838	3	.049
DPNDCY_RATIO	356.965	478.566	278.965	28.269	3	.000
drylandszie	348.741	470.342	270.741	20.045	3	.000
Tot_Hhld_yr_incm	329.884	451.486	251.884	1.188	3	.756
Tot_assets	331.973	453.574	253.973	3.277	3	.351
Extension_workers_Ext_ind_ex	352.787	474.389	274.787	24.091	3	.000
Community_Ext_index	338.633	460.234	260.633	9.937	3	.019
Commodity_org_ext_index	332.102	453.704	254.102	3.406	3	.333
AREA_DMY	338.073	459.675	260.073	9.377	3	.025
GENDER	331.956	453.557	253.956	3.260	3	.353
SAVING_DMY	344.767	466.369	266.767	16.071	3	.001

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

APPENDIX D: Parameter estimates for multinomial logit regression

Parameter Estimates								95% Confidence Interval for Exp(B)	
K_MEANS CLUSTERS ^a	B	Std. Error	Wald	df	Sig.	Exp(B)			
							Lower Bound	Upper Bound	
2	Intercept	5.298	1.876	7.979	1	.005			
	age_head	-.036	.024	2.265	1	.132	.965	.921	1.011
	education_years	-.127	.078	2.673	1	.102	.881	.756	1.026
	HHLD_SIZE	.111	.060	3.452	1	.063	1.118	.994	1.257
	DPNDCY_RATIO	-.070	.018	15.112	1	.000	.933	.901	.966
	drylandsiz	-2.833	1.007	7.919	1	.005	.059	.008	.423
	Tot_Hhld_yr_incm	.000	.000	.897	1	.344	1.000	1.000	1.000
	Tot_assets	.000	.000	.518	1	.472	1.000	1.000	1.000
	Extension_workers_Ext_index	.846	.374	5.121	1	.024	2.330	1.120	4.846
	Community_Ext_index	-.072	.269	.073	1	.788	.930	.549	1.575
	Commodity_org_ext_index	.371	.221	2.822	1	.093	1.449	.940	2.232
	[AREA_DMY=0]	.161	.873	.034	1	.853	1.175	.212	6.501
	[AREA_DMY=1]	0 ^b	.	.	0	.	.	.	.
	[GENDER=0]	-.681	.554	1.510	1	.219	.506	.171	1.499
	[GENDER=1]	0 ^b	.	.	0	.	.	.	.
	[SAVING_DMY=0]	-.976	.620	2.479	1	.115	.377	.112	1.270
	[SAVING_DMY=1]	0 ^b	.	.	0	.	.	.	.
3	Intercept	-.351	1.649	.045	1	.831			
	age_head	.014	.021	.443	1	.506	1.014	.974	1.056

Parameter Estimates

K_MEANS CLUSTERS ^a	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
education_years	-.003	.067	.002	1	.962	.997	.875	1.136
HHLD_SIZE	-.094	.080	1.382	1	.240	.910	.777	1.065
DPNDCY_RATIO	.019	.013	2.102	1	.147	1.019	.993	1.045
drylandsiz	-.685	.401	2.918	1	.088	.504	.229	1.106
Tot_Hhld_yr_incm	.000	.000	.009	1	.924	1.000	1.000	1.000
Tot_assets	.000	.000	.918	1	.338	1.000	1.000	1.000
Extension_workers_Ext_index	-.884	.298	8.825	1	.003	.413	.230	.740
Community_Ext_index	-.629	.279	5.077	1	.024	.533	.308	.921
Commodity_org_ext_index	.079	.204	.152	1	.697	1.083	.726	1.615
[AREA_DMY=0]	1.394	.618	5.088	1	.024	4.031	1.201	13.538
[AREA_DMY=1]	0 ^b	.	.	0	.	.	.	.
[GENDER=0]	.477	.497	.921	1	.337	1.611	.608	4.267
[GENDER=1]	0 ^b	.	.	0	.	.	.	.
[SAVING_DMY=0]	-1.888	.591	10.208	1	.001	.151	.048	.482
[SAVING_DMY=1]	0 ^b	.	.	0	.	.	.	.
4	Intercept	-29.050	4.761	37.235	1	.000		
	age_head	.042	.054	.610	1	.435	1.043	.939
	education_years	-.462	.224	4.251	1	.039	.630	.406
	HHLD_SIZE	-.130	.222	.345	1	.557	.878	.568
	DPNDCY_RATIO	-.008	.033	.055	1	.815	.992	.931
	drylandsiz	.785	1.492	.276	1	.599	2.192	.118
	Tot_Hhld_yr_incm	.000	.000	.000	1	1.000	1.000	1.000

