

**RISK PREFERENCES AND CONSUMPTION DECISIONS IN ORGANIC
PRODUCTION: THE CASE OF KWAZULU-NATAL AND EASTERN CAPE
PROVINCES OF SOUTH AFRICA**

By

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Submitted in fulfilment of the requirements for the degree of

PhD (Agricultural Economics)

in the
Department of Agricultural Economics and Extension
Faculty of Science and Agriculture
University of Fort Hare,
Alice
South Africa

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April 2012

DEDICATION

In Memory of

My Mother

Veronica Nasambu Kisaka

April – June 9 1999

“For all the sacrifices you made towards my education to ensure I reached this far. Without your hard work, encouragement and unending support this dream would never have become a reality. I love you mum.”

To my husband and special friend Lwayo Samuel Jembe, thank you for giving up your dream to support my dream. May God richly bless you.

DECLARATION

I hereby certify that this thesis is the result of my own original work and has not previously been submitted to another university for the purpose of a degree. Where use has been made of the work of others, such work has been duly acknowledged in the text.

Signed

Date 13 April 2012**MAGGIE KISAKA – LWAYO**

ACKNOWLEDGEMENTS

I would like to thank the following individuals and organizations who made this work possible. Professor Ajuruchukwu Obi, words cannot express my sincere gratitude and heartfelt appreciation for your intellectual guidance and encouragement during your academic supervision of my thesis. Your comments and discussions provided valuable insight, resulting in the compilation of this thesis and completion of my PhD. I am also grateful and acknowledge the contribution of the staff of the Department of Agricultural Economics at the University of KwaZulu-Natal. Special mention is made of Mr. M.A.G Darroch and Dr. S.R.D Ferrer who laid the foundation for my research study at KwaZulu-Natal and supervised my work while I was registered at the University of KwaZulu-Natal. The data from this work was calibrated and further analysis incorporated to enable me address the question of consumer awareness and consumption dimensions of organic agriculture. To my colleagues at the University of Fort Hare who gave critical input during the seminar presentation: after some introspection, I realised I needed to improve my research further. Thank you for this valuable input.

Thank you LIMA Rural Development Foundation through Mr. Thokozani Buthelezi who co-ordinated the survey and provided logistical support for the KwaZulu-Natal study. Appreciation to the enumerators of KwaZulu-Natal and the researchers in the Eastern Cape who assisted with the data collection and data entry. I would like to acknowledge the contributions of the participants at the CIAT Symposium on “Innovation for a Green Revolution in Africa” whose constructive comments resulted in the publication of an aspect of my study in the book on the Green Revolution in Africa in 2011. I also acknowledge the contributions of the anonymous reviewers of the articles submitted to the International Journal of Agricultural Management (IJAM) and the peer reviewers for the Annual Conference of the International Food and Agribusiness Management Association (IFAMA). Their highly constructive comments on those accepted papers contributed in no small way in focusing this thesis more appropriately.

To my girlfriend Josephine Musango, thank you for being there when I needed guidance with STATA 11. Special mention is made of my friend Lynn Stefano, with

whom I started this journey. Grateful acknowledgement and appreciation is extended to my mentors Professor Lena Nekhone of Egerton University, Njoro, Kenya, Professor Robert Okalebo and Professor H.K. Maritim of Moi University, Eldoret Kenya, many other educators, friends and students who encouraged, motivated and positively influenced me. May God Bless you.

This thesis would not have been made possible without the unwavering spiritual, emotional and physical support of my dear husband Lwayo S Jembe. In 2007 when all seemed lost, you reminded me to finish the race. Thank you for being there every step of the way and for being my number one fan. During my study period, my lovely girls Faith Nichome and Rehema Mose sacrificed to be on their own while I studied. Thank you for the endurance and giving me space to do my work and be away from home for long periods. To my little boy Emmanuel Lwayo who reminded me that I had unfinished business. I will always love you. The research for this thesis was partially funded by the FORD Foundation and their financial support is gratefully acknowledged.

Above all, I thank the almighty GOD to whom all glory is given.

ABSTRACT

Despite phenomenal success of the commercial agricultural sector in South Africa and significant progress in integrating smallholders since democratic reforms, food security concerns remain. Recent global increases in food prices have further exacerbated vulnerabilities and made it imperative to examine alternative food production questions in the country. Organic agriculture is identified as one of the sustainable approaches to farming and offers insights towards a paradigm shift in food and nutritional security. Notwithstanding, consumer awareness, knowledge and consumption of organic foods are significantly lower in developing than developed countries. Risks associated with adoption of organic practices need to be explored to address the supply and demand constraints. Similarly, while consumer awareness of organic foods is the first step in developing demand for organic products, it does not necessarily translate to consumption. Therefore it is important to investigate these issues.

The objectives of this study were to: (i) describe the demographic and socio-economic characteristics of organic farmers and consumers; (ii) establish the determinants of farmers' decision to participate in organic farming distinguishing between the fully-certified organic, partially-certified organic and non-organic farmers; (iii) elicit farmers risk preferences and empirically analyse farmers sources of risk and risk management strategies; (iv) explore consumer awareness, perceptions and attitudes regarding organic products; and (v) identify the factors that influence consumer's preference and consumption of organic products.

A total of 400 respondents were surveyed, consisting of 200 smallholder farmers in KwaZulu-Natal and 200 consumers in the Eastern Cape. The KwaZulu-Natal study was conducted earlier and identified the following as major sources of risk, lack of consumer awareness of organic products and lack of information among producers about consumer preferences for organic products. This informed the need to undertake a consumer awareness and preference study, in order to inform producers. The Eastern Cape is a bordering province to KwaZulu-Natal with similar socio economic conditions and a major consumer of produce from KwaZulu-Natal. It was also expected that in the intervening period there could have been awareness about the product. An

indication of its appeal would not be in the consumption of the product by the people who grow it, but by consumers who reside in bordering regions. Producer and household questionnaires were used to record household activities, socio-economic and institutional data as well as household demographics through personal interviews. The Arrow Pratt Absolute Risk Aversion (APARA) coefficient was used to measure the farmer's degree of risk aversion and the experimental gambling approach to establish the risk classification. Consumers were also asked about their awareness and knowledge about organics, attitudes and perceptions towards organics, preference and consumption patterns.

The ordered probit results indicate that older farmers, who are less risk averse and reside in the sub-ward Ogagwini, Ezigani, and Hwayi were more likely to be certified organic farmers. Similarly, the propensity to adopt organic farming is positively correlated to household size, livestock ownership, asset base and tenure security. The risk analysis indicates that at higher pay-offs most farmers are intermediate to moderately risk-averse, with little variation according to personal characteristics, and that non-organic farmers tend to be more risk averse than fully-certified and partially-certified farmers. In general, price, production and financial risks were perceived as the most important sources of risk. Using Principal Component Analysis (PCA), seven principal components (PCs) explaining 66.13% of the variation were extracted. Socio economic factors having a significant effect on the various sources of risk are age, gender, education, location, information access and risk taking ability. The most important traditional risk management strategies used by the surveyed farmers are crop diversification, precautionary savings and participating in social networks.

There was general awareness of what constituted organic foods with many consumers associating organic foods with health and nutrition, chemical free and produced using indigenous methods of production. However, there was low awareness of organic products among consumers with little or no knowledge of organic certification and standards. According to the logit model the major factors influencing consumer awareness of organic products are: gender, education, employment status, and location of the respondents, person/household member responsible for shopping and the price perception of the decision maker. The discriminant analysis showed that the consumption of organic products is significantly affected by age of the consumer,

location, person/household member responsible for shopping, consumer awareness of organics, price perception and label trust. The findings from this study provides useful practical insights for policy makers, farm advisers and researchers in the design of effective and efficient policies, programmes and projects which can affect the adoption of organic practices, increase smallholder farmers capacity to manage risk and drive growth in the organic food market.

Key words: Organic farming; Ordered probit; Arrow Pratt Absolute Risk Aversion; Principal components; Logistic Model; Discriminant Analysis; Risk preferences; Consumer awareness.

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ACRONYMNS AND ABBREVIATIONS

ACIAR	Australian Centre for International Agricultural Research
ADM	Amatole District Municipality
AERC	African Economic Research Consortium
AFIT	Association for Fairness in Trade
AFRISCO	African Farmers Certified Organic
AGRA	Alliance for a Green Revolution in Africa
AOFF	African Organic Farming Foundation
APARA	Arrow Pratt Absolute Risk Aversion
ASARECA	Association of Strengthening Agricultural Research in Eastern and Central Africa
ASGISA	Accelerated and Shared Growth South Africa
BCM	Buffalo City Metropolitan
BDOCA	Biodynamic and organic certification Authority
BMP	Best Management Practices
CAADP	Comprehensive African Agriculture Development Programme
CAP	Common Agricultural Policy
CARA	Constant Absolute Risk Aversion
CFA	Comprehensive Framework of Action
CGIAR	Consultative Group on International Agricultural Research
COP	Cereal, Oilseeds and Protein
CPRA	Constant Partial Risk Aversion
CRRA	Constant Relative Risk Aversion
CVM	Contingent Valuation Method
CYMMIT	<i>Centro Internacional de Mejoramiento de Maíz y Trigo</i>
DAFF	Department of Agriculture, Forestry and Fisheries
DARA	Decreasing Absolute Risk Aversion
DARCOF	Danish Research Centre for Organic Farming
DBSA	Development Bank of Southern Africa
DEU	Direct Elicitation of Utility
DFID	Department for International Development
DH	Herfindhal Index
DPRA	Decreasing Partial Risk Aversion

DRRA	Decreasing Relative Risk Aversion
EAAE	European Association of Agricultural Economists
ECDC	Eastern Cape Development Corporation
ECSERO	Eastern Cape Socio-Economic Review and Outlook
EDI	Enterprise diversification Index
EFO	Ezemvelo Farmers Organization
EM	Experimental Methods
EMG	Environmental Monitoring Group
EPOPA	Export Promotion of Organic Products in Africa,
EPP	Extension Package Program
EPWP	Extended Public Works Programmes
ESA	Environmentally Sensitive Areas
EU	Expected Utility
EUT	Expected Utility Theory
FADN	Farm Accountancy Data Network
FAO	Food and Agriculture Organisation
FAOSTAT	Food and Agriculture Organisation Statistics
FARA	Forum for Agricultural Research in Africa
FIAN	Food First Information and Action Network
FLO	Fair-trade Labelling Organizations
FSA	Food Safety Agency
GDN	Global Development Network
GDP	Gross Domestic product
GIS	Geographic Information System
HDI	Human Development Index
HLTF	High Level Task Force
HSRC	Human Sciences Research Council
HYV	High Yielding Varieties
IARA	Increasing Absolute Risk Aversion
ICS	Internal Controls Systems
IDP	Integrated Development Plan
IFAD	International Fund for Agricultural Development
IFOAM	International Federation of organic Agriculture Movement
IFPRI	International Food Policy Research Institute

IIED	International Institute for Environment and Development
IIH	Induced Innovation Hypothesis
IISS	International Institute for Strategic Studies
ILO	International Labour Organisation
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPRA	Increasing Partial Risk Aversion
IPRA	Increasing Partial Risk Aversion
IRRA	Increasing Relative Risk Aversion
ISRDP	Integrated Sustainable Rural Development Programme
ITC	International Trade Centre
KRIBHCO	Krishak Bharati Cooperative
KSD	King Sabata Dalindyebo
LDF	Linear Discriminant Function
LED	Local Economic Development
MCDM	Multiple Criteria Decision Making
MDG	Millennium Development Goals
MLE	Maximum Likelihood Estimation
MOTAD	Minimization of Total Absolute Deviations
MVP	Marginal Value Product
NARO	National Agricultural Research Organisation
NEPAD	New Partnership for Africa's Development
NEPAD	New Partnership for Africa's Development
NOSB B	National Organic Standards Board National Organic
OAASA	Organic Agricultural Association of South Africa
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Square
ORTDM	OR Tambo District Municipality
OTA	Organic Trade Association
PCA	Principal Component Analysis
PRA	Partial Risk Aversion
PROVIDE	Provincial Decision-Making Enabling
RRA	Relative Risk Aversion
SADC	Southern African Development Community

SAT	Sustainable Agricultural Technologies
SEDA	Small Enterprise Development Agency
SEUM	Subjective Expected Utility Maximising Model
SMME	Small, Medium and Micro Enterprises
SPSS	Statistical Package for the Social Sciences
SRI	Systems of Rice Intensification
SSA	Sub Saharan Africa
STATSSA	Statistics South Africa
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
VEMM	Vegetation Environmental Management Model
VIF	Variance Inflation Factor
VOFO	Vukuzakhe Organic Farmers Organization
WHO	World Health organisation
WS-NIS	Water Services National Information System

CHAPTER 1

INTRODUCTION

1.1 Background

Despite phenomenal success of the commercial agricultural sector in South Africa and significant progress in integrating smallholders since democratic reforms, food security concerns remain in South Africa. Recent global increases in food prices (Figure 1.1) have further exacerbated vulnerabilities and make it imperative to examine alternative food production questions in the country. In December 2010, the Food and Agricultural Organisation (FAO) food price index rose above its 2008 peak. The index dropped to an 11-month low in October 2011, but food prices still remain generally higher than in 2010 and very volatile (FAO, 2011) (Figure 1.1).

The World Bank (2010) reports that domestic staple food prices in several countries particularly in Sub-Saharan Africa experienced double digit increases in 2009. It estimated that the impact on undernourishment or hunger has been as much as 8% in 2009 (World Bank, 2010). Similarly according to Cuesta (2011), global prices of food in July 2011 remained significantly high and are close to the 2008 peak levels, with the World Bank Food Price Index increasing by 33 % in the last year. Efforts need to be scaled up at all levels to strengthen the resilience of small farmers to future shocks and to improve food and nutrition security over the long term (FAO, 2011).

The Food and Agriculture Organisation (FAO) (2007) states that hunger, poverty and environmental degradation persist even as concerns about global human security issues continue to increase. Moreover, the last decade provides incontrovertible evidence of diminishing returns on grains despite the rapid increases of chemical pesticide and fertilizer applications, resulting in lower confidence than these high input technologies will provide for equitable household and national food security in the next decades (Sanders, 2006).

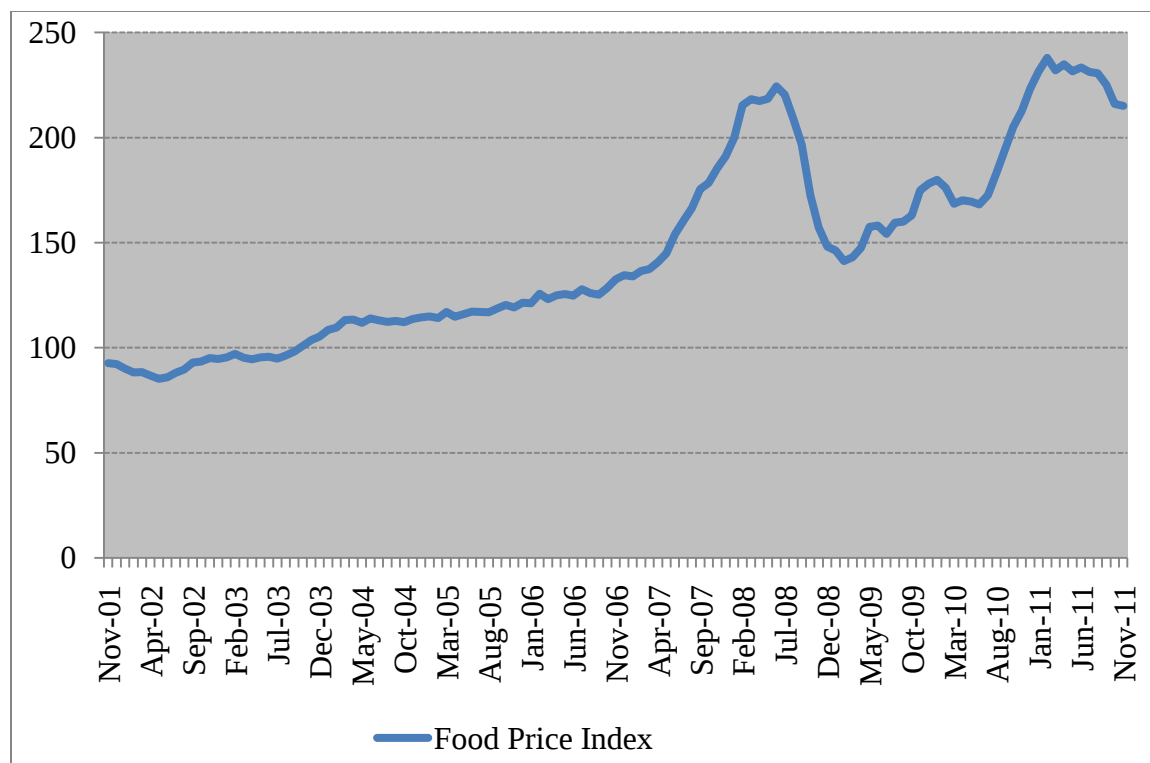


Figure 1.1: Trends in global food prices

Note: 2002-2004 = 100. (Source: FAO, 2011)

Between the 1960s and 1990s, the "green revolution", promoted by various international institutions and agricultural research centres, took place with the objective of modernizing agriculture in non-industrialized countries (Das, 2002). Early results in Mexico and, subsequently, in South-East Asia were spectacular from the point of view of production per hectare, but this increase in land yield did not have a direct impact on the reduction of hunger in the world. Thus, although world agricultural production increased by 11% the number of hungry people in the world also rose by 11%, from 536 million to 597 million (Reichmann, 2003). Africa on the other hand went from being a net exporter of basic food staples in the 1960s to a net importer in the 1970s (Benson, Mugarura and Wanda, 2008; Ivanic and Martin, 2008). There is thus an urgent need to increase food production to alleviate the widespread poverty and food insecurity in this region. Given the increasingly limited room for the further expansion of cultivated area in many countries in Sub-Saharan Africa, there is no substitute for a "green revolution", which enhances crop yield per unit of land, in an effort to boost the food production

in Sub-Saharan Africa (Kijima, Otsuka and Sserunkuuma, 2011; Diao, Headey and Johnson, 2008)

The absence of the “green revolution” in Africa has been attributed to the lack of adoption of improved crop germplasm or even the absence of appropriate varieties for the continent (Sanchez, 2002) but perhaps more pervasive has been the gradual depletion of soil fertility through decades of removing nutrients with crop harvests but not replenishing them through the addition of sufficient amounts of fertilizer, mineral, or organic (Sanchez, 2002; Drechsel, Gyiele, Kunze and Cofie, 2001). Recent efforts to accommodate African peculiarities have resulted in the establishment of the Alliance for a Green Revolution in Africa (AGRA) which aims to strengthen food security through an integrated multidisciplinary approach to deliver a uniquely African green revolution (Dano, 2007). It aims to double the incomes of 20 million smallholder farmers by 2020, reduce food insecurity by 50% in at least 20 countries, and put at least 15 countries on track to attain and sustain an African green revolution that supports smallholder farmers, protects the environment and helps farmers adapt to climate change. Many of these efforts emphasize technological change. Similarly, the Forum for Agricultural Research in Africa (FARA) and the New Partnership for Africa’s Development (NEPAD) have initiatives that promise to turn things around as quickly as possible.

Organic agriculture is one of the sustainable approaches to farming and offers insights towards a paradigm shift in food and nutritional security (Byerlee and Alex, 2005). The UNEP-UNCTAD (2007) indicates that organic agriculture offers developing countries a wide range of economic, environmental, social and cultural benefits. The global markets for certified organic products have also grown rapidly over the past two decades (Figure 1.2) (Sahota, 2011).

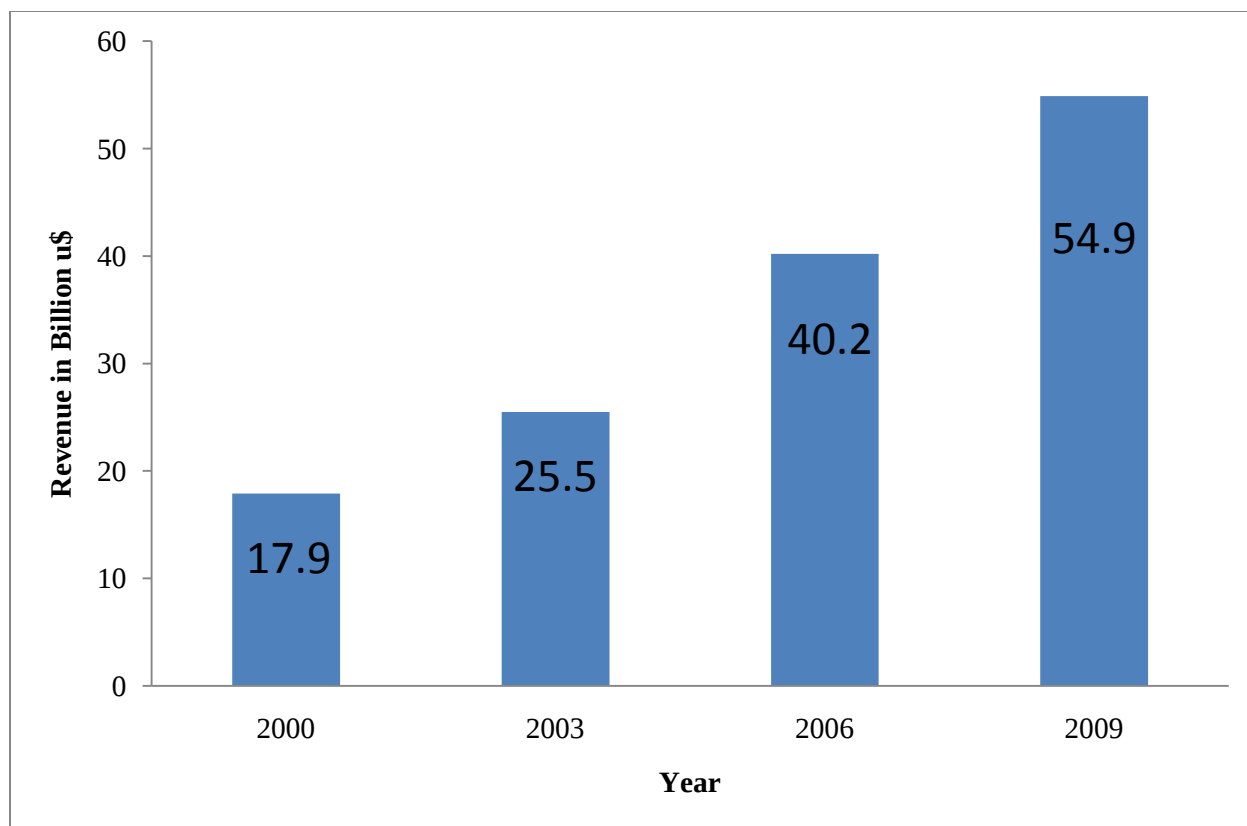


Figure 1.2: Development of the global market for organic products.

(Source: Sahota, 2011)

In 2009, the global market for certified organic food and drink was estimated to be 54.9 billion US dollars¹ (Sahota, 2011). This represents a 37% growth from 2006 sales estimated at 40.2 billion US dollars and a 207% increase from year 2000 sales estimated at 17.9 billion US dollars (Figure 1.2). While most sales are in North America and Europe, production is global with developing countries producing and exporting ever-increasing shares (Sahota, 2011). Due to expanding markets and attractive price premiums, numerous studies in Africa, Asia and Latin America indicate that organic farmers earn higher incomes than their conventional counterparts (IFAD, 2003). Moreover, organic products more easily meet the ever stringent requirements on maximum residual levels of synthetic agro-chemicals, as organic standards prohibit their use (UNEP-UNCTAD, 2007).

¹ U\$= appr 6.78Rands

On the development side, organic production is particularly well-suited for smallholder farmers, who comprise the majority of the world's poor. Resource poor farmers are less dependent on external resources, experience higher yields on their farms and enjoy enhanced food security (UNCTAD, 2006). Organic agriculture in developing countries builds on and keeps alive their rich heritage of traditional knowledge and traditional land races. It has been observed to strengthen communities and give youth incentive to keep farming, thus reducing rural-urban migration. Farmers and their families and employees are no longer exposed to hazardous agro-chemicals, which is one of the leading causes of occupational injury and death in the world (UNCTAD, 2006).

Evidence clearly shows that organic agriculture is a promising activity and its contribution to sustainable food security encompasses the Millennium Development Goals (MDG) 1 on alleviating hunger and poverty; also address MDG 7 on environmental sustainability; and MDG 8 on partnerships (Scialabba, 2007). However, developing country markets for certified organic products are small even if, growing. Latin America is the leading region among developing countries for certified organic agriculture production, with Argentina and Brazil having the most developed domestic markets (IFAD, 2005). The Asian region has experienced steady expansion in organic agriculture production and sales, especially in China, Malaysia, the Philippines, India, Singapore and Thailand. In Africa, certified organic agriculture is relatively underdeveloped, but growing especially in East Africa, Egypt, South Africa and Tunisia (Gibbon, 2006).

There are few published statistics, on the current state of organic agriculture in aggregate around the world. This is in relation to the state of organic production, country profiles and certification. Most available statistics have been informally collected and are sporadic in terms of frequency of collection and geographical area covered (FAO, 2009d). However, as organic production increases so does the interest in organic market dynamics and studies are being carried out in order to analyse the future potential for organic agriculture.

1.1.1 The organic agriculture sector

According to Willer and Arbenz (2011), organic farming is practiced in approximately 160 countries of the world and the area under organic management is continually growing. Currently 32.2 million hectares (ha) are being managed organically globally by more than 1.2 million producers (Willer and Klicher, 2009). Figure 1.3 shows the organic agricultural land and other organic areas in the continent in 2009. As depicted in Figure 1.3, Oceania has almost one-third of the global organic agricultural land with 12.2 million ha. Europe, a region that has had a very constant growth of organic land over the years, has one quarter of the world's organic agricultural land with 7.8 million ha. The share of Latin America is slightly lower than that of Europe (23%) representing 6.4 million ha (Figure 1.3). This is followed by Asia with 2.9 million ha comprising 9.6%, North America with 2.2million hectares comprising 7.1% and Africa with an estimated 0.9 million hectares comprising 2.8%. The countries with the greatest certified organic areas are Australia (12 million ha), Argentina (4.4 million ha) and United States (1.95million ha) (Willer and Klicher, 2011).

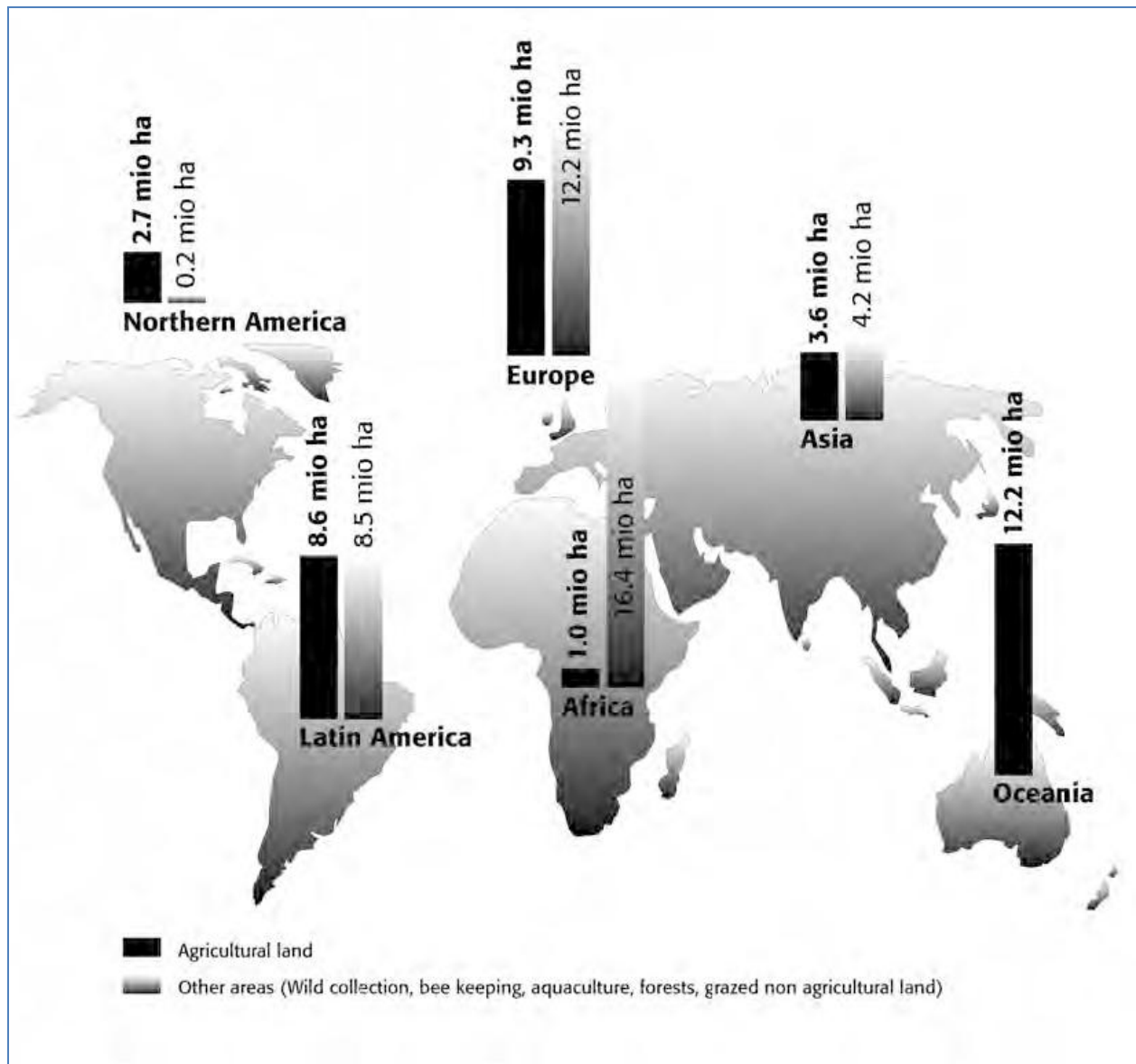


Figure 1.3: Organic agricultural land and other organic areas

Source: FiBL/IFOAM, 2011

In Africa, the shift towards organic production is also slowly growing with 39 countries at the moment having sizeable hectares under organic production (Willer and Klicher, 2009). This applies only to organic certified land and neglects the vast areas under non- certified organic farming example in the poor rural areas of Sub-Saharan Africa. Figure 1.4 below shows the ten countries in Africa with the most agricultural land in hectares. According to Figure 1.4, South

Africa has the third largest area under organic farming with 50,000ha, trailing Tunisia which has the largest area of 154,793ha and Uganda with 88,439ha (Willer and Klicher, 2009).

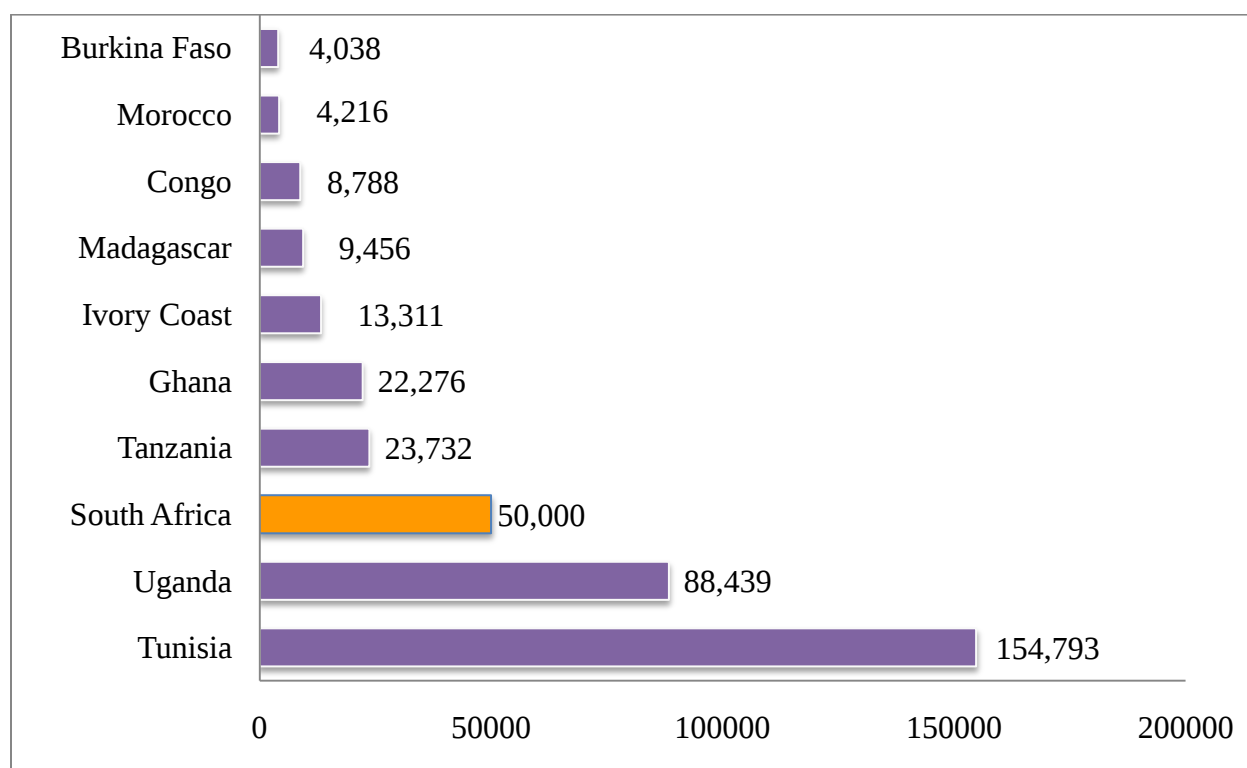


Figure 1.4: The ten countries in Africa with the most organic agricultural land in hectares

Source: FiBL/IFOAM 2011

Most of the organic farms in Africa are very small family smallholdings (Willer and Yuseffi, 2006) and approximately 20% of the total area under certified organic farming in Africa is in South Africa, with 250 certified commercial farms (Walaga, 2003). In Africa, certified organic production is mostly geared to products destined for export beyond Africa's shores. However, local markets for certified organic products are growing, especially in Egypt, South Africa, Uganda and Kenya (Parrott, Ssekyewa, Makunike and Ntambi, 2006). With a few exceptions, notably Uganda, most African countries do not have data collection systems for organic farming and certified organic farming is relatively underdeveloped, even in comparison to other low-income continents. Some expert opinions suggest that this is due to lack of awareness, low-income levels, lack of local organic standards and other infrastructure for local market certification (Ssekyewa, 2005). Organic certification is mainly organized under group

certification systems, using an internal control management system operated by the exporter, who holds the organic certificate (Willer and Yussefi, 2006). This reflects the strong tendency for organic agriculture to involve smallholder farmers, which mirrors the situation of smallholders being responsible for 90% of African agricultural production (Boadi and Bokanga 2007).

According to Moffet (2001), in 1999 only 35 farms were certified in South Africa, whereas in 2000 this number had increased to approximately 150. GROLINK (2002) estimates that 240 farms with a total area of 43 620 ha (including pastures and in-conversion land) were certified in 2002. Certified organic produce in South Africa started with mangoes, avocados, herbs, spices, rooibos tea and vegetables (ITC, 1999). This has now expanded to include a much wider range of products. Organic wines, olive oil and dairy products are now being produced (Scialabba and Hattam, 2002). The Organic Agricultural Association of South Africa (OAASA) estimates that there are approximately 100 non-certified farmers, farming about 1000 hectares, following organic principles, who market informally through local villages or farmers markets (*ibid*). In the latter case, no differentiation is made between organic and non-organic produce.

South Africa has had an organic farming movement dating back many years, although it has grown in “fits and starts” (Arnold, 1997). Organic approaches have to make a trade off between market oriented commercial production and increasing the productive capacity of marginalized communities (Millstone and Lang, 2002). The growth of the organic industry has resulted in organic farming being practised in the Western Cape, KwaZulu-Natal, Eastern Cape, Northern Cape and Gauteng Province (Table 1.1). As discussed by Mahlanza, Mendes and Vink (2003) and Troskie (2001) changing consumer preferences towards more health and environmental awareness has led to an increase in the demand for products produced using sustainable production methods. GROLINK (2002) states that South Africa has in contrast with other Sub-Saharan countries, a substantial domestic market for organic products. This is an indication that the potential for organic farming in South Africa is not only based on access to the export market in Europe and the USA but also on the local demand. The domestic market is robust with two domestic retailers (Woolworth and Pick ‘n’ Pay) selling reasonable amounts of organic produce

and both are now starting to insist on certification for this produce as well as farmers markets attracting large number of buyers.

Table 1.1: Overview of certified organic farms and areas in South Africa

Certifying bodies Province	Ecocert ²	Afrisco	SGS ³	BDOCA	Others	Total farms	Total Hectares
Western Cape	65	0	23	5	7	102	7,000
Eastern Cape	5	13	3	0	0	21	3,000
Northern cape	5	0	0	0	2	7	2,000
Free State	7	0	2	0	0	9	2,000
KwaZulu-Natal	4	11	1	1	0	17	500
Mpumalanga	8	0	2	2	0	12	500
Limpopo	12	0	2	2	0	16	5,000
North West	3	1	1	1	0	6	500
Gauteng	3	0	0	12	0	15	2,000
Unsure of province	-	-	4	-	8	12	1,500
Total	114	25	38	23	17	217	24,000

Source: Auerbach, 2003

The University of KwaZulu-Natal is also developing extension and training packages, largely based on organic principles, to Zulu communities in the province of KwaZulu-Natal (Adey, Kotze and Rijkenberg, 2003). Similarly, the University of Fort Hare Nguni Project in partnership with the Agricultural Research Council, seeks to breed indigenous Nguni cattle. The aim is to target the niche organic market that is health conscious. So far 35 communities in the Eastern Cape have benefitted from this project (van der Merwe, 2006). Auerbach (2003) estimates the total value of organic produce in South Africa to be between R200million and R500million from large scale farms to very small organic units of between 0.5-5ha.

² ECOCERT is an organic certification organization, founded in France in 1991. It is based in Europe but conducts inspections in over 80 countries, making it one of the largest organic certification organizations in the world

³ SGS is an international inspection verification, testing and certification company

One approach taken to improve smallholder access to organic markets has been the formation of certified organic groups using guidelines developed by the International Federation of Organic Agriculture Movement (IFOAM) and enforced by certification agencies such as Ecocert/AFRISCO (African Farmers Certified Organic) in the case of South Africa (IFOAM, 2003). Under the group certification system, organic farmers can either grow and market their produce collectively or produce individually but market collectively. This ensures that smallholder farmers especially in developing countries are not marginalised and unduly excluded from the organic sector due to factors beyond their control. Several organic farming groups have emerged in South Africa in the last decade notably Ezemvelo Farmers Organization (EFO), Vukuzakhe Organic Farmers Organization (VOFO), Ikusasaletu Trust and Makhuluseni Organic Farmers Organisation.

There is a growing interest in developing and developed countries to improve the livelihoods of poor smallholder farmers facing production and marketing constraints in fresh produce supply chains (Acquah and Masanzu, 1997). Technological advances have long been identified as a panacea for problems affecting smallholders with numerous studies investigating factors affecting adoption of new and improved technologies, institutions, and farming systems, including organic agriculture (Duram, 1999; Freyer, Rantzau and Vogtmann, 1994). Organic agriculture requires a management system that enhances biodiversity, biological cycles and soil biological activity with minimal use of off-farm inputs, and which promotes practices that restore, maintain and improve ecological harmony (NOSB, 1995). It represents the most regulated form of agriculture as it adheres to legally defined standards and norms of production, processing, and labelling. A shift to organic agriculture by farmers therefore encompasses ecological, agronomic, economic (farm income, markets and food security), social, and institutional dimensions (Scialabba, 1999).

Increasing demands for food throughout the world, together with aspirations among consumers for a more improved or varied diet have also led to intensive methods of food production and the shift towards organic farming systems (Griffin, 2003). Whereas the shift in the Western world is environmentally driven, in South Africa, the shift towards organic farming and certification is market driven, with the aim of getting reliable household income. DARCOF (2000) defines

organic farming as an approach to agriculture where the aim is to create integrated, humane, environmentally and economically sustainable agricultural production systems. Maximum reliance is placed on locally or farm-derived renewable resources and the management of self-regulating ecological and biological processes and interactions in order to provide acceptable levels of crop, livestock and human nutrition, protection from pests and diseases, and an appropriate return to the human and other resources employed. Reliance on external inputs, whether chemical or organic, is reduced as far as possible. According to IFOAM (2011), organic farming is one of several approaches to sustainable agriculture.

1.1.2 Defining organic agriculture

Referring to the definition developed by the Codex Alimentarius, on the basis of contribution from experts from all over the world, organic farming involves holistic production management systems (for crops and livestock) emphasizing the use of organic management practices in preference to the use of off-farm inputs (Codex Alimentarius Commission, 2010). This is accomplished by using, where possible, cultural, biological and mechanical methods in preference to synthetic materials (FAO/WHO, 2011).

According to Reintjes, Haverkort and Bayer (1992), organic farming is often superior economically in terms of net income and risk of production and the steadily deteriorating terms of trade in agriculture could strengthen its competitiveness. This applies more so to poverty stricken smallholders farmers. For most of these farmers, organic farming is the better option if appropriate know-how and market access became available. Many small scale farmers produce organically, however without organic certification lack access to organic markets. The main problem has been the high fixed costs associated with certification. This can be addressed through group certification leading to a decrease in the average fixed costs at certification.

Welch and Graham (1999) state that organic farming is associated with sustainable agriculture, a relatively new paradigm of food production. However, for many subsistence farmers in, their traditional methods of production which exclude the use of chemicals and pesticides are closely associated with organic farming. Farmers in Msinga and Embo in rural KwaZulu-Natal associate

these traditional farming methods with poverty, subsistence farming, their perceived low social class and cultural norms (Modi, 2003). However it is significant that the terms used to describe organic farming concur with the view that organic production lends credence to sustainable food security (Althieri, 1998) and a conscious decision is taken to go organic. The move by the farmers to get certified is aimed at commercializing organics for improved household incomes and access to food. This is because of the high price premiums for organic foods in the market.

Most organic systems aim to operate within a closed system with input resources produced on farm (Piva, 2002). In order to achieve maximum input use, organic farms are usually mixed enterprises involving a balance of pasture, crops and livestock. The integration of crop and livestock can be a key factor in making rotational crop systems work and improving crop management. Organic farming therefore tends to operate in a closed system using renewable resources whenever possible and minimizing reliance on off farm inputs as much as is practical, with crop and livestock being an integral component of the farming system. Less reliance on external inputs means reduced costs. This technology is thus best suited for the rural households, most of whom are resource-poor. Joining forces with other organic farmers particularly where complimentary, seasonal or other conditions exist can make resource use more effective and enterprises more profitable for all involved.

1.2 Problem statement and justification

Modern agricultural methods have resulted in spectacular increases in productivity (Hine and Pretty, 2006). However, the majority of the chronically hungry are small farmers in developing countries who produce much of what is eaten, are often too poor to purchase inputs and are marginalized from product markets (UNCTAD, 2008). Scialabba (2007) argues that seventy-five percent of the world's 1.2 billion poor live in rural areas of developing countries. They suffer from problems associated with subsistence production in isolated and marginal locations with low levels of technology. These subsistence and smallholder's livelihood systems are prone to the risks of drought and floods, crop and animal diseases and market shocks. However they also possess important resilience factors associated with the use of family labour, livelihood diversity and indigenous knowledge that allow them to exploit risky environmental niches and to

cope with crises. Pro-poor policies and technology options based on efficiency in production and employment generation associated with family farms can be expected to improve these household conditions.

Due to the prevailing constraints and conditions for numerous small scale farmers to succeed, the practice of organic agriculture has been identified as a pathway to sustainable development and enhancing food security. Arguably, the sustainable choice for agricultural development and food security is therefore to increase total farm productivity *in situ*, in developing countries particularly sub-Saharan Africa. Attention must focus on the following: (i) the extent to which farmers can improve food production and raise incomes with low-cost, locally-available technologies and inputs (this is particularly important at times of very high fuel and agro-chemical prices); (ii) whether they can do this without causing further environmental damage; and (iii) the extent of farmers' ability to access markets (Tilman, Cassman, Matson, Naylor and Polasky, 2002; Smil, 2000). Organic farming is one of the sustainable approaches to farming that can contribute to food and nutritional security (FAO, 2007). Driven by increasing demand globally, organic agriculture has grown rapidly in the past decade (Willer, Rohwedder and Wynen, 2009). Policy makers at the primary end of the food chains must wrestle with the dual objective of reducing poverty and increasing the flow of ecosystem services from rural areas occupied by small scale farmers and/or family farms (Oelofse, Høgh-Jensen, de Abreu, de Almeida, Sultan, Yu-Hui, de Neergaard, 2010).

The identification of organic agriculture as a development pathway, leading to improved livelihoods, is based on a central assumption that decreased use of external inputs, combined with price premiums for products will provide economic gain which can improve aspects of the farmer's livelihood, for example food access, health, or education (Kilcher, 2007). Pannell, Marshall, Barr, Curtis, Vanclay and Wilkinson (2006) state that the adoption of an innovation such as a conservation practice is principally influenced by the characteristics and circumstances of the farmer and the characteristics of the practice, especially its relative advantage over existing practices and landholder's ability to try the practice. Farmers adopt an innovation if they expect that the practice will help them achieve their goals, which may include economic, social and environmental goals. Within this conceptual framework, there is compelling evidence that

adoption is strongly affected by risk related issues (Sattler and Nagel, 2010; Marra, Pannell and Abadi- Ghadim, 2003; Beal, 1996).

Several studies have reviewed and summarized the factors that influence adoption decisions in agriculture example Knowler and Bradshaw (2007) and Padel (2001). However, there appears to be a paucity of empirical studies which address the practical implications of risk, specifically in relation to the adoption of organic farming practices by smallholder farmers. Even more so, there are no readily accessible and contextualized studies that combine quantitative investigations of the influence of motivations and risk perceptions on the adoption of organic practices in South Africa. As farmers are the ultimate decision makers in the adoption process, understanding their perceptions of a given technology are important in the adoption process is critical in designing information dissemination and support programmes.

Moshini and Hennessey (2001) and Antle (1987) conceded that despite the general consensus amongst agricultural economists that risk constitutes a prevalent feature of agricultural production, risk related research in the discipline had failed to provide useful information for farm management. Twenty years later, Just (2003) convincingly argued that the large volume of research on the topic by agricultural economists had still not adequately addressed the question: “Does risk matter in farm decisions?” In particular he criticized risk related literature in agricultural economics for typically using aggregate instead of farm level data, failing to account for heterogeneity in farmers risk preferences and for analyzing specific production decisions without due consideration for holistic risk management (Just, 2003). The relative lack of information about (especially) organic farmers’ risky environment and their management strategies means that there are limited useful practical insights for policy makers, farm advisers and researchers. This would be useful in the design of effective and efficient policies, programmes and projects, which can affect adoption of organic and conservation practices to an extent where the performance by agriculture shows rapid and measurable improvements especially among small holder farmers.

On the other hand, the interest of consumers and public institution in organically produced foods has increased in response to consumers’ concerns about food safety, human health and the

environment (Tsakiridou, Boutsouki, Zotos and Mattas, 2008). Consumer awareness and knowledge is a critical factor in changing the attitude and behaviour of consumers towards organic foods, which in turn is expected to drive the growth in the organic food markets (Briz and Ward, 2009). Studies that have investigated the knowledge, awareness, attitude and behaviour of consumers towards organic food in both developed and developing countries include Magistris and Gracia (2008), Michaelidou and Hassan (2008). Chakrabarti (2010) argues that the consumer awareness and knowledge as well as consumption of organic foods are significantly higher in developed countries as compared to developing countries. In countries like South Africa, where organic food markets are still in the early phase of its growth, there is comparatively low level of awareness (Hall, 2002).

In general, consumers have positive attitudes towards organic products which are perceived as healthier than conventional alternatives (Mahlanza *et al.*, 2003). However, the market size for organic foods remained low due to both supply and demand side constraints in South Africa (Auerbach, 2003). Consumer awareness and market potential for organics has been under-researched in South Africa according to Niemeyer and Lombard (2003) and Irwin (2002). These studies confirmed the lack of literature available on consumer purchase and demand attributes of organic products. This is echoed by Du Toit and Crafford (2003) who encouraged research in the area of food purchasing behaviour of the South African Consumer. Success with organic foods depends on consumer acceptance and use. Potential consumers may not even be aware of organic foods or may have the wrong perception even when aware. Consumer awareness of organic foods is the first step in developing demand for organic products. Yet awareness does not necessarily translate to consumption. It is therefore important to investigate these issues.

The research is undertaken among smallholder farmers in KwaZulu-Natal Province and consumers in the former homelands of the Eastern Cape Province. While the Eastern Cape is a major consumer of produce from neighbouring KwaZulu-Natal, this is also informed by the fact that the market potential and growth of organic products is determined by the demand and growth of organics beyond the borders of its production region into the neighbouring provinces and eventually throughout the country. The Eastern Cape Province is bordering KwaZulu-Natal

and was hence selected as the starting point in determining the level of awareness and market latent for organics. This will give an indication if indeed there is potential for market growth in the organic sector, which will guide the inferences made thereof and implications for South Africa. There are also similarities in the socio-economic status and rurality of the two provinces and the fact that both provinces' economic dependence is on agriculture with huge potential for organic agriculture development.

1.3 Research objectives

The overall objective of the study is to model economic aspects of organic crop production systems, understanding farmers' risk perceptions and consumer awareness for organic products. This study seeks to contribute to the body of knowledge that will inform policy recommendations on improved access to food and household incomes by smallholder rural communities, strategies to manage risk and increase the market potential for organics.

Specifically the study will pursue the following objectives:

1. To describe the demographic and socio-economic characteristics of organic farmers and consumers;
2. To identify the determinants of farmers' decision to participate in organic farming distinguishing among the fully-certified organic, partially-certified organic and non-organic farmers;
3. To elicit farmers risk preferences and empirically analyse farmers sources of risk and risk management strategies;
4. To explore consumer awareness, perceptions and attitudes regarding organic products;
5. To identify the factors that influence the consumer's preference and consumption of organic products.

1.4 Research questions

The research questions are categorised to address the production and consumption of organic products. The research questions for organic production seek to address organic technology adoption, farmers risk preferences and mitigation as well as policy options. The organic consumption research questions seek to address consumer awareness, consumption and preference for organics.

The research questions posed are:

- (i) What are the socio-economic and/or institutional characteristics that distinguish among fully-certified organic, partially-certified organic and non-organic farmers in the study area?
- (ii) Do smallholder farmer risk preference matter in technology adoption among smallholder farmers?
- (iii) What are the farmers' sources of risk and how do they have a bearing on their risk management strategies?
- (iv) What is the level of consumers' awareness, perception and attitude regarding organic products?
- (v) What factors influence consumer preferences and consumption of organic products?
- (vi) What policy recommendations could be made that impact technology adoption, increase smallholder farmers ability to bear risk and enable role players have a better understanding of consumer organic purchase decisions.

This information is essential for policy makers, researchers and project managers. In answering the above research questions, the study uses quantitative data gathered in household surveys among respondents in the study areas of KwaZulu-Natal and Eastern Cape Provinces as well as qualitative information gathered in interviews and published literature.

1.5 Significance of the study

High levels of poverty among rural households in South Africa have focused attention on whether a shift to organic farming by some smallholder farmers can improve household incomes and food security. This shift has been induced by the intervention of various stakeholders, most notably the government through the Departments of Agriculture, and is geared towards commercialization to provide more stable household income and improve access to food. Hence, understanding the factors that cause these farmers' to fully, partially or not adopt improved technological approaches such as organic farming with its associated benefits is crucial for improved design and transfer of the recommended practices. These smallholder farmers have the option to gain organic certification and participate in the formal organic supply chain. The determinants of their adoption decisions will enable government and various stakeholders develop and implement programs aimed at improving agricultural production.

According to Binswanger (1982, 1980), Dillon and Scandizzo (1978) and Moscardi and de Janvry (1977), poor smallholder farmers are risk averse and their production and economic environments are characterized by a high degree of uncertainty (Roumasset, 1976). Owing to their relatively low wealth, smallholder farmers are also expected to be relatively more vulnerable to risk and consequently, risk is expected to be an important determinant of their decisions. These general conclusions and observations have stimulated extensive research into the effects of risk on smallholder farmer's adaptation. The case of rural poor households whose capacity to bear risk is low, tend to exhibit a risk averse behaviour. Income or production shocks could thus have a drastic impact on the households.

An insight into the sources of risk has clear implications as to how the perceived riskiness of organic farming may be reduced, thus increasing the likelihood that relatively more risk-averse farmers will adopt organic farming. Knowledge of farmers' risk preferences could help in the design of technological and institutional practices tailored to their economic behaviour in order to improve the likelihood that rural development programs will succeed in improving household incomes. The findings of this study will provide guidance on how the government and/or the private sector can focus on developing policies that help farmers reduce and/or manage risk and

tailor literacy and risk management education and strategies towards the various farmer groups and consumers in South Africa.

Notwithstanding, organically produced foods have shown steady growth in South Africa albeit being in the early stages of growth compared to other developing nations. Even with strict adherence to the production practices and increasing availability, the majority of consumers are still not aware of organically produced alternatives. Awareness of organics does not necessarily translate into actual consumption. Achieving awareness and understanding the linkage between awareness and purchasing organics is fundamental to impacting the demand for organically grown products. Consumer awareness of organic foods is the first step in developing demand for organic products. Given the potential importance of organics, a focus of this analysis is on awareness and consumption of organically grown foods. Success with organic foods depends on consumer acceptance and use which will contribute to market growth.

1.6 Outline of the thesis

Chapter 1 of this thesis presents the background to the study, presenting the food security situation, the organic agriculture sector globally and in Africa and the definition of organic agriculture. The chapter proceeds to sets out the problem statement and justification for the study as well as the objectives of the study. The research questions are posed and the scientific significance of the research is argued. The literature review has been spreads across chapters 2, 3 and 4. These chapters seek to provide the link between the role of organic agriculture as a sustainable approach to farming and its potential to address food and nutritional security while establishing the factors that affect its adoption as well as delving into smallholder farmers risk bearing capacity and its implication for their decision making in organic agricultural production.

Chapter 2 is a review of the state of agriculture, analysing the global food and agricultural crisis, the associated response to this crisis and the case of organic agriculture as a form of sustainable agriculture. The chapter proceeds to present the status of agricultural production and food security in Africa and the role of agriculture in the South African national economy. The trends in the organic sector in South Africa are outlined, addressing the domestic market for organic

products, consumer trends and certification guidelines as outlined by IFOAM. **Chapter 3** is a review of relevant literature on agricultural technology adoption, addressing the basic concepts and theoretical foundation of technology adoption, factors affecting the adoption of agricultural technologies, mode and sequence of agricultural technology adoption, barriers to agricultural technology adoption and concludes with approaches to analysing technology adoption and diffusion.

Chapter 4 provides the background to risk in agriculture. The importance of risk in agricultural economics is articulated. The chapter proceeds with the information on the agricultural risk sources and risk management strategies. The expected utility theory and measure of risk aversion is discussed and the justification presented for the use of the Arrow Pratt Absolute Risk Aversion to measure decision makers risk aversion. The Chapter concludes with the various methods for measuring risk attitudes for agricultural producers. **Chapter 5** presents the study methodology, introducing the study areas of KwaZulu-Natal and Eastern Cape provinces. The population study group of smallholder producers and consumers is explained and data collection methods and instruments presented. The variables are specified in this section as is the background on the empirical data analysis models used in the study.

The research findings and analysis of results are presented in chapters 6, 7 and 8. These chapters present the findings on organic technology adoption, smallholders risk preferences, sources and management strategies as well as the consumer awareness and market potential for organics respectively. The determinants of organic farming adoption among smallholder farmers in KwaZulu-Natal are explained in **Chapter 6**. This commences with the descriptive statistics of the surveyed data of the smallholder farmers. The results of the ordered probit model that identifies the determinants of organic farming adoption is presented and discussed in this chapter with reference made to findings by similar studies. **Chapter 7** is a presentation of the results on risk and risk management among smallholder farmers in KwaZulu-Natal. The farmers risk preference classification are analysed and explained. The results of the link between the farmers risk preference and observable socio-economic variables are presented and explained. The farmer's sources of risk are identified and ranked and the results of principal components

analysis on the farmers' sources of risk presented. This chapter concludes by presenting the farmer's risk management strategies.

Chapter 8 is a presentation of the consumer's awareness and knowledge of organic products as well as their preferences and consumption choices. The descriptive analysis of the sampled Eastern Cape consumers is presented and the results of the empirical analysis that determine consumer awareness and consumption of organic products discussed. **Chapter 9** concludes with the summary of the study and the policy implication of this study. Areas of further research are suggested.

CHAPTER 2

THE STATE OF FOOD AND AGRICULTURE

2.1 Introduction

Food and nutritional security remain an issue of major concern globally and especially in developing countries. The role of organic agriculture as a sustainable approach to address these twin issues is hence relevant. This chapter gives an overview of the global food and agricultural crisis that peaked in 2008 and the response to the food and agricultural crisis at the global, national and local levels. The chapter proceeds to review the case of organic agriculture as a form of sustainable agriculture and further presents analyses of the agricultural production and food security in Africa. Also presented is the debate in the recent years on whether organic agriculture can feed the world. Further, the role of agriculture in the South African National economy is presented and the organic sector trend in South Africa analysed with reference to the domestic market for organic products, general consumer trends, inspection and certification of organic product. The chapter concludes with a review of issues around the consumer awareness and knowledge as well as preference and purchase of organic products.

2.2 The global food and agricultural crisis

Food production is a global concern and changes in the global environment affect both the way it is conducted and its outcomes, in terms of the level of food supply, food pricing, and whether or not the objectives of food production are realized. In 2008, the price of food rose dramatically in many parts of the developing world. According to the World Bank (2008), although fluctuations in food prices and availability occur all the time, the rapidity and scale of recent swings was unprecedented. The sharp price rises of 2007 and 2008 were caused by a combination of increased global demand, rising fuel prices, biofuels production, export restrictions, crop failures, financial speculation and dwindling stockpiles (UNCTAD, 2009). As a result, the global grain reserves declined to about 50 days worth of supply, compared with 115 days in 2000. This is partly because global demand for food outstripped supply in the past few

years and partly because stockpiles reached historic lows when crops in some key producing countries failed in 2006/7 (UNCTAD, 2009).

According to Clapp and Helleiner (2010), the extreme food price volatility that erupted in 2007–08 brought havoc to world food markets and pushed millions into a situation of food insecurity. It is estimated that 50–100 million more people in the developing world were pushed into hunger during 2007 (IISS, 2008). As millions of people were pushed into the category of ‘food insecure’ over the course of 2008, food riots broke out in a number of developing countries. South Africa on the other hand witnessed labour unrests with calls for wage increases to stem the rising food and fuel costs. The total number of undernourished people on the planet topped 1 billion for the first time in mid-2009, marking a dramatic setback for the UN goal of reducing the number of hungry people to no more than 420 million by 2015 (FAO, 2009a). After world food prices had risen by 40% on average in 2007, further sharp gains were seen in early 2008, according to the UN Food and Agriculture Organisation (FAO, 2009b). Because this global food crisis was widely attributed to the failure of food supply to meet rising demand, it prompted a number of high profile international initiatives to expand the global supply of food as well as its availability to poorer countries where chronic underinvestment in the agricultural sector has continued.

Mitchell (2008) reported that the International Monetary Fund (IMF) price index of internationally traded food commodities rose by 56 per cent from January 2007 to June 2008. Then, almost as suddenly, food prices on international markets fell back sharply in the latter half of the year. By November 2008, agricultural commodity prices had fallen by 50 per cent from their record high earlier in the year (FAO, 2008). This appeared to be mainly due to a reduction in consumption with people seemed to be eating less, particularly in the developing world.

Ultimately, the 2008 crisis has highlighted the fragility of the supply/ demand balance and the food system has proved vulnerable to external shocks (IISS, 2008). On the supply side, as a result of economic liberalization and industrialization, the numbers of small, local agricultural producers have decreased and the developing world has become more dependent on imports from developed nations (Nicoll, 2010). There is considerable scope to increase agricultural yields

in poorer nations with the correct assistance and investment in agricultural technologies that aim at increase production and ensure food self sufficiency as well as investment in infrastructure. This is because investment into agriculture has been steadily declining over the past 30 years (FAO, 2009c). Due to the growing perception that agriculture was unprofitable against the backdrop of low commodity prices, developing countries were pushed to open their markets and realize food security through low-cost imports, rather than investing in their own farmers.

While in 1979, aid for agriculture constituted 18% of total development assistance, it declined to 2.9% in 2006 (IFAD, 2008a). Naturally, agricultural productivity growth also decreased, “from some 3.5 per cent in the 1980s to about 1.5 per cent today” (IFAD, 2009b), as government spending and supportive policies were missing. The World Bank (2008) estimates that by 2030 global demand for food will rise by 50%. The situation is compounded by the fact that more than 1bn people live on less \$1 a day, nearly 3bn on less than \$2 a day and an estimated 923m are undernourished. In large parts of Africa, the World Bank says, two-thirds of disposable income is spent on food (Clapp and Cohen, 2009). Hence the urgent need to address the food and agricultural crisis bedeviling the world and more specifically the African Continent.

2.3 Responses to the food and agricultural crisis

Agricultural growth is a crucial element in resolving food price crises, enhancing food security, and accelerating pro-poor growth (ASARECA, 2008). It is essential that the evolving response at national and international levels addresses the immediate challenges poor and food insecure people face. Sound economic and agricultural policies, including significant investments in agriculture, can prevent gruesome outcomes. In view of the financial crisis and the constraints and risk-averse behavior of the private banking sector, much of the investment would have to be facilitated by the public sector (IFPRI, 2008).

The food crisis was prioritised on the international agenda in 2007/2008 following the establishment of the High-Level Task Force (HLTF) on the global food crisis in April 2008. This task team brought together the UN system with its specialised agencies, funds and programmes and the Bretton-Woods Institutions, in order to develop a common strategy to

combat the crisis and to coordinate this strategy's implementation (FIAN, 2008). The HLTF (2008) drafted the Comprehensive Framework of Action (CFA), in which it identified two sets of necessary short- and long-term actions to combat the crisis. The short term actions were aimed at meeting the immediate needs of vulnerable populations by firstly enhancing emergency food assistance, nutrition interventions and safety nets, secondly boosting smallholder farmer food production, thirdly adjusting trade and tax policies and fourthly to manage macroeconomic implications. The proposed long term actions aimed to build resilience and contribute to global food and nutrition security. The HLTF (2008) CFA also has four main foci; firstly to further expand social protection systems, secondly to sustain smallholder farmer-led food availability growth, thirdly to improve international food markets and fourthly to develop an international consensus on biofuels. The HLTF coordinates the implementation of this strategy and coordinates donor cooperation at all levels.

Other initiatives included the McGill University's Global Food Security Conference (2009) in Montreal which examined the effects of the recent financial crisis on global food security, identified investment priorities for the agricultural sector including critical areas for research and capacity building and evaluated the effects of markets and trade, biofuel production and climate change on current and future world food production and the environment. Delgado (2008)'s presentation on the Global Food Crisis Response Program (GFRP) of the World Bank emphasized the need to reduce the negative impact of high and volatile food prices on the lives of the poor, support for governments in the design of sustainable policies that mitigate the adverse impacts of high and volatile food prices on poverty and support for broad-based growth in productivity and market participation in agriculture to ensure an adequate supply response as part of a sustained improvement in food supply. Beddington (2011) presented a compelling case for action in the global food system. The author stressed the aim to place the food system within the context of wider policy agendas. Beddington (2011) argues for decisive action and collaborative decision making across multiple areas, including development, investment, science and trade, to tackle the major challenges that lie ahead and drew attention to the un-sustainability of the food system – food currently being produced at the expense of ecosystem health

The FAO is leading international efforts to eradicate hunger, improve nutrition and living standards world-wide, focusing on developing rural areas (FAO, 2008). It is one among various players in the field. The growing number of future harvest centres around the world has also been necessitated by the renewed interest in technology development to stimulate agricultural production among smallholders especially in the developing nations (HRC, 2008). The New Partnership for Africa's Development (NEPAD), an African initiative also aims to eradicate poverty, advance development and end marginalization with a special focus on Africa. The Comprehensive Africa Agriculture Development Programme (CAADP) of the NEPAD seeks to boost agricultural productivity in Africa through the four main pillars of land and water management, market access, food supply and hunger, agricultural research (CAADP, 2011).

The growing recognition of the importance of smallholder agriculture is a very positive trend. Smallholder agriculture is the key to local and global food security and the engine for development and economic growth for most developing countries. Seventy-five per cent of the world's poorest people - 1.05 billion women, children and men - live in rural areas and depend on agriculture and related activities for their livelihoods (IFAD, 2009a). Although smallholder agriculture can indeed be more productive in relative terms and environmentally friendlier compared to large-scale commercial farming, more and more farmland world-wide is now taken up by large plantations cultivating agro-export crops, agrofuels and transgenic soybean. Yet, world-wide, 1.4 billion smallholder farmers still support almost 2 billion people and "in Africa alone, 33 million smallholder farmers account for 80% of the continent's agricultural outputs" (Omiti, Otieno, McCullough and Nyanamba, 2007).

Dano (2009) argues that what is really needed is a "truly *green* revolution" in Africa based on sustainable production devoid of chemical fertilizers and energy intensive input that further marginalize smallholder farmers. The "truly *green* revolution must be based on traditional and local knowledge, integrating smallholder's expertise and needs and taking into account regional diversities. Bindraban, Bulte, Giller, Meinke, van Oort, Oosterveer, van Keulen, Wollni (2009) reiterate that there is no one-size fits- all technology package, but rather there is need to aim for the diversification of local crops, organic fertilizers and promote agro-ecology. Respect for environmental protection is as crucial as the safeguarding of natural resources. Measures

must be taken to regenerate soils and conserve water. A truly *green* revolution must be African-led and empower marginalised farmers, especially women, and improve their access to local, regional and global markets, in order to fight hunger and poverty.

Båge (2008) cites the case of Vietnam, which serves as a prime example of smallholders' potential to drive economic growth and reduce poverty. Almost three quarters of its population live in rural areas and survive off agriculture. According to Bage (2008), in the last two decades, the country has successfully transformed from a major importer and food-deficit country into one of the largest rice-exporters in the world. Increased productivity and growth are largely due to development of the smallholder sector. Growth rates increased to 7 % and poverty rates dropped from 58% in 1993 to 13% in 2007 (Båge, 2008).

2.4 The case for organic agriculture as a form of sustainable agriculture

Driven by increasing demand in North American and European markets, organic agriculture has grown rapidly on a global scale in the past decades (Willer *et al.*, 2009; Raynolds, 2004) as a model for sustainable development (Sneddon, Howarth and Norgaard 2006). Organic agriculture is now practised in a broad array of environments and settings across the globe. Developing countries with large organic certified areas include Argentina, Brazil, China and India. In Africa, the leading countries are Uganda, Tanzania, Kenya and South Africa (Willer *et al.*, 2009). Locally produced organic foods in West cannot meet the demand for counter-seasonal and tropical products; therefore there is an increasing reliance upon organic imports from the global South (Raynolds, 2004; Barrett, Browne, Harris and Cadoret, 2002).

Policy makers at the primary end of these food chains must wrestle with the dual objectives of reducing poverty and increasing the flows of ecosystem services from rural areas occupied by small-scale and/or family farms. Concurrently, organic agriculture is promoted in a development context for a variety of reasons, including improved food security and improved livelihoods through, for example, increased incomes (UNEP-UNCTAD, 2008; Kilcher 2007; UNCTAD, 2006). Additionally, the adoption of organic agriculture in developing countries is considered to

provide economic, social and cultural benefits (UNCTAD, 2006). Organic agriculture may thus be regarded as an example of a market-based development paradigm while maintaining a livelihood priority (Høgh-Jensen, Egelyng and Oelofse, 2009).

The identification of organic agriculture as a development pathway, leading to improved livelihoods, is based on a central assumption that decreased use of external inputs, combined with price premiums for products will provide economic gain which can improve aspects of farmer's livelihood, for example food access, health, or education (Kilcher, 2007). Organic agriculture is generally considered to reduce external input costs due to the non use of pesticides and mineral fertilizers and increased internal nutrient recycling using green manures, composts and animal manures. However, given that labour use might increase as a result of adoption, the reduction of external costs depends very much upon how labour is substituted and whether farms supply their own labour or hire labour.

Furthermore, reduction of costs from the cessation of use of pesticides and fertilizers depends upon whether farmers are able to supply their own manure or if they practise 'input-substitution' (UNEP-UNCTAD, 2008). The debate as to what potential benefits organic agriculture might offer to small-scale or family farms often centres on the impact upon yields, with critics of organic agriculture arguing that adoption of a system with inferior yield levels (Goklany, 2002) and high certification costs (Barrett *et al.*, 2002) may disadvantage small-scale farmers. The potential benefits of organic agriculture depend, however, upon a number of highly context specific factors.

The International Fund for Agricultural Development (IFAD) concluded in an evaluation of organic agriculture in Latin America that organic agriculture can be of major value to poorer farmers. They stressed, however, that this requires management of a range of knowledge intensive factors, including farmer organization, technical support and quality control (IFAD, 2002). A study of food security and organic agriculture in Africa (UNEP-UNCTAD, 2008) supports this conclusion, stating that development of social capital at the local level to meet the required management and knowledge levels is a prerequisite for the development of organic agriculture. Consequently, studies must consider the farm scale, including the farming family,

the organisation along the value chain and not just the yield of selected crops. Furthermore, while yield decreases on organic farms in the developed world are well documented (IFAD, 2002), the reality for smallholders in developing countries may be more diverse, since conversion to certified organic production also includes commercialisation of the production.

The farm scale effects of the adoption of organic agriculture in developing countries are under-researched. The production of organic coffee has received most attention; for example Tovar, Martin, Cruz and Mutersbaugh (2005) investigated differences in producer type and certification in Mexico. Valkila (2009) and Bacon (2005) investigated the impact of organic coffee production on farmer welfare and vulnerability in Nicaragua, whilst Bolwig, Gibbon and Jones (2009) examined the revenue effects of organic coffee production in Uganda. Eyhorn, Mahesh and Mader (2007) compared on-farm impacts of organic cotton production with conventional cotton in India. On a farm level basis, Bakewell-Stone, Lieblein and Francis (2008) investigated the potential of organic agriculture to sustain livelihoods in Tanzania and found that, whilst there may be benefits for farmers, there are also a number of risks associated with the international trade focus of organic agriculture, particularly the strong focus on ‘target’ crops for export.

2.5 The debate on organic agriculture

Organic agriculture’s productivity and potential contribution to feeding 9 billion people is not only a crucial question, but also one of its most contentious issues (de Ponti, Rijk, and van Ittersum, 2012). Statements on the feasibility of feeding the world with organic agriculture are often directly or indirectly based on comparisons of organic and conventional yields. Stanhill (1990), using mostly data from before 1985, was probably the first to conduct an extensive literature review of organic–conventional comparative yield data. Penning de Vries, Rabbinge and de Groot (1997) used crop growth simulations to conclude that organic agriculture can only produce enough food to feed 9 billion people at a global level (but not in every region) assuming diets with modest amounts or no animal proteins. On the basis of a review of comparisons of organic and conventional empirical yield data and simulations Lotter (2003) argues that, if meat consumption is reduced, large-scale conversion to organic agriculture is feasible without resulting in food shortages.

More recently, Badgley, Moghtader, Quintero, Zakem, Chappell, Avile's-Va'zquez, Samulon and Perfecto (2007) also used comparative yield data to argue that organic production can 'contribute substantially' to feeding the current and future world population, and that it may even be possible to reduce the agricultural land base. A result that was heavily disputed by Cassman (2007), Connor (2008) and Goulding, Trewavas and Giller (2009) as they argued that the yield data used by Badgley *et al.* (2007) and the assumptions made on nutrient availability in organic systems, particularly nitrogen, were too optimistic. Connor (2008) argues that organic agriculture does not need the ability to feed the world to contribute within agricultural production but provides some with justification to solve perceived and real production and environmental challenges in agriculture and food supply in a single step by large-scale transformation to organic agriculture. An important issue to the acceptance of organic agriculture is found in the question of its productivity. Existing analyses have put the carrying capacity of organic agriculture at 3–4 billion, well below the present world population of 6.2 billion (Connor, 2008).

The principal objections to the proposition that organic agriculture can contribute significantly to the global food supply are low yields and insufficient quantities of organically acceptable fertilizers. de Ponti *et al.* (2012) did a review and meta-analysis of 362 yield datasets, comparing organic and conventional agriculture. The results showed that currently organic yields of individual crops are on average 80% of conventional yields. These findings are an intermediate position between empirical data presented by other authors. Stanhill (1990) found a value of 91% using data from the 1970s, Goulding *et al.* (2009) found a value of 65% on the basis of 25 data entries for wheat, while Badgley *et al.* (2007) found a value of 130%. de Ponti *et al.* (2012) suggests that the latter value, however, was distorted as many of the data for developing countries had relative yields far greater than 100%. Connor (2008) agrees. The author further states that while the analysis of yield gaps for organic and conventional agriculture was at crop and field level. The results cannot readily be up scaled to higher system levels.

The other aspect of the debate is the unavailability of sufficient organic fertilizers. Organic agriculture relies for its crop nutrients on natural soil fertility, legume crops, compost and manure. When legumes are grown as a green manure crop instead of a food or fodder crop to add

nitrogen to the system, the average yield of food and fodder crops over the entire rotation is reduced. Yield data of the entire cropping or farming system should in those cases be adjusted accordingly, as was done for instance by Korsath (2008) and Taube, Loges, Kelm and Latacz-Lohmann (2005). Quite often, however, legumes serve as food or fodder crop, in which case nitrogen fixation is not at the cost of overall food production and part of the fixed nitrogen is made available to other crops in the rotation (Wander, Yun, Goldstein, Aref and Khan, 2007; Welsh, Tenuta, Flaten, Thiessen-Martens and Entz, 2009). In those cases, still additional nitrogen (and other nutrients) must be added to the cropping or farming system through other sources to make it possible to attain relatively high yields for the non-legume crops in the rotation.

Another important source of nutrients in organic farming is manure. Some of the successful organic production systems are dependent on relatively large manure applications imported from outside the farming system (Clark, Horwath, Shennan, Scow, Lanini and Ferris, 1999; Jaim and Al Kader, 1998). If these systems were to be adopted more widely in a given region, manure may become a limiting resource, thus reducing overall organic food crop yields (Jaim and Al Kader, 1998). By applying manure to food crops, rather than returning manure to fodder-producing areas, fodder yields may also decrease due to soil nutrient depletion.

According to Naegeli and Torrico (2009), while organically produced food seems not to be able to feed the World's Population, there are strong evidences that organic agriculture might help to alleviate the number of people suffering from hunger especially in developing countries. Given the strong negative externalities of conventional agriculture, the diversification of production as a basic principal of organic agriculture can contribute to the improvement of food security (Zundel and Klicher, 2007) which may improve the nutritional level in rural communities. The expanding global market for organic products (Connor, 2008; Badgley *et al.*, 2007) and the possibilities for smallholder farmers in developing countries to access markets (Naegeli and Torrico, 2009) can have very positive effects on the rural economies, triggering rural development. The increasing awareness of what people consume also has positive effects on organic agriculture as an alternative option for agricultural production. Organic agriculture may thus be an option in some areas to support strongly rural development.

2.6 Agricultural production and food security in Africa

Agricultural production in most African countries is dominated by small-scale farmers who produce 90% of the food consumed and make up at least 73% of rural African households (IFAD, 2005). Despite this situation where a high percentage of the population depend on farming, the food demand cannot always be met from this source. According to Southgate (2009), food demand has grown to unprecedented levels while agricultural growth has declined. Ndhleve, Jari, Musemwa and Obi (2011) note that in fact agricultural production in general has been on the decline for the past three decades. The estimated agricultural production per capita declined by 22% between 1971 and 1984. Castelfranco (2010) quoting the United Nations Food Agency, FAO states that food import bills for the world's poorest countries are predicted to rise 11 % in 2011 and by 20% for low-income food-deficit countries while the previous forecast of 1.2% expansion in world cereal production is expected to shrink downward due to bad weather. The central issue therefore is how to accelerate the agricultural production growth rate to meet the needs of the ever growing population. The role of agriculture as a fundamental instrument for sustainable development, poverty reduction and enhanced food security in developing countries cannot be over-emphasized (Bindraban *et al.*, 2009). It is a vital development tool for achieving the Millennium Development Goals, one of which is to halve by 2015 the share of people suffering from extreme poverty and hunger (World Bank, 2008). Throughout the developing world, agriculture accounts for around 9% of the GDP and more than half of total employment.

Pinstrup-Andersen (2002) states that in countries where more than 34% of the population are undernourished, agriculture represents 30 % of GDP and nearly 70% of the population relies on agriculture for their livelihood. This fact has in the past been used in support of the argument as to why developing countries should move away from agriculture and invest in technology. Because over 70% of the poor live in rural areas, where also the largest proportion of the food insecure live, it is evident that we cannot significantly and sustainably reduce food insecurity without transforming the living conditions in these areas. The key lies in increasing the agricultural profitability of smallholder farmers and creating rural off-farm employment opportunities.

In Africa, agriculture is a strong option for spurring growth, overcoming poverty, and enhancing food security. Agricultural productivity growth is also vital for stimulating growth in other sectors of the economy. However, agricultural productivity in Africa has continued to decline over the last decades and poverty levels have increased. Currently, agricultural productivity growth in Sub-Sahara Africa lags behind that of other regions in the world, and is well below that required to achieve food security and poverty goals (World Bank, 2008). Increasing agricultural productivity in Africa is an urgent necessity and one of the fundamental ways of improving agricultural productivity is through introduction and use of improved agricultural technologies. Therefore the question is will investments in agricultural technology by themselves be sufficient to ensure long-term productivity growth in the farm sector and, more importantly, for rural poverty reduction? As rapidly rising food prices threaten food security and the poverty gains made by developing countries, many have blamed declining funding for agricultural technology development for this state of affairs (Smil, 2000).

As noted by Duflo, Gale, Liebman, Orszag and Saez (2006), the rapid population growth has made Africa to be no longer viewed as a land-abundant region where food crop supply could be increased by expansion of land used in agriculture. Large areas in Africa are increasingly becoming marginal for agriculture and arable land has become scarce in many African countries. This makes the need for intensification of land use through use of productivity enhancing technologies critical for achieving food security. Yet, the rate of adoption of productivity enhancing technology options like organic agriculture have been substantially lower in Africa than in Asia and Latin America (Byerlee and Eicher, 1997). Similar observations are also made by Ariga, Jayne, and Nyoro (2006). According to Howard, Kelly, Maredia, Stepanek, and Eric (1999), high external input technologies, lack of infrastructure, research, development, and even extension are major obstacles to increasing fertilizer application rates in sub-Saharan Africa.

Figure 2.1 below presents the production of the five (5) most important food and agricultural commodities in Eastern Africa (Figure 2.1A), Central Africa (Figure 2.1B), Northern Africa (Figure 2.1C), Southern Africa (Figure 2.1D) and Western Africa (Figure 2.1E). The production is presented per 1000 metric tonnes for the year 2010. According to Figure 2.1, the main production is energy sources of food with limited protein and vitamin sources ranked among the top five most important food and agricultural commodities. Figure 2.1 illustrates the need for food and nutritional security in Africa. African countries need to increase their investment in long-term interventions such as dietary diversification, food sufficiency and bio-fortification. These have lower maintenance costs, a higher probability of reaching the poor who are vulnerable to food insecurity, and produce sustainable results. Johns and Eyzaguirre (2007) state that dietary diversification still remains the best way to provide nutritious diets to the sustainability of any population. It is possible to obtain the right mix of food to alleviate malnutrition from that which is locally produced (Mwaniki, 2003). The probability of so doing is increased with increase in locally produced foods.

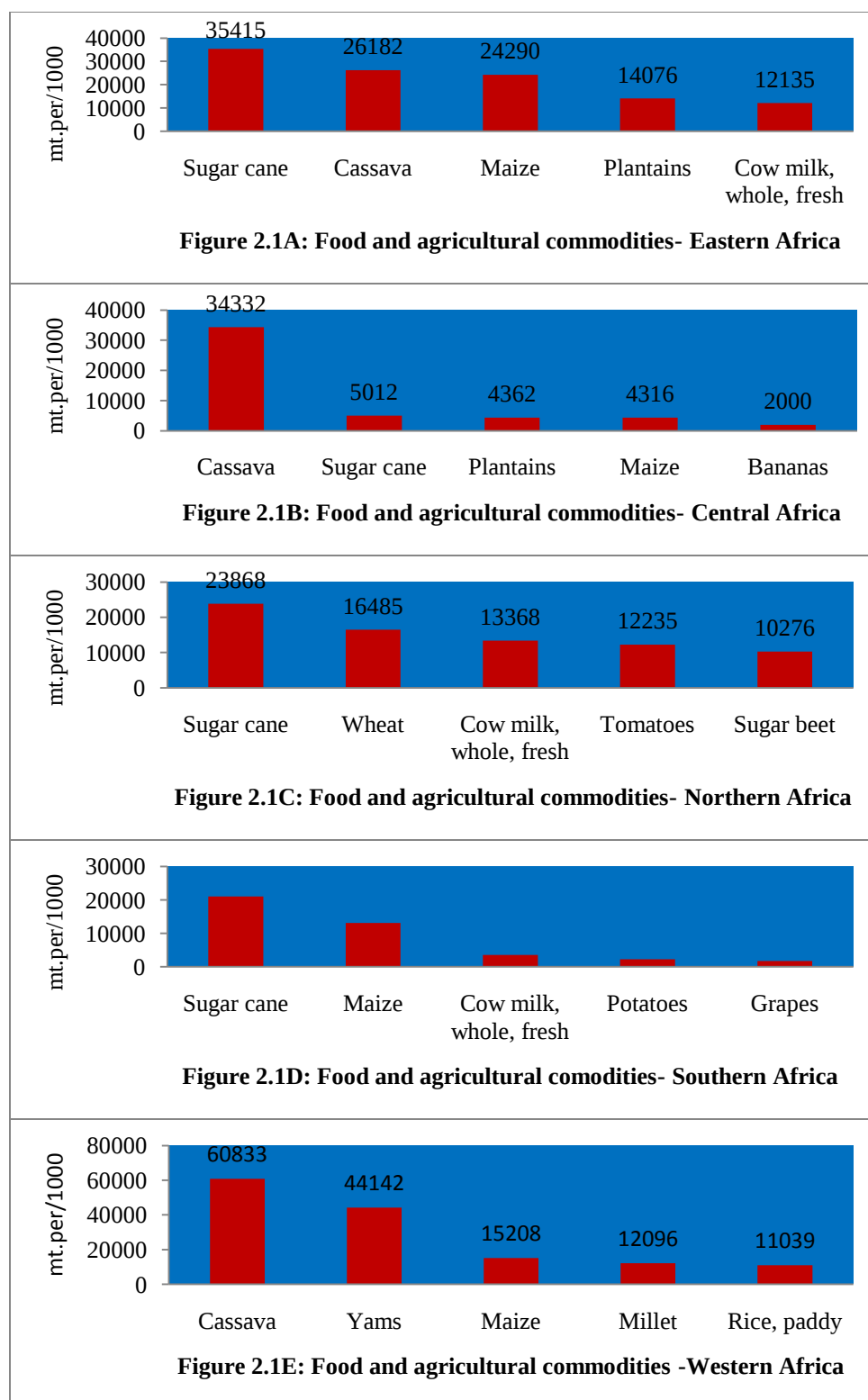


Figure 2.1: Food production in Africa

Source: FAOSTAT, 2010

Barrett (2010) states that food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern. Food security has three aspects; food availability, food access and food adequacy (Latham, 1997). Food availability relates to the supply of food. This should be sufficient in quantity and quality and also provide variety.

Food access addresses the demand for the food. It is influenced by economic factors, physical infrastructure and consumer preferences. Hence food availability, though elemental in ensuring food security, does not guarantee it. For households and individuals to be food secure, food at their access must be adequate not only in quantity but also in quality. It should ensure an adequate consistent and dependable supply of energy and nutrients through sources that are affordable and socio-culturally acceptable to them at all times. Ultimately food security should translate to an active healthy life for every individual (Heidhues, Atsain, Nyangito, Padilla, Gheri and Vallée, 2004). The illustration of the definition of food security in Figure 2.2 emphasizes the '*stability*', '*availability*' and '*accessibility*'.

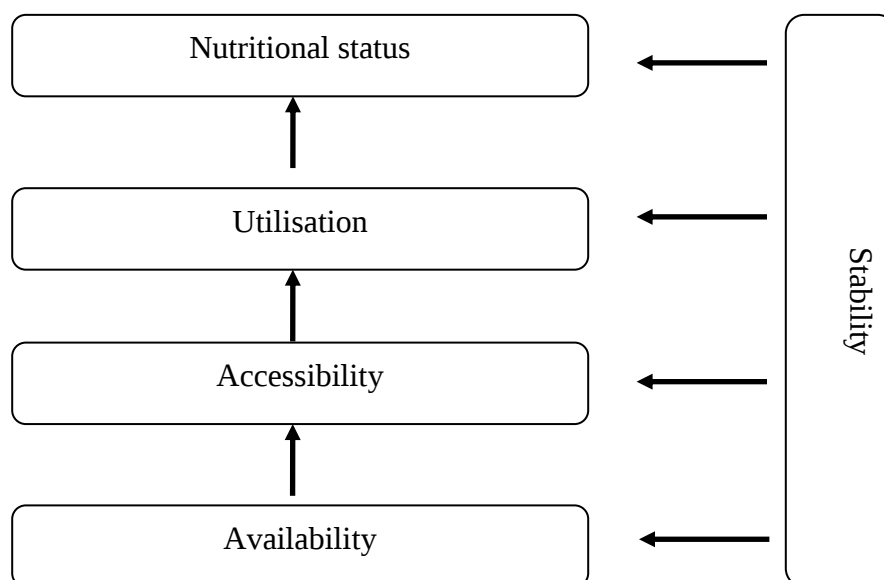


Figure 2.2. Conceptual framework of food security and nutrition

Food insecurity conversely exists when people do not have adequate physical, social or economic access to food as defined above. Food insecurity has the potential to influence food intake and ultimately the health and nutritional status of households. Over seventy percent of the food insecure population in Africa lives in the rural areas. Figure 2.3 shows the distribution of food insecurity in Africa. Ironically, smallholder farmers, the producers of over 90% of the continent's food supply, make up the majority (50%) of this population. The rest of the food insecure population consists of the landless poor in rural areas (30%) and the urban poor.

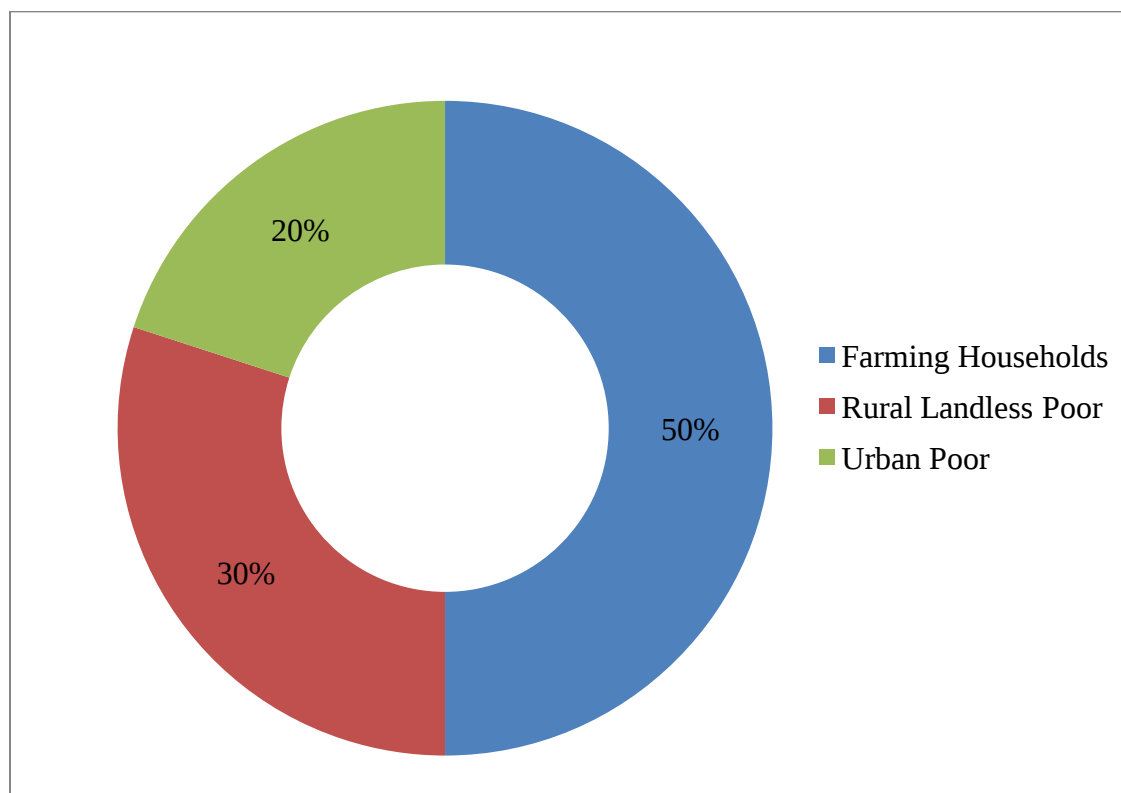


Figure 2.3: The proportion of food insecure in Africa

Source: (Heidhues *et al.*, 2004)

In developing countries over 85% of the food consumed by poor households in rural setting is obtained from the farm (IFPRI 2008). The importance of foods purchased from markets in meeting household food security depends on household food income and market price. The seasonality of foods available at the household level may highly influence food availability in places where little to no food preservation is practiced. This is the case with fruits and vegetables, which are highly perishable. Food security in poor developing countries has been

severely undermined by food price rises of recent years, especially the spike in grain prices during 2007/2008. That event graphically illustrated “that food in particular – and agriculture more generally – is not a ‘sector’ in developing countries in the same sense as energy or health, but simultaneously is a way of life, a pathway to poverty alleviation, and a primary contributor to economic welfare and political stability for the majority of the population (Voegele, 2010)

According to STATSSA (2000), about 35% of the South African population or 14.3million South Africans are vulnerable to food insecurity. Among these, women, children and the elderly are the most vulnerable. In South Africa the cause of hunger and malnutrition is not due to a shortage of food but rather an inadequate *access* to food by certain categories of individuals and households in the population (Vogel and Smith, 2002). Statistics South Africa has shown that food insecurity is not an exceptional, short-term event, but is rather a continuous threat for more than a third of the population (HSRC, 2004). The vast majority of South Africans buy their staple foods from commercial suppliers, rather than growing it themselves and are therefore dependent on having (direct or indirect) access to cash (Department of Agriculture, 2002).

2.7 The role of agriculture in the South African national economy

The South African agricultural sector is dualistic in nature. It comprises of a vibrant, well integrated and highly capitalised commercial sector on the one hand and fluctuating subsistence sector on the other hand (May and Carter, 2009; Vink and Kirsten, 2003). Agricultural activities range from intensive crop production and mixed farming in winter rainfall and high summer rainfall areas to cattle ranching in the bushveld and sheep farming in the arid regions. Maize is the largest locally produced field crop and the most important source of carbohydrates in the Southern African Development Community (SADC) for animal and human consumption. South Africa is the main maize producer in the SADC region, with an average production of about 8.9 metric tones (mt) a year over the past 10 years (DAFF, 2010). Maize is produced mainly in North West, the Free State and Mpumalanga. A total of 6.9 mt of maize was produced in 2006/07 on two million hectares of land (developing agriculture included) (DAFF, 2010). Because of the highly dualistic nature of South Africa agriculture, government has focussed attention to develop and support small-scale farming which is predominant in rural areas.

According to the 2007 commercial agricultural census (STATSSA, 2009a), there are 39 982 commercial farm units in the country, producing about 95% of the agricultural output, the overwhelming majority of which are situated on 87% of the total agricultural land. In contrast, and despite the land reform initiatives since 1995, the black subsistence and smallholder producers are predominantly settled in the former homelands and rural reserves, and produce on the remaining 13% of the agricultural land (Feynes and Meyer, 2003). During the 1990s there emerged a growing rural-urban divide. The share of South Africa's poor population living in rural areas rose from 60% to 70 % during 1995-2000 (Hoogeveen and Özler, 2005). Agriculture is an important sector for their rural livelihoods, employing one in four rural workers. However, agriculture grew only half as fast as non-agriculture during 1990-2005 (World Bank, 2008), because gains from export growth were more than offset by rising import penetration (Jooste, van Schalkwyk and Groenewald, 2003). This poor performance is undoubtedly responsible for some of the rise in rural poverty.

The total contribution of agriculture into the economy increased from R27 billion in 2001 to R36 billion in 2007. The total gross value of agricultural production for 2007/08 is estimated at R111 760 million compared to R93 390 million the previous year. However, the importance of agriculture in the overall economy has been declining over the long term. Agriculture's share of GDP fell from 20% in the 1930s to 12% in the 1960s; around 6% in the 1980s; 7% in the 1990s and less than 4% in 2000 (Jooste *et al.*, 2003). Despite agriculture's small and declining share of the economy, it remains an important source of employment. In 2003 more than a million people worked in agriculture out of a total employment of 11.5 million (Casale, Muller and Posel, 2004). Around 70% of agricultural workers are employed as labourers on large commercial farms, where they earn one-third of the national average wage. These 60,000 commercial farms occupy 87 % of total agricultural land and produce 95% of all marketed output (Vink and Kirsten, 2003). By contrast, the remaining 300,000 agricultural workers are smallholder farmers, who occupy 13% of agricultural land in the more remote regions of the country. These subsistence-oriented farmers earn less than five percent of the national average wage (Casale *et al.*, 2004). Thus, not only is there a growing rural-urban divide, but there is also a divide within agriculture. Smallholders derive much of their income in the form of subsistence production;

hence the contribution of subsistence farming to food and income security in South Africa cannot be ignored.

The three main sectors of agricultural production in South Africa are field crop production (33% of total agricultural output in 2001-03), livestock production (40%) and horticulture (27%). Overall, agricultural production is well diversified. Although South Africa has the ability to be self-sufficient in virtually all major agricultural products, the rate of growth in exports has been slower than that of imports. Farming contributes some 8% to the country's total exports. The largest export groups are wine, citrus, sugar, grapes, maize, fruit juice, wool, and deciduous fruit such as apples, pears, peaches and apricots. Other important export products are avocados, dairy products, flowers, food preparations, hides and skins, meat, non-alcoholic beverages, pineapples, preserved fruit and nuts, sugar, and wines. A number of high-growth niche markets are emerging, such as organics, herbal beverages and luxury sea foods (Jooste *et al.*, 2003).

2.8 Organic sector trends in South Africa

There are two distinct classes of organic agriculture observable in South Africa, namely certified organic production and non-certified or agro-ecological production (Parrott *et al.*, 2006). Certified production is earmarked mainly for export markets in Europe and North America, while agro-ecological farming is practiced to address challenges faced by smallholders. The organic farming sector has grown slowly but steadily over the past ten years in South Africa (Auerbach, 2003). Previously the sector was plagued by divisions, but small and large scale producers have now come together to form the South African Organic Sector Organisation. Historically, formal organic farming developed among commercial farmers mainly for the export market. At the same time, traditional farming did not use chemical fertilizers or poisons and the more progressive traditional farmers used crop rotation and fertilized their soil with kraal manure. These practices are similar to organic farming and in areas where there is an existing tradition of conservation agriculture, it has been easy to introduce organic farm management for household food security and for the commercial market (Modi, 2003).

The South African Government also now has an Organic Agriculture Policy and is forming a National Organic Commission following the report on the organic value chain, commissioned by

the Department of Trade and Industry. The industry as a whole was given a great boost in 2001 with the publication of the National Department of Agriculture's Draft Organic Standards, which are based on the EU 2092/91 Regulations, the IFOAM standards, and Codex Alimentarius. These guidelines are necessary in the face of the prevalence of Genetically Modified Organisms (GMOs) in South Africa. According to Organics South Africa (2011), the risks of using genetic engineered crops in agriculture is great and genetic modification should not be used in the production of food that is labeled safe and healthy. Organic farming has been crafted in such a way to produce food that is good for human health, the environment and the animals involved. Genetically engineered crops are not in line with this position. This point of view is shared by organic movements worldwide and consumers. Tresoldi (2011) notes that many thousands of hectares in South Africa have been planted with genetically modified (GM) crops. And because there is no proper labeling of foodstuffs, there is limited information on how much of the food consumed everyday has been genetic engineered.

The South African organic sector has a long history dating back to the 1970s. The sector had about 50 small scale organic farmers in 1990 and the first group of farmers was certified by the United Kingdom Soil Association in 1993 (Moffet, 2001). This has increased in leaps and bounds over the years. However there is lack of consensus on the number of certified organic farms (Rundgren, 2006). The available statistics focus on large commercial farms and mask the extent of the communal and subsistence farmers' involvement in organic farming. South Africa has very few cases of documented smallholder organic growers and groups. According to Rundgren (2006), South Africa has begun to appreciate the role of organic agriculture in creating incomes and generating foreign exchange for the national economy, but like many other African states, the non-financial benefits of organic farming are rarely acknowledged and recognised. The potential for organic growth in South Africa is huge, not only driven by exports, but by a growing substantial domestic organic market unlike in many other African states (GROLINK, 2002). EPOPA (2006) estimated the value of the South African organic market to be R100 million across all categories of produce a testimony to the rapid growth of this agricultural sector over the last 15 years. Many large retail chains are also actively promoting organic products, particularly those supplied by smallholders who are given very little support, but are used extensively in the retailers' advertising campaigns.

2.8.1 Domestic market of organic products

South Africa has a growing organic market with products being sold in several specialized stores and supermarket chains. Major supermarket chains such as Woolworths and Pick 'n Pay now offer a limited range of organic produce (Auerbach, 2003). Organic food can also be purchased at health food stores and at craft markets such as the Michael Mount organic market in Bryanston, Johannesburg. Wensleydale organic farm outside Johannesburg offers an organic fruit and vegetable delivery service direct to the public. In KwaZulu-Natal farmer markets include: Amphimarket in North beach, Karkloof farmers' market in Howick, Pietermaritzburg farmers market in Pietermaritzburg and Shongweni farmers and crafts market in Assegai (GROLINK, 2002). Some other large supermarket chains, Hyperama and Shoprite Checkers for instance, are planning to introduce an extensive organic product range. Because there are no implemented national standards on organic agriculture, labelling of products is not controlled (EPOPA, 2006). Regarding the price policies, domestic sales do not benefit from price premiums at the moment; so many farmers want to move quickly to exports. Production includes cereals, fruit and vegetables, herbs, teas and wines. Some companies already export to the European Union, and several others are starting to export (Yussefi and Willer 2009).

2.8.2 General consumer trends

The growth in organic agriculture has been paralleled and promoted by the public's increasing awareness of health and lifestyle issues. Following the major global trends in food consumption, consumers' focus on health, convenience and the growing impact of private supermarket labels (ACNielsen, 2006) are taking stance in the South African context. Health foods are usually associated with a price premium which only wealthier consumers can afford. However, the movement towards healthy staples in the form of consumption of larger quantities of fruit and vegetables, which is a more affordable health movement, is the fastest growing health activity across all the consumer wealth groups in South Africa (ACNielsen, 2005). Despite the food trends in South Africa, there are not yet strong alternative food quality movements. However, there is a small but growing interest especially for organic food and free range produce and food purchased at local markets (Farmers Weekly, 2006). Even though wealthier consumers are the

main target group for alternative quality foods (mainly due to the price premium associated with the products); there is a movement among less wealthy consumers to spend on selected luxury items within their budget constraints. Furthermore, the emerging middle class is a large portion of the population and is moving into wealthier consumer groups over time. South Africa's growing middle class has the income, education and potential interest in alternative quality food products and could contribute to further growth in these markets, especially for the organic food sector in South Africa, thus constituting a significant target group for organic produce retailers (Mawson, 2007; Business Day, 2007).

Hartman (2006) concedes that furthering the education and awareness experience, consumers with medical conditions such as cancer, actively seek organic produce, irrespective of certification status. These consumers usually purchase produce directly from producers at farmers' market, where trust and consistent supply are more significant than the need for certification. It is also apparent that parents of young children are becoming increasingly aware of the health risks associated with non-organic and processed / refined foods, and consequently seek organically grown food, irrespective of the certification status thereof (Thompson and Kidwell, 1998).

2.8.3 Inspection and certification of organic products marketed domestically

The South African organic sector receives support from a number of organizations such as the African Organic Farming Foundation (AOFF). AOFF aims to introduce organic agriculture and its benefits, such as improved nutrition, job creation, poverty alleviation, environmental protection and trading opportunities to resource-poor rural communities in South Africa (AOFF, 2004). This is one of a number of attempts by formal business to include this sector of the population in organic production. Others include the establishment of certified grower groups of small-scale farmers, who have supplied their produce into the mainstream domestic organic market (EPOPA, 2006). There are eight different certification bodies active in South Africa for both domestic and international market. Two local certification bodies include AFRISCO associated with Ecocert and the Biodynamic and organic certification Authority (BDOCA), both of which certify exports to Europe, North America and Japan (Parrot *et al.*, 2006). AFRISCO is

also a member of the International Federation of Organic Agriculture Movements (IFOAM). IFOAM is the worldwide umbrella organization for the organic movement, uniting more than 750 member organizations in 116 countries.

The BDOCA was set up by the Biodynamic Agriculture Association of South Africa, mainly to certify organic farmers to the draft national standards and also to provide biodynamic certification. Both bodies certify for the domestic market according to the New Draft Regulations on Organic Production developed by the National Department of Agriculture, Forestry and Fisheries, (DAFF, 2010a). There is, therefore, no legal requirement for produce sold as organic to be certified in South Africa. However, the two supermarkets that sell organic produce, Woolworths and Pick n Pay, only accept certified produce, in practice most if not all produce labelled as organic is likely to be organic. Many other chains and stores sell organic food, but mostly do not question the organic label (GROLINK, 2002).

2.8.4 Smallholder group certification guidelines

AFRISCO is particularly concerned to promote organic production amongst smallholders in South Africa and the rest of the southern African region and thus to improve both the ecological conditions, and rural employment and incomes. It promotes organic production among small-scale emerging farmers by providing training providers with non-remunerated guidance on the principles of organic production (AFRISCO, 2011). There has been a lot of work in recent years on standardising the rules for internal controls systems (ICS) for organic smallholder farmers. The rationale for an ICS is to bring down the cost of organic certification to smallholders by establishing a group that can do much of the monitoring itself. IFOAM (2005) argues that participation of smallholder farmers in organic farming is only feasible under group certifications. However, it is important to clarify the definition of ‘smallholder’ and ‘smallholder group’ as they carry different meanings across different countries.

The term ‘smallholder’ differs between countries and varies from one geographical location to another. The majority of sub-Saharan population living in rural areas can be considered as smallholders mainly because of their limited resource endowments relative to other farmers in

the same sector (Dixon, Taniguchi, Wattenbach and Tanyeri-Arbur, 2004). The size of land holdings also varies between countries and farming systems and is normally less than one hectare in areas with high population densities (Cotula, Vermeulen, Leonard and Keeley, 2009). Despite small farm sizes and poor resources endowments having often been regarded as the hallmarks of a smallholder, differences also exist with regard to household expenditure pattern, use of external labour, resource allocation, cash crop production, livestock ownership, off-farm activities and proportion of produce sold (Vermeulen and Cotula, 2010).

In the South African context, smallholders are commonly classified as subsistence, emerging, or commercial farmers (Cousins, 2010). As a proportion of total farmers in South Africa, subsistence farmers are the majority and commercial farmers a minority with emerging farmers, those with a desire to produce on a commercial scale, sandwiched in between (Aliber, Baipethi and Jacobs, 2009). The vast majority of South African smallholders come from a historically disadvantaged background. Since farm land sizes varies from country to country, IFOAM (2003) precludes the use of farm size in defining a smallholder, relying instead on a matrix of eight criteria (Table 2.1) of which at least six criteria must be satisfied before a farmer can be classified as a smallholder for organic certification purposes. Table 2.1 also presents the criteria used in qualifying a smallholder farming group for certification purposes. Only qualifying smallholders are permitted to form an organic smallholder farming group.

Table 2.1: Criteria used by IFOAM to define smallholders and smallholder farming

Smallholder criteria*	Smallholder farming group criteria
▪ Use of low-technology based production system ▪ Farming system dependent on family labour ▪ Farmer has limited capacity to market his or her own crop ▪ Farmer has limited capacity for farm administration ▪ Farmer has limited capacity to communicate in the language of the organic certifying agent ▪ The farm has limited storage and or storage capacity ▪ The farm's average annual income from the certified product is below approximately 5 000 United States dollars taken over a number of years (e.g. 5 years) ▪ The farm would spend over 2 per cent of commodity export value on external inspection when not certified in a group (taken over a number of years e.g. 5 years).	▪ The cost of (individual) certification must be disproportionately high in relation to the sales value of the product sold. ▪ The farm units are mainly managed by family labour. ▪ There must be homogeneity of members in terms of geographical location, production system, size of the holdings, and marketing system. ▪ No maximum amount of hectares per farmer is set. ▪ Minimum size of the group is dependent on the situation, but must be large enough to sustain a viable Internal Control System. A practical guideline is a minimum of 30 to 50 smallholders per group. ▪ Maximum size of the group is decided by the group and depends on the group's structure, capacity, and communication system. It is an element in the risk assessment process.

*The criteria can be adjusted by certification bodies to suit local conditions provided

According to IFOAM (2003), the smallholder farming group criteria shown in Table 2.1 must be supplemented with information about the general description of the operator, which must define the type of producer organisation (like co-operative, association, exporter with producers on contract). The smallholders' farming units must be clearly identifiable under a clear administrative system and there must be a clear relationship between the group's central administration and the smallholders.

2.8.5 Internal control systems for certified organic smallholder groups

The development of systems worldwide by smallholder groups in association with certification bodies to ensure compliance with organic standards started long before government regulations were introduced. One of the cornerstones of group organic certification is the establishment of an Internal Control System (Augstburger, Eisenlohr, Rüegg and Wilhelm, 2002). IFOAM (2003) gives the following definition of an Internal Control System:

“An Internal Control System is a documented quality assurance system that allows the external certification body to delegate the annual inspection of individual group members to an identified body/unit within the certified operator. (As a consequence, the main task of the certification body is to evaluate the proper working of the Internal Control System.)”

The Internal Control System must have an operator (legal form), a group production unit (for which the operator is responsible) when smallholders produce collectively and a farming unit or area, organic and or non-organic for which individual group members are responsible when production is done individually (Augstburger, Eisenlohr, Rüegg and Wilhelm, 2002). The rationale for an Internal Control System is to reduce the cost of organic certification to smallholders by establishing a group that can do much of the monitoring itself. Then the certifier's job is to ensure that group processes and data collection are working well and to check regularly on a sample of the farms. According to IFOAM (2003), the basic elements of an Internal Control System are a documented description of the Internal Control System, a documented management structure, a responsible manager, internal regulations (production standards, and sanctions), conversion rules, a contract between the group and the certification body (e.g. AFRISCO), identified internal inspectors, and training of personnel including the manager, internal inspectors, producers and handlers.