Parameter Estimates

K_MEANS CLUSTERS ^a	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
Tot_assets	.000	.000	1.915	1	.166	1.000	1.000	1.000
Extension_workers_Ext_index	1.143	.894	1.636	1	.201	3.137	.544	18.085
Community_Ext_index	-2.455	1.576	2.427	1	.119	.086	.004	1.884
Commodity_org_ext_index	.582	.574	1.026	1	.311	1.789	.581	5.514
[AREA_DMY=0]	2.898	1.442	4.037	1	.045	18.137	1.074	306.375
[AREA_DMY=1]	0 ^b	.	.	0	.	.	.	.
[GENDER=0]	.433	1.242	.122	1	.727	1.543	.135	17.610
[GENDER=1]	0 ^b	.	.	0	.	.	.	.
[SAVING_DMY=0]	22.941	.000	.	1	.	9183426944.793	9183426944.793	9183426944.793
[SAVING_DMY=1]	0 ^b	.	.	0	.	.	.	.

a. The reference category is 1.

b. This parameter is set to zero because it is redundant.

APPENDIX E: Estimates of the Fractional Logit GLM

Generalized linear models
 Optimization : ML
 Deviance = 39.22559842
 Pearson = 35.85803582
 No. of obs = 171
 Residual df = 157
 Scale parameter = 1
 (1/df) Deviance = 0.2498446
 (1/df) Pearson = 0.2283951
 Variance function: $V(u) = u*(1-u/1)$ [Binomial]
 Link function : $g(u) = \ln(u/(1-u))$ [Logit]
 AIC = 0.878148
 Log pseudolikelihood = -61.08165368 BIC = -768.0156

SID	Coef.	Robust Std. Err.	z	P>z	[95% Conf.]	Interval]
AGEHHLD	0.2121274	2.89E-01	7.30E-01	0.464	- 0.3551638	0.7794186
AGE_SQRD	-0.00025459	0.0002324	-1.1	0.273	-0.00071	0.0002008
EDUCATION	- .07019832***	2.58E-02	- 2.73E+00	0.006	-1.21E-01	- 0.0197141
HHLD_SIZE	0.01050919	1.95E-02	0.54	0.589	-2.76E-02	0.0486364
GENDER	.52707426**	0.2280945	2.31	0.021	0.0800172	0.9741313
TOT_ASSETS	1.076e-06**	4.38E-07	2.45	0.014	2.17E-07	1.94E-06
ARA_LAND	 0.05972009	0.1728718	0.35	0.73	- 0.2791024	0.3985426
MARRIED	- .45755854**	0.2167616	-2.11	0.035	- 0.8824034	- 0.0327137
INFRAST	.26924098***	0.100961	2.67	0.008	0.0713611	0.4671209
SAVING_DMY	.49804817**	0.2086127	2.39	0.017	0.0891748	0.9069215
AREA_DMY	 0.33349123	0.2811819	1.19	0.236	- 0.2176152	0.8845976
AGRI_TRAIN	.47451942**	0.2412747	1.97	0.049	0.0016296	0.9474092
CREDIT	-.54883029**	0.2523737	-2.17	0.03	-1.043474	-0.054187
_cons	- 2.0711074***	0.7302582	-2.84	0.005	-3.502387	- 0.6398275