IFOAM and FLO (2001) state that at household level, growers should have formal commitment, field records, and maps for each farm, annual inspection protocols, and a farm inspection report/form completed for each farm. An internal approval committee evaluates prospective members. The certified group should show a commitment to use internal sanctions, keep a

regularly updated growers' list, assess risk, employ community surveillance, and document post-harvest procedures, including product flow and quantities (IFOAM, 2003). These measures suggest that smallholders will need external help in starting up and abiding by the IFOAM requirements.

Of the 5 per cent of agricultural land certified organic in South Africa, the proportion of land farmed by smallholders remains unknown (Rundgren, 2006). KwaZulu-Natal, apart from being one of the main agricultural provinces of South Africa, has also been home to the country's first organic groups known to be either fully certified or in the process of becoming certified (Gadzikwa, Lyne and Hendriks, 2006). As of 2004, only a handful of grower organic groups existed such as EFO with 151 members, Vukuzakhe Organic Farmers Organisation (VOFO) with 40 members and Makhuluseni Organic Farmers Organisation (MOFO) with 41 members, all in KwaZulu-Natal. Northern Cape has Heiveld Co-operative with 42 members growing rooibos tea individually. EFO was established in 2001, while VOFO and MOFO were both established in 2003. EFO members produce independently, but market collectively, whereas VOFO and MOFO members produced and marketed vegetables collectively (Gadzikwa *et al.*, 2006).

2.9 Consumer awareness and knowledge about organic products

Interest in organically produced food is increasing throughout the world in response to concerns about intensive agricultural practices and their potential effect on human health as well as on the environment (Roitner-Schobesberger, Darnhofer, Somsook and Vogl, 2008). Thus, the promotion of organic agriculture constitutes an important option not only for producers but also to respond to consumers' desire for higher food quality and food production that is less damaging to environment systems. Understanding the types of consumers who purchase organic produce is particularly important for growers, processors, and retailers since organic produce has long been considered a 'gateway' product with consumers often entering the organic market by first purchasing organic produce and subsequently widening their purchases to include other organic products (Hartman 2004, 2006).

In this context, a consumer-oriented analysis of organic foods is of paramount importance to policy makers. For them, to have a clear understanding of consumers' organic food purchase decisions and the factors explaining consumers' decisions to buy organic foods would be very relevant in order to help them to define the organic market and promote organic food and healthy lifestyles.

Studies that investigated the level of consumer awareness and knowledge about organic foods include Cunningham (2002), Demeritt (2002), Hill and Lynchehaun (2002), Kenanoğlu and Karahan (2002), Øystein, Persillet and Sylvander (2002), Compagnoni, Pinton and Zanolli (2000), Environics (2001). A critical review of these studies suggests that overall there is some consumer awareness about organic foods around the world. This awareness is high especially in Western Europe, where the organic market is relatively well developed, compared to other regions of the world. Although there is general consumer awareness around the world, the literature also suggests that consumers have inconsistent interpretations about what is 'organic'. Jolly, Schutz, Diaz-Knauf and Johal (1989) found that respondents associated organic produce with no pesticides, no artificial fertilizer, no growth regulators, and residue-free products. In a more recent study for the UK, respondents described organically produced food as one that is more natural and healthy, compared to conventional food (Hill and Lynchehaun, 2002). Although consumers typically understand the general issues associated with organic farming, many tend not to understand the complexities and niceties of organic farming practices, and the associated quality attributes (Hill and Lynchehaun 2002). This hypothesis by Hill and Lynchehaun (2002) helps to explain why some studies like Hutchins and Greenhalgh (1997) and Wolf (2002) reported confusion and/or inconsistencies with consumers' understanding of the organic concept.

Many organic consumers identify organic products based on the organic logos and/or labels attached to the product. Indeed, several studies (Øystein *et al.*, 2002; Wessells, Johnston and Donath 1999) have found a positive relationship between consumer purchase decisions and organic product labelling. Consumers generally perceive an organic label as assurance that the product is organic. More accurately, organic food labels help transform the credence characteristics of such products into search attributes, thereby allowing the consumer to better

evaluate quality before deciding to buy the product (Caswell, 2000). Thus, deceptive or inaccurate labelling can convey the wrong signals to prospective buyers.

It is important to note that knowledge and awareness about organic products may not necessarily translate into direct purchase because of barriers that could limit the ability of consumers to transform such knowledge and perceived demand into actual demand. This is partly because many potential organic consumers, especially in Western industrialized countries, are sceptical about organic labels (Giannakas, 2002); stemming from reported cases of mislabelling (Landay, 1996), and misrepresentation of conventionally produced food as organic (Gregory, 2000). Furthermore, in regions of the world where the organic agriculture sector is not well developed, and the process of organic certification and standardization is not uniform, few truly believe in the organic label (Wang, Halbrendt and Webb, 1997). Thus, although informed consumers may want to purchase organic products, scepticism about the true organic attributes may hold them back from doing so.

Demeritt (2002) argues that consumer knowledge and awareness will continue to be important in the organic food market in two respects. First, there is still a segment of the potential market that is not yet informed about organic foods. A second dimension to the knowledge and awareness puzzle is the possibility that those who do not consider organic products may have a general knowledge about them, but do not have enough detailed information to clearly differentiate the unique attributes of organic from conventionally grown alternatives.

2.10 Consumers preference and purchase of organic products

Several consumer studies have been undertaken to assess consumer preference for organic products (Demeritt, 2002; Wolf, 2002). The empirical papers analysing the factors affecting consumers' purchase decision for organic foods found that the main reasons why consumers buy organic food products include the health and environmental attitudes of consumers, the production origin of the product (local), consumers' economic characteristics and, to lesser extent consumers' socio-demographic characteristics. In particular, consumers' health attitudes have been found to be significant in explaining consumers' organic purchases (Padel and Foster,

2005). Moreover, consumers' environmental attitudes are factors determining consumers' purchase of organic foods (Verhoef, 2005). In general, it can be said that the more favourable health and environmental attitudes consumers have, the more likely they would buy organic food product and with higher intensity.

While income has been found to be a factor in explaining organic food purchases in some empirical studies conducted in Europe (Tsakiridou, Konstantinos and Tzimitrakalogianni, 2006), income has not been statistically significant in determining organic food purchases, according to studies carried out for USA consumers (Zepeda and Li, 2007). Socio-demographic characteristics were found to be significant in explaining the decision to buy organic foods (Zepeda and Li, 2007). Tsakiridou *et al.* (2006) stated that that older, more educated consumer and those living in larger households are more likely to buy organic food products.

Organic product knowledge is also an important factor because it represents the only instrument that consumers have to differentiate the attributes of organic products from those of conventional ones, and to form positive attitudes and quality perceptions toward these products. According to Kuhar and Juvancic (2005) organic knowledge is determined by various socio-demographic characteristics, lifestyles and information on organic products available on the market.

The framework presented in Figure 2.4 reflects the factors affecting consumers' attitude and willingness to purchase. Consumers' willingness to purchase is affected by exogenous factors like processing, packaging, certification and labeling and consumers' knowledge and awareness about the products. If an individual cannot clearly differentiate between two alternative products, a price premium on the organic product can confuse and/or affect the individual's purchasing decision. Consumers' education, occupation, household size along with product attributes affects their attitude and preference to buy the products. These factors further depend on consumers' household income and product price to make a decision for purchase (Figure 2.4).

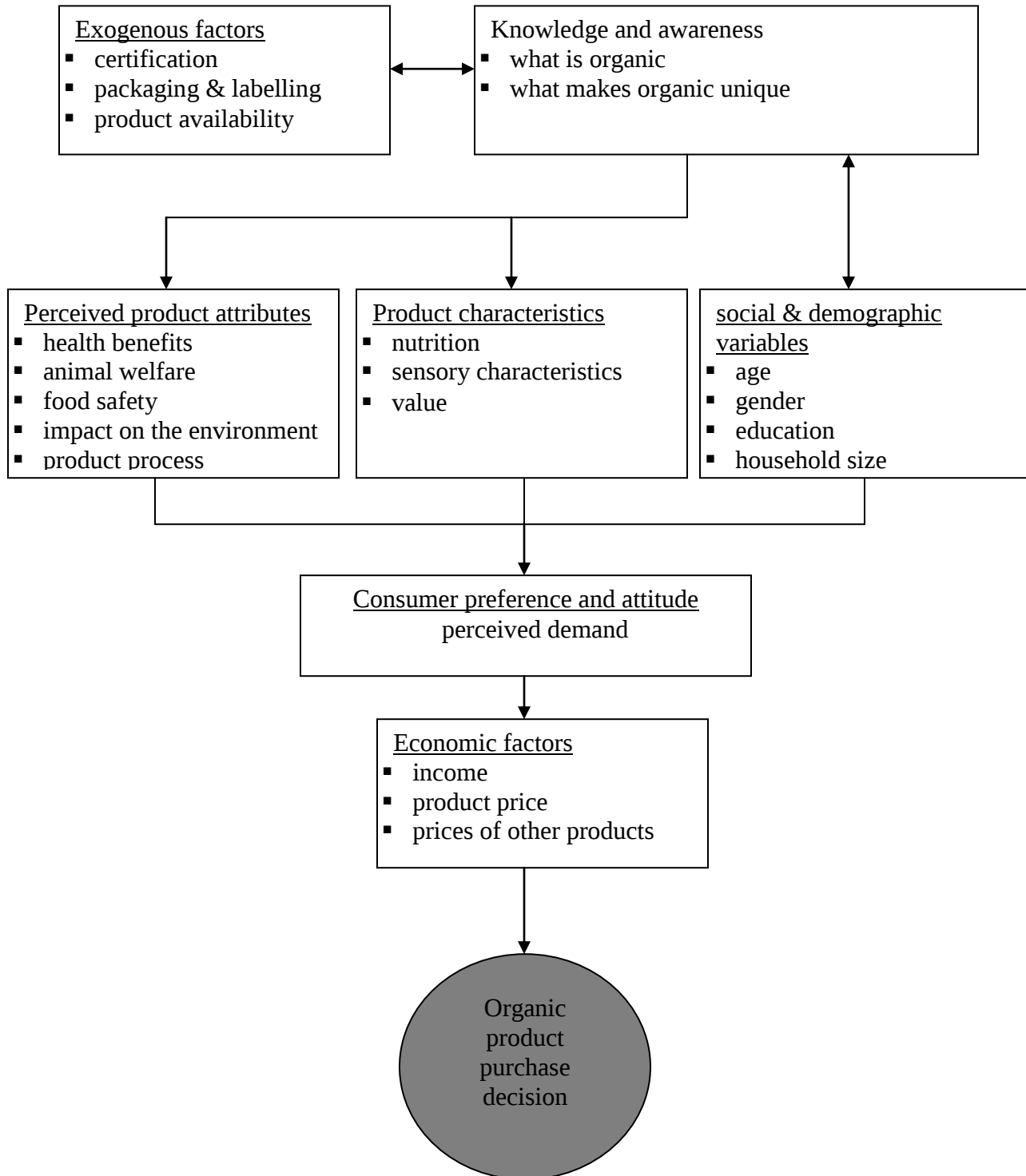


Figure 2.4: Framework of factors affecting organic consumer attitudes and purchase decisions (Adapted from Bonti-Ankoma and Yiridoe, 2006)

2.11 Chapter summary

Food and nutritional security remain an issue of major concern globally especially in developing countries. The global food and agricultural crisis which resulted in a sharp rise in food prices in 2007- 2008 further exacerbated the situation of the vulnerable and drew attention to the imperative to examine alternative food production questions. Ultimately the crisis highlighted the fragility of the supply/ demand balance. The cause of the food crisis was attributed to among other factors, increased global demand, rising fuel prices, crop failure and financial speculation.

As rapidly rising food prices threaten food security and the poverty gains made by developing countries, many have blamed declining funding for agricultural technology development for this state of affairs. DFID (2007) argues that there has been a tremendous effort by the donor community in investing in agricultural productivity and agricultural research in Africa with focus on the adoption of sustainable approaches but that the results have been less than remarkable compared with similar levels of investment in Asia. The question therefore is will investments in agricultural technology be sufficient to ensure long-term productivity growth in the farm sector and, more importantly, for rural poverty reduction? This leads to the analysis of the response to the crisis which included among others: the need for sound economic and agricultural policies, boosting of smallholder food production and investment in sustainable agricultural innovations with emphasis on developing rural areas.

Agriculture's contributions to the food supply, foreign currency earnings, provision of employment, supply of raw materials to other sectors and its role as a market and contributor to the gross domestic product (GDP) in Africa and SA are briefly explained, followed by a discussion of the impact made on the economy as a whole. The role of smallholder and subsistence farming in South Africa is explored. There is a need to significantly increase the productivity of subsistence/smallholder agriculture and ensure long-term food security. This can be achieved by encouraging farmers to pursue sustainable intensification of production through the use of sustainable methods of farming. The identification of organic agriculture as a development pathway, leading to improved livelihoods, is based on a central assumption that

decreased use of external inputs, combined with price premiums for products will provide economic gain which can improve aspects of farmer's livelihood.

Organic sector trends in South Africa show that the organic industry in country is fast growing. According to GROLINK (2002), South Africa, contrary to other Sub-Saharan countries has a substantial domestic market for organic products. This has been as a result of an increasing demand for food as well as changing consumer preferences towards more health and environmental awareness. Organic certification is mainly organized under group certification systems, using an internal control (management) system and guidelines by IFOAM. Consumer awareness of organic food is the first step in developing the demand for organic products. Yet awareness does not always translate to consumption. Given the potential importance of organics, understanding consumer awareness and purchase decisions as well as the associated socio-economic and demographic characteristics of consumers contributes to increased awareness and consumer demand.

CHAPTER 3

AGRICULTURAL TECHNOLOGY ADOPTION

3.1 Introduction

The focus on investment in agricultural productivity and research in Africa has focussed on the adoption of sustainable approaches such as organic agriculture. Its identification as a developmental pathways aims to improve rural livelihoods. This chapter reviews relevant literature on agricultural technology adoption behaviour and diffusion, presenting studies that analyse organic farming adoption and its determinants. It commences with the basic concepts and theoretical foundation of technology adoption delving into the adoption/ diffusion model as studied by several economist, anthropologists, sociologists, educationists and marketers. A critique is given of the factors affecting adoption of agricultural technologies and the findings of various studies with reference to organic farming are presented. The mode and sequence of agricultural technology adoption is examined as are the barriers to technology adoption as outlined by various authors. Finally the different measurement approaches to technology adoption are examined.

3.2 Basic concepts and theoretical foundation of technology adoption

The term “adoption” refers to the process an individual passes through since he or she first hears of an innovation (technology) until it starts to be used on a continuous basis (Rogers, 2003; Gatignon and Robertson, 1991). Mahajan and Peterson (1990) define a technology as any idea, object or practice that is perceived as new by the members of a social system. Innovations are classified into product and process innovations. A product innovation is an end product for consumption while a process innovation is an input to a production process (Rogers, 1983). The agricultural technology considered in this study falls in the second category. In this study the terms technology and innovation are used interchangeably. A social system is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. A social system encompasses individuals, organisations, or agencies and their adoption strategies (Knudson, 1991; Rogers, 1983).

A distinction must be made between the individual adoption by a firm or farmer and the aggregate adoption or diffusion. Feder, Just and Zilberman (1985) defines the level of adoption as the degree or intensity with which a new technology is used when the farmer has complete information about it. Such intensity can be measured as the amount of use of that technology or as whether the farmer uses or not the technology. Adoption is the outcome of a dynamic decision-making process that includes learning about the technology through the collection of information or the experimentation (Feder, Just and Zilberman, 1985).

The term ‘diffusion’ refers to the level of aggregate adoption of a given technology or innovation within a social system in a specific moment in time. The proportion of adopting individuals or firms is a measure of the degree of spread or diffusion of that technology in that moment (Karshenas and Stoneman, 1995; Feder and Umali, 1993). Most studies on the issue analyse the pattern of the aggregate adoption over time to identify the specific trends in the cycle of the diffusion of the technology. The effect of technological change on the state of this system depends, finally, on the degree to which innovations are transmitted, with technological change being the main contributor to economic growth (Stoneman, 1986) Thus, it is important, from a policy perspective, to understand which factors affect the adoption rate of a particular technology.

The economic literature on technological innovation adoption has developed along two different lines to explain why some farmers adopt while others do not. One path uses individual-level discrete choice models (Moreno and Sunding, 2005; Foltz, 2003) while the other uses aggregate models describing the adoption process of a technology and its possible future evolution (Knudson, 1991; Fishelson and Rymon, 1989). Conceptually, the latter are just an aggregation of the former, over individuals and time.

Technologies play an important role in economic development (Caerteling, Di Benedetto, Dorée, Halman and Song, 2011; Wang, Chien and Kao, 2007; and Martins and Marques, 2006). In agriculture, among the most frequently advocated strategies for climate adaptation and economic development is technology research and development (Rosenberg, 1992; Houghton, Jenkins and Ephraim, 1990). There is a strong belief in the ability of technology to continue to provide

farmers with the needed strategic and tactical options for handling future environmental problems and uncertainties (Bidabadi and Mashemitabar, 2009; Popp, 2006). Such views are understandable, given many well-documented examples of induced innovation in agriculture, where progress in basic research and technology development has been linked to economic and social stimuli (Hayami and Ruttan, 1985). Induced innovation is one of the foundational economic theories of technical change. First proposed by Hicks (1932), it asserts that changes in relative prices of factors are expected to induce development and implementation of new technology to save relatively more expensive factors. It explains the nature of technical change by justifying impacts of research investments and provides a systematic theoretical basis for productivity growth. Since empirical research on the Induced Innovation Hypothesis (IIH) (Hayami and Ruttan, 1970) began it has been tested in many countries and industries.

Technological change can lead to productivity growth by either expanding the total output or increasing application of the relatively cheap inputs and trimming down use of the more or less expensive inputs. The direction of technological change in agricultural production has been the subject of intense research efforts over the last thirty years (Huffman and Evenson, 1993). This topic is frequently studied in two different ways. One is to consider the effects of investment in research and development on technological change (Alston, Craig and Pardey, 1998; Evenson, 1993; Evenson and Mckinsey, 1991). The other is to explain technological change by testing the induced innovation hypothesis (Baldi and Casati, 2005; Hockmann and Kopsidis, 2005; Clark and Youngblood, 1992; Kawagoe, Otsuka and Hayami, 1986; Binswanger, 1974; Hayami and Ruttan, 1970; Hicks, 1932).

In adoption studies, diffusion refers to the rate of adoption and communication of a technique or an idea through certain channels over time among the members of a social system. It has been widely studied by economists, sociologists, anthropologists, educationalists, and marketers (Rogers, 2003; Ruttan 2001, 1996; Guerin and Guerin, 1994; Feder and Umali, 1993). The first important adoption study in agriculture was Ryan and Gross's (1943) article that examined the adoption of hybrid corn seed in the United States. They found that the adoption process began with a small number of farmers who adopted hybrid corn soon after it was released (whom they labeled "innovators"). From these farmers, the innovation diffused to other farmers from

interaction with the original adopters and the spread of information. Ryan and Gross also found that the rate of adoption of hybrid seed corn followed an S-shaped curve (Figure 3.1), and that there were different types of adopters at different stages of adoption (Figure 3.2).

Figure 3.1 illustrates adoption over time. Typically, the adoption rate of an innovation goes through a period of slow, gradual increase before experiencing a period of relatively dramatic and rapid growth. Cumulative adoption described with the S-shaped curve results from the fact that only few farmers adopt the new technology in the early stage of the diffusion process (Rogers, 1962). At this stage, only a minority of farmers has acquired full information about the potential advantages of the technology, hence the pace of adoption is slow. Moreover, fear of possible risks associated with the new technology enhances farmers' reluctance to adopt. However, the degree of risk reduces as more farmers adopt, so that the rate of adoption increases. Adoption increases gradually and begins to level off, ultimately reaching an upper ceiling.

Obviously, not all individuals in a social system adopt a technology at the same time and based on that, Rogers (1962) divided adopters into five adopter groups: innovators, early adopters, early majority, late majority and laggards. In describing the characteristics of these groups, he suggested that differences exist between adopters at different stages of the distribution curve. Figure 3.2 depicts a stylized normal distribution of the types of adopters grouped into the five categories: innovators, early adopters, early majority adopters, late majority, and laggards. On one extreme of the distribution are the innovators who adopt an innovation very early in the diffusion process. On the other extreme are the laggards who resist adopting an innovation until rather late in the diffusion process, if ever (Rogers, 2003).

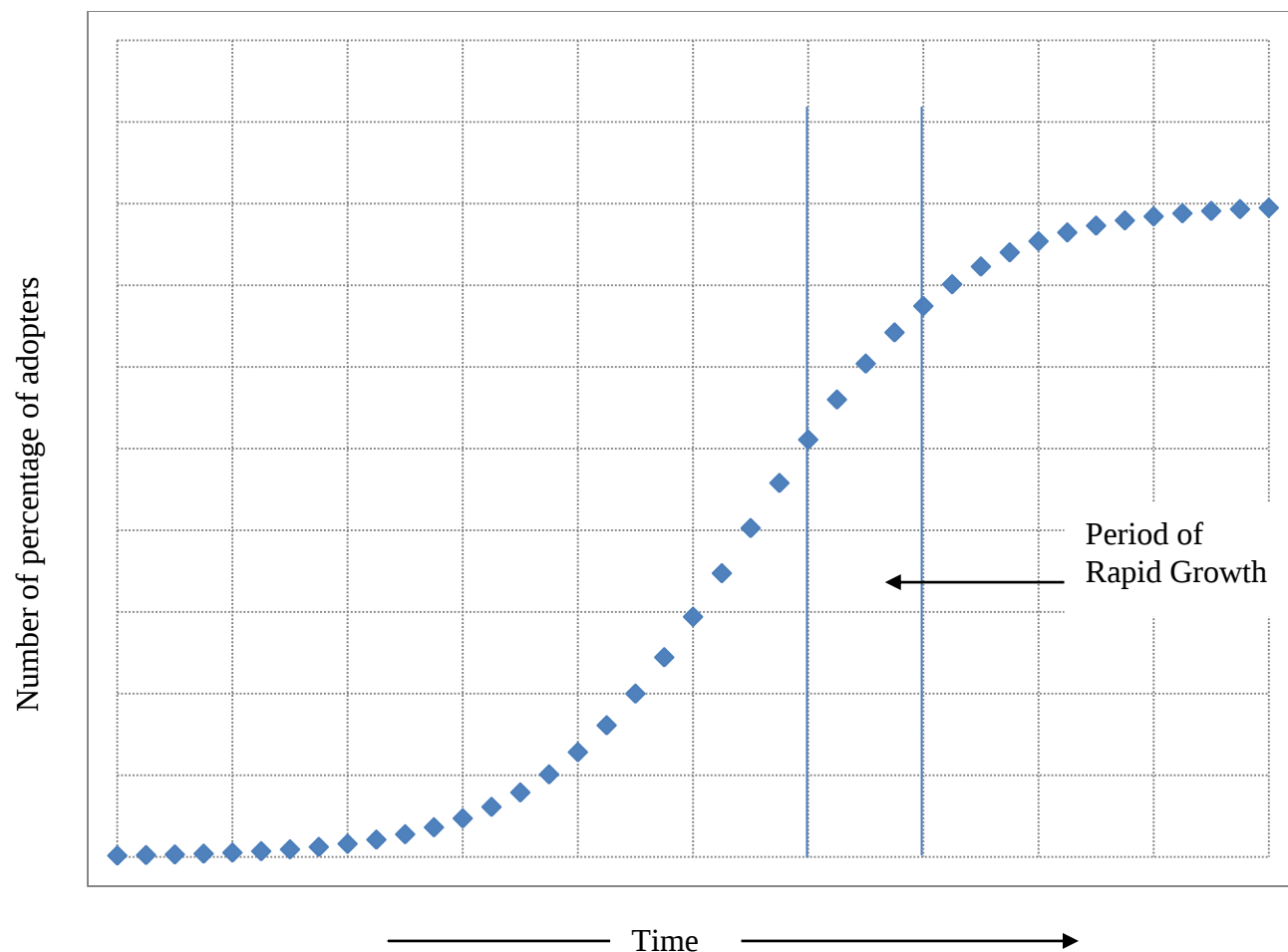


Figure 3.1: S-Curve of adoption over time

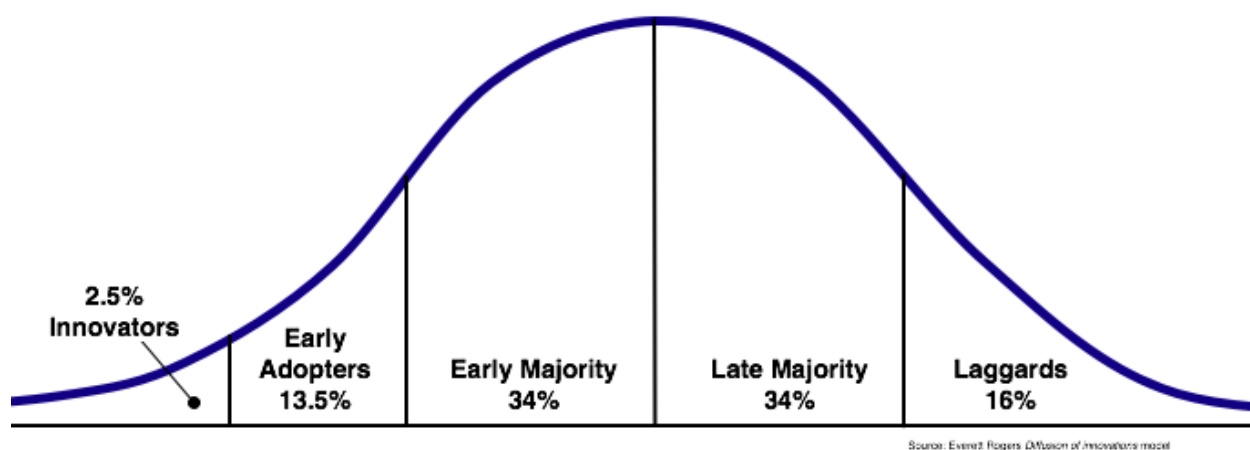


Figure 3.2: Categories of adoption over time

Since Ryan and Gross's (1943) original study, there have been many theoretical models that have studied the adoption of agricultural innovations (D'Emden, Llewellyn and Burton, 2006; Morrison, 2005; Rogers, 2003; Fuglie and Kascak, 2001; Abadi and Pannell, 1999; Pannell, 1999; Shampine, 1998; ; Fischer and Arnold, 1996; Knudson, 1991; Feder and Slade 1985, 1984; Lindner, Pardey and Jarrett, 1982; Beal, Rogers and Bohlen, 1957; Griliches, 1957;). Much of the early research into agricultural innovation tended to focus on farmers who adopted innovations early. General conclusions from such research were that these farmers (as compared to non-adopters) tended to be younger, more educated, more cosmopolitan, have higher incomes, have larger farm operations, and be more reliant on primary sources of information (Stephenson, 2003). Griliches' (1957) seminal economic study of the diffusion of hybrid corn linked adoption with profitability and rejected the influence of many sociological variables thought previously important. To illustrate in more detail the categories of adoption suggested by Figure 3.2, Table 3.1 describes the "typical" profile of different types of adopters.

Table 3.1: Description of farmer adoption groups

	Innovators	Early adopters	Early majority	Late majority	Laggards
Personal characteristics	Most educated, younger than average, highest net worth	Higher than average education, younger than average, not necessarily younger than innovators, with larger operations	Above average education and age, medium net worth	Less educated than average, older than average, less than average net worth	Least educated, oldest, and lowest net worth
Risk preferences	Can afford and do take calculated risks	More willing to take risks than average farmer	Must be sure idea will work before adopting. Has more limited resources than earlier adopters	“Skeptical,” overwhelming pressure from peers needed before adoption occurs	Most risk averse of all farmer groups
Position in the community	Respected for being successful, but sometimes ridiculed by neighbors	Provide a disproportionate amount of community leadership and are respected as a good source of new farm information by neighbors	Generally not elected leaders, but may have informal leadership. Lots of people talk over ideas with them. May look to early adopters	Take few leadership roles and do not participate in many activities outside of the community	Semi-isolated
Attitude to social norms	Largely ignores neighborhood pressure	Willing to be opinion leaders	Highly value the opinions their neighbors and friends hold about	Skeptical of new ideas, need overwhelming peer pressure	“Traditional,” oriented to the past

			them	before adopting	
Organizational memberships	Frequently belong to organizations at the county, regional, state, or national level. Often have informal contacts outside community	Participate more than average in community groups (e.g., churches, etc.) and in government extension activities	Less active in formal groups than innovators or early adopters, but more active than later adopters. Do attend extension meetings and demonstrations	Participate less actively in formal groups, but form the bulk of membership	Participate least actively in formal groups, coops, and government agency programs. Suspicious of extension agents and agriculture Sales people

Sources: Morrison (2005), Wejnert (2002) and Rogers (1962);

3.3 Factors affecting adoption of agricultural technologies

Technological change has been a major factor shaping agriculture in the last 100 years (Cochrane, 1979; Schultz, 1964). The uptake of new technologies or farming practices has attracted considerable interest over the years. Hence, there is a vast literature on the adoption and diffusion of technologies in agriculture (Feder *et al.*, 1985). Nevertheless, the majority of these studies tend to focus on the classic comparison between adopters and non-adopters of a technology (e.g. Dadi, Burton and Ozane, 2004; Burton, Rigby and Young, 2003; DeSouza, Young and Burton, 1999), with very few empirical studies investigating differences between early and late adoption of new technologies in general and organic farming in particular.

In order to understand what causes or constrains the adoption of new technologies, several researchers have examined the influence of various determinants on adoption decisions. Hence, there is a vast literature on technology adoption in agriculture. However this is mainly based on the classic comparison between adopters and non-adopters (e.g. D'Emden *et al.*, 2006; Dadi *et al.*, 2004; Sheikh, Rehman and Yates, 2003; Feder and Slade, 1984). Compared to the large amount of literature on technology adoption, few empirical studies distinguish between early and late adopters, despite differences among adopter groups over time being well acknowledged in the literature (Feder *et al.*, 1985). One of the few examples is a study by Barham, Foltz, Jackson-Smith and Moon (2004). The authors explore agricultural biotechnology adoption of Wisconsin dairy farmers and distinguish among non-adopters, early, late and dis-adopters. Their results show, for example, that attitudes toward the technology and location are linked to early adoption, while farm size and complementary technology are important factors for all adopter groups. Further, Diederer, van Meijl, Wolters and Bijak (2003) considering a range of innovations, investigate differences between innovators, early adopters and laggards utilising Dutch data. The findings of this study indicate that structural and socio-demographic characteristics explain the difference in adoption behaviour between early and later adopters, while information gathering and active

involvement in the development of the new technology explain differences between innovators and early adopters.

So far, the only empirical contributions looking at early and late adopters of organic farming are by Best (2008) and Flaten, Lien, Ebbesvik, Koesling and Valle (2006). Flaten *et al.* (2006) compare farm and farmer characteristics, as well as goals and motives of Norwegian early, mid and late adopters of organic farming. In addition to differences in farming practices between early and later adopters, their results reveal changing motives for conversion over time. Best (2008) compares early and late adopters of organic farming in Germany and test the “conventionalization hypothesis” meaning that organic farming is developing into a modified version of conventional agriculture. His results indicate a development towards more specialized farms, but most farmers still express a high level of environmental concern. Although Best (2008) and Flaten *et al.* (2006) provide good insight into the adoption process over time, both studies are exploratory in nature, and focus on differences between organic farmers, rather than investigating differences in the adoption between the groups.

Many studies that have evaluated the factors affecting adoption of new agricultural technology include Baidu-Forson (1999), Hassan, Kiare, Mugo, Robin and Labosa (1998), Nkonya, Schroeder, and Norman (1997), Adesina and Baidu-Forson (1995), Feder *et al.* (1985) and Shakaya and Flinn (1985). Most of these studies focus on the relation of key variables to the adoption behaviour of farmers. Similarly, there has been a growing body of research interest in the economics of technology adoption, yielding literally hundreds of publications. Of these many studies, some have examined the possible determinants of technology adoption using survey results (example Roberts, English, Larson, Cochran, Goodman, Larkin, Marra, Martin, Shurley and Reeves, 2004; Batte and Arnholt, 2003; Daberkow and McBride, 2003; Arnholt, Batte and Prochaska, 2001), while others have investigated the need for suitable econometric methods to account for the interrelationships among adoption decisions, causing selectivity biases (example Roberts, English and Larson, 2002; Fernandez-Cornejo, Daberkow and

McBride, 2001; Khanna, 2001; Napier, Robinson and Tucker, 2000; Traore, Landry and Amara, 1998; Dorfman, 1996).

Existing literature shows that adoption of organic farming by farmers is influenced by personal attributes of the farmer, farming systems and resource characteristics, institutional, infrastructural and environmental factors (Padel, 2001; Rigby, Young and Burton, 2001; Jha and Hojjati, 1994). In line with this, attitudes and preferences are important determinants of adoption decisions (De Cock, 2005; De Souza, Young and Burton, 1999; Ajzen and Fishbein, 1977). Personal attributes of the farmers include age, education level, sex. Farming systems and resources constraints comprise cultivated area, family size, availability of appropriate inputs example seed, equipment, machinery and the liquidity position of the farmer. Institutional and infrastructural factors example laws and regulations governing the supply and accessibility of credit, extension advice, training and input markets. Environmental factors give farmers and input suppliers' incentives to participate in a given new technology subject to expected gains.

3.3.1 Role of age in technology adoption

Age is a primary latent characteristic in adoption decisions. However there is contention on the direction of the effect of age on adoption. Age was found to positively influence adoption of sorghum in Burkina Faso (Adesina and Baidu-Forson, 1995), and Integrated Pest Management on peanuts in Georgia (McNamara, Wetzstein and Douce, 1999). The effect is thought to stem from accumulated knowledge and experience of farming systems obtained from years of observation and experimenting with various technologies. In addition, since adoption pay-offs occur over a long period of time, while costs occur in the earlier phases, age (time) of the farmer can have a profound effect on technology adoption. Hossain, Alamgir and Croach (1992) revealed that the probability of adoption of new farming practices increased with age among farmers in Bangladesh. Similarly Bembridge (1991) in his study focusing on maize technology transfer in a typical homeland maize-growing area in South Africa established that thirty per cent of producers were over 60 years of age.

Conversely age has also been found to be either negatively correlated with adoption, or not significant in farmers' adoption decisions. Hassan *et al.* (1998) for Kenya and Kimseyinga and Kyotsi (1998) for Malawi, Adesina and Baidu-Forson (1995) for Ethiopia, Celis, Milimo and Wanmali (1991) for Zambia, Polson and Spencer (1991) for Nigeria, reported that the farmer's age is negatively related to adoption of agricultural technology, implying that older farmers are less likely to be adopters. This may be due to the fact that older farmers are more likely to be conservative to the introduction of new innovations and reluctant to change. Freud, Phillipe and Jacques (1996) in Cote d'Ivoire found that the farmer's age and adoption of modern varieties of cocoa were not related. Similarly, studies on adoption of BT Cotton in South Africa by Gouse, Kirsten and Jenkins (2003), land conservation practices in Niger (Baidu-Forson, 1999), hybrid Cocoa in Ghana (Boahene, Snijders and Folmer, 1999), rice in Guinea (Adesina and Baidu-Forson, 1995), fertilizer in Malawi (Green and Ng'ong'ola, 1993) and established that age was either not significant or was negatively related to adoption.

Older farmers, perhaps because of investing several years in a particular practice, may not want to jeopardize it by trying out a completely new method. In addition, farmers' perception that technology development and the subsequent benefits, require a lot of time to realize, can reduce their interest in the new technology because of farmers' advanced age, and the possibility of not living long enough to enjoy it (Caswell, Fuglie, Ingram, Jans and Kascak, 2001; Khanna, 2001). Furthermore, elderly farmers often have different goals other than income maximization, in which case, they will not be expected to adopt an income-enhancing technology. As a matter of fact, it is expected that the old that do adopt a technology do so at a slow pace because of their tendency to adapt less swiftly to a new phenomenon (Tjornhom, 1995).

3.3.2 Role of gender in technology adoption

Effective application of agricultural technologies in production has strategic gender implications. The productivity of labour will be altered depending on accessibility of the technology between men and women. In many small-holder farms, technology is mostly at the disposal of men whereas women contribute 70% of agricultural production

(Lubwana, 1999). With reference to gender and technology, the questions that arise are whether the technologies are gender neutral or hindering women participation or not addressing a gender concern. Though technologies gender neutral, they often become biased towards one gender during project formulation and implementation. This is because of the disjuncture between the planners and the used of the technology.

Sheng (1989) states that though research has been conducted on various conservation tillage technologies to increase production, many times they have not all been adopted. The social and economic conditions in which the activity is being carried out determine the lack of neutrality in the process of technology selection and adoption. The lack of neutrality is apparent not only from the social and economic perspective, but to a much greater extent, from the perspective of gender in that, no account is taken of who participates in the production process and to what extent. Technology offers women new opportunities to close the gender gap in physical strength. The utilisation of technology in developing human and material resources can be dramatically enhanced when women are included, since they are responsible for 50 - 60% of agricultural production and most domestic tasks (Sheng, 1989). In most African social contexts, women have limited access to resources, especially land and to information and new technologies.

There are several empirical studies that have been conducted on the effect of gender to technology adoption. Doss and Morris (2001) found no significant association between gender and the adoption of improved maize technology among rural farmers in Ghana, although the gender of the household head was important. Phiri, Franzel, Mafongoya, Jere, Katanga, and Phiri (2004) showed that the adoption of improved fallow practices among poor households in Eastern Zambia is gender-neutral. Essa and Nieuwoudt (2001) in KwaZulu-Natal showed that male farmers tend to adopt hybrid seed maize and fertilizer. The argument advanced is that constraints to women adopting technology include socially conditioned inequalities in the access, use and control of resources and credit. They also reported a positive association between the adoption of maize growing and the presence of male decision makers among small scale farmer support programs in

South Africa. Similar findings were reported by Semgalawe (1998) on the adoption of soil conservation programmes in Tanzania.

3.3.3 Role of education and training in technology adoption

Development of the educational level of a population is required if countries have to domestically produce, adapt, transfer and receive new technologies. According to Lyne (1985), improved education services enhance the adoption of new farm technologies in KwaZulu-Natal. Venter, Vink and Viljoen (1993) came to the same conclusion, namely that the low level of educational training is the most limiting factor on technology adoption among small-scale commercial farmers in Venda. Studies that have sought to establish the effect of education on adoption in most cases relate it to years of formal schooling (Feder *et al.*, 1985; Tjornhom, 1995). Generally education is thought to create a favorable mental attitude for the acceptance of new practices especially of information-intensive and management-intensive practices (Caswell *et al.*, 2001) on adoption.

Education is thought to reduce the amount of complexity perceived in a technology thereby increasing technology's adoption. Barrett and Moser (2003) in Madagascar, Semgalawe (1998) in Tanzania, Strauss, Bardosa, Thomas, and Gomes (1991) in Brazil, Kebede, Coffin and Gunjal (1990) in Ethiopia and Feder *et al.* (1985) found that education is an important determinant of production efficiency and technology diffusion. Formal education and training in agriculture improves farmers' ability to acquire accurate information, evaluate new production processes, use new agricultural practices and understand the benefits of adopting appropriate farm practices (Saha, Love and Schwart, 1994a; Lindner, 1987). When technology is new and widely profitable, farmers' schooling may increase the probability of adoption as it enhances their ability to acquire, interpret and use information about such technology. Hollaway, Shankar and Rahman (2002) postulate that education can encourage new technology adoption by lowering learning costs or it may discourage adoption since education provides more profitable off-farm employment opportunities and new technologies may reduce the ability of farm operators to substitute their time inputs away from cultivation.

However the level of education required for technology adoption is also dependent on the level and complexity of the given technology. Low levels of education can be accompanied by training on a given technology to improve its adoption and transfer. According to Peres (1997), the programme to develop entrepreneurship abilities in rural youth, PROJOVEM was geared towards small scale farmers in Latin America with low level of education. The programme was implemented in Brazil in the beginning of 1997 with the main aim to prepare rural youngsters to manage small farms in a competitive and sustainable way and thus increase the level of income of their families. This programme also comprises the adoption and correct management of new technologies (Peres, 1997). Training is one of the most critical factors of the technology transfer process. Stroebe (2004) stated that training to enhance the technology transfer and adoption programmes at the sheering sheds in QwaQwa, played an important role in training the small ruminant farmers in the correct use and adoption of medication technologies. This technology does not require high education levels. Nagy, Sanders and Ohm (1988) pointed out that one of the important sections of a support programme for technology adoption is farm management training and demonstration. There are many technologies available that do not require formal or high educational level. In these cases training projects are needed to develop the desire for new technologies and its implementation by the farmers (Abdulai, Owusu and Bakang, 2011; Bucciarelli, Odoardi and Muratore, 2010).

3.3.4 Role of household size in technology Adoption

Family labor is one of the most important inputs to smallholder farm production (Byerlee and Collinson, 1980; Ruthenberg, 1976; Schultz, 1964). Farmers with limited resources often struggle to supply sufficient labor to meet periodic labor demands that arise from seasonal-specific cultivation patterns (Collinson, 2000; Gill, 1991; Delgado and Ranade, 1987). By requiring labor inputs at different times, a management strategy of crop diversification can lessen short term labor scarcities. Nevertheless, peak labor demands often persist and limit agricultural production and associated earnings of the entire farm household. Whereas some technologies save labour for the adopting household, others require additional labour. Labour saving technologies such as a piece of machinery is

more likely to be adopted by households that benefit from saving labour. This could be because labour is sparse and local wages are high or more likely because labour market problems make it difficult to hire extra labour. Labour-intensive technologies, on the other hand, are more likely to be taken up if hired labour is abundant and cheap, or if opportunities for household members to seek non-farm employment are artificially depressed. Organic farming is generally labour-intensive, involving more manual labour and less mechanization.

The perceived lower costs of household labour as compared to hired labour are due to the fact that hired labourers have less incentive to work hard than do family labourers, because they are not consumers of the output. This means that the household may have to invest in supervising hired labourers, which can result in even greater costs (Wubeneh and Sanders, 2006). Together, these labour market problems may prevent households from adopting agricultural technologies that are beneficial in terms of yields and prices, but which require additional labour. Besides the fact that rural labour markets often place costs on agricultural households, they are also typically seasonal, with all households requiring labour inputs at the same time. This further emphasizes the benefits of household labour. The periods of high demand and wages often coincide with the planting season when food resources are scarce, farmers without access to household labour will be deterred from investing in new technologies at planting time. Family size has been identified as positively associated with the adoption of animal traction in Burkina Faso (Kimseyinga and Kyosti, 1998) and the adoption of new agricultural technologies in Ethiopia (Kebede *et al.*, 1990), as larger rural households have relatively more labour resources. Organic farming is a labour intensive technology, implying that households with more people available for family labour are more likely to use the technology. Conversely, Shakaya and Flinn (1985) found that family size did not influence the adoption of rice varieties in Nepal.

3.3.5 Role of farm size in technology adoption

Average farm size varies tremendously across countries. In developing countries particularly, Asia and Africa, the average land holding has been declining over the years and the majority of the farm sizes are estimated at less than one hectare (Huang, 1973). These small farms constitute the backbone of traditional agriculture throughout the developing countries (Devendra, 1983). The impact of farm size on the technology adoption decisions is one of the key issues in most developing countries. Much empirical adoption literature focuses on farm size as the first and probably the most important determinant and is frequently analyzed in many adoption studies (Nkonya *et al.*, 1997; Adesina and Baidu-Forson, 1995; Green and Ng'ong'ola, 1993; Shakaya and Flinn, 1985). This is perhaps because farm size can affect and in turn be affected by the other factors influencing adoption. In fact, some technologies are termed 'scale-dependant' because of the great importance of farm size in their adoption (Doss and Morris, 2001; Boahene, *et al.*, 1999). Rogers (1983) concluded from adoption research that earlier adopters have larger operations than later adopters. In contrast in most countries, the average farm size of organic farms was smaller than conventional farms (Harris, Lloyd, Hofny-Collins, Barrett, Browne, 1998). This pointed to the importance of small subsistence holdings in the organic sector.

There are two schools of thought concerning the effect of adoption on agricultural technology adoption. The relationships between farm size and intensity or farm size and technology adoption are still debated on the academic arena. Two paradigms address this issue as illustrated in Yesuf and Kohlin (2008): one is Boserupian theory which argues that due to population pressure, small farms lead to intensive use of land through adoption of new technologies; and the second is new-Malthusian group, which argues that population pressure leads to the cultivation of marginal lands, and then degrade the land. The impact of farm size on respect to technology adoption can be positive or negative. The first school of thought argues that small farmers utilize the limited resources more efficiently and adopt new technologies at a faster rate (Allaudin and Tisdell, 1988a; Ahmed, 1981; Barker and Herdt, 1978). Schultz's (1964) "poor-but-efficient" hypothesis that "small farmers in traditional agricultural settings are reasonably

efficient in allocating their resources by responding to price incentives” can be fairly considered as one of the enduring themes in rural development economics over the past three decades. Although challenged from some fronts (Duflo, 2006; Ray, 2006; Ball and Pounder, 1996) it has been widely accepted by both economists and policy makers (Abler and Sukhatme, 2006; Ruttan, 2003; Nerlove, 1999; Stiglitz, 1989; Hayami and Ruttan, 1985).

The second school of thought argues that land size positively influences adoption as large farmers generate more income which provides a better capital base and enhances risk-bearing ability (Shiyani, Joshi, Askon and Bantilan, 2002; Sarap and Vashit, 1994) and that smaller farms have less incentive to adopt new technologies compared to larger farmers who benefit from economies of scale (Huffman, 1974). It is often hypothesized that small farms could limit adoption due to high fixed costs especially for tractors, tubewells and oxen and tend to adopt more slowly than large farms. Similarly, Latt and Nieuwoudt (1988) found that the adoption was higher on relatively large farms and in more fertile areas in a study in three rural regions in KwaZulu-Natal. Farmers with larger plots were able to sell more produce and they made more use of improved technologies. Swanepoel and Darroch (1991) came to the same conclusion from research done in the same province, as they found that the adoption of new technology packages were higher among farmers who belong to older “clubs”³, have less formal savings, receive more visits from extension officers, have larger farm sizes and a higher rand monetary value on livestock. They concluded that larger farms reduce transaction costs, which increases the economic advantage and incentives of new technologies.

3.3.6 Role of liquidity and income in technology adoption

Past studies (Langyintuo and Mekuria, 2005; Smale, Just and Leathers, 1994; Adesina and Zinnah, 1993) have shown the significant influence of income on the adoption of improved agricultural technologies by smallholder farmers in developing countries. Access to cash which promotes adoption of risky technologies through the relaxation of liquidity constraints as well as boosts the household’s risk bearing ability (Hardaker, Huirne and Anderson 1997) is hardly available to resource poor farmers for varied

reasons (Langyintuo and Lowenberg-DeBoer, 2006). It is argued that the profitability of a scale neutral technology such as improved seed will induce farmers to sell their productive assets (e.g. motorcycles, bicycles, radios, etc.) to generate sufficient cash to purchase the necessary inputs (Feder *et al.*, 1985). Primarily due to the disproportionate distribution of productive assets among households within a community, one would expect adoption behaviors to differ across socioeconomic groups.

Farm income may affect adoption positively or negatively depending on its' relative contribution to household income and/or farm profitability. Farmers with relatively more wealth and liquidity may be better able to finance the adoption of technologies (Essa and Nieuwoudt, 2001) and appropriate farming practices (Strauss *et al.*, 1991). Wealthier farmers are better able to bear risk and, therefore more likely to try new technologies (Doss and Morris 2001). Nassif (1999) in Morocco, Shideed (1999) in Iraq and Kebede *et al.* (1990) in Ethiopia found a positive significant relationship between income and technology adoption. According to Gardner and Rausser (2001), both the rate and extent of diffusion are positively related to changes in the income from the technology. The existence of agricultural income sources could allow farmers to better manage the costs of some technologies such as fertilizer costs, labour and equipment. Iqbal, Ireland and Rodrigo (2005) in Sri Lanka found that farmers who were likely to adopt intercropping are those who rely principally on their own farm enterprise for their income. Non agricultural incomes on the other hand can reduce risk associated with the trial of new technology.

Langyintuo and Mungoma (2008) showed that the relationship between wealth and technology adoption, using data from households in Zambia proved that within any given farming community, households on the upper part of the wealth continuum are most likely to adopt new technologies because of their secure economic positions. Those on the lower wealth continuum, on the other hand, may be willing to adopt because of their greater desire for upward mobility in the economic group but are unable to invest in new opportunities and therefore lowest in terms of adoption of new techniques. Conversely, Phiri *et al.* (2004) found no barriers preventing low income households from adopting improved fallows in Zambia concluding that improved fallows are a wealth-neutral

technology. Given limited off-farm employment opportunities especially in rural agricultural smallholdings, much-needed increases in household income for improving food security must come from gains in agricultural productivity through better technology and more profitable crops.

3.3.7 Role of location in technology adoption

Many of the studies of rural sociologists emphasized the importance of distance in adoption and diffusion behavior. They found that regions that were farther away from a focal point (where a technology is introduced) had a lower diffusion rate in most time periods. Thus, there is emphasis on adoption and diffusion as a geographic phenomenon. Mansfield (1963) viewed adoption as a process of imitation wherein contacts with others led to the spread of technology. However distance remains a major obstacle for adoption of technologies in developing countries.

Much of the social science literature on innovation emphasizes the role of distance and geography in technology adoption (Rogers 2003). Producers in locations farther away from a regional center are likely to adopt technologies later. This pattern is consistent with the findings by Gardner and Rausser (2001) on threshold models where initial learning and the establishment of a new technology may entail significant travel and transport costs, and these costs increase with distance. Diamond's (1999) book on the evolution of human societies emphasizes the role of geography in the adoption of agricultural technologies. Geography sets two barriers to adoption: climatic variability and distance.

Diamond argues that there were other geographic barriers to the diffusion of agricultural technologies. For example, the slow evolution of agricultural societies in Australia and Papua New Guinea is explained by their distance from other societies, which prevented diffusion of practices from elsewhere. It is a greater challenge to adopt technologies across different latitudes and varying ecological conditions. The establishment of international research centers that develop production and crop systems for specific conditions is one way to overcome this problem. The measures of location used in past

research are varied and typically consist of dummy variables for location represented by the administrative unit or researcher estimates of distance to nearest road (Lapar and Pandley, 1999; Kaliba, Featherstone and Norman, 1997).

Case (1991) argues that ignoring neighbourhood influences not only biases the estimated parameters in standard adoption models, but also sacrifices important policy relevant information. “Secondary” or “copy” adoption in a locality carries forward the momentum generated by the initial investment. The size of this externality constitutes important data for policy makers operating under limited budgets and wishing to maximize returns to extension investment (Hollaway *et al.*, 2002). There is prior evidence that village level synergy exists in rice-fish technology adoption in rural Bangladesh. “Copy” farmers abounded in the areas where the project was based and introduced (Hollaway *et al.*, 2002). The secondary adopters committed increasing amounts of land to the new technology following positive adoption behaviours by their neighbouring farmers within a spatial radius of 2 to 3kms. Mansfield (1963) viewed the diffusion of an innovation as a process of imitation where contact with others leads to the spread of the technology.

According to Koudokpon, Versteeg, Adegbola and Budelman (1995) in South Benin and Atta-Krah and Francis (1987) in Nigeria, several research and development efforts to promote alley cropping and other agro forestry technologies have tended to focus on farmer groups or communities. A community or farmer-group approach to dissemination of information on alley cropping to farmers has advantages if farmers are in close contact with one another or reside in the same area. This allows increasing returns to scale in information dissemination. Secondly, it has economies of scope for extension agencies as they can reach a large number of farmers with different sets of agro forestry technologies. Adesina, Mbila, Nkamleu and Endamana (2000) hypothesized that the proximity of farmers to each other positively influenced the adoption of alley cropping in Cameroon. Adebayo (2009) explored the intricacies of technology adoption in rural based cassava processing enterprises in southwest Nigeria and concluded that the average distance among farmers was not significantly different among adopters and non adopters of the cassava grater. Nweke (2009) indicates that the diffusion of cassava can be described as a “self-spreading innovation” in African agriculture. He emphasized that the physical

presence of the IITA in Nigeria was influential in the diffusion of the Mosaic Resistant TMS Varieties in Nigeria and its adoption among farmers. Such cassava cultivars represent an important contribution to Africa's food security, especially among the poor (Nweke, Spencer and Lynam, 2002) because the improved cultivars raised per capita output by 10% continent-wide, benefiting 14 million farmers. Notwithstanding, Nweke *et al.* (2002) show that the low adoption rates of improved technologies remain an obstacle to the fight against hunger in the continent.

3.3.8 Role of risk considerations in technology adoption

Agriculture is by nature a risky activity, and farmers' risk attitudes are known to deeply influence their choices, especially when dealing with a new technology (Bocque'ho and Jacquet, 2010). It is generally understood that risk-averse farmers are reluctant to invest in innovations about which they have little first-hand experience. Binswanger (1980) found that farmers who are risk-averse will seek risk reducing strategies and technologies to adopt in their farming systems. That is why small scale farmers and emerging farmers will implement technologies that do not necessarily give maximum net returns (Dillon 1986). Sanders, Shapiro and Ramaswamy (1996) concluded that farmers who consider adopting new technologies tend to be pessimistic about possible yield gains until they have more information on the results of new technologies.

Feder and Umali (1993), Leathers and Smale (1992), Tsur, Sternberg and Hochman (1990), Lindner (1987) and Lindner *et al.* (1982) acknowledge that whereas risk has often been considered to be a major factor reducing the rate of adoption of a new technology, the issue of risk in adoption has rarely been addressed adequately and strong empirical evidence to test the common view about its importance and impact has been rare and scattered. Feder *et al.* (1985) in their review of adoption literature attributed this to the difficulties in observing and measuring risk and uncertainty (Lindner, 1987; Akinola, 1986).

Some attempts to seriously investigate empirically the roles of risk and uncertainty in adoption include studies by Abadi Ghadim (2000), Smale *et al.* (1994), Kebede (1992),

Shapiro, Brorsen and Doster (1992), Marra and Carlson (1987), Byerlee and Hesse de Polanco (1986) and Binswanger, Jha, Balaranaia and Sillers (1980). Even fewer studies of risk and adoption have used direct interview techniques to investigate the effect of farmers' risk attitudes and perception of riskiness of enterprises on their allocative decisions (Abadi-Ghadim, 2000; Huirne, Harsh, Dijkhuizen and Bezemer, 1997; Smale *et al.*, 1994; Lindner and Gibbs, 1990; Binswanger, 1980). However, with the exception of Abadi-Ghadim (2000) these studies have generally had low explanatory power.

Shapiro *et al.* (1992) showed that higher levels of adoption of double cropping were associated with higher levels of risk aversion. These findings differed from Brink and Mc Carl (1978) who found an opposite relationship for a similar sample of Corn Belt farmers and Marra and Carlson (1990) on the adoption of double cropping of Wheat/Soyabeans. Shapiro *et al.* (1992) argued that these contradictory results could be explained by noting that the sample of farmers displayed a wide range of risk preferences. They suggested that this may be related to Young's (1979) contention that risk preferences differ by situation and level of risk

Kebede (1992) found that the adoption of new technologies by Ethiopian farmers was significantly positively related to their degree of risk aversion. Smale *et al.* (1994) established that Malawian maize growers' perceptions of the relative riskiness of new seed varieties influenced the probability of their adoption and intensity of cultivation. Smale's study provided strong empirical evidence to support the primarily economic character of the adoption decision and also highlighted the importance of risk in the decision process. Risk aversion tended to reduce adoption, and to a greater extent as relative riskiness and scale increased.

Binswanger *et al.* (1980) elicited the risk preferences of a sample of Indian farmers using several elicitation techniques, one of which included gambling questions with real monetary pay-offs. These methods measured farmers' levels of risk aversion, which were then used in regression analyses of farmers' adoption decisions. Statistical significance tests showed mixed results, and their findings were inconclusive with regards to risk

aversion. Byerlee and Hesse de Polanco (1986) analyzed farm survey data from Mexico to investigate the reasons for stepwise adoption of components of packages of practices. Their regression model showed that adoption of each innovation was explained primarily by its profitability and riskiness. Marra and Carlson (1987) provided an empirical test of some of Just and Zilberman's theoretical results using farm-level data on adoption of double-cropped wheat/soybeans. They found evidence to support the fact that risk preference is likely to be limiting factors in the farm size–adoption relationship.

3.3.9 Role of land tenure in technology adoption

Land rights are the backbone of a land tenure system i.e. the system of rules, rights, institutions and processes, under which land is held, managed, used and transacted (Cotula, 2006). Land rights include ownership and a range of other land holding and use rights which may coexist over the same plot of land (Hodgson, 2004). These rights may be held by individuals, by groups, or by the State. They may be based on national legislation, on customary law or a combination of both. Studies done by Hazell and Lutz (1999), Feder and Feeny (1991), Lutz and Daly (1991), Harrison (1990), Feder and Noronha (1987), Abalu (1977) have demonstrated that the rights that farmers have over natural resources can be important in determining whether they take a short- or long-term perspective in managing resources. For example, farmers who feel that their tenure is insecure, with or without formal rights are less likely to be interested in conserving resources or in making investments that improve the long-term productivity of resources. Therefore stronger land rights and presence of land title are often associated with an increased likelihood of adoption and investment in new agricultural technologies.

Fenske (2011) and Besley (1995) argue that this is far from universal and there are often divergent effects on different types of investments within the same site. Moreover, some of the results themselves, though statistically significant, would hardly qualify as important because of very low marginal impacts. According to Place (2009) and Brasselle, Gaspart and Platteau (2002), although there are strong theoretical reasons why more complete land rights are expected to enhance agricultural technology investment, empirically this link has been found to be weak. Several reasons have already been

identified for this, including adequate incentives in African tenure systems, thin credit markets, endogenous tenure, failures of titling programs, and empirical difficulties

Community rights over land may discourage investment because the community fears negative externalities from investments made (Besley, 1995). This was one of the reasons the system of open fields was inefficient. Collective management inhibited the adoption of new crops and new techniques by requiring consensus (Pannell, Marshall, Barr, Curtis, Vanclay and Wilkinson, 2006). In many indigenous African systems of tenure, investment is expressly forbidden by certain tenancy contracts and is taken as a challenge to the authority of the grantor. In the case of strangers, successful innovation and investment can lead to hostility from local inhabitants (Chauveau, 2002). Similar powers taken by the state lead to analogous results. When land is “owned” by the state, existing tenure arrangements may not give security to the holder, and the state can block endogenous institutional change (Hagos and Holden, 2006). While many indigenous institutions forbid holders of secondary rights from making permanent improvements, other institutional arrangements have emerged expressly for the purpose of facilitating investment, as with sharecropping in the case of Ghanaian cocoa (Abdulai, Owusu and Goetz, 2008).

On the other hand, investment incentives may be sufficient even if indigenous tenure is insecure. If individuals are altruistic towards other members of the community, they may not be discouraged by the possibility that land will revert to the larger group. Similarly, if output is shared, the rest of the community should encourage investment by its individual members (Besley, 1995). In the case of tenancy contracts, the threat of eviction can be used to elicit greater effort from the tenant (Banerjee and Ghatak, 2004). Because time horizons vary greatly across types of investment, insecurity may not matter for many of these (Gebremedhin and Swinton, 2003). All else equal, we should see that the impact of insecurity on tree planting and irrigation will be more substantial than on the use of fertilizers and other inputs (Holden and Yohannes, 2002). Investment in agriculture competes with investment in capital goods, which are recoverable in the event of eviction, and with non-agricultural assets. Even given insecurity, returns in agriculture may still be higher (Hayes, Roth and Zepeda, 1997).

3.3.10 Role of extension services in technology adoption

Studies on the effect of extension education on agricultural technology adoption include (Mariam and Galaty, 1993; Longo and Juliano, 1990). Understanding the impact of extension agencies on the adoption and diffusion of environmentally beneficial technologies is particularly important given the declining status of extension. Vanclay and Lawrence (1994) state that the entire extension apparatus in developed and developing countries is in a state dilemma due to the gradual replacement of traditional public extension services with private extension (Guerin and Guerin, 1994; Umali and Schwartz, 1994). One root of the problem is the longstanding relationship between extension services and the classic adoption/diffusion model (Stephenson, 2003). Both have been based on a shared set of assumptions that were highly effective at promoting the adoption of productivity-enhancing technologies but have proven inadequate to diffusing more ecologically sensitive practices. The classical diffusion model initially fostered a linear approach to the diffusion of innovations in which researchers generate knowledge which extension workers convey to producers (Roling, 1993). This approach generally provides technologies in a “one size fits all” fashion, with little regard to the non-technical factors that affect the adoption of innovations (Davidson and Ahmad, 2003; Adhikarya, 1996). In addition, the lack of a feedback loop tends to favor innovations generated by research institutions, largely ignoring innovations developed on-farm (Davidson and Ahmad, 2003). This approach has been largely discarded throughout the world and is widely regarded today as “naive and counterproductive”.

A more participatory approach to agricultural extension emerged in the United States as well as the developing world. The power structure of partnerships among development agencies, experts, and farmers was addressed, leading to fundamental changes in the system. Through this participatory approach, a new innovation came to be viewed not simply as a new technology delivered to a target group, but as a new practice developed through exchanges of information among stakeholders (Norman and Marlon, 2000). The fundamental reasoning was that researchers could work directly with farmers to address their specific concerns. Farmers were seen more as partners who possess valued knowledge. The participatory approach allows new innovations to be continually and

more easily adapted to new contexts and needs, and guides research through a stronger feedback loop (Buhler, Morse, Arthur, Bolton and Mann, 2002).

Miller, Mariola and Hansen (2008) examined the roles of extension agents on agricultural technology adoption by smallholder farmers in Costa Rica. Miller suggested that a model more appropriate to the adoption of agricultural technologies in a developing country setting should take into account institutional factors, including the mode of interaction between farmers and extension agencies. However results from this study found that EARTH University extension agents had achieved more success in promoting certain technologies, such as biodigestors and worm compost, than others such as traditional compost and agro-ecotourism. The authors concluded that simply entering a community and conducting extension outreach there will not spur the community's farmers to adopt en masse. On the other hand, Schuck, Nganje and Yantio (2002) examined the extent to which extension education can promote adoption of cropping systems by smallholder farmers in Cameroon. The choice of cropping system included slash and burn, multiple crops or mono-cropping. Results indicated that higher visitation rates by extension personnel reduce the likelihood of farmers choosing slash and burn agriculture.

3.3.11 Role of social capital and cooperatives in technology adoption

Social capital refers to features of social organization, such as trust, norms and networks that can improve the efficiency of society, facilitating co-ordinating actions (Portes, 1998). Likewise, the World Bank states “defined broadly, social capital encompasses the formal and informal rules that enable coordinated action and goal achievement” (World Bank 2000). Parthasarathy and Chopde (2000) define social capital as the ability to develop and use various kinds of social networks – and the resources that become available thereof and is central in understanding how farm households, and the farming community in general, adopt and benefit from improved agricultural technologies. Studies have shown the importance of collective action for the successful uptake of technologies for which cooperation is a prerequisite.

However the importance of collective action and the use of social capital in information flows regarding new technology options and adoption procedures, and the actual ways in which communities enhance their collective welfare as a consequence of individual farm level growth, is something about which little is known (Parthasarathy and Chopde, 2000). The authors claim that social capital - in terms of increased ability and willingness to co-operate and work together for achieving common goals, and, sustaining and developing norms and networks for collective action - is crucial for successful uptake, diffusion, and impact of innovations. According to Narayan (1997) while cooperatives advised farmers of the need to incorporate pigeon pea in their crop rotations, and its sustainability capabilities, farmers also obtained knowledge of sustainable practices from older farmers in the community of Vidharbha and Marathwada regions of Maharashtra in India. Legitimacy for trying out the new option seems to have come from community elders who were critical of the new input intensive practices and advocated a return to older practices in achieving sustainability. The authors conclude that social capital is crucial in facilitating adoption, and overcoming constraints of lack of financial, human and natural capital. Collective action actually provides the means to adopt and benefit from agricultural innovations, generate economic and human capital, and make the development process sustainable (Grootaert, 1997).

Amelia, Scott, Bryan, Jinxia and Jikun (2008) analyzed traditional technologies, household level technologies and community level technologies among farmers in Northern China. The study established that the while levels of adoption of water saving technology in northern China increased due to increasing water scarcity, the extent of adoption was quite low. The authors concluded that While they did not have a definitive answer why the adoption of these technologies are higher than other types, it appears that the most successful technologies have been those that are highly divisible, low cost and do not require collective action or large fixed investments.

3.3.12 Role of livestock ownership in technology adoption

The use of compost incorporating manure is part of an organic agriculture system that emphasizes maximum reliance on renewable farm and other local resources. Compost is an organic fertilizer that has the advantage that it improves soil structure and aeration, increases the soil's water-holding capacity and stimulates healthy root development (Twarog, 2006). Thus, both stubble tillage and compost may be appealing options for enhancing productivity with resource-poor farmers, especially in developing countries. Escalating prices and production and consumption have been cited as among the factors limiting the use of inorganic fertilizers in Africa (Kassie, Yesuf and Köhlin, 2008; Dercon and Christiaensen, 2007). As a result traditionally, rural farmers have continued to be inclined to organic methods of production due to their low income and hence inability to afford inorganic fertilizers. Thus, given the aforementioned challenges to inorganic fertilizer adoption, a key policy intervention for sustainable agriculture is to encourage adoption of farming technologies that rely, to a greater extent, on renewable farm and other local resources. Organic farming practices, such as the use of compost, tillage and livestock manure application are among such technologies. The water retention characteristics of these technologies (Twarog, 2006) make them especially appealing in water-deficient farming areas.

In addition to reducing natural risks, organic farming practices enable poor farmers to minimize the financial risk of buying chemical fertilizer on credit and - given that compost, tillage and manure are readily available, hence alleviate the prevailing problem of late delivery of chemical fertilizer (Hailu and Edwards, 2006). Manure is a major component for organic fertilisation. The main source of manure is from livestock. These include cattle, sheep and goats. Chicken manure is also commonly used in rural areas directly or as liquid fertiliser. There exists ample evidence to show that use of compost, tillage and manure can result in higher and/or comparable yields compared to chemical fertilizer (Sasakawa-Global 2008, 2004; Kassie *et al.*, 2008; Edwards, Asmelash, Araya and Tewolde, 2007; Hailu and Edwards, 2006; Mesfine, Abebe and Al-Tawaha, 2005; Hemmat and Taki, 2001). This implies that these organic farming technologies can create

a win-win situation, where farmers are able to reduce direct production costs, improve environmental benefits, and, at the same time, increase their crop yields.

Despite considerable empirical research and attention directed to the issues of technology adoption, a consensus has not been reached regarding the social and economic conditions that lead farmers to conserve soil. The above literature review shows mixed results on the factors that affect technology adoption and diffusion behaviour in agriculture. It does however suggest that the adoption of certified organic farming could vary across the households and that factors such as the farmer's age, gender, education level, household size, proportion of area planted, proportion of income from farming, input cost per hectare, location of households and the farmer's risk attitude should be considered in the local analysis. Chicken ownership was considered because of its significance as a source of manure in the study area.

3.4 Mode and sequence of agricultural technology adoption

In explaining the mode and sequence of agricultural technology adoption, two approaches are common in agricultural adoption literature. The first approach emphasizes the adoption of the whole package while the second approach deals with sequential adoption. Feder and Umali (1993) explored the adoption of agricultural innovations and indicated that most agricultural technologies introduced in the last three decades, particularly the high yielding varieties (HYVs) are in fact a package of interrelated technologies. Accordingly, one major focus in the literature in recent years has been the investigation of the decision-making process characterizing choice of the optimal combinations of the components of a technological package over time (Leathers and Smale, 1991).

One of the first models dealing with a technological package was developed by Feder (1982) incorporating technological complementarities and adoption under uncertainty. The study examines a case where farmers face the choice between a traditional technology (for example, a traditional crop variety) and two innovations-a divisible, scale-neutral technology (for example, a modern variety) and a lumpy technology subject to decreasing costs with respect to farm size(example the tube well). The two

innovations are interrelated because potential output is higher if both technologies are adopted than when only one is adopted. Furthermore, the adoption of the lumpy technology influences the perceived risks associated with the divisible technology. Given a perceived output risk associated with the divisible technology and farmer risk aversion, farmers maximize their expected utility through the dichotomous choice of whether or not to adopt the lumpy technology and the choice of the proportion of land to be allocated to as well as the intensity of use of, the divisible technology.

Nweke (2009) indicates that until the early 1980s, Ghana's food policy favoured cereals because widely-believed myths about cassava discouraged the government from investing in measures to diffuse the TMS varieties to farmers. Interest in the mosaic-resistant cassava varieties was awakened by a severe drought in 1982 and 1983 when cassava survived the drought and helped people cope with food insecurity. In 1993, sixteen years after the release of the TMS varieties in Nigeria, the Government of Ghana released three TMS varieties to farmers resulting in its diffusion and adoption among farmers in the Eastern, Greater Accra, and Volta regions, where farmers prepare *gari* for sale in urban centers. The 16-year delay in Ghana illustrates the need for political leadership in promoting the adoption of new technology from neighbouring countries (Nweke, 2009).

Though new technologies are usually promoted in a package, the response of farmers is often to adopt one or more components and gradually add more components rather than adopting the whole package immediately. Sequential or stepwise adoption of parts of a technological package has been observed in a variety of settings (Leathers and Smale, 1991). The whole package may only be adopted over the period of several years. Previous research has offered a number of theoretical models to explain this adoption process. According to Feder *et al.* (1985), the conventional explanations for the sequential adoption process are lack of credit, limited access to information, aversion to risk, inadequate farm size, inadequate incentive associated with farm tenure arrangements, insufficient human capital, absence of equipment to relieve labor shortage,

chaotic supply of complementary inputs (such as seed, chemicals, and water), and inappropriate transportation infrastructure.

A now old literature on green revolution technology adoption from the 1970's and 1980's analyzed package technologies, and identified sequential adoption patterns in which farmers adopted parts of the package before adopting the whole package (Leathers and Smale, 1991; Byerlee and Hesse de Polanco, 1986). These works were primarily empirical, and argued that fixed costs, credit constraints, risk, uncertainty, and learning all contributed to a sequential adoption pattern. Leathers and Smale (1991) attempted to explain sequential adoption even when farmers are risk neutral and unconstrained in their expenditures using a dynamic Bayesian model. The model demonstrates that in order to learn more about the innovation, the farmer may choose to adopt a component of the package rather than the complete package. Moreover, while early adopters may adopt only parts of a package, later adopters, whose confidence has been raised by the positive experience of their neighbors, may adopt the whole package.

Arega and Hassan (2008) measured the technical, allocative and economic efficiencies of farmers within and outside the Extension Package Program (EPP) in high and low potential agro-ecological zones in Eastern Ethiopia and concluded that in view of the significant positive interactions among components of agricultural technology packages, adoption of the whole technology package is argued to be more profitable than adopting a component or some. Nweke (1974) noted that the relative high growth rate in food grain production achieved by Ghana in 1960-1975 was made possible through the adoption of tractor mechanisation. Farmers were incentivised with tax and credit subsidies to import and own tractors. However, this increase was as a result of area expansion rather than productivity.

3.5 Induced innovation hypothesis and agricultural development

The hypothesis of induced innovation as first proposed by Hicks (1932) and later articulated by Hayami and Ruttan in the early 1970s, is a dynamic process that has earned wide recognition as a predominant economic theory of agricultural development. The

most fundamental insight of this hypothesis is that investment in innovation of new technology is the function of change in resource endowment and the price of the resources that enters into the agricultural production function. This has spawned a conceptual infrastructure that addresses the broader issues of how farmers and public institutions determine priorities for agricultural production (Koppol, 1995).

According to this hypothesis, societies develop technologies that facilitate the substitution of relatively abundant factors of production for relatively scarce factors in the economy. It has been substantiated through establishing a correlation between a measure of factor scarcity and an indicator of the direction of technical change (Hayami and Ruttan, 1985). For example, the constraints imposed on agricultural development by an inelastic supply of land have, in countries such as Japan, Taiwan, Korea, and several south Asian countries, been offset by the development of high-yielding crop varieties designed to facilitate the substitution of fertilizer for land. Similarly, the constraints imposed by an inelastic supply of labour, in countries such as the United States, Canada, and Australia, have been offset by technical advances leading to the substitution of mechanical power for labour.

In Ghana, Nweke (2009) stated that the severe drought of 1882 and 1983 contributed to the adoption of the Mosaic Resistant TMS cassava variety. The Green Revolution of the 1940s to the late 70s in Latin America and Asia on the other hand was in response to food security concerns and involved the development of high-yielding varieties of cereal grains, expansion of irrigation infrastructure, modernization of management techniques, distribution of hybridized seeds, synthetic fertilizers, and pesticides to farmers (Hazell 2009; Gaud 1968). Ndhleve *et al.* (2011) noted that the phenomenal growth witnessed in Asia and Latin America in the 1970s was linked to the Green Revolution. The call for a “New Green revolution in Africa” is partly driven by the food crisis trap that threaten the continent that is a result of among other factors population growth outstripping agricultural productivity, changes in consumer patterns, nature’s curtailment and political neglect, low levels of technology (Ndhleve *et al.*, 2011), .

In recent years the hypothesis of induced innovation has emerged as a basis for understanding potential future agricultural adaptation to climate variability and change (Gitay, Brown, Easterling and Jallow, 2001; Easterling 1996). Beddington (2011) warns that the global food system will experience an unprecedented confluence of pressures over the next 40 years. On the demand side, global population size will increase to eight billion by 2030 and on the production side, competition for land, water and energy will intensify, while the effects of climate change will become increasingly apparent. The need to reduce greenhouse gas emissions and adapt to a changing climate will become imperative. Over this period globalisation will continue, exposing the food system to novel economic and political pressures (Beddington, 2011). Any one of these drivers of change' would present substantial challenges to food security.

Increasing the productivity of smallholders through appropriate application of good practices and improved technologies should be a priority for developing countries wishing to achieve food security. The United Nation (2010) emphasized the need to increase the growth rate of agricultural productivity in developing countries through promoting the development, dissemination and transfer of appropriate, affordable and sustainable agricultural technology while supporting agricultural research and innovation, extension services and agricultural education in developing countries. Beddington (2011) alludes to the need to increase productivity while simultaneously conserving the natural resource base upon which future productivity increases depend.

The “New African Green Revolution” is currently being advanced by AGRA and the Consultative Group on International Agricultural Research (CGIAR) in order to ensure the progress made in addressing poverty and food security over the past decade are not reversed (Delgado, 2008). This challenge is made more difficult by climate change, which is expected to have significant impacts on agriculture and food production patterns, and the fact that African governments have cut back on expenditure devoted to agricultural technology adoption, development and transfer by as much as 37% from 1971 – 1991(Ndhleve *et al.*, 2011) resulting in a slowdown in productivity growth compared to previous decades. It is therefore necessary to substantially increase

investments in international and national public agricultural research and development, strengthening, in particular, the Consultative Group on International Agricultural Research (CGIAR) and the national agricultural research systems. Ruane and Sonnino (2011) argue that technologies must be appropriate, accessible and adapted to the local needs of poor farmers. Preference should be given to technologies promising win–win combinations of enhancing productivity and conserving natural resources.

The CGIAR has been investing heavily in Africa over the years. In 2003, it allocated 45% of its funds, equivalent to US\$180 million, to agricultural research and technology adoption projects in Sub-Saharan Africa, up from 43% the previous year (CGIAR, 2003). The “New African Green Revolution” focuses on research and innovation of agricultural technologies that will spur economic growth through agricultural production. These include a technology package for agriculture involving the use of external inputs, massive agricultural infrastructure and high yielding seeds varieties. The emphasis is also in ensuring response to the environmental consequences. All this has been induced by the food security crisis bedeviling the continent.

3.6 Barriers to agricultural technology adoption

The adoption of new technologies in agriculture in developing countries has attracted much attention from scientists; since agriculture is an important sector in those countries and new technologies seem to offer opportunities to alleviate poverty. But the introduction of many new technologies has met with only partial success as measured by observed rates of adoption (Feder *et al.*, 1985). One of the new technologies toward sustainable development is organic farming which is considered to offer more sustainable alternative to conventional agricultural production (Mader, Fliebach, DuBois, Gunst, Fried and Niggli, 2002) and has experienced considerable growth since the 1980s in many regions of the world, but the conversion to organic farming is connected with changes in farm management techniques, cognitive and psychological barriers which may pose as a challenge for some farmers (Darnhofer, Schneeberger and Freyer, 2005; Schneeberger, Darnhofer and Eder, 2002; Schneider, 2001; Hadatsch, Kratochvil, Vabitsch, Freyer, Götz, 2000).

Harris *et al.* (1998) and Lampkin (1990) have argued earlier that adoption of organic farming is not an easy option for farmers as it carries with it several barriers. These barriers could be technical, economic, social, cultural or legal (Dubgaard and Holst, 1994). Fairweather (1999) also concluded that dealing with issues of technical and economic viability of organic production more comprehensively would require farmers to overcome major obstacle for conventional producers frequently confront and could result in higher rates of conversion. Padel and Lampkin (1994) argued that conversion to organic production may be hampered by:

1. Perceptions (the image of organic farmers and the size of the market).
2. Access to technical and financial information.
3. Institutional barriers (problems in getting loans and certification constraints).
4. Social barriers (particularly in tight-knit communities).

In two studies from Switzerland and the United States, farmers mentioned the professional challenge in organic conversion, rather than problems with conventional systems (Duram, 1999; Maurer, 1997). McEachern and Willock (2000) identified naturalness, market demand and policy factors as important for the conversion decision to organic farming. Worries about weeds and other technical problems were major reasons preventing interested farmers in New Zealand from going ahead with the conversion to organic farming. According to Schneeberger *et al.* (2002), Austrian cash-crop producers hesitated to adopt organic production due to problems with weeds, diseases and insects, and additional labor requirements. Non-organic farmers also listed yield reductions, higher weed and pest infestations and more disease damage on crops as problems associated with the conversion process (Niemeyer and Lombard, 2003). One technical problem for non-organic farmers in New York was their preference of pest and disease resistant crop varieties as compared to natural seeds (Buttel and Gillespie 1988).

The certification issue is another challenge facing organic movements, especially with regards to developing countries. According to Reynolds (2004), onerous and expensive certification requirements create significant barriers to entry of poor Southern producers

and encourage organic production and price premiums to be concentrated in the hands of large corporate producers. Reynolds (2004) suggests that shifting certification costs downstream and empowering local producers to fulfill monitoring tasks should reduce barriers for small-scale producers. Austrian farmers did not adopt organic practices for the following reasons: there were no compensation payments for organics and the willingness to forego net income for benefits of environmentally friendly farming was not there (Darnhofer *et al.*, 2005). Loibl (1999) showed that the principal reasons given for not converting to organic farming were mainly economical, such as the lack of appropriate marketing outlets and additional requirements for labor.

Large-scale and non-organic farmers in South Africa considered fewer marketing opportunities, no premium prices and the lack of subsidies as economic factors keeping them from adopting organic practices (Niemeyer and Lombard, 2003). Also, issues related to the financial viability of organic production systems were identified as barriers for conversion to organic farming. In particular, the studies identified uncertainty over the future level of premiums (Kirner, 1999; FiBL, 1997) perception of a limited future demand for organic products (Padel and Lampkin, 1994), higher labor demands of organic systems (Kirner, 1999; Maurer, 1997), access to more market outlets (Lohr and Salomonsson, 2000; Vogel and Hess, 1996; Padel and Lampkin, 1994) and the additional investments required complying with the standards. Furthermore, a lack of information (Kirner, 1999; Padel and Lampkin, 1994) particularly on technical issues such as alternative strategies for weed, pest and disease control (Fair-weather, 1999; Padel and Lampkin, 1994) and confusion with regards to the standards was frequently mentioned with other institutional barriers, including a lack in government's commitment (Lohr and Salomonsson, 2000; Michelsen and Soegaard, 1999; Padel, Lampkin and Foster, 1999; Padel and Lampkin, 1994).

3.7 Approaches for analysing technology adoption and diffusion

Several analytical approaches have been developed to analyse adoption and diffusion of agricultural innovations. Some are more suited and applied to adoption decisions while others model diffusion better. This section provides a review of the various analytical

models developed and used to study adoption and diffusion of agricultural technologies. Non parametric approaches discussed include count data methods (Isgin, Bilgic, Forster and Batte, 2008; Lohr and Park, 2002), the use of index numbers (Kiani, Iqbal and Javed, 2008; Ehui and Jabbar, 2002) and Data envelopment analysis (DEA) (Cisilinio and Madau, 2007; Seiford and Thrall, 1990; Charnes, Cooper and Rhodes, 1978; Farrell, 1957). Others methods discussed include basic statistics (OECD, 2000; Klepper *et al.*, 1977) and participatory approaches (Hanson *et al.*, 2004). Econometric techniques on the other hand have become increasingly sophisticated in ways that could not have been imagined 20 years ago (Doss, 2006). Many of the econometric approaches work to compensate for the fact that researchers are generally using cross-sectional data to address issues that are inherently dynamic. A non exhaustive discussion on the different econometric approaches is presented in 3.7.2.

3.7.1 Non parametric approaches

Lohr and Park (2002) outlined a model to describe the effects of farm level and regional variables on alternative insect management technology choice within the context of organic farming. In terms of econometric specification, they reject the Poisson model in favour of the Negative Binomial. They found that full time farming does not influence the number of adoptions whereas years of experience and level of education are positively related.

More recently Isgin *et al.* (2008) examined the number of precision farming technologies adopted by farmers using count data methods. Using survey data of 491 farmers, they employ are Poisson and Negative Binomial count data models. Isgin *et al.* (2008) expect education to be positively related to the number of technologies adopted whereas age or other variables measuring experience do suggest a lower number of adoptions. This argument is based on the premise that there is a reduced time period over which a new technology will be rewarded. Also farmers with greater experience with existing technologies farmers may be willing to continue their reliance on existing methods and as

such there may be a status quo bias. This can also be thought of as a consequence of risk aversion.

Kiani *et al.* (2008) applied the Tornqvist-Theil index (TTI) approach to measure total factor productivity (TFP) using outputs and inputs for 24 fields and horticulture crops in Pakistan. The results indicate that agricultural research expenses, number of tractors, and tubewells have positive and significant impact on TFP in the crops sub-sector. Empirical evidence showed attractive marginal rates of return to investments in agricultural research in Punjab. The study concluded that investment in agricultural research has resulted in attractive returns and recommended that supporting and further strengthening research and extension system of the province should be continued. Ehui and Jabbar (2002) argue that superlative-index based total factor productivity measures are a more appropriate technique for assessing the performance of agricultural production technologies and systems. This was based on three case studies from sub-Saharan Africa in which this approach was applied are reviewed.

Data envelopment analysis (DEA) or non-parametric frontier estimation dates back to Farrell (1957). It was operationalized by Charnes *et al.* (1978) and an overview of the method with applications can be found in Seiford and Thrall (1990). No particular production function is assumed. Instead, productivity is defined as the ratio of a linear combination of outputs over a linear combination of inputs. The main advantage of DEA is the absence of functional form or behavioral assumptions. The underlying technology is entirely unspecified and allowed to vary across firms. Cisilinio and Madau (2007) used the Data envelopment analysis to estimate difference in efficiency and productivity between organic and conventional olive producers. Results reveal that the two groups are quite similar and that, even if organic farms still produce a lower “economic value”, they better compensate productive factors, especially in terms of Labour Force. Organic olive-growing farms were more able in using their disposable resources and the higher efficiency permits them to compensate the lower productivity with respect to the conventional farms.

Hanson *et al.* (2004) used a series of focus groups during 2001 and 2002 to explore the risks faced by organic farmers, how they are managed them and needs for risk management assistance. Contamination of organic production from genetically modified organisms was seen as a major risk as well as inadequate crop insurance. Klepper *et al.* (1977) used basic statistics to establish the economic performance and energy intensiveness of organic and conventional farms in the Corn Belt. The results of from the preliminary study suggest that organic farming warrants more intensive research.

OECD (2000) also used basic statistics to examine the effects of prevailing agricultural support policies on the relative profitability of intensive “conventional” and extensive “biological” or “organic” farming practices, and provide some indications of their effects on the environment and on the demand for labour. The study found that the shift to organic farming is, on the contrary, based on pre-existing economies of scope in the form of crop rotation. The additional private costs associated with organic farming bring advantages for the community as it benefits consumers interested in finding what they see as healthy produce but also the general public, who enjoy a better environment. A more balanced system of price support and a factor-price structure more favourable to labour would better foster economies of scope, and hence encourage organic farming.

3.7.2 Econometric approaches

Econometric models, in particular the logit, probit, tobit and multinomial logit models, have been widely used to determine the composition of explanatory variables influencing the adoption process of new technologies by farmers (Shields, Rauniyar and Goode, 1993; Jansen, 1992). Literature suggests that the farm, farmer and institutional factors drive farmers to adopt new technologies (De Francesco, Gatto, Runge and Trestini, 2008; Rehman, McKemey, Yates, Cooke, Garforth, Tranter, Park, and Dorward, 2007; Hattam, 2006). Factors such as the financial and socio-economical impacts of new technologies, effects of new technologies on the risk of the farm, available resources, and technology transfer programmes also have an effect on the decision of the farmer to adopt new technologies (Feder *et al.*, 1985).

When the objective is to identify the socio-economic variables that influence both adoption and intensity of adoption, the probit and the tobit models are preferred (Nichola and Sanders, 1996; Adesina and Zinnah, 1993; McDonald and Moffit, 1980). Different approaches towards adoption models that were used in the past are described by Nichola (1994). There are many econometric studies dealing with economic and environmental aspects of conversion to more sustainable farming systems such as organic farming. It is clear that the majority of the reviewed econometric studies are oriented towards supporting policy making (Feder *et al.*, 1985).

A study by Workneh and Parikh (1999) used probit and ordered probit to examine both the significance of the impact of farmers' perception in adoption decisions of new technology and how perceptions are influenced by the decision to adopt new technology. The probit approach is used to analyse the adoption decision, while farmer perceptions are modelled using the ordered probit methodology since there is an ordering to the categories associated with the dependent variable (Calatrava and Gonzales, 2008; De Cock, 2005; Albisu and Laajimi, 1998). The ordered probit model assumes that there are cut off points which define the relationship between the observed and the unobserved dependent variables (Verbeek, 2008; Pindyck and Rubinfeld, 1981).

Belknap and Saupe (1988) used maximum likelihood to estimate a probit model relating variables to the probability that a farm operator used conservation tillage. Farmers were defined as having adopted conservation tillage if conservation tillage was used on part of the farm. Independent variables were classified as being the physical characteristics of the farm, farm business characteristics and human resources characteristics. Unlike Rahm and Huffman (1984) human capital variables were included in the adoption model to approximate psychological cost of adoption, attitudes and management objectives. Other authors that have used this methodology include Isin, Cukur and Armagan (2007) and Hattam and Holloway (2004) for the estimation of conversion to organic certification and to establish the factors affecting the adoption of the organic dried fig agriculture system in Turkey respectively. Sinja, Karugia, Mwangi, Baltenweck and Romney (2004)

investigated farmers' perception of technology and its impact on adoption of legume forages in central Kenya highlands by estimating the ordered probit model to assess relative importance of each attribute to the farmer.

Lohr and Salomonsson (2000) focused on analysing the factors that determine whether a subsidy is required to motivate organic conversion by using a utility difference model with Swedish data. From these results Lohr and Salomonsson concluded that services rather than subsidies may be used to encourage conversion to organic agriculture. Pietola and Oude-Lansink (2001) focused on analysing the factors determining the choice between conventional and organic farming technology in Finland using a Bellman equation. The choice probabilities were estimated in a closed form by an endogenous Probit- type switching model using Maximum Likelihood Estimation (MLE).

Logistic regression was used by van Vuuren, Larue and Ketchaba (1995) to determine the impact tenant, contract and land characteristics have on adoption of farm practices that enhance productivity and environmental husbandry on rented land. The logit model was also successfully used by Parra and Calatrava (2005) to identify factors related to the adoption of organic farming in Spanish olive orchards. Rigby and Young used logit model to establish why some agricultural producers abandon organic production systems. Wynn, Crabtree and Potts (2001) aimed to model the entry decisions of farmers and the speed of entry to Environmentally Sensitive Areas (ESA) in Scotland. A multinomial logit model was used for modelling entry decisions and a duration analysis was made to quantify the relative speed at which the farmers joined the ESA scheme. They concluded that the logit and duration models were reasonably successful in explaining the probability and speed of entry to the scheme respectively.

Using discriminant analysis, Thompson (1996) identified and ranked the partial effects of the variables that distinguish lessors and lessees in KwaZulu-Natal. The results showed that the most important variable distinguishing lessors from lessees was farm size followed by liquidity. On the other hand, Cooper (1997) made an attempt to estimate the minimum incentive payments a farmer would require in order to adopt more

environmentally friendly “best management practices” (BMPs), using contingent valuation method (CVM). Table 2.1 present other studies that have analysed organic farming adoption and its determinants using various models and methodological approaches. These empirical modelling studies show the importance of incentives and agricultural policy. They provide an understanding of the factors influencing a certain dependent variable example the factors influencing the conversion to more sustainable farming systems and the effect of different policies on the decision making of farmers. The ordered probit model has been applied in this study because of its suitability in modeling categorical dependent variables. It is an especially useful and informative approach to understand the farmers decision on their organic farming status represented by fully-certified organic, partially-certified organic and non-organic.

Table 3.2: Studies that analyse organic farming adoption and its determinants

Study	Sample size		Method of analysis
	Organic	Conventional	
Acs, Berentsen and Huirne (2007)			Dynamic linear programming
Albisu and Laajimi (1998)	97	125	Probit model
Anderson, Jolly and Green (2005)	28	118	Multinomial Logit model
Calatrava and Gonzales (2008)	254		Ordered probit model
Darnhofer <i>et al.</i> (2005)	9	12	Decision tree modeling
De Cock (2005)	93	190	Ordered Probit model
Fairweather (1999)	16	27	Decision tree modeling
Gardebroek and Jongeneel (2004)	16	-	Bayesian approach
Genius, Pantzios and Tzouvelekas (2006)	44	118	Ordered Probit model
Hanson, Dismukes, Chambers, Greene and Kremen (2004)	61	-	Focus group(Qualitative)
Hattam and Holloway (2004)	47	186	Probit model
Isin <i>et al.</i> (2007)	20	107	Probit model
Kerselaers, De Cock, Lauwers and van Huylenbroeck (2007)	-	685	Linear programming
Lohr and Salomonsson (2000)	234	316	Probit model
Musshoff and Hirschauer (2008)			Investment under uncertainty
Parra and Calatrava(2005)	161	161	Logit Model
Pietola and Oude Lansink (2001)	169	779	Switching-type probit
Rigby and Young (2000)	86	35	Logit model
Wossink and Kuminoff (2005)	80	167	Option theory
Cisilino and Madau (2007)	115	114	Data envelopment analysis
Klepper, Lockeretz, Commoner, Gertler, Fast, O'Leary and Blobaum (1977)	14	14	Basic statistics
OECD(2000)	--		Basic statistics
Oude Lansink and Jensma (2003)	29	571	Profit maximization model
Zhengfei, Oude- Lansink, Wossink, and Huirne(2005)	28	405	Damage control

3.8 Chapter summary

Technologies play an important role in economic development and technological change has been a major factor shaping agriculture in the last 100 years. There is a strong belief in the ability of agricultural technology to continue to provide farmers with the needed strategic and tactical options to address food security while addressing environmental concerns. The literature on innovation is diverse and has developed its own vocabulary. In this chapter the basic concepts and theoretical foundation for technology adoption and diffusion is explored with the definition by Rogers (2003) and other authors referred to. A distinction is made between individual and aggregate adoption. The induced innovation as outlined by Hicks (1932) is examined and it has been tested in many countries and industries. The categorization of adopters into innovators, early adopters, early majority, late majority and laggards are illustrated and the cumulative adoption is described as an S-shaped curve resulting from the fact that few farmers adopt the new technology in the early stages of the diffusion process and the essential differences among farmers can explain this phenomenon.

A non exhaustive selection of empirical research in trying to understand the determinants of farmer's decisions to be organic certified are reviewed. The review reveals that adoption or organic farming by farmers is influenced by personal attributes of the farmer, farming systems and resource characteristics, institutional, infrastructure and environmental factors, attitudes and opinions. In explaining the mode and sequence of agricultural technology adoption two approaches are common in literature: the adoption of the whole package or sequential adoption. Various arguments are given for the different approaches to adoption. The barriers to adoption of organic farming are explored and highlighted as (i) perceptions; (ii) access to technical and financial information; (iii) institutional barriers; and (iv) social barriers. Finally the approaches of analyzing technology adoption and diffusion are examined which the analysis revealing that econometric models, in particular the logit, probit, tobit and multinomial logit models, have been widely used to determine the composition of explanatory variables influencing the adoption process of new technologies by farmers.

CHAPTER 4

RISK AND RISK MANAGEMENT

4.1 Introduction

Risk is quintessential in agricultural activities and central to any decision making framework on organic farming adoption. The case of the passage from conventional to organic agriculture exemplifies how a better understanding of risk may provide relevant contributions to fill that frequent gap between technologists and farmers in the evaluation of the possibilities to adopt and implement organic agriculture technologies necessary to achieve a more sustainable agriculture. This chapter commences with a background discussion of risk in agriculture and agriculture development as well as its importance in agricultural economics research. The types and sources of risk in agriculture are presented and discussed. In order to deepen understanding of the farmers risk behaviour, literature on the agricultural risk management strategies employed by farmers is presented and reviewed. The expected utility theory as defined by von Neumann and Morgenstern is explored and the measures of risk aversion commonly used in the literature examined. The need to adjust the Arrow Pratt Absolute Risk Aversion is argued with supporting literature and the three common methodologies for eliciting farmers risk preferences are reviewed.

4.2 Background to risk in agriculture

Risk and uncertainty are pervasive characteristics of agricultural production. They could arise due to several biophysical factors such as highly variable weather events, diseases or pest infestations (Adesina and Brorsen, 1987). Other factors such as changing economic environment, introduction of new crops or technologies, and uncertainties surrounding the public institutions and their policy implementation also combine with these natural factors to create a plethora of yield, price, and income risks for farmers (Anderson, Dillon, and Hardaker, 1985; Mapp, Hardin, Walker and Persaud, 1979; Heyers, 1972). The risk situation is acute for the majority of agricultural producers in sub-Saharan Africa. The low and highly erratic rainfall (Sivakumar 1988), and the

absence of institutional innovations (e.g. crop insurance, disaster payments, emergency loans) to shift part of the risks from the private sector to the public sector, makes risk-management a critical part of farmers' decision making (Shapiro, Sanders, Reddy and Baker, 1993; Adesina and Sanders, 1991; Matlon, 1990).

In the rural areas, risk is a central issue that affects many different aspects of people's livelihoods in the developing world. It is a pervasive characteristic of life in developing countries, especially in rural areas (IFAD, 2008b; World Bank, 2005; Adesina and Quattara, 2000). The economic stability of an entire rural area can be jeopardized by crises caused by different types of natural disasters, from climatic events to livestock or plant diseases. Economic crises caused by the changes of market conditions may also endanger the farm's viability (World Bank, 2005 and Turvey, 2001). According to the IFAD (2008b) nearly 1.4 billion people live on less than US\$1.25 a day. Seventy per cent live in rural area where they depend on agriculture, but where they are also at risk from recurrent natural disasters. Natural disasters have a devastating impact on the food security and overall social and economic development of poor rural households.

The World Bank's (2001) World Development Report indicates that agriculture and agribusiness are the prime sources of income for most families and businesses in developing countries; in 1999, 69% of the population in low-income countries lived in rural areas, compared to 50% in middle-income countries and 23% in high-income countries. Agriculture accounted for 27% of GDP in low-income countries, compared to 10% in middle-income countries and only 2% in high-income countries (World Bank, 2001). These numbers understate the importance of agriculture for economic growth, which is magnified by multiplier effects (through linkages from agriculture to other economic sectors). Agriculture's inherent dependence on the vagaries of weather, such as the variation in rainfall leads to production (or yield) risk, and affects the farmers' ability to repay debt, to meet land rents and to cover essential living costs for their families. Ultimately, the precariousness of farmers and producers translates into macroeconomic vulnerability (Guillaumont, Jeanneney and Brun, 1999; Benson and Clay, 1998).

Unless well managed, weather risks in agriculture slow development and hinder poverty reduction, ultimately resulting in humanitarian crises. According to Beddington (2011) the effects of climate change to the global food system will become increasingly apparent in the next 40 years. The need to reduce greenhouse gas emissions and adapt to a changing climate will become imperative. Poor farmers have few options for coping with significant losses, and in order to reduce their exposure to risk, they often forgo opportunities to increase their productivity (IFAD, 2008b).

In the empirical literature, many researchers have found that risks cause farmers to be less willing to undertake activities and investments that have higher expected outcomes, but carry with them risks of failure (Alderman, 2008 and Adebunsi, 2004). The failure to cope with agricultural risk is not only reflected in household consumption fluctuations but also affects nutrition, health and education and contributes to inefficient and unequal intra-household allocations (Dercon, 2002). The absence of formal credit and insurance markets however, does not imply that rural households have no strategies left to deal with income uncertainty. Traditional risk reducing strategies, however incomplete, helps to cope with risky incomes (Morduch, 1999; Hazell and Norton, 1986). There is vast literature which documents strategies used by rural households to offset the adverse effects of income shortfalls and entitlement failures (Alderman, 2008; Dercon, 2002; Besley, 1995).

Alderman and Paxson (1994) presented a whole range of strategies and distinguish between risk management strategies and risk coping strategies. According to Siegel and Alwang (1999) risk management strategies are decisions and actions taken *ex ante* to lower the probability of a risky event. Jacoby and Skoufias (1998) refer to risk coping strategies as decisions and actions taken *ex post* after the risky event has occurred. While the distinction between risk management and risk coping strategies is very useful from a theoretical perspective, its importance is less crucial from a practical point of view. According to Dercon (2007), in their daily lives, farmers experience at the same time “*fear and fate*”.

4.3 The Importance of risk in agriculture economics research

Uncertainty and risk are typical features in agriculture and basic to any decision making framework (Aimin, 2010). These terms are intertwined and central to any decision making framework. There is substantial literature on defining risk and uncertainty spanning the past several decades (Flaten, Lien, Koesling, Valle and Ebbesvik, 2005; Hardaker *et al.*, 1997; Martin, 1996; Anderson, Dillon and Hardaker, 1988). Greiner, Patterson and Miller (2009) and Knight's (1921) definition of risk and uncertainty is in line with the one given by Hardaker, Huirne, Anderson and Lien (2004) who defined risk as imperfect knowledge where the probabilities of the possible outcomes are known, and uncertainty exists when these probabilities are not known. However, less emphasis is usually placed on the differences between uncertainty and risk because the two have similar effect (variation in level of income) on the farm business enterprises. Hence the two terms are used interchangeably because both contribute to the risk perceived by the decision maker (Greiner *et al.*, 2009; Marshall and Hildebrand, 2002; Gremillion, 1996; Goland, 1993; Mace, 1993; Scarry, 1993). What is important is that risk constitutes an essential feature of the production environment and cannot be ignored when addressing agricultural economics problems (Moschini and Hennessy, 2001). Virtually all the decisions that farm managers are involved in are subject to risk and their responses to the risk that they perceive will continue to influence the efficiency, structure and performance of agriculture.

The importance of risk as a consideration in agricultural economics research is evident from the large amount of related work that has been conducted both locally and internationally over many years. Studies emphasizing the importance of risk include those where risk has been identified as an important component in supply response models (Aradhyula and Holt, 1990). Chavas (2008) as well as Foster and Rausser (1991) also showed that risk is an important consideration in agriculture where sunk costs associated with the asset fixity of capital items and human capital exist. Despite risk being a farmer's perennial problem and farming typically a risky business (Hardaker *et al.*, 2004), unfortunately, paradoxically agricultural economists have made little progress in analysing and measuring agricultural risk in ways that provide useful information for

farm management (Antle, 1983). The conventional risk framework used in risk analysis has not led agricultural economist to ask the most important questions of the effects of risk in agricultural decision making.

Many researchers modeling risk prefer to deal with objective probabilities and impact (Bouma, Francois and Troch, 2005; Ermoliev, Ermolieva, MacDonald, Norkin and Amendola, 2000b; Melnik-Melnikov and Dekhtyaruk, 2000; Johnson-Payton, Haimes and Lambert, 1999; Pradlwarter and Schueller, 1999). Contrary to this, risk perception is a subjective statement of risk by decision-makers, their degree of belief. Risk perception is more like the mental interpretation of risk, broken down into the chance to be exposed to the content and the magnitude of the risk (Hardaker *et al.*, 2004; Pennings, Wansink and Meulenberg, 2002; Senkondo, 2000; Smidts, 1990). Like risk perception, risk attitude plays an important role in understanding the decision-maker's behaviour. Risk attitude is a personal characteristic and deals with the decision-maker's interpretation of the risk and how much he dislikes the outcomes resulting from the risk (Pennings *et al.*, 2002). According to Dillon and Hardaker (1993), risk attitude is the extent to which a decision-maker seeks to avoid risk (risk aversion) or prefers to face risk (risk preference).

There is therefore a need for agricultural economists to understand specifically how risk affects agricultural production. This will in turn suggest how risk affects agricultural decision making and why farmers should be concerned about it. Antle (1983) argues that risk matters primarily because agriculture is a dynamic phenomenon therefore production and price uncertainty affect productivity and expected income. Optimal use of limited resources in the agricultural sector is important for agricultural development (Sargordi, Sharifi, Boerboom, and Keulen Van, 2008) particularly in developing countries where resources are relatively more limited. Resource poor farmers faced with uncertainty that characterises agriculture have to make the decision to make a trade off between producing for food security or profitability. The individual farmers repeatedly make decisions about what commodities to produce, by what method, in which seasons time period and in what quantities. These decisions are made subject to the prevailing farm physical and financial constraints and often in the face of considerable uncertainty.

According to Jeffrey, Gibson and Faminow (1992), traditionally farmers have relied on experience, intuition and comparison with neighbours to make their decisions.

4.4 Type and sources of risks in agriculture

All agricultural enterprises, most especially in developing countries, operate under a situation of risk or uncertainty (Meuwissen, Huirne and Hardaker, 2001). Five general types of risk are described by Hardaker *et al.* (2004). These are described below as: production risk, price or market risk, institutional risk, human or personal risk, and financial risk (Schaffnit-Chatterjee, 2010; Harwood, Heifner, Coble, Perry and Somwaru, 1999).

- **Production risk** derives from the uncertain natural growth processes of crops and livestock. Weather, disease, pests, and other factors affect both the quantity and quality of commodities produced (Langeveld, Verhagen, Van Asseldonk and Metselaar, 2003)
- **Price or market risk** refers to uncertainty about the prices producers will receive for commodities or the prices they must pay for inputs. The nature of price risk varies significantly from commodity to commodity.
- **Financial risk** results when the farm business borrows money and creates an obligation to repay debt. Rising interest rates, the prospect of loans being called by lenders, and restricted credit availability are also aspects of financial risk.
- **Institutional risk** results from uncertainties surrounding government actions. Tax laws, regulations for chemical use, rules for animal waste disposal, and the level of price or income support payments are examples of government decisions that can have a major impact on the farm business (Wolf, Just, Wu and Zilberman, 1998).
- **Human or personal risk** refers to factors such as problems with human health or personal relationships that can affect the farm business. Accidents, illness, death, and divorce are examples of personal crises that can threaten a farm business (Hartman, Frankena, Oude, Nielen, Metz and Huirne. 2004; Huirne, Meuwissen, Van Asseldonk, Tomassen and Mourits, 2003).

The above mentioned risks can be often interrelated, so one event can create several impacts on other realities. All the categories of risk have an effect on the income of the stakeholder. Risk perception can vary from farmer to farmer, from sector to sector and from product to product, it depends on the farmer's experience and on the degree of risk-aversion. Similarly, the risk sources vary in importance from one enterprise to another and from a group of farmers to another (Adesina and Quattara, 2000).

4.4.1 Review of empirical studies on farmers risk sources

A comprehensive review of the literature revealed considerable studies that have been done to identify the sources of risk that affect agricultural producers (Le and Cheong, 2009; Salimonu and Falusi, 2009; Meuwissen *et al.*, 2001; Kinsey, Burger and Gunning, 1998; Stockil and Ortmann, 1997; Osotimehin, 1996). Flaten *et al.* (2005) and Duram (1999) argue that organic farmers are exposed to additional and different sources of risk compared to conventional farmers. Restrictions on pesticide use, fertilizers, synthetic medicines, purchase of feeds etc. influence production risk. Smaller organic markets may mean greater price fluctuations (Lien, Flaten, Ebbesvik, Koesling and Valle, 2003). On the other hand, specific direct payments in organic farming result in greater income stability (Offermann and Nieberg, 2000). At the same time, and for both production types, uncertainty about future government payments may be of concern to farmers. This relative lack of information about organic farmers' risky environment and their reactions to it means that there are few useful practical insights for policy makers, farm advisers and researchers.

In comparing risk and risk management perceptions of organic and conventional dairy farming in Norway, organic dairy farmers had the least risk aversion perceptions (Flaten *et al.*, 2005). Both groups of dairy farmers rated institutional and production risks as major sources of risk, with farm support payments at the top. In contrast, organic farmers put more weight on institutional factors than production systems, in comparison to their conventional colleagues. Conventional farmers are more concerned with the cost of purchased inputs and animal welfare policies. However, both groups had similar

responses on the efficacy of risk management strategies. Financial measures such as: liquidity and cost of production, disease prevention, and insurance were perceived as important ways to handle risks (Flaten *et al.*, 2005). A study among Finnish farmers found changes in agricultural policy as the most important risk factor, while maintaining adequate liquidity and solidity was the most important management response (Sonkkila, 2002).

A study on risk perceptions and management responses of 149 crop and livestock producers in 12 states in the US found that farmers' perception of sources of risk and management responses were significantly different across farm categories and product types (Hall, Knight, Coble, Baquet and Patrick, 2003). According to Harwood *et al.* (1999), for crop producers, weather conditions, crop price and government program were the most important sources of risk, however, a small group of ranchers considered variability in price as relatively unimportant (Wilson, Dahlgran and Conklin, 1993). Dairy farmers in New Zealand ranked price risk and rainfall variability highest, met by routine spraying, drenching, and maintaining feed reserves (Martin, 1996)

Le and Cheong (2009) conducted a study on 256 Vietnamese catfish farming to get an insight into the farmers' perceptions of risk and risk management strategies in their catfish farming. Results suggested that, in general, price and production risks were perceived as the most important sources of risk. Salimonu and Falusi (2009) examined the sources of risk in the last three years in the Osun state, Nigeria. The study identified that five sources constituted the major sources of risk in each of the three years under consideration. These were classified as market failure, price fluctuation, drought, pest and diseases attack and erratic rainfall are the most important sources of risk facing by food crop farmers in Osun State, Nigeria. Others included crop diseases, bush fire outbreak and flood disaster. These had effects on the reduction in farmers' productivity, reduction in farmers' income and food shortage.

Meuwissen *et al.* (2001) studied farmers' perceptions of risk and risk management, by using factor and regression analyses, amongst Dutch livestock farmers. Results showed

that price and production factors were perceived as important sources of risk. Insurance schemes were perceived as relevant strategies to manage risks. The California agricultural producers ranked output price and input cost highest among their production and financial risks (Blank and McDonald, 1995). Ezeh and Olukosi (1991) identified irregularity in input availability, fluctuations in market prices, irregularity in water supply and variability in weather conditions as major risk sources responsible for variation in farmers' income in dry season farming.