Note: * p<0.1; ** p<0.05; *** p<0.01

APPENDIX F: Specification test: regression of the dependent variable on the predicted values and their squares

Iteration 0: log pseudolikelihood = 56.654586
 Generalized linear models No. of obs = 171

Optimization : ML	Residual df = 168
Deviance = 5.161151706	Scale parameter = 0.0307211
Pearson = 5.161151706	(1/df) Deviance = 0.0307211
	(1/df) Pearson = 0.0307211
Variance function: V(u) = 1	[Gaussian]
Link function : g(u) = u	[Identity]
	AIC = -0.627539
Log pseudolikelihood = 56.65458598	BIC = -858.6383

SID	Coef.	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
_hat	0.1813424	0.1244632	1.46	0.145	-0.062601	0.4252858
_hatsq	0.006316	0.0417795	0.15	0.880	-0.0755702	0.0882023
_cons	0.452154	0.0858365	5.27	0.000	0.2839176	0.6203904

APPENDIX G: Estimates for variance inflation factors

Variable	VIF	1/VIF
AGEHHLD	5.61	0.178308
AGE_SQRD	5.31	0.188375
EDUCATION	1.75	0.570388
HHLD_SIZE	1.65	0.60543
GENDER	1.56	0.642277
TOT_ASSETS	1.33	0.754647
ARA_LAND	1.28	0.778905
MARRIED	1.28	0.782763
INFRAST	1.24	0.807437
SAVING_DMY	1.24	0.808049
AREA_DMY	1.24	0.808992
AGRI_TRAIN	1.16	0.861004
CREDIT	1.14	0.87599
AGEHHLD	1.11	0.903289
Mean VIF	1.92	

APPENDIX H: OLS Regression estimates

```
. reg SID age_head age_squared education_years hhldmebrs MALE Tot_assets drylandsiz MARRIED INFRA
> ST SAVING_DMY LM_NDW_NMZ AGRI_TRAIN CR_INF_FML
```

Source	SS	df	MS	Number of obs	=	174
Model	1.47188239	13	.113221722	F(13, 160)	=	3.40
Residual	5.32610286	160	.033288143	Prob > F	=	0.0001
Total	6.79798525	173	.039294712	R-squared	=	0.2165

SID	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
age_head	.0083326	.0070234	1.19	0.237	-.0055379 .0222031
age_squared	-.0000865	.0000598	-1.45	0.150	-.0002046 .0000315
education_years	-.0091862	.004175	-2.20	0.029	-.0174314 -.0009409
hhldmebrs	.000042	.0032832	0.01	0.990	-.0064419 .006526
MALE	.0680194	.035612	1.91	0.058	-.0023109 .1383497
Tot_assets	1.94e-07	9.48e-08	2.04	0.043	6.44e-09 3.81e-07
drylandsiz	.0382415	.0215192	1.78	0.077	-.0042568 .0807397
MARRIED	-.0713839	.0355738	-2.01	0.046	-.1416386 -.0011292
INFRAST_INDEX_1	.0352083	.0159782	2.20	0.029	.0036529 .0667637
SAVING_DMY	.0790915	.0332836	2.38	0.019	.0133597 .1448233
LM_NDW_NMZ	.0302435	.0399412	0.76	0.450	-.0486364 .1091233
AGRI_TRAINING	.0736885	.0362024	2.04	0.043	.0021924 .1451846
CR_INF_FML	-.0607458	.0378512	-1.60	0.110	-.1354983 .0140067
_cons	-.0496485	.2147159	-0.23	0.817	-.4736912 .3743943

```
. estat hettest
```

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of SID

chi2(1)      =      1.97
Prob > chi2  =  0.1604
```

APPENDIX I: Tobit regression estimates