Osoimehin (1996) opined that many factors including vagaries of nature, diseases, insect infestations, general economic and market conditions contribute to the price, yield or net return variability of agricultural producers. Kinsey *et al.* (1998) identified harvest failures of rural households in a resettlement area in Zimbabwe as the major risk source. A few studies have found that geographic location, farm type, institutional structures, and other factors affecting the operating environment of farmers influenced farmers' perceptions of risk and risk management (Meuwissen *et al.*, 2001; Patrick and Musser, 1997; Wilson *et al.*, 1993; Boggess, Anaman and Hanson, 1985;). The studies also pointed to the highly complex and individualistic nature of risk perceptions and selection of management tools (Wilson *et al.*, 1993).

4.4.2 Review of literature on sources of risk among South African farmers

South African studies where farm-level data sets were used to identify the perceived importance of multiple risk sources include those by Hardman, Darroch, and Ortmann (2002), Stockil and Ortmann (1997), Woodburn, Ortmann and Levin (1995), Bullock, Ortmann and Levin (1994), Swanepoel and Ortmann (1993). Ortmann, Woodburn and Levin (1995) conducted a study among 199 commercial farmers in the province of KwaZulu-Natal, South Africa and determined risk sources and strategies. Factor analysis suggested that crop gross income, government policy, livestock gross income, credit access, government regulation and cost were (described as) risk sources. Stockil and Ortmann (1997) in a survey conducted on the perceptions of risk among 112 commercial farmers in KwaZulu-Natal analyzed the importance and dimensions of risk sources. The respondents identified changes in the cost of farm inputs, government legislation (tax,

labour, and land redistribution), the Rand exchange rate, and product prices as the most important sources of risk. Factor analysis of risk sources showed that various dimensions to risk exist, including changes in government policy, enterprise gross income, credit access and cost changes.

A similar study in KwaZulu-Natal among vegetable farmers by Bullock *et al.* (1994) identified price, climate and yield variability as the most important sources of risk in vegetable production. The results also showed that government policies added to the level of uncertainty faced by vegetable farmers. However, a comparative analysis among large and small vegetable farmers portrayed differences in their perceptions of risk. Small farmers perceived changes in credit availability and changes in input costs to be more important risk sources than large farmers, while the latter were more concerned with changing interest rates. Swanepoel and Ortmann (1993) conducted a survey involving 93 farmers in the North-Western Transvaal Bushveld in South Africa which revealed sources of and responses to risk in farm production, marketing and financing. The main sources of risk were considered to be variations in livestock production, rainfall and livestock prices, the threat of land reform, and changes in input costs.

4.5 Agricultural risk management strategies

Farmers' perceptions of and responses to risk are important in understanding their risk behaviour (Flaten *et al.*, 2005). Beal (1996) stated that it is to be expected that risk management strategies adopted by farm managers reflect their personal perceptions of risk and managing such risks is critical for the long-term success of individuals and economic systems alike. (Gremillion 2002, 1996; Cashdan, 1990). The specific strategies through which food producers attempt to control risk, however, are varied and diverse. Some combination of diversification and intensification methods for risk management may employed in a given area, community, or household, and neighboring groups may choose different mechanisms for risk reduction when faced with practically identical subsistence challenges (Henrich and McElreath, 2002); Baksh and Johnson, 1990; Halstead and O'Shea, 1989).

According to Harwood *et al.* (1999) risk management can be defined as choosing among alternatives to reduce the effects of risk. This requires an evaluation of tradeoff between changes in risk, expected returns and entrepreneurial freedom among others. For an individual farmer, risk management involves finding the preferred combination of uncertain outcomes and varying levels of expected returns (Boehlje and Lins, 1998). Risk management strategies can: (1) reduce the exposure of the farm business to risk such as enterprise diversification (Scarry 2008 and Smith, 2006); (2) transfer risk to another party through outsourcing certain aspects of the farm operations, such as production contracting (Goodwin and Ker, 1998); or (3) improve the farmer's capacity to bear risk, such as maintaining liquid assets. Risk management cannot be viewed as a "one size fits all" action (Boggess *et al.*, 1985 and Wilson, Luginsland and Armstrong 1988). Several key decision making criteria that play into the risk management planning process include the goals established for the operation, the risk bearing ability of the farm, and the manager's attitude towards risk (Patrick, Wilson, Barry, Boggess and Young, 1985). Each one of these items will be different for individual family members and each farming unit (Wilson *et al.*, 1993).

Organic farming, which is distinguished from conventional farming by its reliance on the natural processes of ecosystems, may present particular risks and ways of managing risks (Hanson *et al.*, 2004). Organic farming systems virtually exclude what are often thought of as important risk management tools in conventional farming, such as the use of synthetic chemicals and antibiotics (Duram, 1999). Instead, organic farmers rely on their understanding and management of cultural practices such as crop rotation, timing of planting and harvesting, mechanical cultivation, and development of beneficial insect populations (Greene and Kremen, 2003). Organic production techniques, particularly crop rotation, can reduce risk in the longer term. Hanson, Johnson, Peters and Janke (1990) compared a conventional grain rotation with an organic grain rotation during the first nine years of production. He stated that "without organic price premiums, the average annual profits of the conventional rotation were higher than the organic rotation." However, using a safety-first criterion, the risk-averse farmer would choose the organic

system over conventional (Harrington and Niehaus, 1999). More specifically, Diebel, Williams and Llewelyn (1995) noted that with diverse cropping systems, the yields and prices of these various crops do not necessarily move together, which reduces variability of overall farm income.

The United States Department of Agriculture (USDA) (2000) in a review of risk management strategies used by US farmers established that while enterprise diversification can be an efficient strategy for risk reduction for smaller farms it is not necessarily the case for large scale farms and wealthier operators. The degree of diversification in farming also varies significantly across regions and farm sizes. The reasons that could account for this situation are: differences and limitations in farm resources, expertise, market outlets, weather conditions and farmers' risk aversion (Harwood *et al.*, 1999). Alderman and Paxson (1994) presented a whole range of strategies and distinguished between risk management strategies and risk coping strategies. Each category involves a number of specific actions but can be summarized as in Fafchamps (1999). He classified actions as follows: 1) to reduce exposure to shocks ex-ante (fear) farmers carefully choose their location or diversify their plots and crops; 2) to cope with shocks ex-post (fate), rural households use 'self-insurance' via precautionary savings, borrowing, liquidation of assets, smoothing consumption, labour sales and solidarity through risk sharing networks

Poor households in developing countries are known to hold significant amounts of extra saving in a wide variety of forms such as stored grain, cash holdings, jewelry, and livestock (Park, 2006; Fafchamps, Udry and Czukas, 1998; Alderman, 1996; Townsend, 1995; Rosenzweig and Wolpin, 1993.). Park (2006) argued that grain stocks are the most important form of extra saving in developing countries despite their negative returns. This puzzling behavior may be due to the lack of access to credit and/or reliable saving opportunities. Deaton (1991) argued, in the event of unexpected negative shocks, households utilize the financial and physical assets that they have previously accumulated.

Indeed, when farmers happen to be unable to or fail to reduce their exposure to risks *ex-ante*, they have to deal with the shocks *ex post*. Their precautionary savings include assets like food stocks, gold, jewellery, cash or when possible, deposits on savings and checking accounts (Fafchamps, 1999; Behrman, Foster and Rosenzweig, 1997). Sometimes, when they face a long series of negative shocks their precautionary savings run out and they have to borrow. Productive assets usually liquidated to face shocks are livestock, oxen, bullocks, farm tools, artisanal equipment, vehicles and farm buildings (Fafchamps, 1999; Rosenzweig and Wolpin, 1993). Instead of selling their productive assets, some farmers prefer to reduce their consumption even in the face of extreme shocks like drought (Kazianga and Udry, 2006; Fafchamps *et al.*, 1998).

When farmers do not have or when they are not willing to sell their productive assets, they increase their labour supply (Wilson *et al.*, 1988). This includes being engaged in nonfarm activities during less extreme conditions, using child labour and labour bonding during extreme conditions (Barrett, Sherlund and Adesina, 2000; Fafchamps, 1999). In a survey administered in rural Tanzania, De Weerd and Dercon (2006) found that risk sharing was the most frequently mentioned coping strategy. They also discovered that risk sharing is mainly achieved through private gifts, private loans and private labour transfers. However, risk sharing among households from the same village will not adequately insure them against covariate risks like floods, hurricanes, drought or other negative shocks that have a positive covariance between households such as price shocks. All households in the same area are affected at the same time. Therefore, nobody in the same area can help the other. Assistance has to come from outside the affected area.

Rosenzweig and Stark (1989) in their study found that Indian families marry their daughters in distant villages as a coping strategy against covariate risks. Salimonu and Falusi (2009) identified cooperative society, borrowing of money and off farm-work as major risk management strategies used by Nigerian food crop farmer. Although traditional risk management strategies mitigate only a small part of overall risk (Alderman, 2008; Dercon, 2002) in the absence of insurance and financial markets,

households use a combination of these strategies as substitutes to deal with agricultural risks. According to Tomek and Hikaru (2001), farmers are assumed to select a combination of strategies that, for example, maximize net expected returns (profits) subject to the degree of risk they are willing to accept. Clearly, risk management strategies in agriculture vary with farm characteristics and the risk environment (Hope and Lingard, 1992). Farmers' risk perceptions, risk attitudes, objectives as well as the available resource base, influence their decisions and actions.

4.6 Expected utility theory and the measure of the risk aversion of producers

Expected utility theory (EUT) was defined by Von-Neumann and Morgenstern (1944) to explain the reasons behind individual choices involving risk. Since then EUT has been the basis for much of the decision-making theory (Gomez-Limon, Arriaza and Riesgo, 2003) and has the support of most agricultural economists (Schoemaker, 1982; Robison and Hanson, 1997). All theoretical aspects of EUT related to agricultural economics have been discussed in classic works such as those of Hardaker *et al.* (1997), Robison and Barry (1987), Anderson *et al.* (1985) and Barry (1984). The theory assumes that there is a utility function U that assigns a numerical value to each alternative. As most economic decisions are expressed in monetary terms, the utility function may have wealth as argument ($U(W)$), measuring the satisfaction obtained from a given amount of money. However, the satisfaction from either a gain or a loss ($U(X)$) may also be used (Hardaker *et al.*, 1997). In doing so, EUT allows the ranking of alternatives within the context of risk.

The seminal works of Arrow (1965) and Pratt (1964) paid attention to one of the key elements of decision theory (the measure of risk aversion of the economic agents). Arrow (1965) and Pratt (1964) proposed two indicators that overcame the limitations in the use of a cardinal utility function in order to compare differences in risk attitudes. As such, the Arrow Pratt measure of risk aversion for von Neumann-Morgenstern expected utility function have been used extensively to analyse problems in the micro economics of uncertainty (Ross 1981). The risk aversion concept is based on the behaviour of

individuals whilst exposed to uncertainty. It is the reluctance of an individual to accept a bargain with an uncertain payoff rather than another bargain with more certain, but possibly lower, expected payoff (Gill, 2007 and Levy, 2006). The Expected Utility (EU) theory essentially defines risk aversion in terms of the concavity or convexity of the decision maker's utility function at any particular point (Cox and Sadiraj, 2006; Eisenhauer, 2006). Friedman and Savage (1948) showed that the local concavity or convexity of the von Neumann-Morgenstern expected utility function $u(x)$, indicates the local risk preference of a decision maker.

A decision maker is described as locally risk averse (concave utility function), risk neutral (linear utility) function or risk loving (convex utility function) for a particular outcome level if $u''(x) < 0$; $= 0$; or > 0 respectively where $u''(x)$ is the second derivative of $u(\bullet)$ of the expected utility model of von Neumann and Morgenstern (1944) which has recently been generalised by Machina (1982). This measure merely indicates the decision maker's risk preference, but is not an appropriate measure of risk aversion as $u''(x)$ is affected by the linear transformation of x , and consequently its magnitude provides no insight into the severity of the risk attitudes (Rabin and Thaler, 2001; Rabin, 2000; Pratt, 1964). Arrow (1971) and Pratt (1964) independently developed equivalent measures of risk preferences that allow for comparisons of interpersonal preferences- the Arrow-Pratt absolute and relative risk aversion coefficients. Arrow developed them from the probability premium (Babcock, Choi and Feinerman, 1993), whilst Pratt worked from the risk premium (Pratt, 1964). A third and relative measure of risk aversion is the partial risk aversion coefficient developed by Menezes and Hanson (1970). These measures are invariant to positive linear transformations of x . A decision maker is defined as risk averse, neutral or risk loving if these measures are less than, equal to, or greater than zero (Menezes and Hanson 1970; Pratt 1964)

4.6.1 Arrow-Pratt measure of Absolute Risk Aversion (ARA)

Also known as the *coefficient of absolute risk aversion*, mathematically the coefficient for the ARA is calculated as:

$$A(w) = -\frac{u''(w)}{u'(w)}$$

and

$$A(w) = A(x) = -\frac{u''(x)}{u'(x)} \dots \dots \dots (1)$$

Where w indicates total wealth and u'' and u' indicate the second and first derivatives of the von Neumann-Morgenstern utility function, respectively. The measure of ARA is appropriate to describe situations in which total wealth has a fixed stochastic part-income and a variable non stochastic part- initial wealth (Bar-Shira, Just and Zilberman, 1997). Arrow (1971) pointed out that it is natural to hypothesize that the individual's willingness to undertake a certain risky project is greater when he or she is wealthier. In other words, wealthier individuals should have a greater amount of risky assets in their portfolio. Thus the measure of ARA should decrease with wealth.

The coefficient $A(w)$ takes either positive or negative values for risk-loving or risk averse economic agents respectively. When the coefficient decreases as monetary value increases we have Decreasing Absolute Risk Aversion (DARA). Alternatively, if the coefficient increases under the same set of circumstances we have Increasing Absolute Risk Aversion (IARA). Finally, if the coefficient does not change across the monetary level, the decision-maker exhibits Constant Absolute Risk Aversion (CARA), which implies that the level of the argument of the utility function does not affect his or her decisions under uncertainty (Menezes and Hanson, 1970); Pratt, 1964). Since $A(w)$ is not a non-dimensional measure of risk aversion, its value is dependent on the currency in which the monetary units are expressed. To overcome the impossibility of comparing risk aversion among different economic agents Arrow (1965) and Pratt (1964) devised a non-dimensional measure called the Relative Risk Aversion (RRA) coefficient.

4.6.2 Arrow-Pratt measure of Relative Risk Aversion (RRA)

Also known as the *coefficient of relative risk aversion*, mathematically the coefficient for the RRA is calculated as:

$$R(w) = -w \frac{u''(w)}{u'(w)} = wA(w) = wA(x) \dots \dots \dots (2)$$

In situations where both the stochastic and non stochastic components of the wealth are changing proportionally, the appropriate measure is $R(w)$. Arrow's (1971) hypothesis is that when both initial wealth and the risky project are increased by the same proportion, the individual's willingness to undertake the risky project is smaller. In other words, wealthier individuals should hold a smaller portion of risky assets in their portfolio. The $R(w)$ coefficient measures the percentage change in marginal utility in terms of the percentage change in the monetary variable. Hence, relative risk aversion represents the elasticity of the marginal utility function which ranges from 0.5 (slightly risk averse) to 4 (extremely risk averse). Anderson and Dillon (1992) classify agricultural producers according the $R(w)$ coefficient. Although most authors consider values above 5–10 very unlikely (Kocherlakota, 1996), some studies report values of up to 30 (Kandel and Stambaugh, 1991). According to them, these values can be reasonable when the alternatives in place represent a gain or loss of 1% of the total wealth. As with the absolute risk aversion coefficient, there is Decreasing Relative Risk Aversion (DRRA), Constant Relative Risk Aversion (CRRA) or Increasing Relative Risk Aversion (IRRA) behaviour (Menezes and Hanson, 1970; Pratt, 1964).

4.6.3 Measure of Partial Risk Aversion (PRA)

Also known as the *coefficient of partial risk aversion*, mathematically the coefficient for the PRA is calculated as:

$$P(w_0, \pi) = - \frac{[u''(w_0 + \pi)]}{[u'(w_0 + \pi)]\pi} \dots \dots \dots (3)$$

Where

w_0 denotes non stochastic initial wealth, and

π denotes stochastic income

At the point ($W = W_0 + \pi$), PRA is related to the measure of ARA and RRA as follows:

$$P(w_0, \pi) = \pi A(w_0 + \pi)$$

$$P(w_0, \pi) = R(w_0 + \pi) \frac{\pi}{w_0 + \pi}$$

.....(4)

The measure of partial risk aversion is unit less and appropriate to describe situations in which initial wealth is fixed and income is variable. Bar-Shira *et al.* (1997) show that Decreasing Absolute Risk Aversion (DARA) implies Decreasing Partial Risk Aversion (DPRA) with respect to initial wealth and that Increasing Relative Risk Aversion (IRRA) implies Increasing Partial Risk Aversion (IPRA) with respect to income. The opposite does not necessarily hold. It is possible to have DRRA and IRRA at the same time. Menezes and Hanson (1970) alludes that partial risk aversion examines behavior when the prospect changes but wealth remains the same. Increasing Partial Risk Aversion (IPRA) implies a decrease in the willingness to take a gamble as the scale of the prospect increases.

4.7 Using ARA to measure the decision makers risk aversion

The Absolute Risk Aversion Coefficient defined as $A(x) = -\frac{u''(x)}{u'(x)}$ has appeared extensively in literature (Just 2011; Bar-Shira *et al.*, 1997; Chavas and Holt, 1996). Although the ARA are invariant to linear transformations of the u (King and Robison, 1981) they are not invariant to arbitrary rescaling of x or a change in the range and scale of x (Raskin and Cochran, 1986), rendering ARA neither employable in secondary studies, nor comparable between studies without prior adjustments (Just, 2011). The Initial work of Pratt (1964) best demonstrates the impact of both scale and range on

ARA $[A(x)]$. According to Pratt (1964), to measure a decision maker's local aversion to risk, it is natural to consider his risk premium for a small, actuarially neutral risk $\tilde{y}$.

Pratt (1964) developed a relationship between risk premium, the variance of the risky prospects and ARA) as being:

$$\pi(x, \tilde{y}) = \frac{1}{2} \sigma_y^2 A(x) + o(\sigma_y^2) \dots \dots \dots 5$$

Where:

$\pi(x, \tilde{y})$ is the risk premium given a level of wealth and a risky prospect $\tilde{y}$;

σ_y^2 is the variance of the risky prospect;

$A(x)$ is the Absolute Risk Aversion at level of wealth x ; and

$o(\sigma_y^2)$ are the higher order terms in the Taylor series expansion of the expected utility function around the mean of x .

Solving for $A(x)$ in equation 5 yields:

$$A(x) = \frac{2[\pi(x, \tilde{y}) - o(\sigma_y^2)]}{\sigma_y^2} \dots \dots \dots 6$$

If, following Tsiang (1972) the dispersion of the risk prospect is assumed small relative to wealth, then $o(\sigma_y^2)/\sigma_y^2$ may be neglected.

Thus, $A(x)$ is approximately given by:

$$A(x) \approx 2\pi(x, \tilde{y})/\sigma_y^2 \dots \dots \dots 7$$

This exposition is similar to that presented by Mc Carl and Bessler (1989) as part of their discussion on estimating an upper bound on the ARA when the utility function is

unknown. The exact and approximate expression of $A(x)$ clearly indicates that $A(x)$ is dependent on both x and the risk situation, $\tilde{y}$. Thus the ARA has associated with it a unit, the reciprocal of that unit with which $\tilde{y}$ is measured since the certainty equivalent is divided by the variance of $\tilde{y}$. Because σ_y^2 and $E(\tilde{y})$ affects $A(x)$, the magnitude of $A(x)$ is not affected by the use of incremental rather than absolute returns, or *vice versa*.

Furthermore it is apparent that the change in σ_y^2 will affect ARA. For example a mean preserving increase in risk i.e. σ_y^2 increases whilst x and the expected value of $\tilde{y}$ remain constant will decrease $A(x)$. This discussion provides an explanation to McCarl's (1988) concern that if the magnitude of ARA is unaffected by use of incremental rather than absolute terms as hypothesized by Raskin and Cochran (1986) then one could abandon the wealth concept and only look at income. Cochran and Raskin's (1987) reply agrees with McCarl (1988) without explaining how ARA are a function of both initial wealth and stochastic income.

Given the sensitivity of ARA to the scale of data as well as the range of data it is somewhat surprising that ARA have appeared in so many publications without also providing sufficient information about the source of the ARA coefficients or the range and scale of stochastic wealth to allow comparisons with other studies (Cochran *et al.*, 1985; Collender and Zilberman, 1985; Danok, McCarl and White, 1980; Holt and Brandt, 1985; King and Oamek, 1983; King and Robinson, 1981; Tauer, 1986; Ye and Yeh, 1995; Zacharias and Grube, 1984).

In Table 3.1, a summary of commonly used risk aversion coefficients are displayed for two such classifications. Labels in the table reflect classifications provided by the authors wherever possible. The coefficient estimates are based on certainty equivalents or on secondary data from other studies. An analysis of the coefficient estimates demonstrates that little consistency is evident on appropriate coefficients or classifications of specific coefficient values.

Table 4.1: Summary of commonly used risk aversion coefficients

Study	Year	Values of Arrow Pratt elicited	
		Almost risk neutral	Strongly risk averse
Meyer	1977		6.0
King and Oamek	1983	-. 00001 to .00001	.00005 to .0001
Wilson and Eidman	1983	-. 0001 to .0001	.0002 to .001
Love and Robison	1984	-. 00001 to .0002	.0025 to ∞
Zacharias and Grube	1984	-.0000001 to .000001	.000042 to .0035
Cochran, Robison, and Lodwick	1985		.0015
Collender and Zilberman	1985	.000000921	.000109
Greene <i>et al.</i>	1985	.0 to .00125	.005 to .0075
Holt and Brandt	1985	.005 to .005	.02 to .04
Tauer	1985		.0002 to .0003
Tauer	1986	.0001 to .001	.001 to ∞
Saha, Shumway, and Talpaz	1994b	Mean .0075	
Oglethorpe	1995	.000015	.000169
Torkamani and Hardaker	1996	.000001	.001
Bar-shir <i>et al.</i>	1997	Mean .00000045	
Ferrer <i>et al.</i>	1997	Mean .768	
Brunello	2002	Mean 0.153	
Mac Nicol	2007	Mean .650	

Arrow Pratt Risk Aversion coefficients are expressed in several studies to five decimal places and ranges from 12.17(Chavas and Holt, 1996) and 6.0 (Meyer, 1977) to .000000921 (Collender and Zilberman, 1985). Cochran (1986) stated that it “appears reasonable to expect that the preferences of the majority of farmers will be represented with the interval -.0002 to .0015 when measured at after tax net farm annual income levels.” However Raskin and Cochran (1986) demonstrate that a pair of decision makers exhibiting seemingly close values of $A(x)$ such as .0002 and .0003, respectively, would disagree on the value of the 10,001st dollar by a factor of three and on the value of the

50,001 st dollar by a factor of 160. This demonstration emphasizes that researchers should not underestimate the importance of scale.

The need for the explicit specification of the unit of the Arrow-Pratt Risk Aversion might arise when elicited values are used outside the context of the original study (Mac Nicol, 2007; Just, 2011). If a risk aversion coefficient elicited over an outcome space measured in one unit is later applied over outcomes measured in another unit, it must be converted by the appropriate factor (Ferrer *et al.*, 1997). Raskin and Cochran (1986) propose 2 theorems to guide the approximation to necessary conversions:

THEOREM 1. $A(x) = r(x)$. Let $r(x) = -u''(x)/u'(x)$. Define a transformation of scale on x such that $w = x/c$, where c is a constant, x is the outcome variable and w is a wealth level. Then $r(w) = cr(x)$.

THEOREM 2. $A(x) = r(x)$. If $v = x + c$, where c is a constant, and v is a wealth level, then $r(v) = r(x)$. Therefore, the magnitude of the risk aversion coefficient is unaffected by the use of incremental rather than absolute returns (or vice versa).

The notion that range affects Arrow-Pratt Risk Aversion is not new. Wiesensel and Schoney (1989) stated that Arrow-Pratt Risk Aversion elicited from different income levels is not directly comparable. The notion that range affects Arrow-Pratt Risk Aversion is also implied in Mc Carl and Bessler's (1989) approach of estimating an upper bound on Arrow-Pratt Risk Aversion when the utility function is unknown. Kachelmeir and Shehata (1992) also suggested that risk preferences be measured as the ratio of the certainty equivalent to the equivalent value of the income distribution to permit comparison of risk preferences across lotteries of different range.

Feinerman and Finkelshtain (1996) used a similar approach based on the probability premium. These approaches have a drawback in that results cannot be directly applied to some stochastic efficiency techniques, e.g. mean-variance programming models and stochastic dominance with respect to a function. Babcock *et al.* (1993) also note that when the range of wealth distributions varies, the risk premium, expressed as a proportion of gamble size (amount of wealth at risk) and the probability premium convey more information on risk preference than does Arrow-Pratt Risk Aversion. Consequently

Eisenhauer (2006) advocates consideration of these measures when selecting Arrow-Pratt Risk Aversion coefficients to demonstrate the effects of risk preferences on decisions. It is apparent from the range of Arrow-Pratt Risk Aversion elicited, borrowed and assumed, even in recent studies that many agricultural economists are unaware of the impact of range on Arrow-Pratt Risk Aversion e.g. Bar-Shira *et al.* (1997), Chavas and Holt (1996), Saha *et al.* (1994b), Pope and Just (1991), Chavas and Holt (1990), Lins, Gabriel and Sonka (1981). Despite this suggested amendments to Raskin and Cochran's (1986) first theorem, not all risk situations may easily be adjusted to be represented in terms of Rand income or wealth to enable comparison or analysis e.g. in environmental risk (Just and Pope, 2003). An approach is suggested entailing standardization of the data to uniform scale and range prior to calculating an adjusted Arrow Pratt Absolute Risk Aversion coefficient (λ^*) (Nieuwoudt and Hoag, 1993).

The approach outlined by Nieuwoudt and Hoag (1993) may be extended to multivariate utility analysis and applied to environmental analyses where say both wealth and environmental risks may be important. Elicited values are consistent with the absolute risk aversion matrix, R , derived by Duncan (1977) and defined by: $R(x) = [-U_{ij} / U_i]$. R provides a complete representation of an agent's risk preferences for multiple attributes that is consistent with the Arrow Pratt Absolute Risk Aversion coefficient. The diagonal elements represent the agent's absolute risk attitudes with respect to the i th risky attributes.

Whilst Raskin and Cochran (1986) have successfully made agricultural economists aware of the effects of the scale of data on the Arrow-Pratt Risk Aversion many still seem unaware of the effect of range. This discussion has focused on the abilities of the Arrow-Pratt Risk Aversion to convey information about risk aversion assumptions or measurements in research programs. It is shown that an amendment is necessary for Raskin and Cochran's (1986) first theorem if Arrow-Pratt Risk Aversion is to be adjusted for the range as well as the scale of data. It is imperative that sufficient information regarding the risk situation and the population are reported with elicited risk preferences

(Ferrer and Nieuwoudt, 1997). Hence it is important that risk preferences should be reported in a consistent manner such that studies can easily be compared to one another.

4.8 Methods for measuring the risk attitudes of agricultural producers

Several approaches have been used to assess smallholder farmers' risk attitudes. According to Robison, Barry, Kliebenstaein and Patrick (1984), Lins *et al.*(1981) and Young (1979), there are three basic methods of measuring the attitudes to risk of agricultural producers: (i) *Direct estimation of the utility function (DEU)*; (ii) *Experimental methods(EM)*; and (iii) *Observed economic behaviour*.

- *Direct estimation of the utility function (DEU)*: This method involves direct interaction with the decision-maker, with the interview procedures designed to determine respondents' points of indifference between certain outcomes and hypothetical risky options. Respondents' preferred choices among alternative options are thus considered to be indicative of their risk preferences. Empirical application of the DEU approach includes Hardaker *et al.* (1997), Abadi Ghadim and Pannell (1999) and Feinerman and Finkelshtain (1996).

The DEU method has been criticized as being prone to interviewer bias if conducted using hypothetical rather than real lotteries (Binswanger, 1980), subjectivity involved in the identification of the functional form of the utility function, preferences for specific probabilities (for example a 50:50 bet), confounding from extraneous variables, and negative preferences towards gambling (Young, 1979). Although risk preferences elicited using EM may be more reliable than those elicited using DEU methods (Gunjal and Legault, 1995), budgetary restraints may preclude the researcher from asking meaningful questions (Kachelmeier and Shehata, 1992), in which case use of DEU may be preferred to EM.

- *Experimental methods (EM)*: This can be regarded as a variant of the DEU method, in which real gambles/bets are used instead of hypothetical gains and

losses and from their responses, derive the respondent's utility function. Because this approach requires that financial compensation is paid to respondents as a function of their responses to each gamble, this approach has generally been carried out in populations with low per capita income and wealth, example Miyata (2003) in Indonesia, Grisley and Kellog (1987) in Thailand and Binswanger (1980) in India.

- *Observed economic behaviour*: This method was developed in order to represent risk behaviour, tuning the models to fit actual data by adjusting the risk aversion coefficients, usually along with other coefficients. Furthermore, these models rely on either production theory under uncertainty (econometric models) or cropping pattern selection (mathematical programming). Bar-Shira *et al.* (1997), Chavas and Holt (1996, 1990), Saha *et al.* (1994b), Pope and Just (1991), Myers (1989), Moscardi and Janvry (1977) and Wolgin (1975) present good examples of the first category, while for the latter we have Brink and McCarl (1978) and Wiens (1976).

This approach is criticised for confounding risk behaviour with other factors such as resource constraints faced by decision makers (Eswaran and Kotwal, 1990), thus making an individual appear more risk averse than he/she truly is (Binswanger, 1982). This is particularly important in developing countries where market imperfections are prominent and production and consumption decisions, therefore, are non-separable (Sadoulet and de Janvry, 1995). Econometric approaches have advanced considerably over the past three decades, but remain data intensive and open to model misspecification problems. The advantage of EM and DEU approaches over econometric approaches is that the researcher can design experiments where many of the features are under the control of the experimenter.

Young's (1979) review shows that the principle uses of elicited risk aversion coefficients are for (a) farm management extension application, (b) technology adoption and rural

participation applications, and (c) policy and predictive applications. He concluded that considerable heterogeneity in risk preferences among individuals; requirements of frequent updating of individual risk preferences in response to changing objectives, information and attitudes; time, cost and practical problems associated with elicitation of risk preferences are likely to limit their use in extension programmes (Young, 1979).

4.8.1 Elicitation and analysis of farmers risk preferences in developing countries

Dillon and Scandizzo (1978) measured the risk preferences for 103 subsistence farmers in Brazil. Mind experiments involving choice between risky and sure farm alternatives were used to assess risk attitudes of samples of small farm owners and sharecroppers in Brazil. According to Dillon and Scandizzo (1978), results indicate that most subsistence farmers are risk averse, and that risk aversion tends to be more common and perhaps greater among owners than sharecroppers. In an expected utility context, distribution of risk attitude coefficients (based on mean-standard deviation, mean-variance, and exponential utility functions) was diverse and not necessarily well represented by an average sample value (Dillon and Scandizzo, 1978). Further, econometric analysis done by regressing the risk preference against various socioeconomic variables indicated that income level and other socioeconomic variables influenced peasants' risk attitude.

Binswanger (1980) conducted a field experiment with 330 farmers in rural India for both real and hypothetical gambles using lottery choice tasks. When payoffs were small, about half the respondents were in the intermediate and moderate risk-aversion categories. Binswanger's (1980) study found that nearly a third of the respondents were close to risk-neutral or risk-loving, and less than 10% were severely risk-averse. However, as payoffs rose, nearly 80% of the subjects displayed moderate risk-aversion, and risk-neutral or risk-loving behavior almost disappeared. Arrow's prediction held - absolute risk-aversion declined as payoff increased. Here an individual's willingness to accept small bets of a fixed size increased as wealth increased (Arrow, 1971). However, contrary to Arrow's hypothesis, the subjects also displayed decreasing relative risk aversion (Binswanger, 1980).

A series of laboratory experiments were conducted in China by Kachelmeier and Shehata (1992) to elicit people's certainty equivalents for a sequence of lotteries. Ten sessions were conducted with 185 student volunteers at Beijing University. The study differed from Binswanger's (1980) in that here, subjects were not asked to choose between lotteries. Rather, certainty equivalents were elicited for individual lotteries. Several percentages depicting different win levels were used (not just the uniform 50-50% chances that Binswanger (1980) used). Subjects were presented with a lottery involving a prize of value G with probability p , and zero with probability $(1-p)$. If the subject drew a card with a number less than or equal to p , they were awarded the prize. Kachelmeier and Shehata (1992) found that the average ratios of certainty equivalents to expected values for the high-prize trials were systematically lower than the ratios for low-prize trials, across win percentages. Once again, there was a marked trend from risk-loving or risk neutral preferences to risk-averse, as payoffs increased.

Holt and Laury (2002) presented subjects with simple choice tasks that may be used to estimate the degree of risk aversion as well as specific functional forms. They conducted this experiment under both real and hypothetical conditions, using a menu of paired (Option A and option B) lottery choices, similar to Binswanger (1980). The payoffs for Option A, \$2.00 or \$1.60, were less variable than the potential payoffs of \$3.85 or \$0.10 in the "risky" option B. The probabilities were explained using throws of a ten-sided die, and ranged between 1/10 and 10/10(sure win). Holt and Laury (2002) controlled for wealth effects between the high and low real-payoff treatments, by subject being required to give up what they had earned in the first low-payoff task in order to participate in the high-payoff decision. Results from Holt and Laury (2002) showed that most subjects chose the safe option when the probability of the high payoff was small, and then "crossed over" to option B, almost never returning to A. A few more returned in the hypothetical treatment. Once again, the subjects showed increasing degrees of risk-aversion in the high-payoff treatments than the low-payoff treatments.

This result is qualitatively similar to that reported by Kachelmeier and Shehata (1992) and Smith and Walker (1993) in different choice environments. The results indicate that most individuals are risk averse with little variation according to personal characteristics,

although wealth has a slight negative effect on risk aversion especially at low pay offs (Holt and Laury, 2002). Distribution of risk aversion was more widely spread at low levels and for hypothetical gambles, suggesting at higher pay offs one is more likely to elicit true risk preferences. The results support the hypothesis of increasing partial risk aversion with increasing payoff levels similar to Bas-Shira *et al.* (1997).

4.8.2 South African research on farmers risk preferences

The first study on risk preferences of South African farmers was done by Lombard and Kassier (1990). Using the interval approach to measuring risk attitudes, they elicited the risk attitudes of 52 farmers in the Western and Southern Cape. The concept of generalised stochastic dominance was used in the interval approach developed by King and Robison (1981) to elicit the risk attitudes of farmers at five different after tax net income levels of –R5000, R15 000, R53 000, R70 000, and R110 000. Risk attitudes were measured using the Arrow Pratt Absolute Risk Aversion coefficient on a sixteen point scale ranging from -0.001 to 0.01 for each of the income levels. A comparison of the empirical measures of risk aversion obtained from studies by Officer and Halter (1968); Halter and Mason (1978); Lin, Dean and Moore (1974) reveals that Arrow-Pratt coefficients, $r(\cdot)$, have ranged from -.0002 to .0012 for the farmers surveyed.

Lombard and Kassier (1990) found that the degree of intertemporal stability in risk attitudes varied between the specified income levels and there seemed to be a negative relationship between the accuracy of the risk interval on the one hand and the consistency of choice on the other hand. The response to two control questions indicated a varying degree of consistency at each income level. Risk averse, risk seeking and risk indifferent attitudes were observed (Lombard and Kassier, 1990).

Meiring and Oosthuizen (1993) measured 34 irrigation farmers' absolute risk-aversion coefficients by means of the interval approach. The study was carried out in the area of the P.K. le Roux dam (Vanderkloof Dam), Northern Cape, South Africa. Meiring and Oosthuizen (1993) analysed the influence of adjustment of the absolute risk-aversion scale, as well as the width of cumulative distributions on respondents' risk-preferences.

The consistency of risk-attitudes was also determined. Results of the elicitation of risk preference by Meiring and Oosthuizen (1993) established that the majority of farmers in Vanderkloof revealed extreme risk-preferences: either risk-seeking or risk-aversion. They further established that, the decision makers who completed the questionnaire at the higher levels of bank balances were significantly more consistent than those who completed the questionnaire at the lower levels. If the width over which the distributions extend, increases, the preferences of a few farmers tends to change from risk-neutral to risk-averse. This study by Meiring and Oosthuizen (1993) concluded that by propagating the concept of probability distributions for the evaluation of risky alternatives, a better understanding of risk and risk management can be brought about, which will result in easier obtaining of risk measuring results.

The risk preference for irrigation farmers in the Winterton area of South Africa was elicited by Botes, Bosch and Oosthuizen (1994). The aim was to measure the absolute risk aversion coefficients of irrigation farmers in the Winterton area and establish if these were significantly affected by annual income and wealth. A similar methodology was used to that by Meiring and Oosthuizen (1993) to elicit risk preferences. Risk intervals were selected and adjusted for the scale of currency as outlined by Raskin and Cochran (1986). This produced risk intervals in the range of -0.00030 to 0.00170. The study concluded that decision makers became more risk averse when wealth instead of annual income is at stake. Risk aversion coefficients measured at low, medium and high annual income and wealth levels, showed no change when annual income or wealth levels increased and the majority of irrigation farmers had risk neutral annual income and wealth risk preferences (Botes, Bosch and Oosthuizen, 1994). This study is important because adjusting Arrow-Pratt Risk Aversion for the comparison of income and wealth risk preferences is essentially the first attempt in literature to adjust Arrow-Pratt Risk Aversion for the range of data.

A direct elicitation of utility approach was used to measure risk preferences of commercial sugar cane farmers in the UMzimkhulu, Sezela and Eston sugar mill areas of KwaZulu-Natal (Ferrer *et al.*, 1997). Arrow- Pratt Absolute Risk Aversion coefficients were elicited and adjusted for both range and scale of the data, to allow both inter and

intra study comparisons of risk preferences. A total of 53 farmers surveyed of which 57.2% were risk averse, 29.6% risk neutral and 13.2% risk preferring. Ferrer *et al.* (1997) found that on average the farmers in the study were risk averse although risk preferences varied significantly amongst individuals. Regression analysis further indicated that on average sugar cane farmers are averse to a possible loss in wealth relative to initial wealth and they exhibit increasing absolute risk aversion although at a decreasing rate with increasing gamble range (Ferrer *et al.*, 1997).

4.9 Chapter summary

This section commences with an introductory background to risk in agriculture and its effect on people's livelihoods. The importance of risk in agricultural economics research is argued due to the fact that risk and uncertainty are quintessential features in agriculture. These terms are closely entwined and central to any decision making framework. The different opinions on the importance of risk and uncertainty to the decision maker and in agricultural production are presented as argued by the various authors. The section proceeds to review studies dealing with the type and sources of risks in agriculture broadly categorized into business and financial risk. These are defined in detail. A review of empirical studies on farmers risk sources globally and in South Africa is presented. The findings suggest that risks and management responses vary across geographical regions and farm types. As a result, risk modeling should be adapted to the unique conditions of the domain being investigated and go beyond price and yield risks. As a minimum requirement, production (including inputs), marketing, and financial considerations must be integrated into a realistic decision making framework (Patrick *et al.*, 1985). The agricultural risk management strategies are aimed at mitigating against risk faced by farmers. The literature established that risk management options include 1) reducing the exposure of the farm business to risk, 2) transferring risk to another party; or 3) improving the farmer's capacity to bear risk.

A conceptual model for risk preference analysis is outlined as most models of decision making under risk require the knowledge of the decision makers risk preference. Bernoulli models and Expected utility (EU) models are presented and their pros and cons

articulated. The definition of risk aversion by Friedman and Savage (1948) in reference of Von Neumann-Morgenstern expected utility function is outlined as is the measures of risk aversion by Arrow (1971) and Pratt (1964). They independently developed equivalent measures of risk preferences that allow for comparisons of interpersonal preferences. These are absolute risk aversion, relative risk aversion, partial risk aversion and the Arrow-Pratt Absolute Risk Aversion coefficient. The case for and how to adjust the ARA for the range and scale of the data is also presented due to the importance of reporting risk preferences in a consistent manner such that studies can easily be compared to one another.

Elicitation procedures are categorised as experimental methods (EM), direct elicitation of utility (DEU) approaches, and econometric methods. The EM and DEU approaches are advanced over the econometric approach in that the researcher can design experiments where many of the features are under the control of the experimenter and suited to the area under study. The section is concluded by a review of the four studies in South Africa that have previously elicited risk preferences. However all these studies have focussed on the risk preferences of large scale commercial farmers.

CHAPTER 5

METHODOLOGY

5.1 Introduction

This chapter describes the research methodology for data collection and analysis for the study. A description of the background of the study areas in KwaZulu-Natal and Eastern Cape provinces includes the following sub sections: the geographical location, history of the former homeland, demographics, natural resource base, agricultural potential and land use patterns in the area. Information on the population study group (sampling frame) is presented and the data collection methods and instruments used to obtain socio-economic, demographic, institutional and household data are described. The sampling procedure is then outlined. The primary data collection involved personal interviews with the head of the household using a structured questionnaire. This is complemented by secondary literature obtained from documented information. The methodology of eliciting the risk preferences of the sample farmers is also described using the Arrow Pratt Absolute Risk Aversion and the experimental gambling approach. The chapter proceeds to describe the variables used in the adoption model and their unit of measurement as well as the specification and description of variables used in the consumer analysis. The resulting data were employed in different levels of analysis. The chapter concludes by giving the empirical specification and estimation procedures for the fitted models.

5.2 Study area

The study was carried out in KwaZulu-Natal and the Eastern Cape Provinces. The selected study area is in the rural Umbumbulu magisterial district, uMgungundlovu District Municipality, Mkhambathini Local Municipality of KwaZulu-Natal province in South Africa (Figure 5.1) and the former Transkei (OR Tambo District Municipality) and former Ciskei Homelands (Amatole District Municipality) of the Eastern Cape Province. The former Transkei study area is represented by rural Nyandeni location, Mthatha suburbs and the peri-urban area of Chris Hani Location in Bedford area, Efata all situated in the OR Tambo District Municipality.

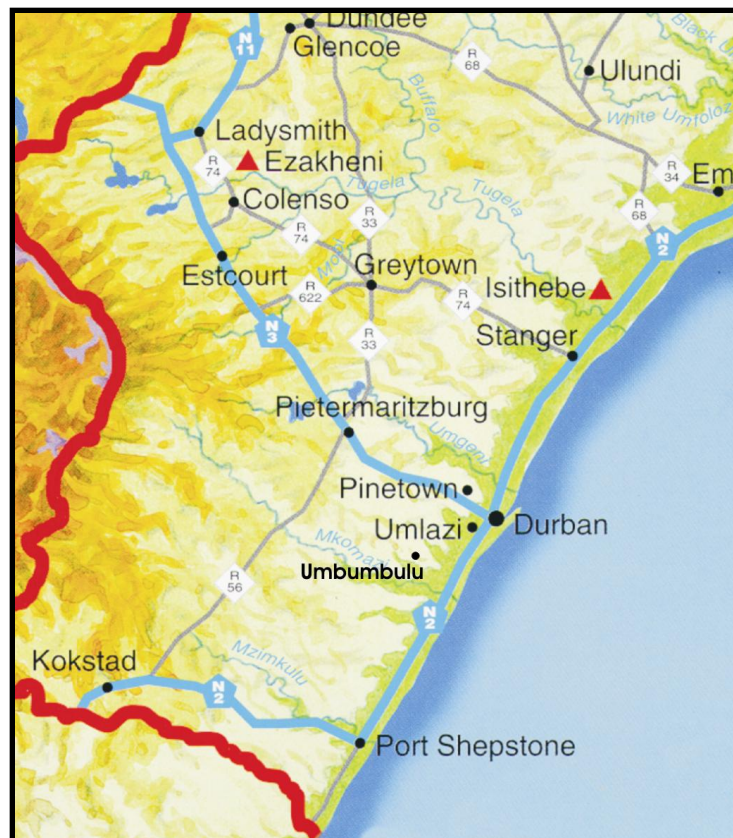
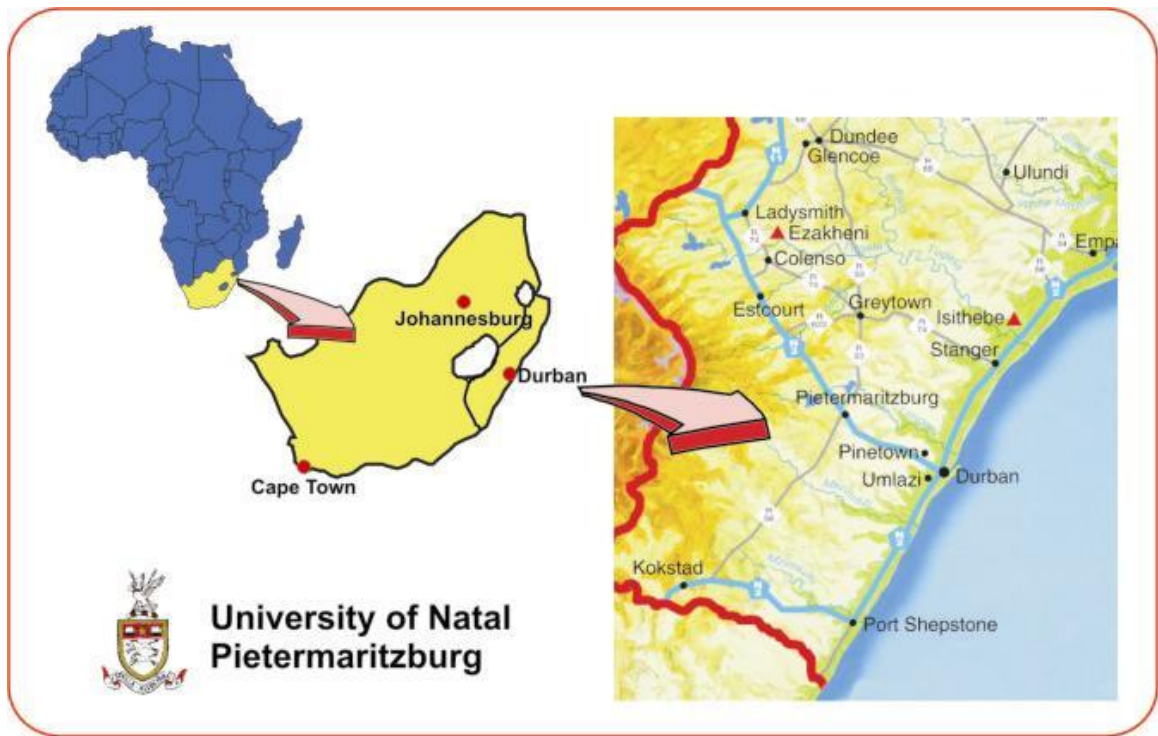


Figure 5.1: Map of KwaZulu-Natal showing study area
 Source: University of KwaZulu-Natal, Cartographic unit, 2004

The former Ciskei homelands are represented by the study areas of rural Cata village in Keiskammahoek, East London suburbs and peri-urban areas of Kwezana village (near Alice Town) and Thsathsu village (near King Williams Town) all situated in the Amatole District Municipality. Figure 5.2 graphically shows the former homelands of the Transkei and the Ciskei, while Figure 5.3 shows the Eastern Cape Province graphically outlining the OR Tambo and Amatole District Municipalities.

The Umbumbulu area is one of the former homelands of KwaZulu-Natal province. The province has the largest concentration of people who are relatively poor, and social indicators point to below average levels of social development (STATSSA, 2006). According to the mid-year population estimates by STATSSA (2010) the province has a population of 10.6 Million people 67 percent of whom reside in communal areas of the former KwaZulu-Natal homeland (STATSSA, 2010). It is important to note that the census 2011 was recently conducted in October and results will be expected in 2012. These communal areas account for 31 percent of the provinces total land area and are characterized by smallholders practising low output subsistence agriculture (Matungul 2001). Subsistence agriculture is an important livelihood option for many rural families contributing a significant portion of their household income. The study area is thus largely rural with rugged topography.

The rural (Nyandeni location), peri-urban (Chris Hani Location) and Urban (Mthatha) study areas referred to as the former Transkei homeland are situated in OR Tambo District Municipality. The OR Tambo District Municipality is the second poorest Municipality in the Eastern Cape Province with some areas having poverty levels of as high as 82 % (OR Tambo District Municipality Integrated Development Plan, 2011). About 67% of the households within the district have income levels that range between R0 and R6, 000. Only 5% of the households have an income above R42, 000 per annum (OR Tambo District Municipality Integrated Development Plan, 2011). The district Municipality has the second highest population of all the districts with more than 1,504,411 inhabitants (OR Tambo District Municipality Integrated Development Plan, 2011). For a mostly rural district it also has a high population density of 90 people per square kilometre. The OR Tambo District Municipality has an area of 15,535 square

kilometres about 9% of the province. There are very few coloured and white inhabitants and the population is 99% Africans. The first language is Xhosa but Zulu is also used in some areas of the district.

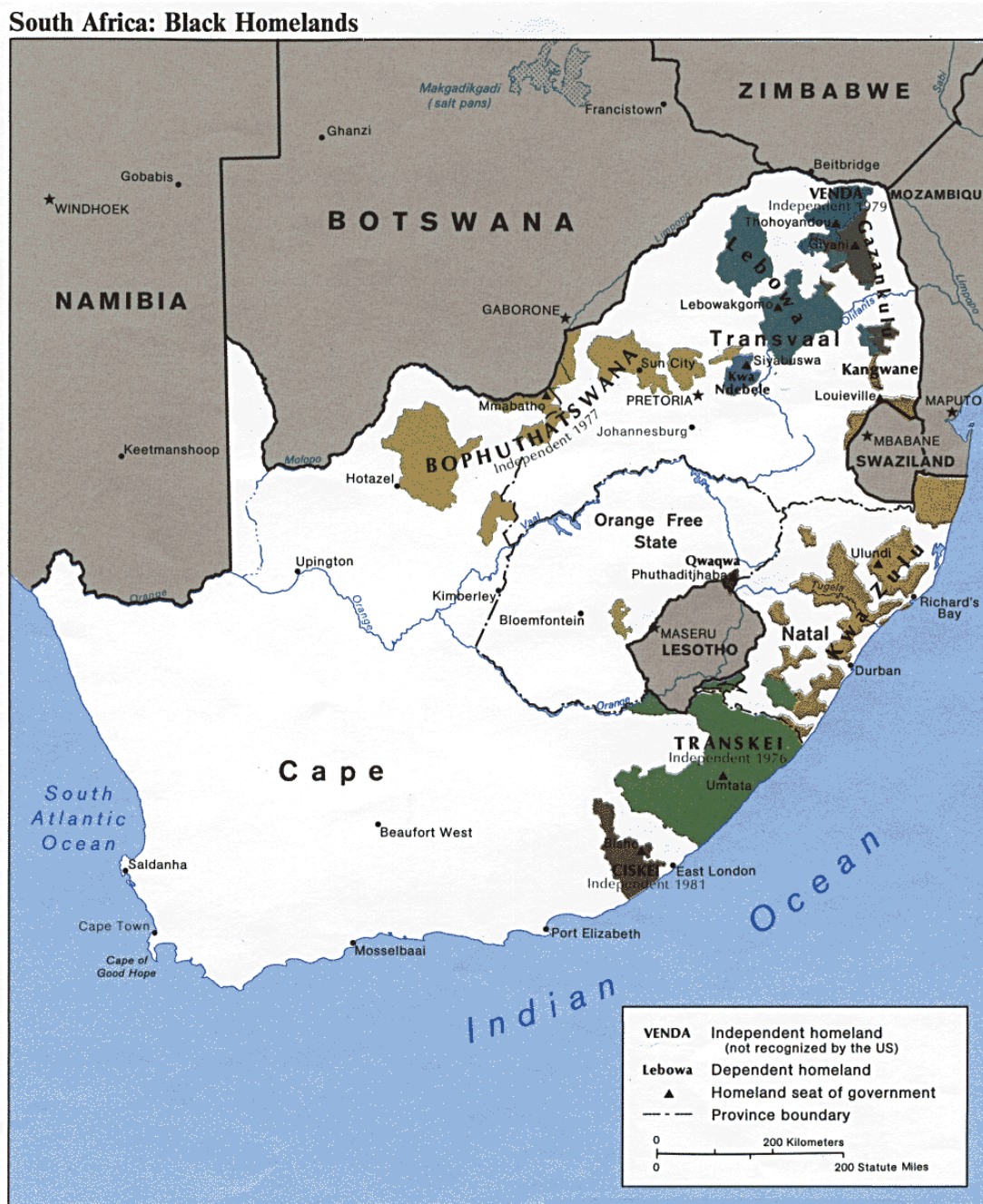


Figure 5.2: Former Ciskei and the former Transkei areas of the Eastern Cape

Source: www.lib.utexas.edu/maps/africa/south_african_homelands.gif.

Source: Eastern Cape Development Corporation (ECDC) (2008a)

The demographic profile of the OR Tambo District Municipality emphasises high levels of dependency. In 2007, 41.7% of the population was under the age of 15 years (Community Survey, 2007). All the indicators of poverty and human development demonstrate that the district has some of the highest levels and concentration of poverty in the Eastern Cape and in the country as a whole. Although the Human Development Indicator (HDI) indicates a slight improvement in the quality of life for people in the District, other poverty indicators point to an increase in poverty.