```
. tobit SID age_head age_squared education_years hhldmebrs MALE Tot_assets drylandszie MARRIED INF
> RAST SAVING_DMY LM_NDW_NMZ AGRI_TRAIN CR_INF_FML, ll ul
```

Tobit regression

	Number of obs	=	174
	LR chi2(13)	=	39.92
	Prob > chi2	=	0.0001
Log likelihood = -45.443984	Pseudo R2	=	0.3052

SID	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
age_head	.0145315	.0099766	1.46	0.147	-.0051704 .0342334
age_squared	-.0001449	.0000847	-1.71	0.089	-.0003121 .0000224
education_years	-.0132129	.0057143	-2.31	0.022	-.0244974 -.0019283
hhldmebrs	.0007499	.0044357	0.17	0.866	-.0080097 .0095096
MALE	.0834463	.0488518	1.71	0.090	-.0130265 .1799192
Tot_assets	2.41e-07	1.26e-07	1.92	0.057	-.7.11e-09 4.90e-07
drylandszie	.0454377	.0288172	1.58	0.117	-.0114708 .1023462
MARRIED	-.0820618	.0491755	-1.67	0.097	-.179174 .0150504
INFRAST_INDEX_1	.0480834	.02162	2.22	0.028	.005388 .0907788
SAVING_DMY	.1164923	.045231	2.58	0.011	.0271697 .2058149
LM_NDW_NMZ	.0458464	.0551538	0.83	0.407	-.0630718 .1547646
AGRI_TRAINING	.0825776	.0496219	1.66	0.098	-.0154161 .1805712
CR_INF_FML	-.0928392	.0524917	-1.77	0.079	-.1965003 .0108219
_cons	-.2711482	.3031845	-0.89	0.372	-.8698793 .327583
/sigma	.2384282	.0167159		.2054175	.2714389

Obs. summary:

55	left-censored observations at SID<=0
118	uncensored observations
1	right-censored observation at SID>=.64872292

APPENDIX J: Research questionnaire

The contribution of farming to the welfare of rural households in KwaZulu-Natal

Introduction

My name is _____ from the University of KwaZulu-Natal. The University is conducting a research that is looking at **livelihood activities, welfare and incomes of the rural households in KwaZulu-Natal**. There are no right and wrong answers to the questions. The information will be treated as **CONFIDENTIAL** and is solely for academic purposes only. The interview will take about 45 minutes.

Identification

Interviewer name		Date of interview	
Name of key respondent		Respondent telephone	
District*		Local municipality**	

*District 1= 2= 3=

**Local Municipality 1= 2= 3=

SECTION A: HOUSEHOLD DEMOGRAPHICS

A1. Please answer the following with respect to the household head*.

A1.1 What is the household name

.....

A1.2 What is the gender of the household head 1=MALE 2=FEMALE

A1.3 What is the age of the household head.....years

A1.4 Please indicates the marital status of the household head

1=Single 2=Married 3=Divorced 4=Widowed

A1.5 Education level of the household head (*specify e.g. Grade 5*)

A1.5 What is the main occupation of the household head? (*Tick the appropriate response*)

- 1=Fulltime farmer
- 2=Regular salaried job
- 3=Seasonal/temporary job
- 4=Unemployed
- 5=Self employed

6=Student

7=Retired

8=Other (specify).....

A2 What is the total number of your permanent household members**?	
A3 How of many of the household members are adults (15 years old or more)?	
A4 How of many of the household members are children (less than 15 years old)?	
A5 How of many of the household members are MALE?	
A6 How many of the household members cannot work due to chronic sickness or old age?	
A7 How many household members are employed?	Permanently Temporarily

*Household head refers to the de facto household head that stays in the household for 4 days or more per

SECTION B: HOUSEHOLD LIVELIHOOD STRATEGIES

Farming Activities

B1. Is your household involved in Farming Activities ? 1=Yes/ 0=No.	
---	--

B2. If yes, complete the **Livestock Income** and/or **Crop Income** table(s) below.

B2.1 Crop Income

Crop/Vegetable Name	Hectares (ha) Allocated last season (2014-15)	Output (bags or tons or bundles etc.)	Retention (bags or tons or, bundles etc.)	Sales (Rands)
				R
				R
				R
				R
				R
				R

B2.1.1 What is the main purpose for this engaging in **cropping activities**? (Tick the appropriate response(s))

1=Main source of food

2=Extra source of food