On the other spectrum, the study areas of rural Cata village, East London suburbs and the peri-urban areas of Kwezana and Thsathsu communities are referred to as the former Ciskei homelands and are situated in Amatole District Municipality. The Amatole District Municipality is named after the legendary Amatole Mountains (Eastern Cape Tourism Board, 2011). Amatole is the most diverse district municipality in the province. It contains the most popular Metropolitan in the country, the Buffalo City Metropolitan, which includes East London, King William's Town and Mdantsane. Two-thirds of the district is made up of ex-homeland areas. The Amatole Mountains that lie northwest of King William's Town give the district its name. The well-watered coastal strip gives way to the former Transkei hills (ECDC, 2008b). The district has a moderate Human Development Index of 0.52. This district has over 1,635,433 inhabitants (Community Survey, 2007), and a moderately high population of 78 people per square kilometre. The population is mainly African with some whites and coloureds. Amatole District Municipality has the second highest economy in the province. The private sector is dominated by manufacturing in the areas of motor industry, food processing, textiles and clothing.

The following subsections below describe the study areas in terms of geographical location, history of the former homelands, demographics, natural resources base, agricultural potential and land use.

5.2.1 Geographical location of study area

According to the Mkhambathini Local Municipality Integrated Development Plan (2011), the Mkhambathini Local Municipality was established in terms of Section 155 (1) (b) of the Constitution of the Republic of South Africa (1996) following the 2000 local government elections. It is one of the seven (7) category B municipalities comprising uMgungundlovu District Municipality. It shares municipal executive and legislative authority with uMgungundlovu District Municipality. Mkhambathini Local Municipality is located along the south-eastern boundary of uMgungundlovu District Municipality and adjoins Richmond and Msunduzi Local Municipalities to the west, uMshwati to the north and Durban/eThekweni Metropolitan to the east. It covers an area of approximately 917km² and is the second smallest municipality within uMgungundlovu District Municipality after Impendle (Mkhambathini Local Municipality Integrated Development Plan (2011).

The study was conducted within the Umbumbulu Magisterial district within Mkhambathini Local Municipality of KwaZulu-Natal Province. The area is situated south-east of Durban and consist of five traditional authorities: Embo, Embo-Kwakhazela, Embo- NkishisiMahla, Embo-Timuni and Embo-Vumakwenza. Following current district municipal boundaries, the study area is at the confluence of four magisterial districts; Ugu, eThekweni, Sisonke, and UMgungundlovu.

The study areas in the former Transkei are situated in the OR Tambo District Municipality which is one of the six district municipalities and one of the four Integrated Sustainable Rural Development Programme (ISRDP) nodes of the Eastern Cape Province. It covers less than 80% of what used to be marginalised homeland of former Transkei and is formed by five Local Municipalities, namely:-

- ☐ King Sabatha Dalindyebo (Mthatha and Mqanduli)
- ☐ Nyandeni (Libode and Ngqeleni)
- ☐ Mhlontlo (Qumbu and Tsolo)
- ☐ Port St. Johns
- ☐ Ngquza Hill (Flagstaff and Lusikisiki)

The OR Tambo District Municipality is located to the east of the Eastern Cape Province, on the Indian Ocean coastline of South Africa. It is bordered by the Alfred Nzo District Municipality to the north, the Ukhahlamba District Municipality to the northwest, the Chris Hani District Municipality to the west and the Amatole District Municipality to the South-West. According to the OR Tambo District Municipality Integrated Development Plan (2011) the District Municipality is classified as a Category C2 municipality, indicating a largely rural character (it is estimated that some 93% of the district population resides in rural areas with a consequent dispersed settlement pattern) and low urbanisation rate, as well as limited municipal staff and budget capacity. The OR Tambo District Municipality Integrated Development Plan (2011) further states that all but King Sabata Dalindyebo (KSD) local municipality are classed as Category B4 (rural, mainly subsistence) reflecting limited institutional capacity and areas characterised by small centres, limited SMMEs and market opportunities, dependence on public support and LED activities that are principally at the level of the small project.

The King Sabata Dalindyebo local municipality is classed as a Category B2 (large core town/s with surrounding agricultural areas) municipality reflecting reasonably adequate budgets and staff, urban centre(s) with associated resources where local economic development activities are emerging into strategies and programmes to take advantage of economic potential, as well as substantial numbers of small medium and micro enterprises, considerable market opportunities, but limited private sector business development services (OR Tambo District Municipality Integrated Development Plan, 2011). The study was conducted in the rural, urban and peri-urban areas of OR Tambo District Municipality. These are Mthatha suburbs, peri-urban area of Chris Hani Location, Efata and the rural area of Nyandeni Location.

The Amatole District Municipality on the other hand occupies the central coastal portion of the province, bordered by the Eastern Cape districts of Cacadu, Chris Hani and OR Tambo, respectively to the west, north and east. The District extends over 23,577.11km² and includes seven local municipalities and one Metropolitan (Buffalo City, Amahlathi,

Nxuba, Nkonkobe, Ngqushwa, Great Kei Municipality, Mnquma and Mbhashe Local Municipality), incorporating 21 former magisterial districts. Amatole District Municipality includes all former administrative areas of the Eastern Cape, namely former Transkei and former Ciskei homeland areas and former cape provincial areas. According to the Amatole District Municipality Integrated Development Plan (2011), Amatole District Municipality is classified as a Category C2 Municipality, indicating a largely rural character and low urbanisation rate, as well as limited municipal staff and budget capacity. Mbhashe, Mnquma and Ngqushwa are classed as Category B4 (rural, mainly subsistence), and Great Kei, Amahlathi, Nkonkobe and Nxuba as B3 (small towns, agricultural) municipalities, reflecting limited institutional capacity and areas characterised by small centres, limited SMMEs and market opportunities, dependence on public support and LED activities that are principally at the level of the small project (Amatole District Municipality Integrated Development Plan, 2011). Buffalo City Municipality is the only Category B1 (Secondary City) municipality in the province, reflecting relatively large budgets and staff, a well developed formal business sector and enterprises that have access to market supplied business services (Amatole District Municipality Integrated Development Plan 2011). The study was conducted in the rural, urban and peri-urban areas of Amatole District Municipality. These are East London suburbs, Kwezana and Thsathsu peri-urban areas around Alice Town and King Williams Town and the rural area of Cata.

5.2.2 History of the former homelands of Umbumbulu, Transkei and Ciskei

Historically, Umbumbulu Magisterial District was part of Umlazi, which in 1847 was declared a location (under the Locations Act of 1846). Subsequently under the tribal's authority's Act of 1951, Umbumbulu like other locations was further sub-divided into tribal authorities whose boundaries were defined and made lawful in 1968 (Makhanya, 1997). In accordance with the Bantustan Self Government Act of 1959, the area became a magisterial area of the KwaZulu homeland. The KwaZulu homeland area was not one distinct and continuous area but rather consisted of fragments divided by the South African Natal Province. Likewise the history of the tribal areas has resulted in territorial

discontinuous areas. It is this territorial patchwork that the KwaZulu-Natal province is trying to develop into a modern non-segregated economy. The division of Umbumbulu from Umlazi and the subsequent sub-division into nine tribal areas was as a result of factional and territorial fights between different lineages according to Mr Dlomo (an 83 year old former school teacher who settled in the area in 1913).

The former homelands were set up by the South African government prior independence for Xhosa-speaking people (Wikipedia, 2011). The former Transkei, then officially the Republic of former Transkei, was a Bantustan. This area was aside for members of a specific ethnicity and nominal parliamentary democracy in the south-eastern region of South Africa. Its capital was Umtata (renamed Mthatha in 2004) (Constitution of the Republic of the former Transkei, 1976). The former Transkei represented a significant precedent and historic turning point in South Africa's policy of apartheid and "separate development"; it was the first of four territories to be declared independent of South Africa.

Throughout its existence, it remained an internationally unrecognised, diplomatically isolated, politically unstable *de facto* one-party state, which at one point broke relations with South Africa, the only country that acknowledged it as a legal entity. Throughout its existence, former Transkei's economy remained dependent on that of its larger neighbour, with the local population being recruited as workers into South Africa Rand Mines (Barber, 1999). The former Transkei government was a participant in the Codesa negotiations for a new South Africa. The territory was reincorporated into South Africa on 27 April 1994, and the area became part of the Eastern Cape Province. In 1994, it was reintegrated into its larger neighbour and became part of the Eastern Cape Province.

The former Ciskei on the other hand was a Bantustan in the south east of South Africa. It covered an area of 2,970 square miles (7,700 km³), almost entirely surrounded by what was then the Cape Province, and possessed a small coastline along the shore of the Indian Ocean. Under South Africa's policy of apartheid, land was set aside for black peoples in self-governing territories. The former Ciskei was designated as one of two homelands or "Bantustan" for Xhosa-speaking people. Xhosa speakers were resettled there and to

former Transkei, the other Xhosa homeland. The former Ciskei had a succession of capitals during its existence. Originally, Zwelitsha served as the capital with the view that Alice would become the long-term national capital. However, it was Bisho (now spelled *Bhisho*) that became the capital until former Ciskei's reintegration into South Africa.

At the end of the nineteenth century, the area between the Fish and Kei rivers had been set aside for the "Bantu" and was known as the former Ciskei (Cameron, 1986). The Europeans gave the name *former Ciskei* to the area to distinguish it from the *former Transkei*, the area north of the Kei. In 1961 former Ciskei became a separate administrative region and in 1972 was declared self-governing under the rule of Chief Justice Mabandla and then Lennox Sebe. In 1978 it became a single-party state under the rule of Lennox Sebe and in 1981 it became the fourth homeland to be declared independent by the South African government and its residents lost their South African citizenship. However, there were no border-controls between South Africa and former Ciskei. In common with other Bantustans its independence was not recognised by the international community.

5.2.3 Demographics

Since the 20th Century, Umbumbulu area like the other homelands has been characterised by rapid population growth. It is situated in Mkhambathini Local Municipality which is located within Umgungundlovu District Municipality. The latter is one of the fastest growing districts in the province in both demographic and economic terms (Mkhambathini Local Municipality Integrated Development Plan, 2011). Although it may not be possible to establish a satisfactory temporal data series for the study area, historical census data can provide some indications of the demographic trends experienced in the area. Until the 1980 census, Umbumbulu was presented as part of the rural areas of Umlazi, Port Shepstone and Umzumbe. According to the 1960 census data the population of these three locations more than doubled from 91,500(1904) to 220,500(1960). In the 1980 census, Umbumbulu (Embombulu) appears for the first time as a separate geographical unit.

From the 1985 census it is clear that the population of Umbumbulu more than tripled from 1960 onwards. This growth rate exceeds that of the KwaZulu population growth rate. The Government demarcated new municipal boundaries in 2005 (STATSSA, 2009b) resulting in the Umbumbulu area demarcated within the uMgungundlovu District Municipality. The mid year population estimates for KwaZulu-Natal province for 2011 according to STATSSA is 10, 819,130 compared to 9 426 017 as per the 2001 population census data (Table 5.1). This mid year 2011 estimates represents 21.39% of the total population of 50.59million (STATSSA, 2011). The provincial representation of males against females is 48% to 52% respectively. Table 5.1 further provides information on the population trends for the province and district Municipality from 2001- 2011 based on mid year estimates as provided by STATSSA (2011).

Table 5.1: Mid-year population estimates for KwaZulu-Natal Province

Year	Population Estimates	
	KwaZulu-Natal Province	uMgungundlovu District
2001	9,557,165	375,427
2002	9,557,165	383,092
2003	9,752,211	389,170
2004	9,835,710	395,013
2005	9,910,636	399,662
2006	9,974,344	402,226
2007	10,045,594	404,406
2008	10,105,436	407,012
2009	10,449,300	409,237
2010	10,645,400	385,769
2011	10,819,130	390,357

Source: STATSSA (2011) and WS-NIS (2011)

The social costs of the global financial crisis were greater within the province with its negative effect on the manufacturing sector and subsequently other multiplier effects. The province of KwaZulu-Natal experienced a significant in-migration of about 283 000 people (Table 5.1) during the crisis (WS-NIS, 2011). The majority of these people

migrated out of the province and in most cases from rural areas in the province in search of work in other provinces, most notably the Gauteng province. However with the scarcity of work and uncertainties as a result of the crisis they decided to migrate back to KwaZulu-Natal, but significantly to the urban regions of the province adding to the urbanization phenomenon experienced in the province (STATSSA, 2011). The percentage distribution of the projected provincial share of the total population, 2001–2011 has remained relatively stable at between 21.26% and 21.39%. The former Transkei and former Ciskei have been consolidated post 1994 after the democratic dispensation to constitute the Eastern Cape Province. Population statistics of the former homelands are scanty; however an analysis of Table 5.2 below shows a steady growth in population in the Eastern Cape Province and constituent districts of OR Tambo and Amatole District Municipalities.

Table 5.2: Mid-year population estimates for the Eastern Cape Province

Year	Population Estimates		
	Eastern Cape province	OR Tambo District	Amatole District
2001	6,283,071	1,297,897	969,964
2002	6,298,146	1,299,414	970,202
2003	6,317,613	1,303,394	973,045
2004	6,341,999	1,308,268	976,331
2005	6,371,308	1,319,209	973,781
2006	6,388,359	1,324,709	973,743
2007	6,426,690	1,332,659	979,582
2008	6,469,517	1,341,533	986,095
2009	6,508,275	1,349,573	991,998
2010	6,084,355	1,219,521	905,780
2011	6,125,832	1,230,242	911,851

Source: WS-NIS 2011.

Comparing 2001 census data and the 2010 population estimates, the Eastern Cape provincial share of the total population has fallen in the Eastern Cape (from 14.4% to 13.5%). This has been attributed to the fact that the Eastern Cape apart from Limpopo is

the province in the country that has experienced the largest outflow through the migration of people mainly to Gauteng and Western Cape Provinces (STATSSA, 2011). It is anticipated that the net population in the province will continue to decline over the next number of years. The high migration rate for economic reasons; poverty conditions that affect health; and the high incidence of HIV/AIDS and TB all contribute to this projected negative annual growth rate. The Provincial average life expectancy at birth, 2001–2006 and 2006–2011 are 49.1 and 50.2 years for males and for females are 54.2 and 54.4 years respectively.

The Community Survey (2007) indicates that the population of the OR Tambo District Municipality constitutes approximately 20% of the total population for Eastern Cape while the Amatole District Municipality constitutes approximately 14% of the province of the Eastern Cape. The average population density per sq.km for the administrative area in 2007 was 116 persons. Generally, population's spatial density patterns within OR Tambo District Municipality vary. The District has the largest population and the highest population density of all the districts in the Eastern Cape. The largest portion of the district population is concentrated in the western part of the district around the main urban centre, Mthatha. The King Sabata Dalindyebo (KSD) Local Municipality has the largest population in the district with 429 233 people and accounts for 29% of the total district population. The two study sites of Mthatha and Chris Hani location are in KSD Local Municipality. The population in Nyandeni Local Municipality the rural study site has an estimated population of 314 273.

The population in Amatole District Municipality is unevenly distributed among the seven Local Municipalities and Metropolitan City. The number of households is 458,582 (Community Survey, 2007). According to the Amatole District Municipality Integrated Development Plan (2011), the majority of the Amatole District Municipality population reside within the Buffalo City Metro (42.8%), followed by Mnquma LM (16.4%) and Mbhashe LM (16.1%). The two Local Municipalities with the smallest percentages of the Amatole District Municipality population are Nxuba (1.5%) and Great Kei (2.9%). The population density within the Amatole District Municipality has steadily decreased since

2002. While the population density was 70.4 people per square kilometre in 2002, it decreased to 69.3 people per square kilometre in 2009 (Amatole District Municipality Integrated Development Plan, 2011).

5.2.4 Natural resource base

The Umbumbulu District is situated 29°56⁰⁰ E and 30°30⁰⁰ N, and has an altitude ranging from 394 to 779 m high above sea level. Although there is rainfall throughout the year, the main rainfall is between November and March. The annual mean rainfall in Umbumbulu is 956 mm. The mean, minimum and maximum temperatures for the place are 18.6 °C, 13.4 °C and 24.0 °C respectively (Camp, 1998). The duration for the rainy season is 241 days in a year. The area is located in a moist coastal hinterland region. Only 15 per cent of the total Umbumbulu area has high potential for annual cropping. Another nine percent is arable, but less favourable for annual cropping. The climate is favourable for a wide range of adapted crops and the area has a year-round growing season. Agriculture in this communal area is predominantly rain-fed.

Most of the OR Tambo District Municipality receives an annual rainfall of above 800mm, which decreases steadily moving inland. The coastal areas receive a fair distribution of its rainfall throughout the seasons including winter, whereas the more inland areas receive at least 80% of their precipitation in the period between October to March. Temperature range from a mean minimum of 14.3 – 19.8 °C in January and 1.8-13.4 °C in July to a mean maximum in 14.3 – 25.3 °C in January and 19.5 – 21.4 °C in July. The environment of the OR Tambo District Municipality area has a wide range of habitats, including upland and coastal grassland, coastal forest, valley thicket, thorny bushveld, coastal and marine habitats.

OR Tambo District Municipality is underlain by a variety of rock types representing a considerable time span. These include sandstones and shales, through which magmas have intruded to form dolerite dykes represents the conduits that fed the lavas that form the higher lying areas of the Drakensburg, Kimberlites, diatremes and other centres of volcanic activity also occur at a number of localities within OR Tambo District

Municipality. The underlying geology and geomorphology of the region are closely tied to the formation of the soils. As such more arable and productive soils are located in the Eastern and North- Eastern portion of the District, covering Flagstaff, Bizana and Lusikisiki. Environmental degradation, soil erosion in particular is a major concern in the OR Tambo District Municipality. This imposes a number of limitations to the possible uses of land and hence the economic viability.

The natural environment of Amatole District Municipality is similarly diverse, including moist mountainous, well-watered coastal and semi-arid Karoo, thornveld, succulent and thicket areas. The District includes part of the Wild Coast and is home to Cwebe and Dwesa Nature Reserves, and extends inland to include mountainous areas, centered on the Amatole Mountain Range. Amatole is the most diverse district municipality in the Eastern Cape. Two-thirds of the district is made up of communal areas. The terrain of the district is equally diverse. The climate is moderate for most of the year, but with hot periods from December to February. Although the area receives rainfall throughout the year, it is primarily a summer rainfall region, with the months of June and July being the driest and coldest. The mean annual precipitation varies from 1 000 mm along the coast to 700 mm inland above Butterworth and 1200 mm in the Amatole mountains (ECDC, 2008b). The western side of the district is considerably dryer, with less than 500mm per annum, than the Eastern side, which has rainfall as high as 1000 mm per annum along the coast.

5.2.5 Agricultural potential and land use patterns

The land use pattern in Umbumbulu in KwaZulu-Natal is predominantly agricultural in nature and is characterised by small-scale subsistence farming (see Figure 5.4 below) and some marginal sugarcane cultivation. Farming provides the potential for providing cash income at a time when the population pressure is increasing and urban incomes are diminishing (Agergaard and Thomsen, 2006). Subsistence agriculture is an important livelihood option for many rural families contributing a significant portion of their household income.



Figure 5.4: Typical homestead in Umbumbulu: Mr Maphumulo's farm

Crops grown include *amadumbe*⁴, potatoes, beans, maize, some sugarcane, bananas, chilies and peanuts. Maize, legumes and potatoes are the main crops grown. Subsistence agriculture occurs mostly in tribal areas. These areas are largely under developed and in a food deficient situation. These areas are heavily populated and the individual family heads all receive individual allotments for residential and cultivation use. Commonage is shared for grazing purposes. Small patches of maize are planted by most homesteads but otherwise much of the land is reverting back to natural grasslands. Associated with these areas is a general degradation of the land due to overgrazing and incorrect grassland burning for grazing purposes. Access to land is a basic asset for people if they want to pursue a living in agriculture. In Umbumbulu, access to land for habitation, cultivation

⁴ This is a starchy, herbaceous and perennial tuber crop identified scientifically as *Colocasia esculenta*, and is important as a famine reserve crop among smallholders.

and grazing was and is allocated by the chief of the tribe (*inkosi*) and his headman (*induna*). The land is owned by the tribe and people have the permission to occupy.

The OR District Municipality population is largely populated in rural settlements and is considered to have a rich natural resource that gives it a comparative advantage whilst posing developmental opportunities in agriculture. At present, the structure of the OR Tambo District Municipality's economy does not promote high rates of economic growth. As a result of historical factors, the district economy is hampered by several blockages, bottlenecks and constraints that limit the level of growth and development. With the municipality having identified amongst others, agriculture, as a key driver for local economic development, the agricultural sector does not make a large contribution to the district's Gross Domestic Product (GDP), and has continued to maintain a small share of 1.8% to the total district GDP. Despite this, the sector retains its position as the backbone of rural livelihoods in the largely un-urbanized areas of OR Tambo District Municipality. The importance of agriculture can therefore not be undermined, as an informal rural based activity. When consideration is made of the rural based agriculture; the sector becomes an integral component of the OR Tambo District Municipality Local Economic Development (LED) landscape, through its ability to provide for community livelihoods, by generating employment and fighting endemic poverty in the district.

Agriculture therefore plays an integral part in the development the district economy but the agricultural sector potential in the district remains largely untapped. Although subsistence farming - essentially maize and stock – is fairly general throughout the area, practices remain less than effective in relation to the potential. Subsistence farming as a remedy to poverty alleviations needs massive support to households within the district. With plans for new dams and associated water supply systems, there may be opportunities for commercial scale irrigated agriculture projects. The communal tenure system results in issues that require creative management approaches and in this respect fencing of arable land may represent improvement. Land claims have affected agriculture production in some areas of the district; a remedy to such challenges will foster developmental goals of the district.

Research trials have been conducted for high value crops such as cotton, sunflower and cassava. The Kei fresh produce market seeks to increase potato and banana production in the district working in partnership with ASGISA- EC. A farmer support unit has been established within the market so as to assist local farmers develop quality produce and be able to market their produce in the region. Livestock farming within the OR Tambo District Municipality is by far the biggest livestock farming practice in communal farming in the whole country, 631 674 cattle, 732 478 goats and 1 225 244 sheep. Existing forestry plantations in the Eastern Cape cover 176 000 ha, a large proportion of which is located in the OR Tambo District Municipality.

OR Tambo District Municipality thus has a predominantly a rural landscape with a rural population residing in traditional villages and traditional homes. The towns are located along the main access roads serving as rural service centres to the surrounding rural population. The land ownership in the district vests mainly in the following main structures: government through the Department of Rural Development and Land Reform as the main custodian of communal land. Legal forms of land tenure in the district include freehold, permission to occupy, leasehold and grazing rights on commonage. The District has a number of land claims which tend to be communal in nature. This results into claimants and extents of the land being claimed not clear in all instances, making it difficult to adjudicate and resolve/settle land claims.

Agriculture in most parts of the Amatole District Municipality has not yet developed beyond subsistence because of constraints facing agriculture in rural areas. The prospects of agriculture currently look dim because of the lack of inputs, resources and a lack of interest from the youth. The communal farming areas are characterised by low technical input, low cost, low yield enterprises with poor infrastructure and support services. The agricultural enterprises are very limited in their potential to increase the contribution to the Gross Domestic Product of the area due to a number of constraints. The Amatole region is characterized by diverse land use and ownership linked to natural resources as

well as past political systems and boundaries. Areas of the former homelands are mainly communally owned with high population densities. These exist alongside privately owned commercial farm land with much lower population densities and very different agri-enterprises.

The process of land reform is critically linked to transformation of agriculture and there is a need to align the agricultural development plan with the land reform and settlement plan. Commercial agriculture is characterised by private ownership, larger more viable farming units, higher levels of technical input and expertise, higher cost structures, higher yields and access to better infrastructure and support systems. The complexity of the land reform environment has been acknowledged with reference to the areas of land access, land tenure, and land administration. Agriculture is mostly small scale crop farming and open grazed livestock. Farming is largely for subsistence rather than commercial sale, although some black emerging commercial farmers are present. The Amatole District Municipality faces challenges of developing the natural resource potential of the ex-homeland areas through livestock farming. The district contains the best grazing lands suitable for livestock production in the province. Community private partnerships and improved farming methods can transform communal livestock production into commercial livestock farming. Expanded livestock production in Amatole District Municipality holds potential for small-scale tanneries and leather craft industries. Agriculture plays a small role in the formal employment providing only 8.0% of formal employment. Agriculture in the ex-homelands is mainly small scale crop farming and open grazed livestock, and the farming is more for subsistence than for commercial sale. The coastal belt south of East London is where the main Pineapple farming industry is, as well as citrus, horticulture and livestock being farmed.

5.3 Population study group

The population study groups are drawn from KwaZulu-Natal and the Eastern Cape provinces. In KwaZulu-Natal, the study was done among the Embo traditional authority community of Umbumbulu district. These comprised of members of the Ezemvelo

Farmers Organisation (EFO) and non members, the latter drawn from five of the neighbouring wards. The EFO was established in 2001 comprising 20 members. The EFO is unique as it is the first example of smallholder group organic certification in South Africa. Certification in this study refers to accreditation by certification body, Africa's Farms Certified Organic (AFRISCO) in South Africa. The organisation was formed to co-ordinate production and supply capacity for a formal organic supply chain for these smallholder farmers to a major South African supermarket group, develop best practices in production methods and assist new growers in the conversion period of establishing the organic production systems.

Three internal inspectors were trained by the Rainman Foundation, a Landcare Training centre at Assegay in KwaZulu-Natal. The EFO were certified in conversion after one year by AFRISCO in 2002. The farmers were allowed to sell their produce to Assegay Organics and Pick 'n Pay (through Assegay Organics) in 2001. They sold *amadumbe* and Irish potatoes only from May to August 2001. Later traditional potatoes, pumpkins and indigenous vegetables were also approved for marketing to the same outlets. In 2002 the EFO members had increased to 54 and in 2003 they had 110 new applicants. By 2004 the membership had grown to 48 fully-certified organic and 103 partially-certified organic with the number of internal inspectors having increased from three to eight.

In 2003, the Department of Economic Development in, KwaZulu-Natal provided support through funding to develop the EFO as an organic group. Through this project, the farmers received material for fencing, building of chicken houses, kraal manure and a second hand tractor. Green beans were introduced as a non-traditional crop in 2003/2004. The fully-certified organic farmers in this study are those who have been certified by the accreditation body AFRISCO and are selling through the formal supply chain, the partially-certified organic farmers are in the process of getting organically certified, while the non-organic group are not certified and are not entirely following organic practices. The fully-certified organic and partially –certified organic follow organic management practices incorporating where possible cultural, biological and mechanical methods.

In the Eastern Cape the consumer awareness and market potential study was conducted among 200 consumers drawn from the former Transkei homelands represented by peri-urban Chris Hani location, rural Nyandeni and Mthatha suburbs constituting 100 consumers and former Ciskei homelands represented by rural Cata, peri-urban Kwezana and Thsathsu village and East London Suburbs constituting 100 consumers. These included consumers who know about organic food and those that are not aware of organic food.

Interest in organically produced food is increasing throughout the world in response to concerns about conventional agricultural practices, food safety and human health concerns, animal welfare considerations and concern about the environment. The same trend can be affirmed to in South Africa as well. These concerns, along with observed organic consumer behaviour have led, in part, to the emergence of a health conscious middle class population in South Africa. The Eastern Cape consumer is no exception. The future of organic agriculture in South Africa and in particular the Eastern Cape will to a large extent, depend on consumer demand. The spectrum of the KwaZulu-Natal and Eastern Cape sample covers the value chain process of organic production in KwaZulu-Natal and organic market and consumption in the Eastern Cape.

5.4 Data collection methods and instruments

A total of 400 respondents were interviewed, representing 200 farmer respondents from KwaZulu-Natal and 200 consumer respondents from Eastern Cape provinces. The Eastern Cape Province is bordering KwaZulu-Natal with similarities in the socio-economic status and rurality of the two provinces. Both provinces' economic dependence is on agriculture with huge potential for organic agriculture development. The Eastern Cape is also a major consumer of produce from KwaZulu-Natal. In KwaZulu-Natal, the crop production survey was conducted during October-December 2004 while the consumer awareness and market potential survey in the Eastern Cape was conducted in July-August 2011. The production survey obtained socio-economic, demographic, institutional and household data via questionnaires through interview

sessions with the principal decision maker in the participating EFO households and among the non-organic farmers. Farm level information was recorded for the previous growing season. The survey farmers in Umbumbulu district, KwaZulu-Natal was stratified into three groups: fully-certified organic farmers (early adopters), partially-certified organic farmers (later adopters) and non-organic farmers (non-adopters).

The 200 Kwazulu-Natal farmers surveyed consisted of a census survey of 151 organic farmers and members of EFO that were purposively selected (48 fully-certified members and 103 partially-certified farmers), and another sample of 49 non-organic farmers who were not EFO members that was randomly selected within the same region from a sample frame constructed from each of the five neighbouring wards. The survey instrument recorded all household activities (farm and non-farm), enterprise types, crop area and production levels, inputs, expenditures and sales for the past season. Socio-economic and institutional data, such as household characteristics, land size and tenure arrangements, farm characteristics and investment in assets were also captured. Other questions related to farmers' management capacity and demographic characteristics such as the supply of on-farm family labour and education status.

Two different producer questionnaires were designed for members and non-members of EFO. A third household questionnaire was administered to households of both organic and non-organic farmers that participate in the producer questionnaire. The survey was conducted by a team of trained enumerators from the study area. These enumerators had to be fluent in both English and Zulu. The survey instrument recorded all household activities (farm and non-farm), enterprise types, crop areas and production levels, inputs, expenditures and sales for the past season. The questionnaires also captured socio-economic and institution data such as household characteristics, land size and tenure arrangements, farm characteristics and investment in assets. Other questions related to farmers' management capacity and demographic characteristics such as the supply of on-farm family labour and education status. The farmers' were also asked hypothetical questions designed to elicit their risk attitudes. The risk aversion of the sampled farmers

was measured using the Arrow Pratt Absolute Risk Aversion (APARA) coefficient and the Experimental gambling approach.

The farmers were further asked in the field survey to give their perceptions of the main sources of risk that affect their farming activity by ranking the set of 20 potential sources of risk listed in the appendix on likert-type scales ranging from 1 (no problem) to 3 (severe problem). These sources of risk were developed from findings of the research survey and from past research on the sources of risk in agriculture, challenges that smallholder farmers face in trying to access formal supply chains. The farmers were also requested to score any other sources of risk(s) that they wanted to add to the list of hypothesized sources of risk. These sources of risk are ranked from 1-being the most important source of risk to 20-being the least important source of risk ones. The ranking was done by averaging the scores on each source of risk and assigning a rank accordingly.

The study area in the Eastern Cape was stratified into the former Transkei (covering the OR Tambo District Municipality) and former Ciskei homelands (covering the Amatole District Municipality) representing a broad spectrum of consumers across the province. The stratified study areas were further clustered into rural, peri-urban and urban areas. The respondents were selected by simple random sampling to avoid bias. The survey targeted consumers who had used or were aware of organic food or products and as well as those who had not used or were not aware of organic foods or products before. This was to get a better understanding of the variability of consumers and a better understanding of consumer demand. The study in the former Transkei involved 100 consumers represented by a selection of 30 respondents from Chris Hani peri-urban location in Bedford, EFATA area, 40 respondents from Mthatha suburbs of Southernwood and Fort Gale areas and 30 respondents from Nyandeni rural areas all situated in OR Tambo District Municipality. In the former Ciskei, 100 consumers interviewed included 30 respondents from rural Cata in Keiskamahook, 40 respondents from the East London Suburbs of Amalinda and Southernwood and lastly 30 respondents drawn from the peri urban area of Kwezana Village (near Alice Town) and Tsathu

villages(near King Williams town) all situated in the Amatole District Municipality. The consumer respondents were drawn to be representative of different income groups (low, middle and upper income groups).

The questionnaire was administered to the 200 consumer respondents using structured questionnaires consisting of closed and open ended questions. A face- to-face survey mode (direct interviewing) was used given the low response rate of mail interviews in developing countries (Al-Subaihi, 2008) and in South Africa in general (Du Toit and Crafford, 2003). The structured questionnaire included both open and close ended questions. The questions included in the questionnaires are guided by the framework of factors which affect organic consumer attitudes and purchase decisions as discussed in the literature review (Figure 2.4). The study of organic food purchasing behaviour is difficult because organic food products are available in the market together with conventional ones and the purchase decision depends on many factors that can vary sharply across individuals. Organic food products posses some credence characteristics not directly observable by consumers but which play an important role when shopping. Then, whether consumers decide to purchase organic foods will depend on many factors, including consumers' attitudes toward these unobservable organic foods characteristics (i.e. environmental protection, healthiness) which are included in the questionnaire. Consumers' behaviour is determined by attitudes. The attitudes towards the product are formed not only by nutritional and healthy needs, enjoyment, convenience, safety, transparency, environmental motives, etc. but also by the product perception. Finally, the perception of a product is the result of the product information (knowledge about the product). The questionnaire considered variables defined in detail in Table 5.6.

The two main methodologies that are used to elicit and analyse risk preferences for Umbumbulu farmers are the (i) Arrow Pratt Absolute Risk Aversion (APARA), and (ii) Experimental gambling approach. These are described below.

(i) Using the Arrow Pratt Absolute Risk Aversion (APARA):

The risk aversion of the 200 farmers in the survey was measured using the Arrow-Pratt Absolute Risk Aversion (APARA) coefficient. APARA is defined as $-U''(x)/U'(x)$ where U'' and U' are the second and the first derivative of a von Neumann-Morgenstern utility function $U(x)$ (von Neumann-Morgenstern, 1944). In this study the negative exponential utility function, $U(x) = -\exp\{-\lambda x\}$ is assumed for simplicity because it has a constant APARA (λ). The utility function is estimated in this study by asking farmers hypothetical questions regarding risk alternatives. Here, the farmers are presented with the option to take a gamble or a sure amount of money. To begin the trial, respondents were required to choose between the hypothetical options of a specified lottery and a certain monetary amount. Deductions (increments) from (to) the certain monetary alternative were made as appropriate and the question re-asked. This was repeated until a point of indifference was reached determining each subject's certainty equivalent for that gamble.

Utility functions of the forms $U_g(x) = -e^{-\lambda_g x}$ and $U_g(x) = -e^{-\lambda_g^* x^*}$ were assumed where

$x^* = (x - x_{\min})/(x_{\max} - x_{\min})$, normalising the x^* range from 0 to 1. Values of the Arrow-Pratt Absolute Risk Aversion (λ_g) and "adjusted Arrow-Pratt Absolute Risk Aversion" (λ_g^*) coefficients were calculated from the elicited certainty equivalents for all participants and for all lotteries by fitting the respective function $f = 0.5 + 0.5e^{-\lambda(x_{\max} - x_{\min})} - e^{-\lambda(x - x_{\min})}$ and $f = 0.5 + 0.5e^{-\lambda^*} - e^{-\lambda^* x^*}$ (Nieuwoudt and Hoag, 1993). Standardisation was undertaken by converting the distribution ($x_{\min} \leq x \leq x_{\max}$) into a distribution ($0 \leq x^* \leq 1$) where $x_{\min}$ and $x_{\max}$ are the minimum and maximum values on the x -scale. This provides a unit-less expression of the absolute risk aversion function (Ferrer *et al.*, 1997 and Nieuwoudt and Hoag, 1993). The derivation of the standardization is presented below. For example the negative exponential utility function, $U(x) = -\exp\{-\lambda x\}$, is assumed for simplicity since it has a constant $ARA = \lambda$, and the distribution ($x_{\min} \leq x \leq x_{\max}$) is converted into a distribution ($0 \leq x^* \leq 1$) where $x_{\min}$ and $x_{\max}$ are the minimum and maximum values on the x -scale.

Let $x^* = (x - x_{min}) / (x_{max} - x_{min})$

Therefore $x = x_{min} + x^* (x_{max} - x_{min})$

Where $U(x) = -e^{-\lambda x}$ and $U(x^*) = -e^{-\lambda^* x^*}$

Hence $\lambda^* = \lambda (x_{max} - x_{min})$ since $\lambda x_{min} = \text{constant}$8

(Nieuwoudt and Hoag 1993)

This simple transformation to equation 8 provides a unit less expression of the absolute risk aversion function λ^* , by multiplying ARA, λ by range of x . Clearly changes in both the range and scale of the data are accounted for. The adjusted ARA (λ^*) Coefficient should then be reported with the information on the risk situation and population characteristics, including wealth for which they were elicited. Then these local properties may be used to derive global properties of risk preferences for populations. Researchers will be able to select appropriate λ^* coefficients for secondary studies or the interval approach to elicit risk preferences, and through knowledge of the new risk situation, may calculate the appropriate λ coefficient.

Table 5.3 summarises these lotteries. The lotteries ranges varied from R380 to R240. These were considered significant amounts in the study area. Probability of a win or a loss was described as the flip of a coin to overcome the probability of preference. The mean adjusted Arrow-Pratt Absolute Risk Aversion coefficients over both lottery questions were used as a measure of the risk preference in this study. It is expected *a priori* that principal decision makers in this study will be risk averse.

Table 5.3: Characteristics of the hypothetical lotteries

Lottery	x_{max}	x_{min}	Range	Probability(P)
1	380	20	360	0.5
2	240	80	160	0.5

(ii) Using the experimental gambling approach:

The study farmers were presented with a series of choices among sets of alternative prospects (gambles) that do not involve real money payments. The amount of money

was relatively equivalent to the average expected annual income ($R400 \approx US\$67$) from crop farming in the Umbumbulu area. This amount was determined in a pilot study in the Umbumbulu area and a workshop that was conducted by the survey co-ordinator together with enumerators who lived in the study area. The experiment follows the method developed by Binswanger (1980) who measured the risk preference of 240 rural farmers in India using actual financial compensation at significant levels of between 50-200 Indian rupees. Respondents were required to make a simple choice among eight gambles whose outcomes were determined by a flip of a coin. Binswanger (1980) reported that the experimental approach remedies some of the more serious measurement flaws of the direct elicitation utility (DEU) interview method reporting that evidence on risk aversion using DEU through pure interviews is unreliable, nonreplicable and misleading even if one is interested only in a distribution of risk aversion rather than reliable individual measurements (Young, 1979).

Survey respondents were presented with a choice of six hypothetical risky prospects (see Table 5.4). For each risky prospect, the probability of winning, p is 50 per cent, described as the toss of an unbiased coin. Each farmer is asked to select one of the six prospects O, A, B, C, D, or E. If a farmer selected alternative O, (s) he received R100 (about US\$14) whether the coin landed on heads or tails. An individual choosing A hypothetically received R90 on head and R180 on tail. By not choosing the relatively 'safe' alternative O, the individual stood to lose R10 if head, but gain R80 if tail (the expected gain increased by R35). Choosing A instead of O thus means that the standard deviation in gain is increased from R0 to R45. For the successive alternatives, A to B and B to C and C to D, the same is true: the expected gain increases, but so does the spread between the two outcomes. Alternatives D and E have the same expected gain but alternative E has a larger spread, implying that only a risk preferring individual would make the step from D to E. When risk is viewed in terms of gains, income or wealth, as in utility based choice theories, the prospects involve more risk the further down the table are the choices.

Table 5.4: Payoffs and corresponding risk classifications for each game

Choice	Head Low payoffs (Rands)	Tail High payoff (Rands)	Risk aversion class	Approximate partial risk aversion coefficient (S)	Mean partial risk aversion coefficient (Z)
O	100	100	Extreme	>7.5	8.250
A	90	180	Severe	$7.5 - 2.0$	3.873
B	80	240	Intermediate	$2.0 - 0.812$	1.274
C	60	300	Moderate	$0.812 - 0.316$	0.507
D	20	380	Slight to neutral	$0.316 - 0$	0.1580
E	0	400	Neutral to Preferring	< 0	0.0005

To get a unique measure of partial risk aversion coefficient for each game level, the utility function with Constant Partial Risk Aversion (CPRA) is used. This depicted as the equation below:

$$U = (1 - S)c^{(1-S)} \dots\dots\dots 9$$

Where

S is the coefficient of risk aversion, and

c is the certainty equivalent of a prospect.

If a respondent is indifferent between two consecutive prospects (say 1 and 2) given that both prospects have equal probabilities of a good or bad outcome, then we have: $E(U_1) = E(U_2)$, and hence $(1 - S)c_1^{(1-S)} = (1 - S)c_2^{(1-S)}$. Since there is no algebraic solution to

this equation, we solve for S using a standard numerical method in Microsoft Excel software. So, the partial risk aversion coefficient S is computed by solving the equation for indifference (equal expected utility) between two consecutive alternatives, using the CPRA utility function.

The upper and lower limits of the CPRA coefficients for each prospect of our experiment are given in Table 5.4. In this function S is constant, implying that an individual's preference over a given set of lotteries will be unchanged if the payoffs are all increased (decreased) by the same factor (Sillers 1980). For example, a farmer who was indifferent between a lottery paying R50 with certainty and one paying R45 with a 50% chance and R95 with a 50% chance would also be indifferent between receiving R500 with certainty and a lottery paying R450 and R950 with equal odds. The CPRA utility function provides acceptable approximations to the true structure of farmers' preferences (Sillers, 1980). The fifth column in Table 5.4 shows the end points of the constant partial risk aversion coefficients (S) implied by each possible choice, while the sixth column gives the geometric mean⁵ as a measure of S .

These questions separate the respondents into six distinct risk preferring categories (refer to Table 5.4 column 4) depending on which options they choose. The categories can be ranked into risk aversion without having to assume a particular functional form for the utility function. Additionally the responses provide bounds for the coefficient of risk aversion if one assumes that the partial risk aversion is constant over the relevant range (Binswanger, 1980; Siller, 1980). The participants' choices between the different prospects reveal which alternative gives them the highest utility. Assuming constant partial risk aversion, each observed response represents a category of risk aversion in which the true but unobservable risk aversion falls within. The results are analysed by grouping the respondents according to the six possible ranges of risk preferences implied by their responses to the questions.

⁵ For alternative D at one of the endpoint, $S=0$ and the geometric mean of both the end points would be zero, therefore the arithmetic mean was chosen. For alternative O, the upper bound of $S=\infty$ with a lower bound of 7.50 because few people chose alternative O in this experiment, is it reasonable to assume that their partial risk aversion should not exceed 7.50 by a large margin and this value was increased by 10% to 8.25. In the case of alternative E a value of zero is given to S . For purposes of the regression an arbitrary value of 0.0005 is set.

5.5 Variable specification and definition

The description and unit of measurement of the dependent variable used in the adoption empirical model are presented in Table 5.5. The hypothesized relationship of these dependent variables to the explanatory variables is discussed in detail in section under literature review on factors affecting technology adoption. The farmer's decision to adopt or not to adopt certified organic farming is hypothesized to depend on the explanatory variables of age, gender, education, household size, farm size, proportion of household Income from farming, Off farm income, Input cost, Location, land tenure security, livestock, chicken ownership, risk attitudes and asset. These are listed in Table 5.5. These represent both continuous and categorical variables used in the analysis. The continuous variables take any numerical value in a real. Categorical variables take a numerical value of one or zero and are also called binary or dummy variables.

Table 5.5: Definition of empirical model variables and their and hypothesized relationships with adoptions of organic farming

Variable	Description	Unit	Hypothesized sign
AGE	Respondents Age	Years	$\pm$
GENDER	Gender of household head (Male = 0; Female = 1)	Dummy variable	+
EDUCATION	Number of years of schooling for household head	Years	+
HOUSEHOLD SIZE	Number of people in the household	Number	+
FARM SIZE	Farm size	Hectares	-
FARM INCOME	Proportion of household income from farming	Percentage	+
OFF FARM INCOME	Off farm income	Rands	-
INPUT COST	Input cost per hectare	Rands	—
LOCATE	Household's location (Sub-ward) Ogagwini /Ezigoleni =1 ;Other =0	Dummy variable	+
LAND TENURE	Tenure security (1=yes; 0=otherwise)	Dummy variable	+
LIVESTOCK	Number of Livestock owned	Number	+
CHICKEN	Number of Chicken owned	Number	+
RISK	Farmer's risk attitude	APARA coefficient	-
ASSETS	Index for asset ownership	Number	+

The variable AGE is measured in number of years. This is a continuous variable and it is expected *a priori* that the hypothesized sign of the coefficient of AGE could be positive or negative (Abadi Ghadim and Pannell, 1999). GENDER will be included as a

categorical variable, which is one if the head of the farm is a women and zero if otherwise. GENDER is hypothesized to have a positive or negative sign because whereas as male-headed households are likely to have better access to information and services and hence be innovators (Staal, Baltenweck, Waithaka, deWolff, and Njoroge, 2002), in rural areas in KwaZulu-Natal, many men seek wage employment and farming is hence undertaken by women farmers. This is more so in the case of men seeking wage employment in the mines in Johannesburg or nearby large sugarcane plantations in KwaZulu-Natal.

The variable EDUCATION is measured in terms of the highest grade the farmer has achieved in formal education and recorded as a continuous variable. As a cross measure, EDUCATION is also proxied as a categorical variable with literacy and arithmetic abilities. Enumerators were trained to ask questions in English and *isiZulu*. It was hypothesized that farmers who can read *isiZulu* or English and can make basic calculations (add, subtract and multiply) would be more able to use organic farming technologies than illiterate or poor arithmetic skilled farmers. The dummy variable is a one for farmers with the above-mentioned abilities and zero if otherwise. The EDUCATION variable, representing the level of education of the household head in years, is hypothesized to be positively related to adoption of certified organic farming as more education provides an opportunity for the individual to acquire and process information about the technology (Hollaway *et al.*, 2002).

The HOUSEHOLD SIZE was established by obtaining information on household members residing in the home as well as their names and ages. Large family size implies more labour for labour intensive activities (Staal *et al.*, 2002) and hence the hypothesized sign for HOUSEHOLD SIZE and adoption is positive. Following Barker and Herdt (1978), Ahmed (1981) and Allaudin and Tisdell (1988b) the relationship between FARM SIZE and adoption of certified organic farming is hypothesized to be negative as small farmers utilize their limited resources more efficiently and adopt new technologies at a faster rate. This supports Shultz's (1964) 'poor- but- efficient hypothesis. Income is represented by FARM INCOME and OFF FARM INCOME. The farm income is

represented in rands and the proportion of income from farming is also calculated as a percentage. Farmers with more FARM INCOME are hypothesized to be innovators because they have more funds to acquire resources and invest in the technology. This is also an incentive to invest in technologies that improve household incomes. On the other hand the hypothesized sign for OFF FARM income is expected to be negative more so if it represent a greater percentage contribution to household income.

The INPUT COST represents the rand value of input cost per hectare. This is hypothesized to have a negative effect in adoption. The variable LOCATE refers to the sub-ward of the respondent and captures the difference's between adopters that are not accounted for by other variables and spatial characteristics. Several authors Rogers (2003), Shideed (1999) and Semgalawe (1998) have found that the further away farmers are from the focal point where the technology was first introduced, the longer technology diffusion takes. In this study the first adopters of the certified organic farming technology were from sub-wards Ogagwini and Ezigoleni and the 54 fully certified members come from these sub-wards. The LAND TENURE variable refers to the security of tenure. This is depicted as a categorical variable of 1 if the farmer has security of tenure and 0 otherwise. It must be noted that in most rural areas in South Africa especially the former homelands, land is traditionally owned however farmers have the right to occupy. This variable was obtained by establishing if the farmer had the right to build structures on farm, plant trees, bequest, and lease out or sell the land. If the farmer responded in the affirmative, it meant that the farmer had security of tenure. Stronger rights to land are often associated with increased likelihood of adoption of agricultural technologies.

The number of LIVESTOCK is represented as a continuous variable and represents livestock owned by the household. Ox-driven draughts are common in the rural areas of KwaZulu-Natal for ploughing the land. The use of compost manure also precludes that farmers have access to this manure either through owning livestock or their ability to buy manure. The hypothesized sign of livestock and adoption is hence positive. The number of CHICKEN owned is likely to have a positive impact on adoption of certified organic farming as chicken manure is widely used in the study region as a substitute for

commercial fertilizers. The study hypothesizes a negative relationship between RISK and adoption of certified organic farming. The variable RISK is established through the calculation of the APARA coefficient. Risk-averse farmers are reluctant to invest in innovations of which they have little first-hand experience (Marra and Carlson, 1990). The index for ASSET ownership is represented as a continuous variable. This variable is used to establish the wealth index level of the farmer and is measured using principal components based as a list of assets. Wealthier farmers are expected to have a greater risk appetite in the adoption of certified organic farming.

Variables used in the consumer awareness and market potential study are presented in Table 5.6 below.

Table 5.6 Definition of empirical variables used in the consumer awareness analysis

FACTORS	TYPE OF QUESTION/LEVEL OF MEASUREMENT
Gender	1 if respondent is Male; 2= Female
Age	Age of the respondent (1-5 Classification)
Education	Education level of respondent (1-4 Classification)
Occupation	Occupation of respondent (1-6 Classification))
Household size	Household size in numbers
Person Shopping	Person responsible for shopping (1-3 Classification)
Place of shopping	Place of shopping (1-6 Classification)
Distance	Distance to the nearest shop in kilometres
Meat/Chicken	Meat/Chicken grade preference (1-3 Classification)
Income	Average monthly income (1-5 Classification)
Children	1= Children under 18 in the household; 0= otherwise
Organic awareness	Organic awareness (1-8 Classification)
Certification knowledge	1= yes; 2 = no
Organic consumption	1-No; 2= considered; 3= Yes
Organic Shopping Preference	Preference shopping areas for Organic Food (1-6 Classification)
Product groups of Choice	Organic product choices (multi-optional)
Purchase	Considerations in purchasing organics (ranking)
Knowledge of organics	Respondents knowledge about organic food (1-5 classification)
Perception	Respondents perceptions about organic price (1-5 classification)
Trust	Respondents trust about organic label (1-4 classification)
Taboo	Food taboo(Multi-optional)
Lifestyle	Lifestyle conditions of the household (List: 1= yes; 2= no)
Assets	Assets owned by the household (List: 1= yes; 2= no)

5.6 Data analysis Models

The different models used in the analysis are presented below. These are the ordered probit, principal component, ordinary least square, binary logistic and discriminant analysis model.

5.6.1 The ordered probit model

This section presents the background to the ordered probit model as well as the mathematical representation of the model. The ordered probit model is used to identify the determinants of farmers' decision to participate in organic farming distinguishing among the fully-certified organic, partially-certified organic and non-organic farmers;

5.6.1.1 Introduction and application of model

Multiple response models are used when the number of alternatives that can be chosen is more than two. They are developed to describe the probability of each of the possible outcomes as a function of personal or alternative specific characteristics (Verbeek, 2008). Ordered response models are applied where there exists an ordered or logical ordering of the alternatives. In this case it is assumed that there exists an underlying latent variable that drives the choice between the alternatives (Verbeek, 2008). The results in this case will be sensitive to the way in which the alternatives are numbered. The modelling methodology used to establish the determinants of the farmers organic farming status is the ordered probit model.

The ordered probit is suitable for modelling with a categorical dependent variable (in this study the organic farming status). Multivariate modelling is an especially useful and informative approach to understanding the farmer's decision on their organic farming status. This is because multiple factors contribute to their decision on whether to be fully certified organic, partially certified organic or non-organic. Ordered probit is especially appropriate in this study because like Ordinary Least Square (OLS) it identifies the statistical significant relationships between the explanatory variables and the dependent

variable. BUT unlike the OLS regression, ordered probit discerns unequal differences between ordinal categories in the dependent variable (McKelvey and Zavonia, 1975; Greene, 2003).

5.6.1.2 Mathematical representation of the ordered probit model

In this study, the dependent variable of the farmer's organic farming status was placed in three ordered categories in the survey. The smallholder farmers are classified as fully-certified organic farmers, partially-certified organic farmers and non-organic farmers. An ordered probit model is used to determine the factors that influence a farmer's organic farming status. Based on the review of literature, the model is estimated as follows

(1) Organic farming status = $f(\text{age, gender, education, household size, farm size, farm income, off farm income, input costs, land tenure, location, land tenure, livestock, chicken ownership, risk attitudes and assets})$10

The organic farming status is modelled using the ordered probit model with the model outcomes:

$S_i = 3$ (fully-certified organic),
 $S_i = 2$ (partially-certified organic farming) and
 $S_i = 1$ (non-organic farmers).

The farmer's decision on their organic farming status is unobserved and is denoted by the latent variable s_i^* . The latent equation below models how s_i^* varies with personal characteristics and is represented as:

$$s_i^* = X_i' \alpha + \varepsilon_i \dots\dots\dots 11$$

Where:

- the latent variable s_i^* measures the difference in utility derived by individual i from either being fully-certified organic, partially-certified organic or non-organic.
- ($i = 1, 2, 3, \dots, n$) n represents the total number of respondents. Each individual i belongs to one of the three groups.
- X_i is a vector of exogenous variables,
- α is a conformable parameter vector, and
- the error term ε_i is independent and identically distributed as standard normal, that is $\varepsilon_i \sim NID(0, 1)$.

The observed variable (S_i) relates to the latent variable (s_i^*) such that

$$S_i = \begin{cases} 1 & \text{if } s_i^* \leq 0 \\ 2 & \text{if } 0 < s_i^* \leq \gamma \\ 3 & \text{if } s_i^* > \gamma \end{cases} \dots\dots\dots 12$$

Taking the value of 3 if the individual was fully-certified organic and 1 if the individual was non-organic. The implied probabilities are obtained as:

$$\begin{aligned} \Pr \{S_i = 1 | X_i\} &= \Pr \{s_i^* \leq 0 | X_i\} = \Phi(-X_i' \alpha), \\ \Pr \{S_i = 3 | X_i\} &= \Pr \{s_i^* > \gamma | X_i\} = 1 - \Phi(\gamma - X_i' \alpha) \\ &\text{and} \\ \Pr \{S_i = 2 | X_i\} &= \Phi(\gamma - X_i' \alpha) - \Phi(-X_i' \alpha) \dots\dots\dots 13 \end{aligned}$$

Where γ is the unknown parameter that is estimated jointly with α . Estimation is based upon the maximum likelihood where the above probabilities enter the likelihood function. The interpretation of the α coefficients is in terms of the underlying latent variable model in equation 11.

The probability of the farmer being fully-certified organic can be written as

$$\Pr(S_i = 1) = \Phi(X_i' \alpha_1), \dots \dots \dots 14$$

Where $\Phi(\cdot)$ is the cumulative distribution function (cdf) of the standard normal. (Verbeek, 2008).