3=Main source of income

4=Extra source of income

5=Clothing

6=Construction

7=Other

(specify).....

B2.1.2 How many household members are involved in cropping activities ?	
--	--

B2.1.3 How many of these are MALE?	
------------------------------------	--

B2.2 Livestock Income

Livestock (e.g. sheep, goats, cattle)	Current herd size	Number <u>bought</u> in the last 3 years	Number <u>sold</u> in the last 12 months	Sales (Rands)
				R
				R
				R
				R

B2.2.1 What is the main purpose for this engaging in **livestock activities**? (*Tick the appropriate response(s)*)

- 1=Main source of food
- 2=Extra source of food
- 3=Main source of income
- 4=Extra source of income
- 5=Clothing
- 6=Construction
- 7=Other

(specify).....

B2.2.2 How many household members are involved in livestock activities ?	
--	--

B2.2.3 How many of these are MALE ?	
---	--

B2.3 Please indicate by ticking against the appropriate response for the statement that follows.

Farming income is an important contributor to the welfare of the household.	
--	--

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

Agricultural Wage Income

B3. Do you earn agricultural wage income ? 1=Yes/ 0=No.	
---	--

B4. If yes, complete the table below.

Household member 1=Household head 2=Spouse 3=Daughter 4=Son 5=Other(specify e.g. cousin) * specify also the gender in parenthesis (M/F))	Frequency of earning agricultural wage income 1=daily 2=weekly 3=monthly 4=other (specify)	Number of months in the last 12 months household member received such income	Wage rate (Rand per month/week/day (specify))
			R

			R
			R
			R
			R
			R

B4.1 What is the main purpose for Agricultural Wage Income? (Tick the appropriate response(s))

- 1=Main source of food
- 2=Extra source of food
- 3=Main source of income
- 4=Extra source of income
- 5=Clothing
- 6=Construction
- 7=Other

(specify).....

B4.2 Please indicate by ticking against the appropriate response for the statement that follows.

Agricultural Wage Income is an important contributor to the welfare of the household.

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

Non-Agricultural Wage Income

B5. Are you involved in Non-agricultural wage income? 1=Yes/ 0=No.

B6. If yes, complete the table below.

Household member 1=Household head 2=Spouse 3=Daughter 4=son 5=other(specify e.g. cousin) * specify also the gender in parenthesis (M/F))	Non-agricultural wage income 1=handicrafts, 2=lumbering, 3=formal employment, 4=unskilled wage labour, 5=beer brewing, 6=shoe repairing, 7=barbering, 8=butchery (specify).	Frequency of earning non-agricultural wage income 1=daily 2=weekly 3=monthly 4=other (specify)	Number of months in the last 12 months household member received such income	Wage rate (Rand per (specify))
				R
				R
				R
				R
				R

B6.1 What is the main purpose for Non-Agricultural Wage Income? (Tick the appropriate response(s))

- 1=Main source of food
- 2=Extra source of food
- 3=Main source of income
- 4=Extra source of income
- 5=Clothing
- 6=Construction
- 7=Other
(specify).....

B6.2 Please indicate by ticking against the appropriate response for the statement that follows.

Non-Agricultural Wage Income is an important contributor to the welfare of the household.	
1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree	

Self-employed Income

B7. Are you involved in Self-employed income? 1=Yes/ 0=No.				
B8. If yes, complete the table below.				
Household member 1=Household head 2=Spouse 3=Daughter 4=son 5=other(specify e.g. cousin)	Self-employed income 1= (spazas) sales of marketable products such as sales of commodities 2=transportation 3=other (specify).	Frequency of earning Self-employed income 1=daily 2=weekly 3=monthly 4=other (specify)	Number of months the in the last 12 months household member received such income	Income rate (Rand per....(specify))
				R
				R
				R
				R
				R
				R

B8.1 What is the main purpose for Self-employed Income? (Tick the appropriate response(s))

- 1=Main source of food
- 2=Extra source of food
- 3=Main source of income
- 4=Extra source of income
- 5=Clothing
- 6=Construction

7=Other
 (specify).....

B8.2 Please indicate by ticking against the appropriate response for the statement that follows.

Self-employed Income is an important contributor to the welfare of the household. 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree	
---	--

Remittance Income

B9. Do you receive Remittance Income ? 1=Yes/ 0=No	
--	--

B10. If yes, complete the table below.

Remittance income received from friends and relatives **not** presently living in the household.

Remitter 1=Relative 2=Friend 3=Other (specify)	Gender 1=MALE 2=FeMALE	Frequency 1=Monthly 2=every two months 3=every three months 4=Other (specify)	Usual amount Received
			R
			R
			R
			R

B10.1 What is the main purpose for **Remittance Income**? (*Tick the appropriate response(s)*)

- 1=Main source of food
 - 2=Extra source of food
 - 3=Main source of income
 - 4=Extra source of income
 - 5=Clothing
 - 6=Construction
 - 7=Other
- (specify).....

B10.2 Please indicate by ticking against the appropriate response for the statement that follows.

Remittance Income is an important contributor to the welfare of the household. 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree	
--	--

Local Natural Endowment Income

B11. Are you involved in Local Natural Endowment Income ? 1=Yes/ 2=No.	
---	--

B12. If yes, complete the table below.

Local natural endowment income

Household member 1=Household head 2=Spouse 3=Daughter 4=son 5=other(specify e.g. cousin)	Local Natural Endowment Income Seasonal activities within the communities such as: 1= mining 2=lumbering, 3=collection of fruits for sale 4=Other(specify)	Frequency of earning Local Natural Endowment Income 1=daily 2=weekly 3=monthly 4=other (specify)	Number of months the in the last 12 months household member received such income	Wage rate (Rand per (specify))
				R
				R
				R
				R

B12.1 What is the main purpose for **Local Natural Endowment Income**? (*Tick the appropriate response(s)*)

- 1=Main source of food
- 2=Extra source of food
- 3=Main source of income
- 4=Extra source of income
- 5=Clothing
- 6=Construction
- 7=Other
(specify).....

B12.2 Please indicate by ticking against the appropriate response for the statement that follows.

Local Natural Endowment Income is an important contributor to the welfare of the household.

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

Migratory Wage Services

B13. Are you involved in **Migratory Wage Services***? (OR Does any of the household members migrate to earn income on a seasonal or permanent basis?) 1=Yes/ 0=No

***Migratory wage Services** involves formal and informal employment in nearby or distant rural, peri-urban or urban communities on a seasonal or permanent basis.

B14. If yes, complete the table below.

Household member 1=Household head	Frequency of earning Migratory	Number of months the in the last 12 months household member received such income	Wage rate (Rand per (specify))

2=Spouse 3=Daughter 4=son 5=other(specify e.g. cousin)	Wage Services 1=daily 2=weekly 3=monthly 4=other (specify)		
			R
			R
			R
			R

B14.1 What is the main purpose of income received from **Migratory Wages**? (*Tick the appropriate response(s)*)

- 1=Main source of food
- 2=Extra source of food
- 3=Main source of income
- 4=Extra source of income
- 5=Clothing
- 6=Construction
- 7=Other
(specify).....

B14.2 Please indicate by ticking against the appropriate response for the statement that follows.

Income received from **Migratory Wages** is an important contributor to the welfare of the household.

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

Other Income

B15. Are you involved in any **Other Income Activities**? 1=Yes/ 0=No.