A measure of goodness of fit can be obtained by calculating

$$\rho^2 = 1 - [\ln L_b / \ln L_o] \dots \dots \dots 15$$

Where $\ln L_b$ is the log likelihood at convergence and $\ln L_o$ is the log likelihood computed at zero. This measure is bounded by zero and one. If all model coefficients are zero, then the measure is zero. Although ρ^2 cannot equal one, a value close to one indicates a very good fit. As the model fit improves, ρ^2 increases. However the ρ^2 values between zero and one do not have a natural interpretation (Greene, 2003). Another similar informal goodness of fit measure that corrects for the number of parameters estimated is

$$\bar{\rho}^2 = 1 - [\ln L_b K / \ln L_o] \dots \dots \dots 16$$

Where K is the number of parameter estimates in the model (degrees of freedom)

5.6.2 Principal component model

This section presents the background to the principal component model as well as its application in the study and the mathematical representation of the model. The method of Principal Components Analysis (PCA) is applied to the scores of the sources of risk identified by the farmers to analyse *further underlying dimensions* of the variation among these sources of risk. The Kaiser–Guttman rule is used to determine the number of principal components that can be extracted and meaningfully interpreted

5.6.2.1 Introduction and application of model

Principal component analysis (PCA) involves a multivariate statistical technique that transforms a number of (possibly) correlated variables into a (smaller) number of uncorrelated variables called *principal components* with minimum loss of information (Dunteman, 1989). The first principal component accounts for as much of the variability in the data as possible, and each succeeding component accounts for as much of the remaining variability as possible (Manly, 2005). The objectives of principal component analysis are to reduce the dimensionality of the data set and to identify new meaningful underlying variables. According to Rao (1964), PCA is the most successful method under the factor analysis approach (Rao, 1964). Each principal component is a linear combination of the original variables with coefficients equal to the Eigen vectors of the correlation or covariance matrix (Manly, 2005). A correlation matrix is used if the variances of individual variates differ much, or if the units of measurement of the individual variates differ otherwise the covariance matrix is used.

5.6.2.2 Mathematical representation

The method of Principal Components Analysis (PCA) was then applied to the scores of the sources of risk to analyse *further underlying dimensions* of the variation among these sources of risk. The decision about which PCs to retain depends on the percentage of the variance accounted for the variable, the absolute variance accounted for by each PC, and whether the PC can be *meaningfully interpreted*.

The PCs were estimated as linear functions of the original sources of risk as:

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

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

$$\vdots$$

$$\vdots$$

$$\vdots$$

$$PC_k = a_{k1}X_1 + a_{k2}X_2 + \dots + a_{kk}X_k$$

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Where;

$k = 1 \dots 20$;

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

$X_1 \dots X_k$ = the sources of risk

The coefficients $a_{i1}, a_{i2}, \dots, a_{ik}$ were chosen such that the first PC ($PC1$) will have as large a variance as possible, the second PC ($PC2$) was chosen to be uncorrelated with the first, and to have as large variance as possible, etc. The PCs thus provide measures of the amount of common variation as well as magnitudes and nature of divergences in the farmers' scores for their perceptions of sources of risk.

The PCs can be most informative since weights are assigned in a way that captures the maximum variance of the variates, thus making it possible to calculate useful indexes from the farmers' scores if the PCs can be meaningfully interpreted (Koutsoyiannis, 1987). There are various methods for determining the optimum number of factors, such as the Scree test, proportion of variance, analysis of residuals and a priori hypotheses. In this thesis, the Kaiser–Guttman rule, which has been most commonly used due to its simplicity and availability in various computer packages (Kaiser, 1960) is used. The Kaiser–Guttman rule states that the number of factors to be extracted should equal the number of factors having an Eigen value greater than one. The rationale for choosing this particular value is that a factor must have variance at least as large as that of a single standardized original variable.

Note that the assumption of PCA is that interval data that is multivariate normally distributed should be used, but Kim and Mueller (1994) justifies the use of ordinal data like Likert-type scales under two conditions: firstly, if the PCA is used to find general clustering of variables for exploratory purpose and secondly, if the underlying correlations among variables are believed to be moderate – say less than 0.6 or 0.7. The PCs in this study are estimated using the covariance matrix as the scores are of the same units, implying that no source of risk is likely to have an undue influence on the PCs due to a much larger relative variance (Manly, 2005).

The relationships between the perceptions of risk sources against farm and farmer socioeconomic characteristics were explored using factor analysis and multivariate regression methods. In regression analysis, the standard factor scores achieved from the factor analyses of the sources of risk were regressed on farms' and farmers' socioeconomic characteristics to identify the impact of these characteristics on the farmers' perceptions of risk sources. Specifically, the regression models can be represented in the form of equation 18:

$$FSR_{it} = f(\text{Age, Gender, Education, Geography, Land size, Information access, Household size, Household Income, Risk taking, } \varepsilon_t) \dots \dots \dots 18$$

Where:

FSR_{it} = standardized factor scores for sources of risk factors ($I = 1, 2, 3, \dots, 7$), achieved from the factor analyses of sources of risk.

Age, Gender, Education, Geography, Land size, Information access, Household size, Household Income, Risk taking = Explanatory variables

ε_t = Error term

All of the regression models were tested for possible violations of the basic assumptions of a linear regression model. Specifically, a simple correlation matrix, and collinearity diagnostics (Tolerance and Variance Inflation Factor, VIF) was inspected to detect any potential multicollinearity. The first order autocorrelation problem was checked using the Durbin-Watson statistics.

A Herfindahl index is used to calculate enterprise diversification and represent the specialization variable. Although, this index is mainly used in the marketing industry to analyze market concentration, it has also been used to represent crop diversification (Llewelyn and Williams, 1996; Bradshaw, 2004). Herfindhal index (DHI) is the sum of square of the proportion of individual activities in a portfolio. With an increase in diversification, the sum of square of the proportion of activities decreases, so also the indices. In this way, it is an inverse measure of diversification, since the Herfindhal index

decreases with an increase in diversification. The Herfindhal index is bound by zero (complete diversification) to one (complete specialization).

$$\text{Herfindhal index (DH)} = \sum_{i=1}^N s_i^2$$

Where

N is the number of enterprises and

s_i is the value share of each i -th farm enterprise in the farm's output.

$s_i = x_i / \sum_1 x_i$ is the proportion of the i -th activity in acreage / income.

5.6.3 The Binary logistic model

This section presents the background to the binary logistic model as well as its application in the study and the mathematical representation of the model. The binary logistic regression is used to determine the factors affecting the consumer's awareness of organic products.

5.6.3.1 Introduction and application of model

Multiple linear regression may be used to investigate the relationship between a continuous (interval scale) dependent variable (Gujarati, 2003). However, socio-economic variables are very often categorical, rather than interval scale. In many cases research focuses on models where the dependent variable is categorical. The Logistic regression is used in instances where the dependent variable is binary or ordinal (Pampel, 2002). The proportions and probabilities for categorical variables are bounded by 0 and 1 and have a binomial distribution. Unlike the normal distribution, the mean and variance of the Binomial distribution are not independent. The mean is denoted by P and the variance is denoted by $P*(1-P)/n$, where n is the number of observations, and P is the probability of the event for any one individual in this example (Pampel, 2002).

The goal of logistic regression is to correctly predict the category of outcome for individual cases. It takes into consideration the factors under investigation, but tries to

establish the most parsimonious model, i.e. to ‘throw out’ factors (or interactions between factors) which does not really matter. To accomplish this goal, a model is created that includes the factors (called “predictor variables”) that are useful in predicting the outcome. For each model calculated a statistics called “Wald test” is used to test the statistical significance of each factor or combination of factors (Gujarati, 2003). The probability value corresponding to this statistic, and taken from the resulting, i.e. the best-fitting model, will be used in the presentation and evaluation of the data (for a detailed description of logistic regression and the underlying calculations (see Rietveld and van Hout, 1993). As for the question how much the factors under investigation actually contribute in the explanation of the actually observed variations, it is helpful that logistic regression gives information about the comparison between the prediction and the actual distribution of the data. This step yields insight into the how good the estimate is, in other words, how much the factors under investigation actually contribute to the outcome.

Criteria for applying Logistic Regression are outlined by Hosmer and Lemeshow (2002) and include:

1. The dependent variable is dichotomous and can be coded into values 0 and 1
2. A single case can be represented in the data set only once (i.e. the observations must be independent from each other)
3. The model must be correctly specified, i.e. contains all relevant predictors and no irrelevant predictors and the categories under analysis must be mutually exclusive and collectively exhaustive.
4. Relative large samples are required (standard errors for maximum likelihood coefficients are large-sample estimates). For most applications, a minimum of 50 cases per predictor variable is sufficient.

(Gujarati, 2003)

In general, the data available for this project meet the criteria, with details discussed in the respective sections.

5.6.3.2 Mathematical representation of the binary logistic model

The binary logistic regression is used to determine the factors affecting the consumer's awareness of organic products. Based on the review of literature, the model is estimated as follows

(1) Consumer awareness = $f(\text{age, gender, education, household size, Children, income, employment status, location, distance, person shopping, consumption, price perception and trust})$19

Consumer awareness of organic products is modelled using the binary logistic regression model with the model outcomes:

$Y_i = 0$ (consumer not aware),

$Y_i = 1$ (consumer aware)

Mathematically, when the logistic regression model involves only one explanatory variable, say X_1 and that X_1 takes only two values, 0 (not aware) and 1(aware). A logistic regression model for this data would correspond to:

$$\log \left\{ \frac{\pi(X_1)}{1 - \pi(X_1)} \right\} = \beta_0 + \beta_1 X_1 \quad \dots\dots\dots 20$$

More specifically the model is

$$\log \left\{ \frac{\pi(X_1 = 1)}{1 - \pi(X_1 = 1)} \right\} = \beta_0 + \beta_1 \quad \dots\dots\dots 21$$

for the consumers who are aware ($X_1 = 1$) and

$$\log \left\{ \frac{\pi(X_1 = 0)}{1 - \pi(X_1 = 0)} \right\} = \beta_0 \quad \dots\dots\dots 22$$

for the consumers who are not aware ($X_1 = 0$)

We see that β_0 represents the logarithm of the odds of response for unexposed individuals, whereas the logarithm of the odds of response for exposed individuals is given by $\beta_0 + \beta_1$.

If we subtract the latter model equation (where $X_1 = 0$) from the former (where $X_1 = 1$), we see that

$$\begin{aligned}\beta_1 &= \log \left\{ \frac{\pi(X_1 = 1)}{1 - \pi(X_1 = 1)} \right\} - \log \left\{ \frac{\pi(X_1 = 0)}{1 - \pi(X_1 = 0)} \right\} \\ &= \log \left\{ \frac{\pi(X_1 = 1)}{1 - \pi(X_1 = 1)} / \frac{\pi(X_1 = 0)}{1 - \pi(X_1 = 0)} \right\} \\ &= \log \left\{ \frac{\text{odds of response when aware}}{\text{odds of response when not aware}} \right\}\end{aligned}$$

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This equation reveals that β_1 , the regression coefficient associated with X_1 represents the logarithm of the odds ratio.

Stated another way, β_1 represents the change in the logarithm of the odds in favour of the response of interest when the corresponding explanatory variable, X_1 , increases by one unit, i.e., from $X_1 = 0$ to $X_1 = 1$.

Clearly, if $\beta_1 > 0$, the log-odds in favour of the response of interest increases as X_1 increases from 0 to 1; conversely, if $\beta_1 < 0$, the log-odds in favour of the response of interest decreases as X_1 increases from 0 to 1.

It should also be evident that if $\beta_1 = 0$, then the log-odds in favour of the response of interest does not change as X_1 changes.

It can be shown that the corresponding model for the probability of response,

$$\pi(X_1 = 1) = \Pr(Y = 1|X_1 = 1) = \frac{\exp(\beta_0 + \beta_1)}{1 + \exp(\beta_0 + \beta_1)}$$

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is an increasing function with respect to the regression coefficient, β_1 , so that an increase in the log-odds in favour of response means that the probability of response increases.

5.6.4 Discriminant analysis model

This section presents the background to the discriminant model as well as its application in the study and the mathematical representation of the model. The determinants of the consumption of organic products is analysed using the discriminant model

5.6.4.1 Introduction and application of model

Discriminant analysis is a statistical technique designed to investigate the differences between two or more groups of cases with respect to several underlying variables. This technique is more appropriate than commonly used measures (correlation, regression, etc) because the variables being predicted are categorical. It provides a more rigorous test than one based on univariate comparison of means, and results in a unit of analysis, predicted category membership, that is more useful in evaluating instructional interventions. Its goal is to classify cases into one or several mutually exclusive groups based on their values for a linear combination of predictor variables (Manly, 1986). In this study, the consumers are classified into three main groups: those that have never consumed organic products, those that have considered consuming organic products and those that have consumed organic products, depending on their consumption status.

Since there are three groups, the number of unique functions that can be extracted is equal to $(g-1)$, where g is the number of groups, or, p , the number of discriminant variables, whichever is less. In this study two Linear Discriminant Functions (LDFs) are computed which are orthogonal (uncorrelated). The analysis assumes that the discriminant function scores (D_{km}) are normally distributed for each group and that the groups have equal variance covariance matrices for the discriminating variables. In practice these conditions are seldom applied strictly as the technique is very robust to departures from these assumptions (Klecka, 1980).

5.6.4.2 Mathematical representation for discriminant analysis model

The LDF takes the mathematical form in equation (25):

$$D_{ikm} = \mu_1 X_{1km} + \mu_2 X_{2km} + \dots + \mu_p X_{pkm} \dots \dots \dots (25)$$

Where;

D_{km} = the score of the canonical discriminant function for case m in group k

X_{ikm} = the value of discriminant variable X_i for case m in group k , and

μ_i = the standardized estimated discriminant coefficient for the variable X_i .

The proposed empirical model for each LDF takes the form in equation (26):

$$\begin{aligned} D_{km} = & \alpha_1 \text{Age} + \alpha_2 \text{Gender} + \alpha_3 \text{Education} + \alpha_4 \text{Household size} + \alpha_5 \text{Children} + \alpha_6 \text{Income} \\ & + \alpha_7 \text{Employment status} + \alpha_8 \text{Location} + \alpha_9 \text{Distance} + \alpha_{10} \text{Person shopping} + \\ & \alpha_{11} \text{Awareness} + \alpha_{12} \text{Price perception} + \alpha_{13} \text{Label Trust} \dots \dots \dots (26) \end{aligned}$$

Equation (26) hypothesizes that the farmer's decision to consume organic products depends on the thirteen (13) explanatory variables listed in equation (26).

In discriminant analysis, the coefficients of the first LDF are derived as to maximise the difference between the group means. The coefficients of the second LDF are derived so as to maximise the difference between the group means, subject to the constraint that the values on the second LDF are not correlated with the values on the first LDF. The bigger the difference between the mean values of the independent variable related to the various groups, the more discriminating is that variable. Discriminant analysis simultaneously analyses all of these mean differences and determines which variables have most discriminating power. It provides a LDF that includes only those variables that should be used in predicting performance. The main advantage of the LDF is that its measure of predictive ability is in terms of the percent of cases that are correctly

classified. Therefore the discriminant analysis is an appropriate technique for use in this study to identify characteristics that differentiate between the three strata.

5.7 Chapter summary

The study area is in Mkhambathini Local Municipality of KwaZulu-Natal Province and the former Transkei and former Ciskei in the Eastern Cape Province. Rural KwaZulu-Natal and rural Eastern Cape Province where the study was conducted have high concentration of people who are relatively poor and population resides in communal areas of the former homelands. These are characterised by small holders who rely on subsistence agriculture as an important livelihood option, contributing a significant portion of their household income. In Mkhambathini LM, the area is located in a moist coastal hinterland region and the climate is favourable for a wide range of adapted crops.

Agriculture is rain fed and the growing season is all year-round growing season. The land use pattern is predominantly agricultural in nature, characterised by small-scale subsistence farming and some marginal sugarcane cultivation. Crops grown include *amadumbes*, potatoes, beans, maize, some sugarcane, bananas, chilies and peanuts. Maize, legumes and potatoes are the main crops grown. The land tenure system is traditional in nature. The land is owned by the tribe and people have the permission to occupy. Producer and household questionnaires are used to collect data from 200 smallholder farmers and the econometric models ordered probit and principal component methods used for analysis are outlined in the text.

The former homelands were also referred to as former Bantustan states in the Eastern Cape Province. The province is characterised of high poverty levels especially in rural areas, high unemployment rates and low income levels. Agriculture therefore plays an integral part in the development of the rural economy but the agricultural sector potential remains largely untapped. Although subsistence farming - essentially maize and stock – is fairly general throughout the area, practices remain less than effective in relation to the potential. The land tenure system is communal with land claims common in the

province. A total of 200 consumers were interviewed in the study. A structured questionnaire was used to establish consumer awareness and consumption of organic products. The Binary logistic model was used to estimate the factors affecting consumer awareness of organic products while the discriminant model is used to establish the determinants of consumption of organic products.

CHAPTER 6

DETERMINANTS OF ORGANIC FARMING ADOPTION AMONG SMALLHOLDER FARMERS IN KWAZULU- NATAL

6.1 Introduction

This chapter presents the results of the analyses of the survey data on organic farming adoption. The data collected for this chapter were derived from interviews with the heads of the household drawn from for the three farmer groups in the study area. Quantitative and qualitative approaches were used to gather and evaluate the data in order to gain deeper understanding of farmers' management decisions and perceptions about certified organic farming. The chapter begins with the presentation of summary statistics of the demographic and socio-economic characteristics of the smallholder farmers. Quantitative variables were expressed as averages, whereas the gender and literacy dummy variables were reported as frequencies and percentages. The ordered probit results for the determinants of organic farming adoption are analysed and discussed.

6.2 Descriptive statistics of surveyed data

This section presents the results of the demographic and socio-economic characteristics of the survey farmers. The section begins with the demographic characteristics followed by the socio-economic characteristics. In both cases summary tables of respective variables are presented. Detailed analysis is made on variables requiring any further interpretation. The summary statistics of the variables comprising demographic and socio-economic data are presented in sub sections 6.2.1 and 6.2.2.

6.2.1 Demographic characteristics of the farmers

Table 6.1 and Figure 6.1 present the summary statistics of age, gender and education of the sampled farmers. The average age of respondents in the study area was generally high, being estimated at 51years but lowest for partially certified members. Fully certified farmers had an estimated average age of 52.6 years and non-organic farmers had an average age of 52.7 years. Only 8.5% of the farmers were below the age of 30 years and cumulatively 23% below the age of 40 years. Overall, these findings are consistent with

previous studies in the province that estimated the average rural household head to be 60 years of age (Matungul, 2001). Similarly, Moloi (2008) concluded that in many rural areas farming is undertaken by farmers who are over 50 years. Pote (2008) also concluded that average age of smallholder farmers in the Eastern Cape is 57 years old with the youngest farmer at 27 years and the oldest farmer at 91 years. One of the reasons for this age pattern might be that farming is mostly considered as an alternative job for people who are retiring from formal wage employment. As a result, the educated young and active people migrate to the urban areas to seek wage employment and only return to farming upon retirement or retrenchment.

Table 6.1: Summary statistics of demographic variables, KwaZulu-Natal

	Fully certified organic Mean (std dev)	Partially certified organic Mean (std dev)	Non-organic Mean (std dev)
Age (years)	52.6 (1.903)	48.6 (1.405)	52.7 (2.110)
Gender (1= female)	0.82 (0.052)	0.71 (0.047)	0.84 (0.053)
Education (years)	4.98 (4.241)	4.37 (4.49)	3.38 (0.607)

Source: Field Data

The youngest farmer in the study area was 19 years and the oldest farmer was 84 years. The results show that very few young farmers are engaged in farming, confirming the preceding findings by Mine (2006) and Ngqangweni and Delgado (2003) and who found that in many African rural settings, the younger generation migrates to urban areas and farming is undertaken by the older generation. On the other hand, with the South African life expectancy at 42.7 years (World Bank 2007) the expectation is that there would be fewer older people in farming. A total of 69.2% of the farmers in the study area were above the World Bank (2007) life expectancy and 9% of the farmers' were over 70 years

of age. This lays credence to previous findings that older persons are more likely to be found in rural areas and also that more people are retiring into farming in rural areas.

Farming in Umbumbulu is done by female farmers as depicted by the 82% female farmers representation among fully certified organic, 71% female farmer representation among partially certified organic and 84% female farmer representation among non-organic farmers (Figure 6.1). These findings are consistent with Marcus, Mac Donald, Maharaj, Manicon and Phewa (1995) who found that most *de facto* heads were female. This is explained by the fact that in the study area most of the men are engaged in wage employment at the neighbouring sugarcane farms as well as employed as migrant workers in the city of cities of Durban, Johannesburg and other parts of South Africa. Farming is hence undertaken by female members of the household. Chipande (2008) stated that it is widely recognised that women especially in Africa dominate agricultural production. Kossoudji and Mueller (1983) noted that studies in least developed countries also suggest that a substantial proportion of farming in rural areas is undertaken by women.

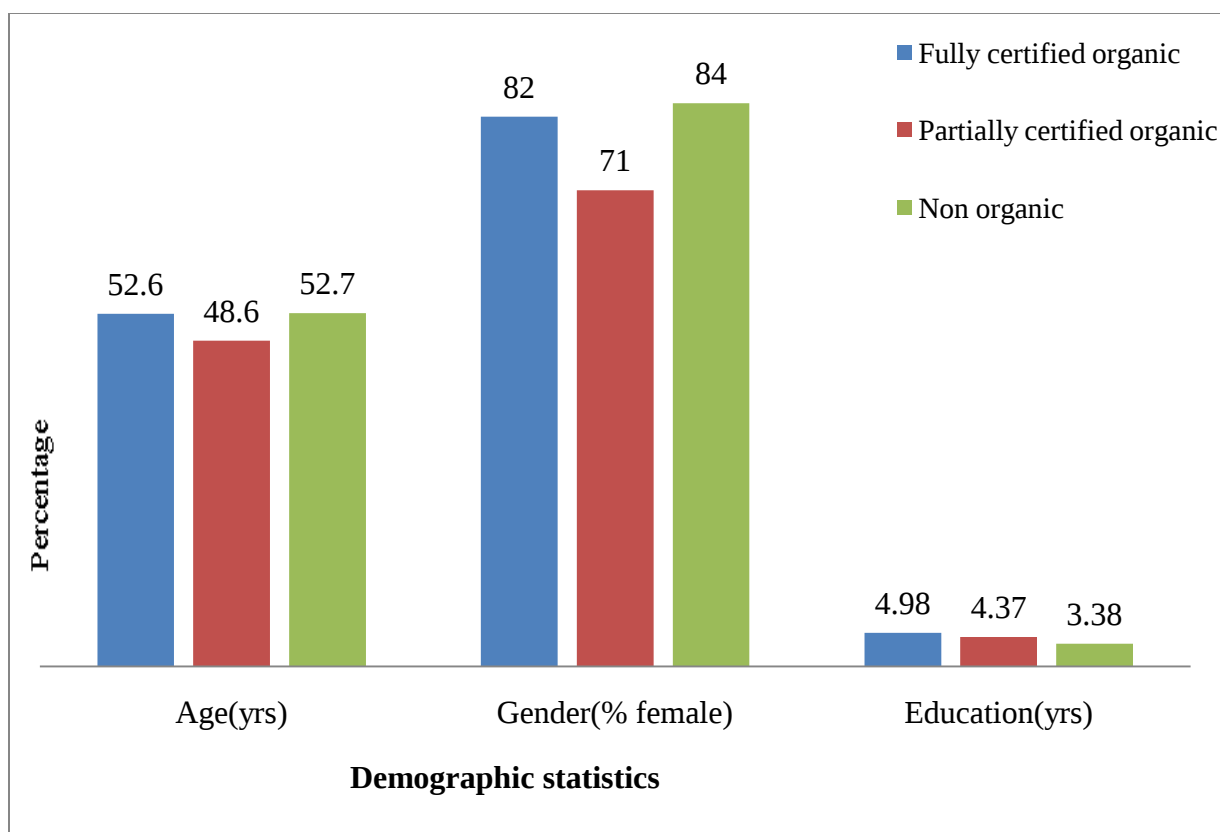


Figure 6.1: Demographic statistics of farmers

The farmer's educational level was measured by their years of formal schooling as well as whether the farmer could read or write English and/ or *Zulu* (the local language). The certified organic farmers had the highest level of education at 4.98 years compared to 3.38 years of formal education for the non-organic farmers. However the educational level in the study area was generally low at 4.3 years of formal schooling education. The proportion of respondents able to read and understand English was very low, ranging from 22.5% amongst non-members to 27.2% for partially certified members and 25% for fully certified organic farmers. This necessitated the questionnaire to be translated to *Zulu* as well as engaging local enumerators who spoke the local language.

6.2.2 Socio-economic characteristics of the farmers

Table 6.2 below presents the summary statistics for the socioeconomic variables that are used in the ordered probit analysis. The average household size for certified organic farmers was 9.49 while for partially certified farmers it was 7.72. The household size for non-organic farmers is 6.06 below the overall average household size of 7.9 (see Figure 6.2). These results indicate that certified organic farmers had larger households than non-organic farmers. The household size is a proxy for family labour which is one of the most important inputs to smallholder farm production. The availability of family labour especially during peak labour demand is important for households that have adopted certified organic farming as organic farming as a technology is labour intensive. On the other hand large family sizes also put pressure on household food demands and hence has implications for the adoption of agricultural technologies that have a bearing on food security and/or commercialization for income sources.

Katungi (2007) found that low external input technologies tend to substitute labour for capital (high external inputs). Organic farming in this instance is categorized as low external input technology. This means that the availability of family labour will affect the adoption of low external input technologies. The relatively high labour intensity of low external input technologies has also been recognized by Lee, Barrett and McPeak (2006).

Table 6.2: Summary statistics of socio-economic variables, KwaZulu-Natal

	Fully certified organic	Partially certified organic	Non-organic
	Mean (<i>std dev</i>)	Mean (<i>std dev</i>)	Mean (<i>std dev</i>)
Household size	9.49 (5.23)	7.72 (3.675)	6.60 (3.46)
Land size(hectares)	0.59 (1.22)	0.71 (1.16)	0.67 (1.43)
Input costs (rands /year)	812.9 (884.9)	309.3 (343.4)	318.2 (302.9)
Proportion of income from farming	0.62 (0.79)	0.38 (1.04)	0.39 (0.626)
Farm Income per yr (rands)	973.17 (1074.51)	417.26 (471.50)	400.28 (429.53)
Location	2.56 (0.60)	1.91 (0.54)	4.00 (0.0)
Risk attitude	0.522 (0.29)	0.581 (0.307)	0.756 (0.29)
Land rights (0=no)	1.98 (0.14)	1.75 (0.56)	1.93 (0.33)
Chicken ownership	15.29 (13.16)	9.25 (8.69)	6.40 (6.62)
Asset ownership (index)	0.983 (0.596)	0.556 (0.586)	0.669 (0.751)

**please note the colours are representation of the graphical indexes from Figure 6.2.1-6.2.10*

Despite land sizes in the study area being generally low, the average hectareage of certified organic farmers was smallest at 0.59 hectares compared to 0.67 hectares for non-organic farmers and 0.71 hectares for partially certified farming (see Figure 6.3). Farmers

with larger parcels of land are unlikely to adopt organic farming (Kyalo, Birech, Freyer and Bett, 2009). Hence farmers who adopt certified organic farming are more likely to have smaller land holdings.

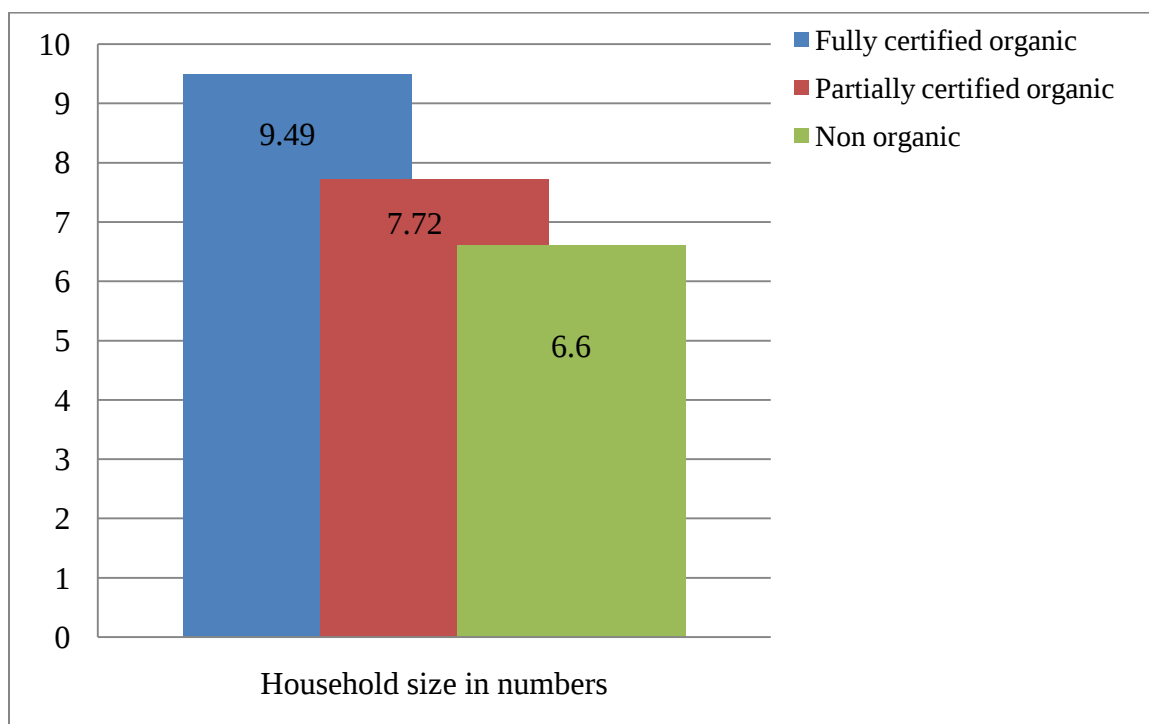


Figure 6.2: Household size of farmers

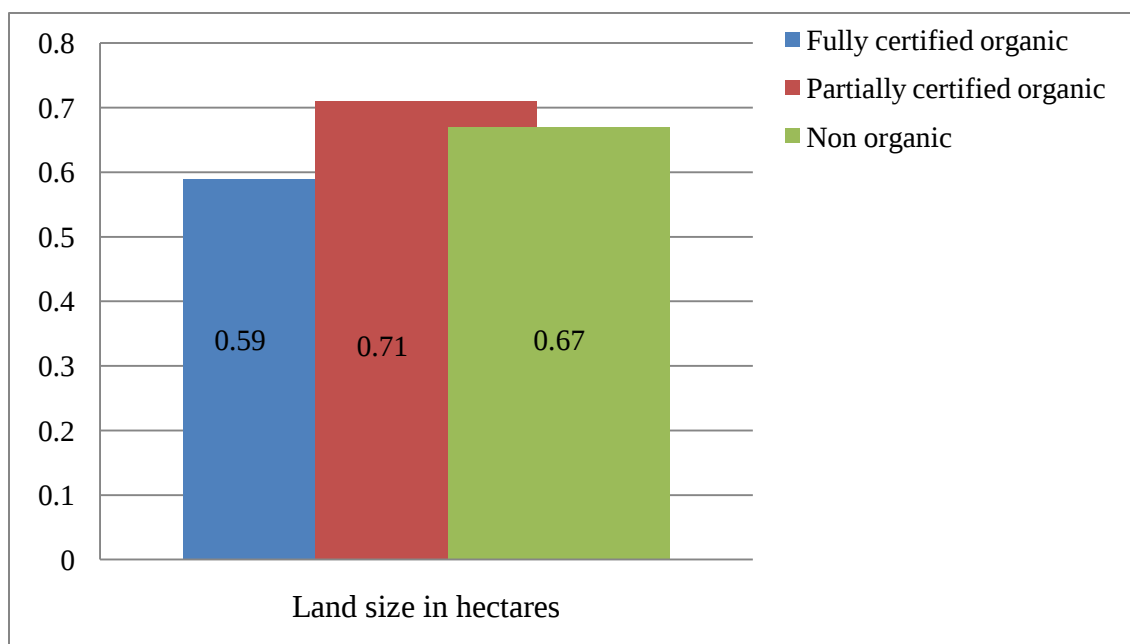


Figure 6.3: Land size of farmers

The minimum hectarage across the farmer groups was 0.01heactares while the maximum hectarage was 7.90, 8.20 and 8.60 for fully certified organic, partially certified organic and non-organic farmers respectively. It should be noted that the large land parcels of over 8 hectares are used to farm sugarcane for commercial purposes. It should also be noted that land tenure in the study area is customary/communal and farmers have the permission to occupy given by the local chief. Input cost per annum for fully certified organic farmers was the highest during the study period at R812.90 compared to R318.25 for non-organic farmers (refer to Figure 6.4). The input cost disparity is as a result of high labour costs incurred by the fully certified organic farmers. The hired labour cost in this case constituted 58% of the input costs incurred by fully certified organic farmers.

The main sources of income were farm and off farm employment, the latter constituting wages or salary income and remittances. Figure 6.5 shows that farm income was highest for fully certified organic farmers at R973.17 compared to non-organic farmers who received R400.28. Partially certified organic farmers received R417.26 as farm income. This is an indication that the adoption of fully certified organic farming and its commercialization has brought economic benefits to these otherwise poor rural households and is an important contributor to household income. According to Figure 6.6, the proportion of household income was highest for fully certified organic farmers at 0.62 compared to 0.38 and 0.39 for partially certified and non-organic farmers respectively. It is interesting to note that 68% of the off farm income is contributed from remittances compared to wage income or salaries.

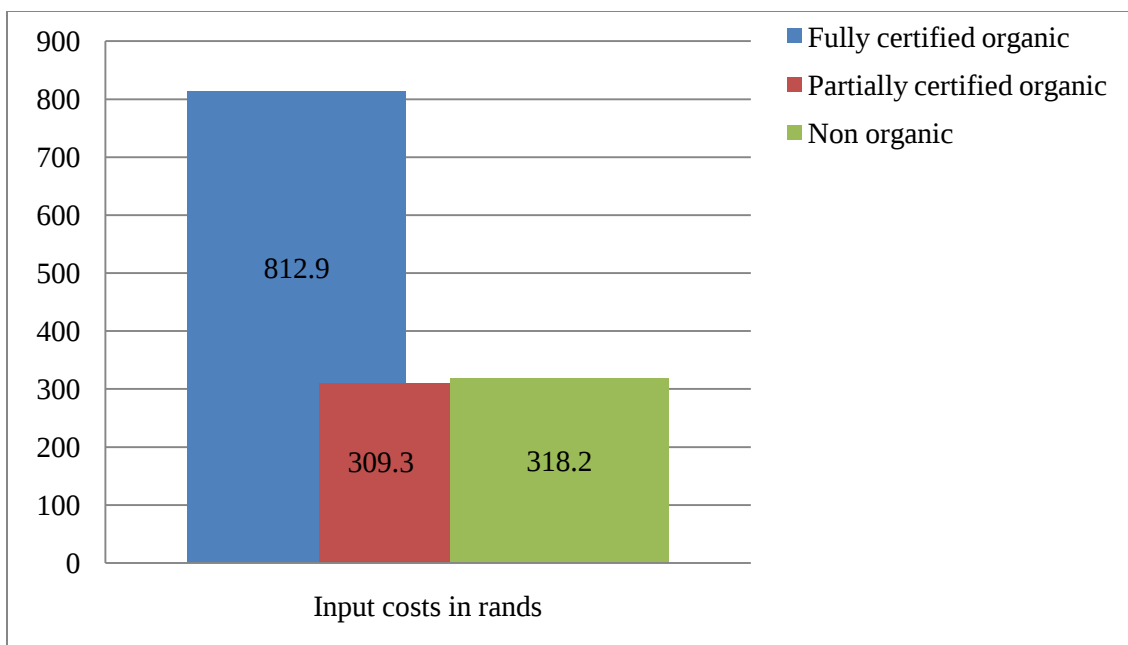


Figure 6.4: Farming input costs in rands

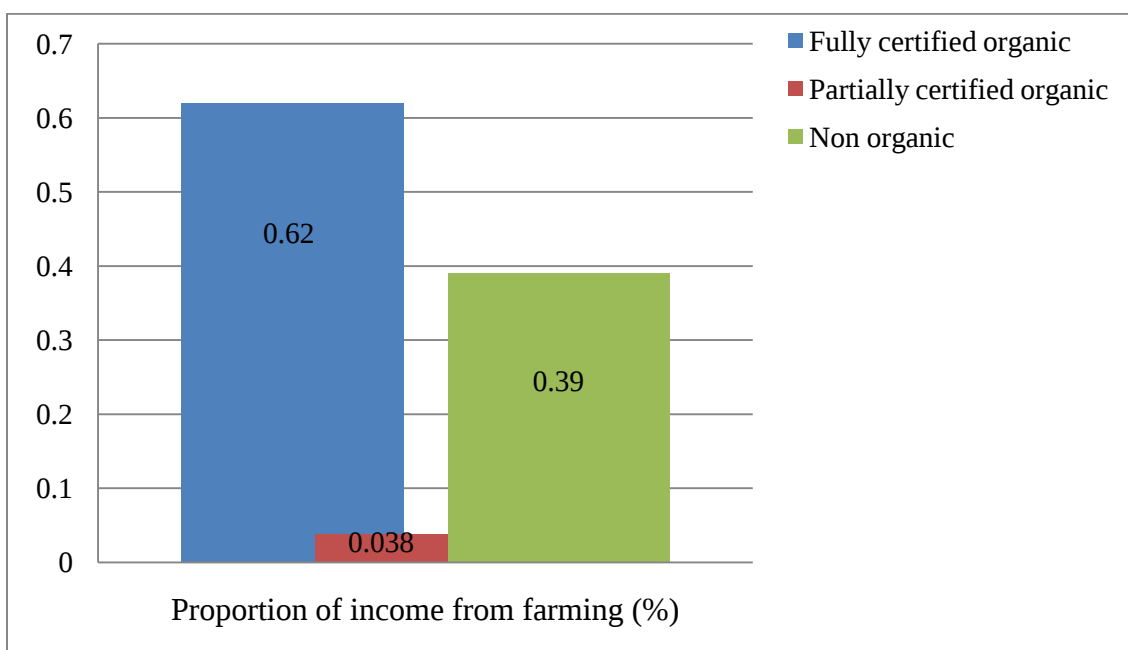


Figure 6.5: Proportion of income from farming

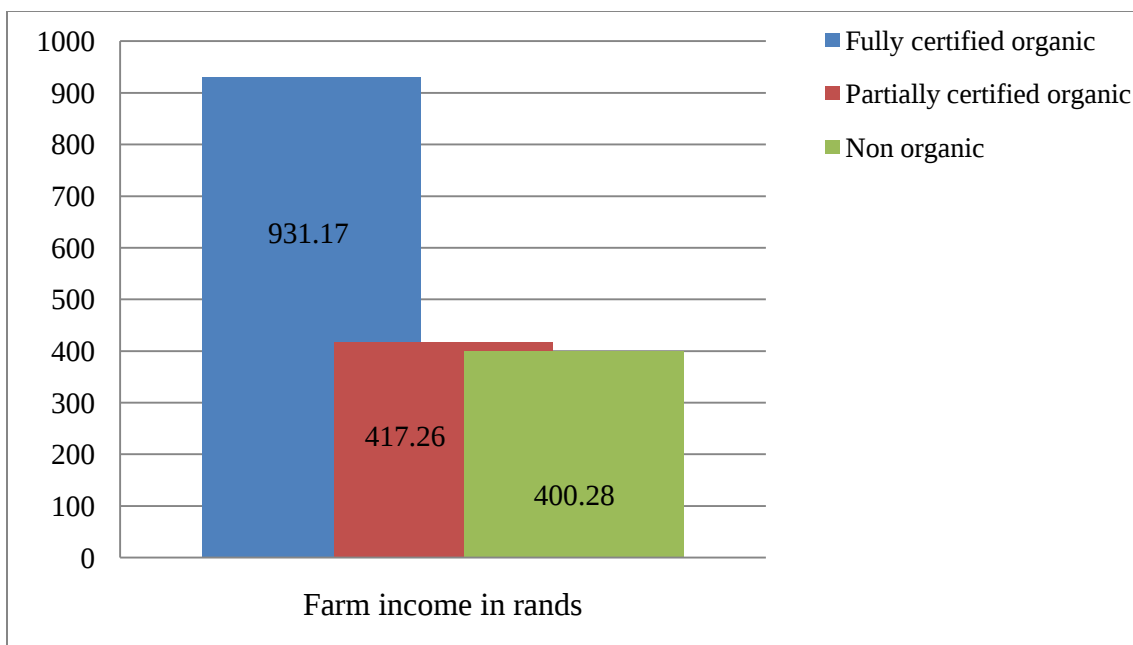


Table 6.6: Farm income in rands

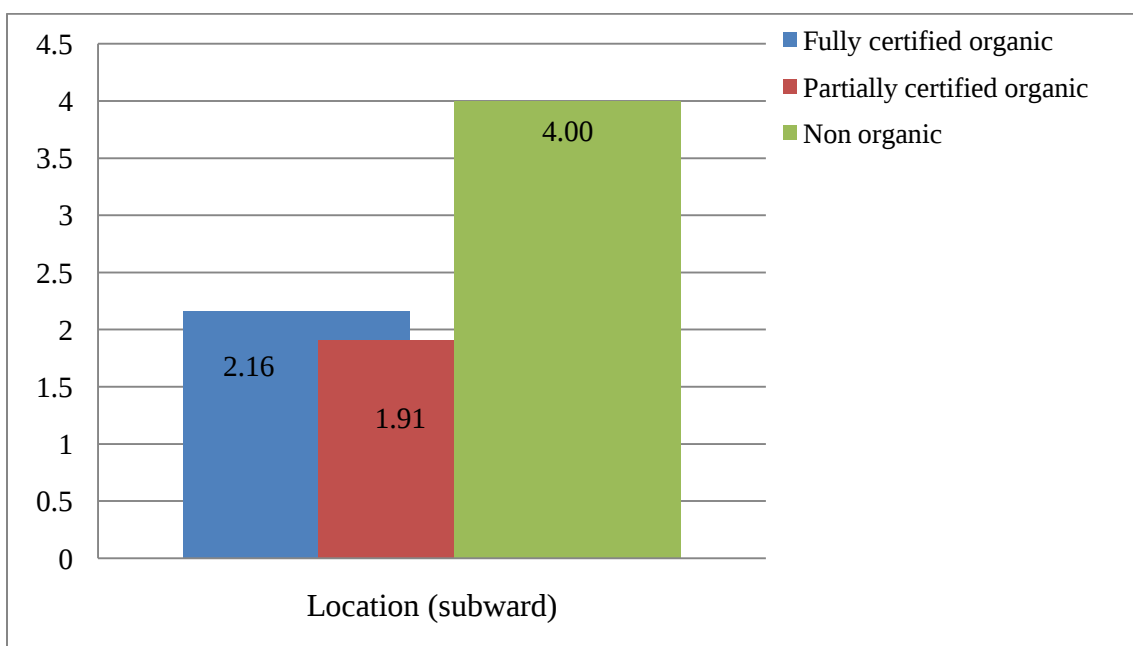


Figure 6.7: Sub-ward location of farmers

The following sub-wards were identified in the study area: Ezigeni, Ezimwini, Eziphambathini, Hwayi, Lower and upper Ogagwini and Nungwane. The original members of EFO were mainly from the areas of Ogagwini and Ezigeni. Consequently membership increased to include farmers from the neighbouring wards of Mahleka, Adams, Nungwane and Hwayi. In this study, the variable location, which refers to the sub-ward of the respondent, was classified as: 1=Ogagwini; 2=Ezigeni; 3=Hwayi; 4=Nungwane. A descriptive analysis of the results shows that overall 57% of the respondents were drawn from the Ogagwini and Ezigeni sub-wards while Hwayi and Nungwane constituted 17% and 26% respectively. The same is depicted in Figure 6.7. Results across the farmer groups' showed that the majority of the certified organic farmers (49.1%) are from Ezigeni sub-ward. A total of 69.8% of the partially certified farmers are drawn from Ezigeni while the majority of non-organic farmers were residing in Nungwane sub-ward. Studies that identified location and distance of the farmer as an important variable in technology adoption include (Ariga, Jayne, Kibaara and Nyoro, 2008; Mwabu, Mwangi and Nyangito, 2006; Langyintuo and Mekuria, 2005). Location, with all its dimensions of market access, demographics and agro-climate, nevertheless remains important to understanding potential for technology use and adoption.

The farmer's risk preference estimated using APARA coefficient was 0.522 for fully-certified farmers, 0.581 for partially certified farmers and 0.756 for non-organic farmers (refer to Figure 6.8). Comparing the risk preference between the farmer groups indicate that non-organic farmers are more risk averse than the organic farmers. Risk-averse farmers are reluctant to invest in innovations of which they have little first-hand experience (Marra and Carlson, 1990). Smallholder farmers in rural KwaZulu-Natal have access to land through permission to occupy with allocation done by the traditional chief of the tribe (*inkosi*) and his headman (*induna*). On average the respondents across the farmers groups acknowledged that the household had rights to exercise on its own cropland the following; build structures, plant trees, bequeath to family members or lease out, with no respondent answering no and the mean for land rights being above 1 indicating the various forms of land rights(refer to Figure 6.9).

Chicken manure is the main source of organic fertilizers in the study area. According to Figure 6.10, fully certified organic farmers had the highest number of chicken with an average of 15.3 chickens owned per household. Non-organic farmers had an average of 6.40 chickens per household and partially certified organic farmers had 9.25. It should be noted that chicken manure is also complimented by animal manure with farmers purchasing animal manure for R20 per wheelbarrow. As part of the incentives to adopt certified organic farming, farmers in the study is were provided with net wire fencing by the Department of Economic Development and Environmental Affairs, KwaZulu-Natal. This was aimed at consolidated the chicken manure for easy collection and subsequent use. Goat manure is also used as is cattle manure.

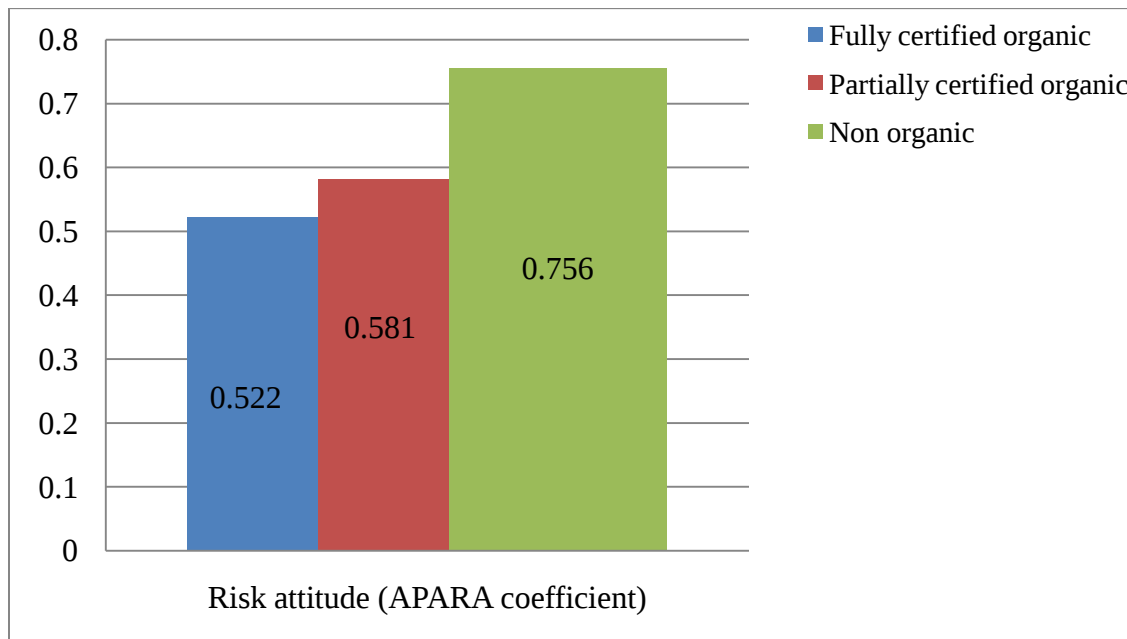


Figure 6.8: Risk attitudes of farmers

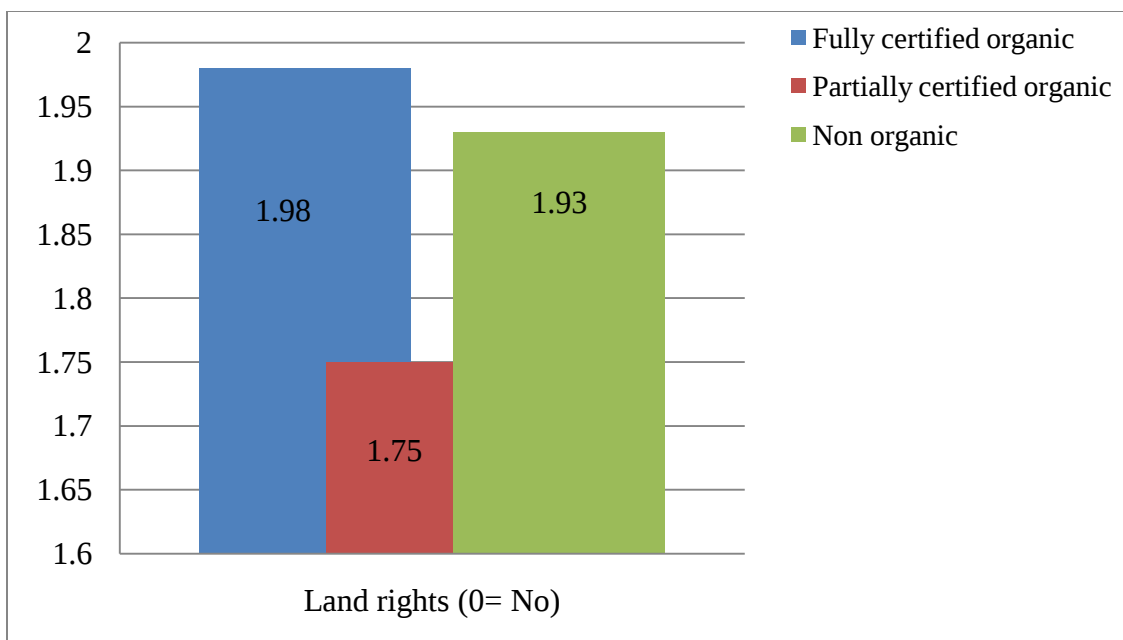


Figure 6.9: Land rights of farmers

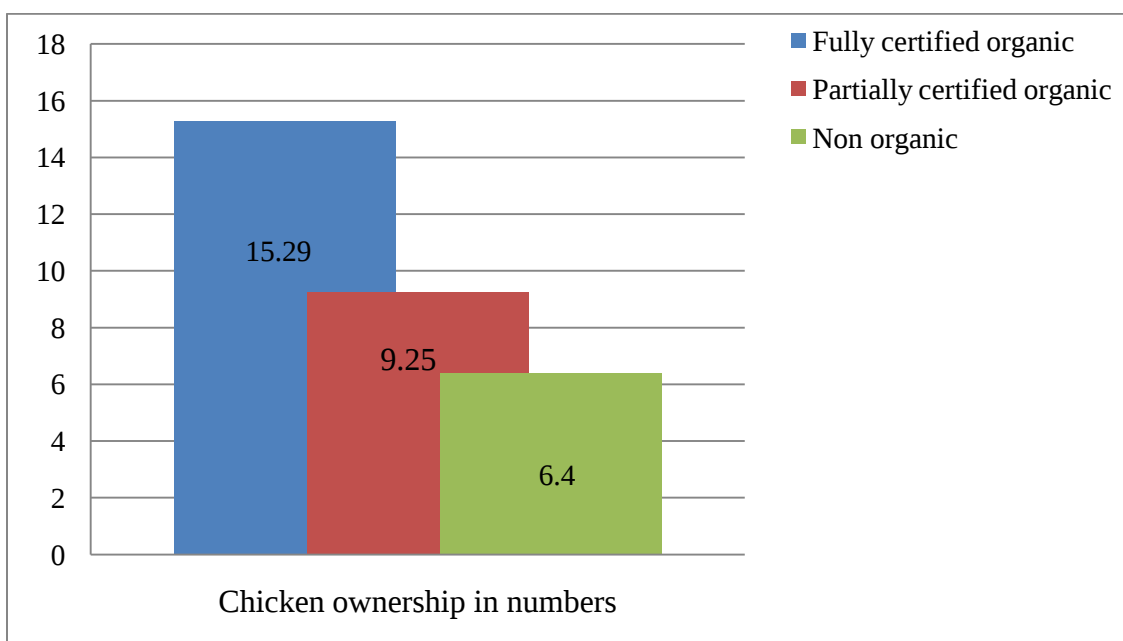


Figure 6.10: Number of chicken owned by farmers

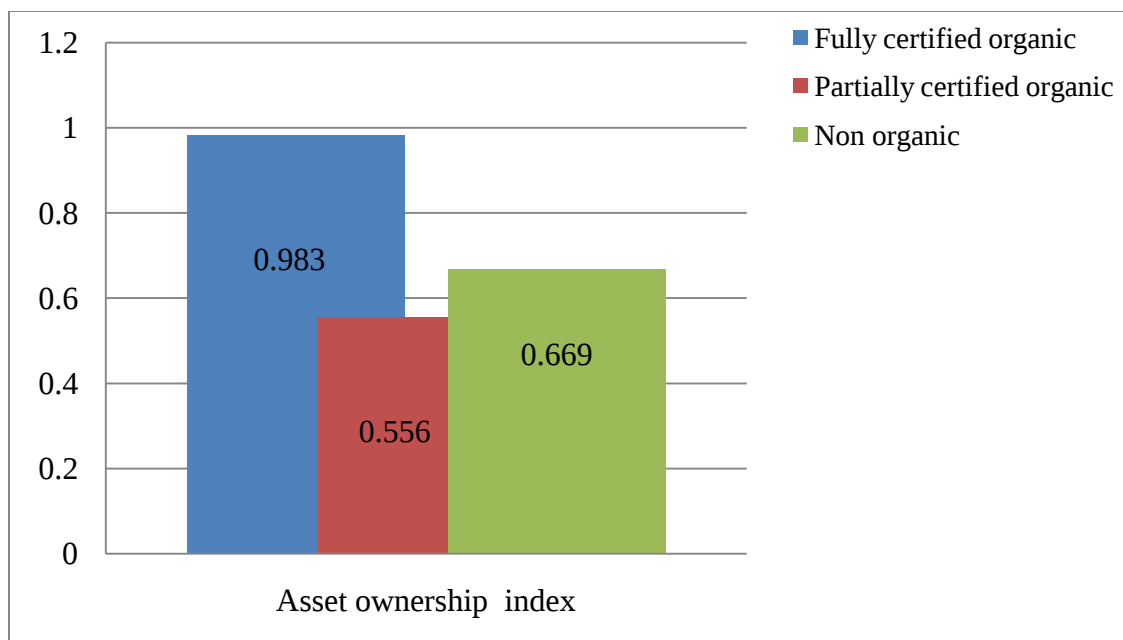


Figure 6.11: Asset ownership of farmers

Asset ownership was measured using principle components analysis to obtain the asset index. The first principle component with an Eigen value of 3.04928 as used to calculate the asset value based on a list of assets. The descriptive statistics show that fully certified organic farmers had more assets than non-organic farmers as depicted in Figure 6.11. Asset value in this case is also an indicator of wealth and liquidity which has implication on adoption decisions.