B16. If yes, complete the table below.

Household member 1=Household head 2=Spouse 3=Daughter 4=son 5=other(specify e.g. cousin)	Other Income Activities capital 1=Capital Earnings 2=Pensions 3=Rental	Frequency of earning Other Income Activities 1=daily 2=weekly 3=monthly 4=other (specify)	Number of months the in the last 12 months household member received such income	Wage rate (Rand per (specify))
				R
				R
				R

				R
--	--	--	--	---

B16.1 What is the main purpose for **Other Income**? (*Tick the appropriate response(s)*)

- 1=Main source of food
- 2=Extra source of food
- 3=Main source of income
- 4=Extra source of income
- 5=Clothing
- 6=Construction
- 7=Other
(specify).....

B16.2 Please indicate by ticking against the appropriate response for the statement that follows.

Income received from Other sources is an important contributor to the welfare of the household. 1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree	
---	--

SECTION C: CAPITAL ENDOWMENT

C.1 HUMAN CAPITAL

C.1.1. Have you received any kind of training/education in the last 12 months? 1=Yes, 0=No

C1.2. If yes, which form of training? List below:

Skills	Who offered/provided the training?

C1.3. Has any of your household members not been able to work or carry out their duties because of illness in the past 12 months? 1=Yes, 0=No	
C1.6 If yes to C1.5 , how many MALES and/or feMALES?	MALES = FeMALES =

C2 PHYSICAL CAPITAL

C2.1. How satisfied are you with the state of the infrastructure in your farming area?

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

Road accessibility	
Markets	

Electricity	
Agricultural water supply	
Drinking water supply	

C2.2. Do you use any transportation to ferry your produce to the market? 1=Yes, 0=No

C2.3. If yes, to **C2.2**, what means of transportation do you use? (*Tick the appropriate*)

- 1=Own transport
- 2=Hired transport
- 3=Other (specify).....

C2.4. Which assets in the following list do you have access to?

Assets	1=Owned 2=hired	1=Individual 2=Communal 3=Group ownership	Value (R)
Cell phone			R
Radio			R
Television			R
Personal computer			R
Block, tile house			R
Block, zinc house			R
Round, thatch house			R
Round pole and mud or shake house			R
Tap			R
Borehole			R
Protected well			R
Water tank			R
Trailers			R
Cultivators			R
Harvesters			R
Fridge/ freezer			R
Bicycle			R
Motorbike (running)			R
Plough			R
Planter, harrow or cultivator			R
Wheelbarrow			R
Tractor			R
Generator			R
			R

C2.5. Have you **bought** or **sold** any asset(s) in the last 12 months? 1=Yes, 0=No

C2.6 If yes to **C2.5**, which assets have you **bought** or **sold**? List below:

Asset bought	Value	Asset sold	Value

	R		R

C.2.7 Do you produce **fresh produce** for the market? 1=Yes 0=No

C.2.8 If yes to **C.2.7**, do you have storage facilities for fresh produce? 1=Yes 0=No

C.2.9 How do you store fresh produce at your homestead (for the vegetable market)?

.....
.....

C.2.10 Do you produce **grains**? 1=Yes 0=No

C.2.11. If yes to **C.2.10**, how do you store grains at your homestead?

.....
.....

C3 NATURAL CAPITAL

C3.1. Indicate the size of land you have access to:

Irrigated land (ha)	Dryland (ha)

C3.2. How do you own the piece of land that you currently have access to?

- 1=Inherited
- 2=Allocated to by the government
- 3=Bought
- 4=Other (specify)

C3.3. How much land did you cultivate in the last 12 months?

.....
.....

C4 SOCIAL CAPITAL

C4.1. Do you, or any your household members, belong to any agricultural cooperative?

1=Yes 0=No

C4.2. If yes to **C4.1**, what are the activities of the cooperative? List below:

.....
.....
.....

.....

C4.3. In what way do you practise agriculture? (Tick the appropriate)

- 1=As an individual or a household
 2=As a member of an informal group
 3=As a member of a cooperative
 4=Other
 (specify).....
-

C4.4. Please rank (1-5) the following information sources listed below based on the importance that they have on your farming activities in the last 12 months.

1=N_{ever} used the source, 2=D_{onot} know/neutral, 3=N_{ot} important, 4=I_{mportant},
 5=V_{ery} important

Information source	Rank (1-5)
Extension officers	
Media (newspapers, radio, TV)	
The Internet (emails, websites, etc)	
Fellow farmers	
Community/irrigation scheme Meetings	
Cooperative leaders	
Non-governmental organisation (NGOs)	
Traditional leaders	
Private organisations	
Phone (SMS, Text)	
Other (specify)	

C4.5. If you belong to groups, which of the following activities do you participate in as groups? (Tick the appropriate)

Activities	0=not at all	1=at times	2=regularly
Land preparation			
Planting			
Weeding			
Irrigation			
harvesting			
Securing produce market			
Hiring transportation for marketing			
Hiring/tractors and machinery for agricultural purposes			
Marketing agricultural produce			
Input procurement			

Negotiating market prices for produce			
Any other (specify)			

C4.6. Do you have disputes as farmers? 1=Yes 0=No	
C4.7 How often do you have disputes as farmers? 1=very often 2=often 3=Neutral 4=occasionally 5=never	

C4.7 Please specify the nature of disputes if any.....

C5 FINANCIAL CAPITAL

C5.1 Are there any household members that receive a government grant?
1=Yes 0=No

C5.2. If yes, please indicate how many members receive:	Old-age grant	
	Child grant	
	Disability grant	
	Foster child grant	
	Care dependency grant	

C5.3. Do you have any form of savings? 1=Yes 0=No	
C5.4 If yes to C5.3 above, which type of saving? 1= Formal 2=Informal (i.e. <i>stokvels</i>)	
C5.5. Have you ever taken credit from a formal place like a bank? 1=Yes 0=No	

C5.6 If yes to C5.5 above, what was the purpose of the loan? (Tick the appropriate)

- 1=Personal borrowing for household consumption
 2=Farming
 3=Other livelihood activity
(specify).....

C5.7 If yes to C5.5, what was the amount that you borrowed?

C5.8. If no to C5.5 above, what was the reason? (Tick the appropriate)

- 1=The interest rate was too high
 - 2=I could not secure the required collateral
 - 3=I have my own funds
 - 4=It isn't accessible
 - 5=Other (specify).....

C5.9. Have you ever taken credit from an informal place? 1=Yes 0=No

C5.10 If yes to C5.9 above, what was the purpose of the loan? (Tick the appropriate)

- 1=Personal borrowing for household consumption

- 2=Farming
 3=Other livelihood activity
 (specify).....

C5.11 If yes to **C5.9**, what was the amount that you borrowed?

.....

C5.12 If no to **C5.9** above, what was the reason? (Tick the appropriate)

- 1=The interest rate was too high
 2=I could not secure the required collateral
 3=I have my own funds
 4=It isn't accessible
 5=Other (specify).....

SECTION D:

D12. Households food security

Please answer whether this happened: **never, rarely (once or twice), sometimes (3 to 10 times) or often (more than 10 times) and always (every day)** in the past 30 days.

Household Food Insecurity Access Scale (HFIAS)	Never	Rarely	Sometimes	Often
1. Did you worry that your household would not have enough food?				
2. Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?				
3. Did you or any household member have to eat a limited variety of foods due to a lack of resources?				
4. Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?				
5. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?				
6. Did you or any household member have to eat fewer meals in a day because there was not enough food?				
7. Was there ever no food to eat of any kind in your household because of lack of resources to get food?				
8. Did you or any household member go to sleep at night hungry because there was not enough food?				
9. Did you or any household member go a whole day and night without eating anything because there was not enough food?				