6.3 Determinants of adoption of organic farming: ordered probit results

The estimation results of the ordered probit models are shown in Tables 6.3 below. To correct for heteroscedasticity, the Huber/White/sandwich estimator of variances is used (White, 1980; StataCorp, 2005) instead of the conventional Maximum Likelihood variance estimator. In the ordered model the dependent variable is ordered where 1= non-organic; 2=partially certified organic and 3= fully certified organic (also see section 5.6.1.2). Therefore, a positive sign for the variable in the ordered probit model means the higher the likelihood of participating and adopting certified organic farming. The signs of the exogenous variables in the ordered probit model explaining the determinants of the farmer's participation in certified organic farming are largely as expected (Table 6.3).

The chi-square value is significant at one percent implying that the explanatory variables taken together influence the farmer's decision to be a certified organic farmer. The Pseudo- R^2 refers to the McFadden's Pseudo- R^2 . Given that the pseudo R^2 does not have the same interpretation as the R^2 in the ordinary least square regression, it is suggested that the interpretation of this statistic is done with great caution (Verbeek, 2008). Variables with a z-statistic of ± 1.96 or greater will significantly affect the farmer's adoption decision to be organic certified at a 95% level or more. Variables with a z-statistic of ± 1.64 or greater but less than ± 1.96 are significant between 90% and 95% confidence levels. A positive value means that the explanatory variable increases the propensity of adoption with an increase in its magnitude.

Table 6.3: Adoption of organic farming among smallholder farmers: Ordered probit model results

Variables	Parameter	Robust std error	P-values
Age	.0194072	.0079204	0.014***
Gender	.3796234	.2707705	0.161
Household size	.0504668	.027152	0.063*
Land size	-.2352607	.1083583	0.030**
Off Farm Income	-.0001223	.0001129	0.279
<i>Location (sub-ward)</i>			
Location (1= ogagwini)	2.894311	.6380815	0.000***
Location (1=ezigani)	4.191274	.7234394	0.000***
Location (1=hwayi)	5.158803	.8495047	0.000***
Risk attitudes	-.7595078	.3773067	0.044**
<i>Fertility (Manure)</i>			
Chicken ownership	.0424046	.0148472	0.004***
Cattle ownership	-.0418692	.0431078	0.331
Goat ownership	-.1005212	.0569375	0.077*
<i>Land tenure rights</i>			
Land tenure (1= build structures)	.4803418	.2372247	0.043**
Land tenure (1= plant trees)	.0235946	.3023182	0.938
Land tenure (1= bequeath)	.1335225	.2619669	0.610
Land tenure (1= lease out)	-.3840883	.2593139	0.139
Land tenure (1= sell land)	.0829177	.2978485	0.781
Asset ownership	.5853967	.205389	0.004***

Significance levels: *** $p < 0.01$: ** $p < 0.05$: * $p < 0.1$

(Source: Field Data)

The ordered probit model successfully estimated the significant variables associated with the farmer adoption decisions. The following variables were found to be significant determinants in the organic farming adoption decision by smallholder farmers in the study area: age, household size, land size, locational setting of the farmer depicted by the sub-wards Ogagwini, Ezigani, and Hwayi, farmer's risk attitude, livestock ownership (chicken and goat ownership), land tenure security as depicted by the rights the farmer can exercise on his/her own cropland to build structures and asset ownership. The estimated parameter for **age** is statistically significant at 1% level of probability and has a positive sign indicating that older farmers tend to be adopters. While this is not consistent with findings in most extension studies, in the study area, the average age of the farmers is over 50 years. Similar findings have been recorded by Matungul (2001). Farming in the study area and many rural areas of South Africa is undertaken by older farmers as the

younger members of the household migrate to urban areas in search for jobs. Farming in many instances is also considered as an alternative option to retirement from wage employment. A similar relationship between adoption and the age of the farmer was found by Hossain *et al.* (1992) who revealed that the probability of adoption of new farming practices increased with age among farmers in Bangladesh. Similarly in China, Feng and Chenqi (2010) established in their study on Sustainable Agricultural Technologies (SAT) that the adoption of SAT is higher among older farmers than younger farmers. This is probably due to previous knowledge gained as these were earlier technologies introduced in Northern China and hence farmers had more experience in using them.

The **household size** coefficient is positive and statistically significant at 10% level of probability. A larger family size is more conducive to adoption of certified organic farming which is a labour intensive technology. Hollaway *et al.* (2002) had a similar result and interpreted it as a confirmation that higher subsistence pressure leads to greater adoption of new agricultural technology aimed at improving food access among households. Large family sizes are also an indication of availability of labour and provide the opportunity for the farm to develop the technical know-how required for certified organic farming. The potential to meet peak labour demand also highlights the importance of the availability of family labour.

The **land area** cultivated of the household was statistically significant at 5% level of probability. However the coefficient was negatively related to adoption implying that smaller farms appear to have greater propensity for adoption of certified organic farming. Once again a “subsistence pressure” argument fits well with the finding by Hollaway *et al.* (2002). Shiyani *et al.* (2002) also found a negative relation between sizes of land holding to the adoption of Chicken pea varieties among smallholder farmers in India while Kallas, Serra and Gil (2010) in their study on organic farming adoption of Catalanian vineyard production concluded that organic farms tend to be smaller than conventional farms. Therefore this result verifies the hypothesis that smaller farmers in comparison to larger farmers adopt new varieties at a faster rate if additional gains are

substantial. In the study area such a pattern was visible on the account that small farmers live on subsistence level that attracts them to adopt innovations which yield better than local varieties and hence promise better incomes from sales, *ceteris paribus*. These results support earlier findings by Allauddin and Tisdell (1998b) in Bangladesh. Allaudin and Tisdell (1988b), Ahmed (1981), Barker and Herdt (1978) also argued that small farmers utilize the limited resources more efficiently and adopt new technologies at a faster rate.

The **neighbourhood coefficient** depicted by the sub-wards ogagwini, ezigani, and hwayi is statistically significant at 1% level of probability. The positive coefficient for these sub-wards (ogagwini, ezigani and hwayi) indicate that farmers who reside in these sub-wards are more likely to be certified organic than those who reside in Nungwane. This suggests the presence of local synergies in adoption which raises the question about the extent to which ignoring these influences biases policy conclusions. The closer a farmer is to the nearest adopter, the higher the frequency of contact, the more likely the farmer will receive valuable information, thus increasing their skill and decreasing their uncertainty (Abadi Ghadim and Pannell, 1999). In this study the first adopters of the certified organic farming technology were from sub-wards Ogagwini and Ezigoleni in Umbumbulu District Municipality.

The **risk attitude** coefficient is negative and statistically significant at 5% level of probability. This implies that fully-certified organic farmers are more likely to take risks compared to the partially-certified and non-organic farmers. Similar findings are reported by Serra, Zilberman and Gil (2008) and Gardebroek (2006) who found that organic farmers are less risk averse than their conventional counterparts. According to Shapiro *et al.* (1992) higher levels of adoption of double cropping were associated with higher levels of risk aversion. These results are also supported by Kebede (1992) who found that the adoption of new technologies by Ethiopian farmers was significantly positively related to their degree of risk aversion.

The statistically significant (at 1 percent level of probability) and positive coefficient for number of **chicken owned** is expected as fully-certified organic farmers were facilitated

into building chicken houses by extension officers from the Department of Agriculture and Environmental Affairs, KZN as an incentive. Chicken manure is also commonly used in the study area as is other animal manure for soil fertilisation. The number of **goats owned** was statistically significant at 10 percent level of probability. The negative correlation to adoption can be explained by the fact that goats in the study area are reared mainly for cultural and ancestral purposes however their manure is used for organic farming. Goat manure can be purchased at R20 per wheelbarrow in the study area hence ownership is not a hindrance to adoption of certified organic farming.

The **land tenure** security of the farmers is positive and statistically significant at 5% level of probability. This implies when farmers have security of land tenure the propensity to adopt certified organic farming is higher. The farmer's perception of tenure security was assessed by the rights the household can exercise on his/her own cropland by building structures. However it should be noted that in the study area, land ownership is customary and farmers have permission to occupy. A study undertaken by Smucker, White and Bannister (2000) on land tenure and the adoption of agricultural technology in Haiti found that formal title is not necessarily more secure than informal arrangements. Informal arrangements based on traditional social capital resources assure affordable and flexible access to land for most people. The perceived stability of access to land via stability of personal and social relationships is a more important determinant of technology adoption than mode of access.

The statistically significant coefficient estimate for the **asset index** at 1% level of probability implies that the higher the number of assets owned, the higher the probability of adoption of organic farming. Asset ownership is a proxy for wealth and liquidity. Doss and Morris (2001) found that wealthier farmers are better able to bear risk and, therefore more likely to try new technologies. Similarly, according to Essa and Nieuwoudt (2001), farmers with relatively more wealth and liquidity may be better able to finance the adoption of technologies and appropriate farming practices (Strauss *et al.*, 1991).

6.4 Chapter summary

The study found that the average age of the farmers was averaged at over 50 years and over 70% were female farmers with low levels of education. Household sizes were large and farm sizes were small. The proportion of income from farming was highest among the fully certified organic farmers. While the average farmer was classified as risk averse, non-organic farmers were more risk averse than their organic counterparts. Despite the tenure system being communal, farmers felt they had tenure rights through the permission to occupy. Fully certified farmers had more assets than their non-organic counterparts as well as chicken and livestock.

The ordered probit model was applied to empirically analyse the determinants of farmers' organic farming status. The ordered probit model successfully estimated the significant variables associated with the farmer's adoption decisions. These were the farmer's age, household size, land size, locational setting, risk attitude, number of livestock (goats and chicken) and asset ownership. The study established that older female farmers with large household sizes were more likely to be certified organic. Similarly, farmers who reside in the sub-wards ogagwini, ezigani, and hwayi were more likely to be certified organic. This suggests the presence of local synergies in adoption which raises the question about the extent to which ignoring these influences biases policy conclusions.

The negative correlation between land size and adoption implies that smaller farms appear to have greater propensity for adoption of certified organic farming. This finding is supported by several studies reviewed in the literature that allude to the fact that organic farms tend to be smaller than conventional farms. The significance of livestock is explained by the importance of manure for organic farming. The study also found that older farmers tend to be adopters supporting findings by Feng and Chenqi (2010). The propensity to adopt was also positively influenced by asset index which is a proxy for wealth.

CHAPTER 7: RISK AND RISK MANAGEMENT BY SMALLHOLDER FARMERS

7.1 Introduction

The chapter presents the results of farmers' risk classification of the smallholder farmers in KwaZulu-Natal Province and compares these to results from similar studies in India, Philippines, Zambia, Ethiopia and Cote d' Ivoire. The perceived sources of risks are ranked and the main sources of risks identified. The traditional risk management strategies used by the farmers are discussed. The results of principal components analysis are presented along with extracted principal components (PCs) that explained most of the variation. The relationship between the farmer's perception of risk sources and farm and farmer characteristics are also explained.

7.2 Risk aversion classification

The responses of the sample farmers are explored and presented in Table 7.1 below for each farmer category. The table presents the distribution of risk aversion preferences for each prospect for the fully certified organic, partially certified organic and non-organic crop farmers, and the number of valid cases analysed for the sample. The distribution of responses was spread across all classes of risk aversion for the pooled data. It can be noted that on average, the majority of the respondents revealed their preference for prospects representing intermediate and moderate risk aversion alternatives across the three farmer groups. Table 7.1 further shows that non-organic farmers were the most risk averse being classified as extremely risk averse at 20.4%, compared to fully and partially certified at 7.3% and 4.2%, respectively. This may explain why they have not adopted certified organic farming despite organic certification being introduced in the area since 2000. On the other hand, the fully certified farmers were the least risk averse, being classified as neutral to risk preferring at 9.1% compared to 7.3% and 4.1% for the partially certified and non-organic farmers respectively. These results conform to *a priori* expectations regarding the risk preference patterns of smallholder farmers.

Table 7.1 Distribution of smallholder farmers according to risk preference patterns

Farmer group	Risk aversion classification					
	Extreme	Severe	Intermediate	Moderate	Slight to neutral	Neutral to preferring
Fully certified organic (n=55)	7.3	5.5	30.9	40	7.3	9.1
Partially certified organic (n= 95)	4.2	8.3	44.8	29.2	5.2	7.3
Non-organic (n= 46)	20.4	8.2	30.6	30.6	0	4.1
Pooled data (n=196)	9.0	7.5	37.5	32.5	4.5	7.0

Source: Field data

A further analysis is done to explain the frequency distribution within each risk aversion class across the farmer groups as displayed in Figure 7.1 below.

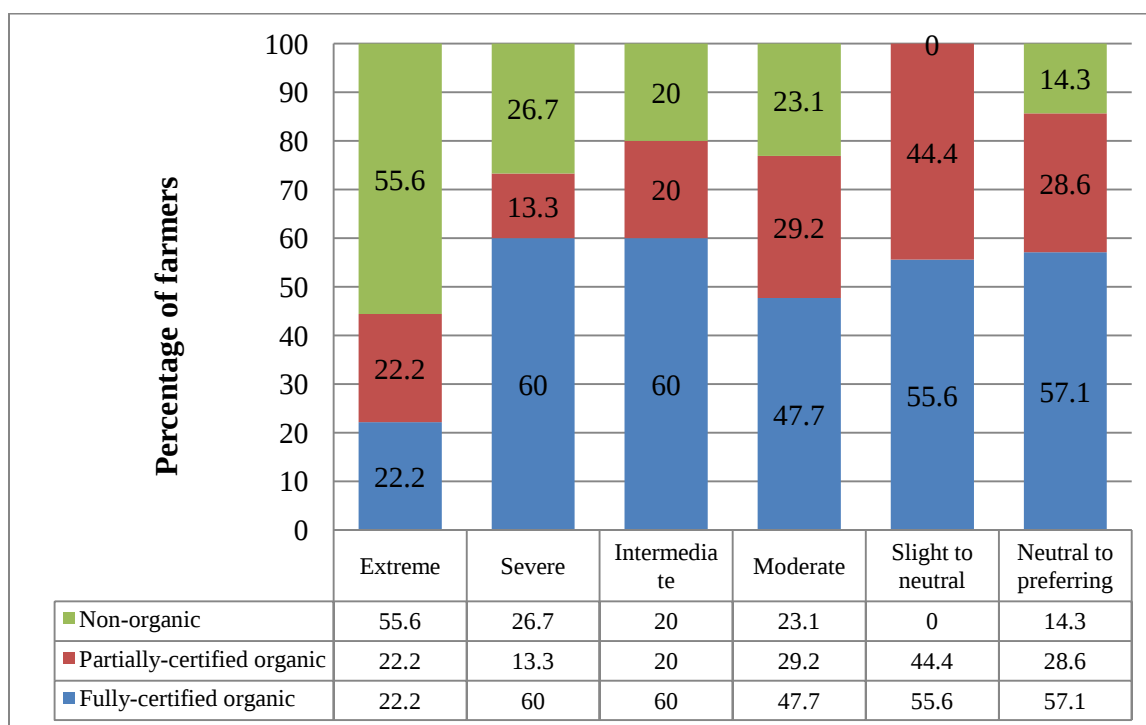


Figure 7.1: Frequency distribution within risk aversion classes across the farmer groups

According to Figure 7.1, the non-organic farmers constituted 55.6% of respondents within the extreme risk aversion class compared to 22.2% for fully-certified organic and 22.2% for partially-certified organic farmers. This is a confirmation of previous findings in this study under section 6.2.2 and presented in Figure 6.8 that explains the non adoption of certified organic farming by the non-organic farmers. In the risk neutral to preferring category, the non-organic farmers constitute only 14.3%. Fully-certified organic farmers constituted 57.1% and partially-certified organic farmers constituted 28.6%.

Table 7.2 below compares the results from this study, which applied the general experimental method, with similar studies using the same methodology for farming communities in the Côte d'Ivoire (Kouamé, 2010), Ethiopia (Yesuf, 2007), Zambia (Wik and Holden, 1998), Philippines (Sillers, 1980) and India (Binswanger, 1980). To facilitate comparisons among the experiments and to give a sense of the experimental pay-offs in terms of local incomes, all pay-offs were expressed in experiment- specific daily or monthly wage units following Wik and Holden (1998). This is equivalent to the monthly wage received by an unskilled agricultural labourer in the study areas in question. These results are shown together with our results from the South African study. According to Table 7.2, comparing the results from this study to the Ethiopian, Zambian, Côte d'Ivoire and Indian experiments, it is found that the proportion of farmers falling in the extreme to severe risk category is higher in the Ethiopian experiment, but lower in the Zambian, Côte d'Ivoire and Indian cases. These results suggest that farm households in South Africa particularly the KwaZulu-Natal province are less risk averse than in Ethiopia, Zambia and Côte d'Ivoire but are much more risk averse than in India and Philippines. The table also reveals that the findings of the South African study are in tandem with findings of the studies done in India, Philippines, Zambia and Côte d'Ivoire, where the majority of the respondents are classified as intermediate to moderate risk aversion (Table 7.2).

Table 7.2 Percentage distribution of revealed risk preferences in five experimental studies

Games	Extreme to severe risk aversion	Intermediate to moderate risk aversion	Risk-neutral to risk preferring	Number of responses
India (Binswanger, 1980)				
50 rupee	8.4	82.2	9.4	107
500 rupee	16.5	82.6	0.9	115
Philippines (Sillers, 1980)				
50peso	10.2	73.5	16.3	49
500peso	8.1	77.6	14.3	49
Zambia (Wik and Holden, 1998)				
1000kw	29.1	46.4	24.5	423
10000kw	36.7	52.5	11	137
Ethiopia (Yesuf, 2007)				
5bir	45.4	33.6	21	262
15bir	55.7	27.5	16.8	262
Côte d'Ivoire (Kouamé, 2010)				
1000FCFA	32.8	53.9	13.3	362
5000FCFA	46.1	45.9	8	362
*South Africa, KZN (Lwayo, 2011)				
400Rands	16.5	70.0	11.5	196

*Source: Field data

7.3 Estimation OLS model for risk aversion and socio-economic characteristics

Table 7.3 gives the estimated regression results for the determinants of Partial Risk Aversion (PRA).

Table 7.3 Parameter estimates for the Ordinary Least Square for Partial Risk Aversion

	Fully-certified organic farmers (n=46)			Partially-certified organic farmers (n=88)			Non-organic organic farmers (n=41)			Pooled (n= 196)		
	β	Std Error	P- value	β	Std Error	P- value	β	Std Error	P- value	β	Std Error	P- value
Constant	-6.422	2.358	.016	-5.904	5.339	.319	-1.992	4.818	.696	-0.642	2.136	0.765
Years of schooling	.067	.075	.382	-0.445	0.202	.079*	-.037	0.108	.746	-0.043	0.78	0.590
Age(years)	.060	.026	.032**	0.171	0.054	.025**	.027	0.061	.674	0.069	0.26	0.013**
Gender (0=male)	1.857	.808	.036**	-0.247	1.819	.897	1.388	1.751	.464	0.267	0.785	0.736
Land size(hectares)	.293	.662	.665	1.492	1.988	.487	-4.342	4.716	.399	-0.881	0.617	0.162
Proportion of income from farming (rands)	1.817	.488	.002*	-5.137	3.230	.173	2.835	4.310	.540	0.472	0.592	0.430
Source of information	2.672	1.145	.034**	6.784	2.276	.031**	-	-		0.501	1.137	0.662
Literacy	2.319	.570	.001***	7.999	1.633	.004***	-0.009	1.388	.995	1.741	0.655	0.011***
Household size	-.034	.060	.575	-0.302	0.225	.238	.019	.170	.917	-0.144	.0070	0.045**
Off farm income	.000	.000	.044**	-0.003	0.001	.111	.001	.001	.516	0.000	0.000	0.068*
Savings (1=yes)	-1.586	.702	.039**	2.081	1.054	.105*	.657	1.542	.688	0.616	0.692	0.379
Adjusted R ²	0.606			0.421			0.64			0.146		
ANOVA	0.003			0.887			0.082			0.086		

***, ** and * indicate statistical significance at 1, 5 and 10 % level of probability respectively

The theoretical expectations of the models are broadly confirmed. The following variables were statistically significant for the fully certified farmers: Years of schooling, age of the farmers, gender of the farmer, proportion of income from farming, source of agricultural information, literacy levels, off farm income and savings by the household. A positive sign in the OLS model is an indication of lower risk aversion. The age of the farmers is positive and statistically significant at 5% level of probability for fully and partially certified organic farmers as well as the pooled data. This implies that older farmers in the study area are more likely to take risks than the younger farmers. This is demonstrated by the fact that the average age of the respondents in the study area was over 50 years. This result supports findings by Hossain *et al.* (1992).

The estimated coefficient for gender is positive and statistically significant at 5 % level of probability for the fully-certified farmers, implying that women were more likely to take risks than their male counterparts. The proportion of income from farming is statistically significant for fully certified organic farmers' at 1%. It should be noted that fully certified farmers have the highest proportion of income from farming (62%), an indication that their adoption of certified organic farming is contributing to increased farm and overall household income.

The main source of agricultural information in the study area is from fellow farmers. This variable was found to be positive and statistically significant at 5% level of probability for the fully and partially certified organic farmers. Farmer-to-farmer information exchange has the propensity to reduce the degree of risk aversion of the farmers. The estimated coefficient of household size is negative for the non-organic crop farmers. This finding supports the interpretation that a larger family size implies higher subsistence consumption needs and aversion to risk. The statistically significant positive estimated coefficient for literacy at 1% level of probability for the fully-certified, partially certified and pooled data indicates that farmers with higher levels of literacy are relatively more willing to take risk (Miyata, 2003). Education and literacy are important for these farmers as the procedure for being certified requires that each farmer understands the certification requirements, and the farming and basic record keeping

procedures that must be followed in order to be certified. The Umbumbulu area has generally low farmer education levels with years of schooling averaging 4.8, 4.1 and 3.5 for the fully-certified, partially-certified and non-organic farmers, respectively.

Household size was significant for the pooled data. The negative coefficient for the fully and partially certified organic farmer suggests that whereas a large family size is an indication of increased labour force from the household, it has a negative effect on risk aversion. A large family means more people to feed which increases the level of vulnerability of the household. Off farm income is found to be positive and statistically significant at 5% level of probability for fully certified farmers and is considered a risk management strategy. The regression results obtained using the partial risk aversion shows that there are more than just the observed explanatory variables that are reported here that explain the risk aversion of smallholder farmers. Risk preference could be better explained by individual psychological factors that were not readily observable for the sample farmers. However the results above point up the socio-economic variables that impact of the farmer's risk aversion.

7.4 Factors affecting choices of risk management strategies

This section presents the results of the farmers' sources of risk. These are ranked from 1-20 in order of priority based on the score of the likert scale. The section also presents the extracted principal components that explain most of the variation. Socioeconomic factors having a significant effect on the various sources of risk are analysed and presented below. The section concludes by presenting the results of the risk management strategies used by the farmers.

7.4.1 Farmers' perception of risk sources

A total of 20 sources of risk were presented to respondents in the survey. Farmers were asked to identify the sources of risk that they have experienced and express how significant they considered each source to be of risk in terms of its potential impact on their farming activity. Each source of risk was scored on a 3-point Likert scale from 1 (no impact) to 3 (high impact) to. In doing this, farmers selected and ranked the different

sources of risk from the less important to the most important. The identified risk sources and their ranking in order of importance are presented in Table 7.4.

The fully-certified organic farmers cited in order of priority, uncertain climate (mean 2.96), lack of cash and credit to finance inputs (mean 2.78) and tractor unavailability when needed (mean 2.76). These risk sources have a direct bearing on production of organic produce. Climatic conditions are beyond the farmers' control, and the top ranking probably reflects the farmers' concerns about the effects of recent drought in the Umbumbulu district. These impacts negatively on crop yield. Due to communal land ownership and strict conditions for credit, farmers have limited options to obtain production credit from financial institutions. Among the sampled farmers only 21 farmers were able to access credit. Farmers in the study area lack collateral that is acceptable to banks. For example, banks required title deeds as proof of land ownership but the majority of black farmers in South Africa and especially in the former homelands still lacked this vital documentation. Tractor unavailability can be attributed to the fact that there is one tractor that has been allocated to the members of Ezemvelo Farmers Organisation. The tractor is leased out at a rental fees. This poses a challenge during the land preparation phase when the demand for its services is at peak.

Similarly, partially-certified farmers also ranked tractor not being available when needed (mean 2.89) and uncertain climate (mean 2.83) as identified sources of risk. The risk of delays in payment for products sent to pack house (mean 2.89) are attributed to various factors, among them the contractual obligation the agent has with the retailer which has a bearing on the duration of payment. Payment is only made to the farmer once the supply has been forwarded to the retailer and there is confirmation of the quantity of produce that has been rejected. The process flow delays payments to farmers. Non-organic farmers also cited uncertain climate (mean 2.82), livestock damage to crops (mean 2.80) and lack of cash and credit to finance farm inputs (mean 2.78). The livestock damage is a result of lack of fencing around the crops planted.

It is evident from the rankings in Table 7.4 that some of the sources of risk were common across the farmer groups. These include the uncertain climate and lack of cash and credit to finance inputs. All the farmer groups ranked “cannot find labour” lowest at a mean of 1.73; 1.76; 2.0 for fully certified, partially certified and non-organic respectively. This is a clear indication that labour is not a constraining factor in the study area and is relatively available. Similarly the partially certified and non-organic farmers also ranked cannot access more crop land at a mean of 1.98 and 1.92 respectively. Lack of access to land was not identified as a major risk as land in the study area is readily available. The South African Government has made great strides through land reform programmes to ensure access to land for small emerging black farmers. The land reform programme remains a priority for the Government. The country's land reform programme has three pillars: (i) restitution, which seeks to restore land ownership or compensate those forced off land during white rule; (ii) redistribution, of mainly agricultural land, to redress the discriminatory colonial and apartheid policies by providing the disadvantaged and poor with access to land; (iii) land tenure reform, which seeks to secure tenure for all South Africans, especially the more vulnerable, such as farm labourer tenants. The customary land system through the permission to occupy remains the basic system of land allocation.

Table 7.4: Identification of risk sources and rank

	Fully certified organic			Partially certified organic			Non-organic		
Constraint	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank
Livestock damage crops	2.56	.744	7	2.82	.488	4	2.80	.539	2
Uncertain climate	2.96	.189	1	2.83	.409	3	2.82	.486	1
Uncertain prices for products sold to packhouse	2.21	.793	13	2.13	.591	16	-	-	-
Uncertain prices for products sold to other markets	1.94	.811	17	2.02	.595	18	2.17	.761	10
More work than the family can handle	2.58	.599	6	2.32	.688	12	2.53	.649	4
Lack of cash and credit to finance inputs	2.78	.567	2	2.58	.615	6	2.78	.468	3
Lack of information about producing organic crops	2.02	.687	15	2.20	.632	14	2.16	.717	11
Lack of information about alternative markets	2.38	.623	10	2.29	.602	13	-	-	-
Lack of proper storage facilities	2.56	.660	7	2.46	.543	9	2.41	.643	7
Lack of affordable transport for products	2.72	.492	4	2.42	.560	11	2.06	.852	12
Lack of telephones to negotiate sales	2.69	.509	5	2.55	.633	8	2.22	.771	8
Inputs not available at affordable prices	2.52	.642	9	2.80	.447	5	2.51	.545	5
Tractor is not available when I need it	2.76	.501	3	2.89	.416	1	2.46	.713	6

	Fully certified organic			Partially certified organic			Non-organic		
Constraint	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank
Cannot find manure to purchase	1.92	.778	18	2.56	.660	7	2.20	.645	8
Cannot find labour to hire	1.73	.764	20	1.76	.816	20	2.00	.764	13
Cannot access more cropland	1.95	.753	16	1.98	.805	19	1.92	.794	14
Delays in payment for products sent to packhouse	2.22	.723	12	2.89	.315	1	-	-	-
Lack of bargaining power over product prices at the packhouse	2.16	.672	14	2.20	.704	14	-	-	-
Lack of information about consumer preferences for our organic products	2.23	.654	11	2.44	.604	10	-	-	-
Packhouse does not reward me fully for my own product	1.86	.780	19	2.02	.866	17	-	-	-

Note: mean score (1 (no problem) to 3 (severe problem) and Rank is in ascending order; 1 means most important and 20 least important

7.4.2 Principal component analysis of farmers' perceived sources of risk

The number of components was obtained by the Kaiser-Guttman rule. Table 7.5 below represents the Eigen value proportions of variance for selecting the optimal number of components. The correlation matrix shows that all of the estimated correlation coefficients between the sources of risk scores are less than 0.7 as articulated by Kim and Mueller (1994). Kim and Mueller (1994) state that the correlation coefficients are fairly robust with respect to ordinal distortions in measurements and such distortions can be restricted if; (i) PCA is used to find general dimensions of the variables in the data and (ii) the underlying correlation among the variables are less than 0.7.

Seven principal components (PCs) that explained 66.13% of the variance in the original scores were extracted from the covariance matrix using STATA 11 as reported in Table 7.5 below. Koutsoyiannis (1987) suggests retaining PCs that meet Kaiser's criterion: have Eigen values of one or above, have estimated component coefficients greater than 0.3, and can be meaningfully interpreted. The Eigen values for the seven PCs are all above one. Varimax rotation did not improve the interpretation of these PCs and the reported PCs are thus unrotated as explained in Norusis (2008). According to the factor loadings in Table 7.5, the factors 1 to 7 can best be described as 'financial and incentives index', 'input-output index', 'crop production index', 'labour bottleneck index', 'lack of production information index', 'lack of market opportunity index' and 'input availability index' respectively.

Principal Components 1: Financial and incentive index

The first principal component (PC1) explained 18.37% of the variance in the explanatory variables with all six estimated coefficients above 0.3 being positive.

“Financial and incentive index” = **(0.3281)** “uncertain prices for products sold to packhouse” + **(0.3690)** “uncertain prices for products sold to other markets” + **(0.3307)** “cannot find labour to hire” + **(0.3734)** “lack of bargaining power over product prices at the packhouse” + **(0.3706)** “lack of information about consumer preferences for our organic products” + **(0.3594)** “packhouse does not reward me fully for my own product”.

This index suggests that respondents who were concerned with uncertain prices for the formal and informal market options are also faced with the risk of labour unavailability as well as lack of bargaining power. These farmers are also concerned about the lack of information on consumer preferences and the ability of the pack house to give farmers incentives for production. According to Hough, Thompson, Strickland III and Gable (2008), buyers have a stronger competitive advantage when they can exercise bargaining leverage over price, quality, service or other terms of sale. This component seems to capture risks associated with financial or farmer liquidity and incentives.

Table 7.5: Estimated principal components for the sources of risk variables

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Proportion	18.37	12.74	8.94	7.66	7.43	5.77	5.21
Eigen Values	3.6748	2.5483	1.7874	1.5325	1.4866	1.1538	1.0417
Sources of risk	Factor Loadings						
Livestock damage crops	0.1100	-0.1156	<u>0.3452</u>	0.2196	0.2857	-0.0013	-0.2347
Uncertain climate	0.0757	0.0462	0.0187	-0.2487	<u>-0.4786</u>	-0.1421	0.2498
Uncertain prices for products sold to pack house	<u>0.3281</u>	-0.0683	-0.0500	0.0549	<u>-0.3858</u>	-0.0258	0.2812
Uncertain prices for products sold to other markets	<u>0.3690</u>	-0.1476	-0.0176	-0.0476	-0.0498	0.1235	-0.1389
More work than the family can handle	0.1083	0.0648	0.2948	<u>0.5425</u>	0.0253	0.1286	-0.0136
Lack of cash and credit to finance inputs	0.0279	<u>0.3881</u>	<u>0.3753</u>	-0.0694	0.1017	0.1417	0.0874
Lack of information about organic farming	0.1746	-0.0545	-0.0123	0.0754	<u>0.3494</u>	-0.1293	0.1272
Lack of information about alternative markets	0.2371	0.0901	0.1686	0.1849	0.0141	<u>0.5791</u>	-0.1677
Lack of proper storage facilities	-0.0776	<u>0.3881</u>	-0.2332	-0.0969	0.2711	-0.1649	-0.0234
Lack of affordable transport for products	0.0498	0.1455	<u>-0.4236</u>	0.2461	0.2707	0.1866	0.2077
Lack of telephones to negotiate sales	0.2397	-0.1594	0.0795	-0.2056	0.2309	<u>0.3997</u>	0.2935
Inputs not available at affordable prices	0.0256	0.2961	<u>0.4164</u>	0.1253	-0.1322	0.1380	<u>0.3008</u>
Tractor is not available when I need it	0.0195	0.2949	0.0251	-0.2040	0.2671	-0.2627	<u>0.4099</u>
Cannot find manure to purchase	0.0410	<u>0.4545</u>	-0.0444	0.0499	-0.2645	0.1226	-0.2108
Cannot find labour to hire	<u>0.3307</u>	-0.0497	0.2221	0.0955	-0.0049	<u>-0.3651</u>	-0.1058
Cannot access more cropland	0.1567	0.1187	0.2744	<u>-0.5214</u>	0.1259	0.0288	-0.1877
Delays in payment for products sent to pack-house	0.1748	<u>0.4314</u>	-0.1998	0.2250	-0.1263	-0.0296	-0.2235
Lack of bargaining power over product prices at the pack-house	<u>0.3734</u>	0.0006	-0.0859	-0.1015	0.0098	-0.1224	-0.2903
Lack of information about consumer preferences for our organic products	<u>0.3706</u>	0.0829	-0.0977	-0.0456	0.1177	<u>-0.3165</u>	-0.0481
Pack-house does not reward me fully for my own product	<u>0.3594</u>	-0.0640	-0.1541	0.1723	-0.0063	0.0119	<u>0.3410</u>

Principal Component 2: Input-output index

The second principal component (PC2) accounted for 12.74% of the variance in the explanatory variables.

“Input-output index” = **(0.3881)** “lack of cash and credit to finance inputs” + **(0.3881)** “lack of proper storage facilities” + **(0.4545)** “cannot find manure to purchase” + **(0.4314)** “delays in payment for products sent to pack house”.

The index shows that fully-certified and partially-certified farmers, who rank lack of cash and credit to finance inputs as a source of risk, are also concerned with the lack of proper storage facilities to store their crops. These farmers also experience challenges to purchase manure for organic farming, and delays in payment for products that have been sent to the pack house. This component could be interpreted as reflecting input-output risk. Lack of liquidity may remain a risk in the short and medium-term as the rural farmers do not have collateral required by the financial institution for access to credit. Land is commonly used as collateral however, for these farmers; the system is characterized by indigenous communal land tenure, which commercial banks do not accept as collateral.

Principal Component 3: Crop production index

The third principal component (PC3) accounted for 8.94% of the variation.

“Crop production index” = **(0.3452)** “livestock damage crops” + **(0.3753)** “lack of cash and credit to finance inputs” - **0.4236** “lack of affordable transport for products” + **(0.4164)** “inputs not available at affordable prices”.

The index shows that farmers who strongly perceive livestock damage to crops as a major source of risk are also concerned about inputs not being available at affordable prices. Across the three farmer groups, lack of cash and credit to finance inputs was identified as a source of risk. However, these farmers did not perceive lack of affordable transport for products as a major risk. The latter can be attributed to the fact that the produce is collected at the farm gate and transport

costs are limited to produce sold in the local market or surrounding farms. This dimension reflects a crop production risk.

Principal Component 4: Labour bottleneck index

The fourth component (PC4) explained 7.66% of the variance in the explanatory variables and implies a labour bottleneck risk.

“Labour bottleneck index” = **(0.5425)** “more work than the family can handle” – **(0.5214)** “cannot access more cropland”.

More work than the household can handle was identified as a major risk. However lack of crop land was not perceived as a risk. The latter is due to the fact that land in the area is not a constraining factor and expansion of cropland is possible upon request to the local headman. On the other hand, organic farming is a labour intensive technology and would require more labour than conventional farming however the returns may be higher if farmers access the niche markets as is currently the case with the fully certified and partially certified smallholder farmers who are supplying an up market food retail store in KwaZulu-Natal province. The labour bottlenecks experience could also be attributed to increasing disability and ailments due to HIV/AIDS and outmigration of the youth. Parallel development especially in the mining and commercial sectors also raises agricultural labour costs.

Principal Component 5: Production information index

The fifth principal component (PC5) displays a variation of 7.43% in the farmers’ rankings, and captures a lack of production information risk.

“Production Information index” = - **(0.4786)** “uncertain climate” – **(0.3858)** “uncertain prices for products sold to packhouse” + **(0.3494)** “lack of information about producing organic crops”.

This risk is closely linked to weak support for extension services and advice to enable smallholder farmers to produce more food and reap greater benefits from their organic farming

and harvest. The South Africa Government is in the process of revitalizing extension services to ensure access to information and improved agricultural practices among smallholder farmers especially in rural areas. Farm extension and rural advisory services occupy a strategic position in the agricultural production cycle. They link farmers to information about appropriate farming practices, when and what to plant, and how to use new technologies like seeds and soil management techniques developed by researchers. Extension service providers also pass on feedback from farmers to policy makers and help to ensure that government policies are effectively meeting the needs of farmers.

Principal Component 6: Market opportunity index

The sixth principal component is a lack of information about alternative markets risk and accounted for 5.77% of the variation in the farmers' scores for the sources of risk.

“Market information index” = **(0.5791)** “lack of information about alternative markets” + **(0.3997)** “lack of telephones to negotiate sales” - **(0.3651)** “cannot find labour to hire” - **(0.3165)** “lack of information about consumer preferences for our organic products”.

What both “established and emerging black smallholders” have in common though is that they farm mainly to add to household food security. Surplus production has remained rare in this rural context. Moreover, the accidental but limited excess farming output is usually sold in local markets (within the village or a nearby makeshift open/roadside market). Raising the general level of well-being of society is positively correlated with the rise and growth of markets. One implication of this hypothesis for smallholder farmers is that in order for them to raise the efficiency of their productive activities, they need to integrate into a system of market relations. The potential or real benefits of developing markets for smallholders are directly relevant to South Africa's second economy project because its primary goal is to craft a mix of strategies to uplift targeted underdeveloped regions (The Presidency 2008, 2007).

Principal Component 7: Input availability index

Finally the seventh principal component is an input availability risk and accounts for 5.21% of the variation.

“Input availability and incentive index” = **(0.3008)** inputs not available at affordable prices + **(0.4099)** tractor is not available when I need it + **(0.3410)** packhouse does not reward me fully for my own product.

The farmers perceived lack of inputs at affordable prices, tractor not available when needed and little or no reward from the pack house as major risk sources. Lack of access to inputs and incentives is a deterrent to the development and growth of smallholder farming. According to the Southern African Trust (2009), Malawi is a great example of how government intervention prioritized smallholder farmers to overcome chronic hunger and achieve national food security. The government introduced a new agricultural growth policy focused on giving subsidized inputs to smallholder farmers. The subsidies have led to a significant boost in production to the extent that Malawi has been exporting surplus staple grains to countries facing a deficit within the Southern Africa region.

7.4.3 Relationship between perceptions of risk sources against farm and farmer socioeconomic characteristics

Relationships between the farmer’s perceptions of sources of risk and the farm and farmer socioeconomic variables were determined using multiple regressions, the results of which are shown in Table 7.6. For each of the independent variables, the table depicts the partial regression coefficients and the levels of significance for the two-tailed t-tests. The goodness-of-fit of the models is indicated by adjusted R^2 .

In the regression analyses, multicollinearity among the independent variables was not found to be a problem (i.e. no variables have been omitted): Correlations were low, and nonlinear principal components analysis drawing on the work of (Gifi, 1990) for socioeconomic variables did not show strong relationships. The variance inflation factors as defined by (Hair, Anderson, Tatham and Black, 2006) had all values around 1. As shown in Table 7.6, the equations for “Financial and Incentive”, “Input-output” and “Labour bottlenecks” are statistically significant at a 1%, 1% and 5% level of significance respectively. The equations for “crop production” and “Input availability” are significant at less than 20%. All Durbin-Watson statistics for the six regression models ranged from 1.5 to 2.5, suggesting that autocorrelation is not a problem for these models (Table 7.6). The goodness of fit is fairly low as is the case for discrete choice models (Verbeek 2008).

Table 7.6: Results of multiple regressions for sources of risk against socio-economic variables

Independent Variables	Description of variable	Sources of risk						
		Financial and Incentive	Input-output	Crop production	Labour bottlenecks	Production information	Market opportunity	Input availability
Constant		-1.35**	-0.362	-0.674	-1.202*	0.291	-0.638	0.1
Age	years	-0.004	0.008	-0.009	0.017**	-0.001	0.007	-0.01
Gender	male=0	-0.321	0.626***	0.52**	-0.127	-0.019	0.024	-0.194
Education	years	-0.013	0.065***	0.002	-0.046*	0.022	0.02	-0.026
Location	1=Ogagwini;2=Ezigani; 3=Hwayi; 4=Numgwane	0.243***	-0.114*	0.074	0.073	-0.049	0.004	0.18**
Land Size	hectares	0.101	-0.084	0.086	-0.208**	-0.028	-0.079	-0.115
Information	hours	0.089***	-0.051***	0.021	0.03	-0.05**	-0.007	-0.008
Household size	number	0.032	0.029	0.028	-0.007	0.02	-0.012	-0.017
Household Income	rands/year	0.045	0.005	0.013	-0.004	-0.001	0.035	-0.008
Risk taking	1= less likely to take risk 2= More likely to take risk	0.05	-0.135	0.057	0.191*	0.064	0.002	0.117
Adj R ²		0.223***	0.188***	0.048	0.12**	0.003	-0.070	0.028*
Durbin Watson statistics		1.464	1.785	1.632	1.642	2.147	2.477	1.779

***, **, * represents significance at 1%, 5% and 10% respectively

An analysis of the socio economic factors identified the following variables to have a significant effect on the various sources of risk: age, gender, education, location, information access and risk taking ability (table 7.6). Older farmers were concerned about the availability of labour while female farmers considered input-output risk and crop production risks as significant and relevant. Farmers residing in the non-organic areas of Hwayi and Numgwane sub-wards were more concerned about financial and incentive risk as well as input availability. These farmers have limited access to financial resources and incentives for production while farmers residing in the pioneer organic areas of Ogagwini and Ezigoleni considered input-output risk as less relevant. Farmers with access to information perceived input output risk and crop production risks as less relevant but financial and incentive risk are significant and more relevant. Farmers who were more likely to take risk perceived labour bottleneck risks as much less relevant.

7.4.4 Risk management strategies used by farmers

The production, financial, market and institutional risks, along with a farmer's attitude toward risk, have a major impact on the choice of risk management strategies and tools (Shapiro *et al.*, 1993). Risk sources cause adversity in yield, prices and production units (Anderson *et al.*, 1985). Each or any combination of the outcomes of the risk sources may lead to low or declining farm income. There are several strategies that farm operators can use to reduce the farm exposure to risks. The strategies can be classified into modern and traditional risk management tools (Harwood *et al.*, 1999). The modern instruments include crop insurance, forward contract and futures, among others (Goodwood and Ker, 1998). In the absence of modern risk management tools especially among rural smallholder farmers, farmers can rely on some traditional strategies to deal with risk. This section summarizes the most important traditional risk management strategies used by the surveyed farmers in KwaZulu-Natal province. These are crop diversification, precautionary savings and participating in social network.

Diversification is a frequently used risk management strategy that involves participating in more than one activity. The motivation for diversifying is based on the idea that returns from various enterprises do not move up and down in lockstep, so that when one activity has low returns, other activities would likely have higher returns. The extent to which a farmer uses on-farm diversification as a risk management strategy was measured using the Enterprise Diversification Index (EDI) also referred to as the Herfindahl Index (DH). Enterprise diversification is a self-insuring strategy used by farmers to protect against risk (Bradshaw, 2004).

The proportion of farmers using different risk management strategies are presented in Table 7.7. The overall Herfindahl index of crop diversification is estimated at 0.61 which indicates that the cropping system is relatively diverse (Table 7.7). These results confirm previous findings by Rahman (2009) who obtained an estimated DH of 0.49-0.69 among smallholder farmers in three regions in Bangladesh. As shown in Table 7.7, non-organic farmers practiced more crop diversification with a DH index of 0.23 compared to organic farmers with a DH index of 0.72. These results are consistent with previous findings in this study measuring farmers risk attitudes and presented in Figure 6.8, that established that smallholder farmers in the study area tend to diversify due to their risk averse nature and that non-organic farmers are more risk averse than organic farmers.

According to Table 7.7, a total of 69.1% of fully certified farmers practised crop diversification compared to 96.8% of the non-organic farmers. A total of 81.2% of the partially certified farmers practised crop diversification. The common crops grown by the organic farmers are *amadumbe*, potatoes, sweet potatoes and green beans while non-organic farmers grew *amadumbe*, potatoes, sweet potatoes, green beans, maize, sugarcane, bananas, chillies and peas.

Table 7.7 Risk management strategies used by the different farmer groups

Risk Management Strategy	Fully certified organic n = 48	Partially certified organic n = 103	Non-organic n = 49
Enterprise diversification index (DH)	0.7220	0.8962	0.2303
Practice crop diversification (% of respondents)	69.1	81.2	96.8
Savings (% of respondents)			
• Savings bank account	60.9	48.9	46.8
Current level of savings ⁶ (% of respondents)			
• less than R500	27.27	37.84	35.29
• R501 – R1000	45.45	29.73	41.18
• R1001 – R5000	21.21	29.73	17.65
• More than 5000	6.07	2.70	5.88
Social networks (% of respondents)			
• Membership of EFO	100	100	10
• Others (burial clubs, <i>stockvel</i> ⁷)	33	25	25

Precautionary saving occurs in response to risk and uncertainty (Feigenbaum, 2011). The smallholder farmers' precautionary motive was to delay/minimise consumption and save in the current period due to their lack of crop insurance markets. According to Cunha, Heckman and Navarro (2005) the quantitative significance of precautionary saving depends on how much risk consumers face. Whereas 60.9% of the fully certified farmers had savings bank accounts, only 46.8% non-organic farmers had bank accounts. The current level of saving in the study area was low with savings ranging from less than R500 to over R5000 per month. The level of savings was low across all groups. Among the fully-certified organic group, most of the respondents (45.45%) saved between

⁶ currency exchange is US\$ 1 ≈ R6.78 as at September 2011

⁷ A *Stokvel* is a club serving as a rotating credit union in South Africa where members contribute fixed sums of money to a central fund on a weekly, fortnightly or monthly basis.

R1000-R5001 whereas most of the partially-certified farmers (37.84%) saved less than R500 per month. Most of the non-organic farmers (41.18%) saved between R501-R1000 per month. Across all groups, however the level of saving greater than R5000 was minimal.

The farmers also engage in social networks as a risk sharing strategy. There were two main categories of social networks that the farmers engaged in. These are farmers association and other social networks most notably burial clubs and *stockvels*. The farmers association is used as a vehicle by the organic farmers to gain access to markets for their organic produce while the burial clubs and *stockvels* are sources of access to credit and/or loans. In the latter instance, farmers do not have to produce collateral. The burial clubs and *stockvels* are common in most rural areas and are a source of mitigating liquidity and financial risk where possible.

7.5 Chapter summary

The results of the risk aversion classification show that the distribution of responses was spread across all classes of risk aversion for the pooled data. It can be noted that the majority of the respondents revealed their preference for prospects representing intermediate and moderate risk aversion alternatives across the three farmer groups and on average. These results conform to *a priori* expectations where non-organic farmers are expected to be more risk averse than fully or partially certified organic farmers. A comparison of the findings of this study against similar studies showed that the findings of the South African study are in tandem with findings of the studies conducted in India, Philippines, Zambia and Côte d'Ivoire where the majority of the respondents were classified as intermediate to moderate risk aversion.

In general price, production and financial risks were perceived as the most important sources of risk. These were identified across the farmer groups as: uncertain climate, lack of cash and credit to finance inputs; tractor is not available when needed, delays in payment for products sent to pack house and livestock damage to crops. Seven principal components (PCs) that explained 66.13% of the variance in the original scores were

extracted namely: the “financial and incentives index”, “input-output index”, “crop production index”, “labour bottleneck index”, “lack of production information index”, “lack of market opportunity index”, and “input availability index”.

An analysis of the socio-economic factors identified the following variables to have a significant effect on the various sources of risk: age, gender, education, location, information access and risk-taking ability. Older farmers were concerned about the availability of labour while female farmers considered input-output risk and crop production risks as significant and relevant. Farmers residing in the non--organic areas of Hwayi and Numgwane sub-wards were more concerned about financial and incentive risk as well as input availability. These farmers have limited access to financial resources and incentives for production while farmers residing in the pioneer organic areas of Ogagwini and Ezigoleni considered input-output risk as less relevant. Farmers with access to information perceived input output risk and crop production risks as less relevant but financial and incentive risk are significant and more relevant. Farmers who were more likely to take risk perceived labour bottleneck risks as much less relevant.

The most important traditional risk management strategies used by the surveyed farmers in rural KwaZulu-Natal are identified as crop diversification, precautionary savings and participating in social network. Enterprise diversification is a self-insuring strategy used by farmers to protect against risk (Bradshaw, 2004). According to Cunha, Heckman and Navarro (2005) the quantitative significance of precautionary saving depends on how much risk consumers face. There were two main categories of social networks that the farmers engaged in. These are farmers association and most notably burial clubs and *stockvels*. The findings are consistent with economic theory which postulates that in the absence of insurance markets, poor farm households tend to be risk averse and are reluctant to participate in farm investment decisions that are uncertain or involve high risk.

CHAPTER 8

CONSUMER AWARENESS AND MARKET POTENTIAL FOR ORGANIC PRODUCTS IN THE EASTERN CAPE

8.1 Introduction

This chapter presents the results of the consumer study, which comprise a descriptive component and the results from the model estimations of consumer awareness and consumption of organic products. The descriptive analysis compares various socio-economic and demographic characteristics of the consumers in the former homelands and across the rural, peri-urban and urban spectra. Further analysis is done on the consumer organic product knowledge and awareness, perceptions and attitudes to organic as well as preference and consumption of organic products. This section concludes with a review of the traditional food taboos among consumers in the province. The results of the logistic regression model are presented to establish the factors affecting consumer awareness of organic products. Further analysis using discriminant analysis identified the determinants of organic product consumption.

8.2 Descriptive analysis of surveyed consumers in the Eastern Cape

This section presents the results of the demographic and socio-economic characteristics of the survey farmers. The section presents the findings on gender, age, education, employment status, income distribution, household composition and distance to the nearest shop for the survey respondents. Table 8.1 presents the summary statistics of the variables discussed below from section 8.2.1 to 8.2.8 and presented graphically from Figure 8.1 to Figure 8.16.

Table 8.1: Summary statistics of socio-economic and demographic variables, Eastern Cape

Variable	Former homelands		Locality		
	Former Transkei (OR Tambo DM) n = 100	Former Ciskei (Amatole DM) n = 100	Rural n = 30	Peri-urban n = 30	Urban n = 40
	% of respondents		% of respondents		
Gender					
Male	43	34	28	40	44
Female	57	66	72	60	56
Age in years					
18-24	17	13	18	16	12
25-34	29	33	12	34	26
35-44	27	16	14	23	41
45-55	20	17	21	19	16
>55	7	21	35	8	5
Education Level					
None	4	9.7	16.1	6.5	1.2
Primary	21	29.1	46.4	32.3	5.9
High school	39	39.8	37.5	48.4	34.1
Tertiary	36	21.4	0	12.9	58.8
Employment Status					
Unemployed	29.4	31	52.6	48.3	2.4
Student	9.8	4	5.3	5	9.4
Housewife/man	10.8	8	19.3	10	2.4
Retired	5.9	1	8.8	1.7	1.2
Working part-time	14.7	11	8.7	18.3	11.8
Working full time	29.4	45	5.3	16.7	72.8
Income Level					
<1000	10	12.5	0	4.8	23.5
1001 – 5000	16	5.8	0	0	25.9
5001-10 000	20	17.3	5.3	17.7	28.2
10 001 – 15 000	30	49	66.7	46.8	16.5
>15 000	24	15.4	28.1	30.6	5.9
Household size in number	5.2	4.33	5.18	4.98	4.31
Children < 18 years	79	55.8	71.9	71	61.2
Distance in Kms	6.71	9.63	12.67	9.32	1.38

Source: Field Data

8.2.1 Gender of consumers

Gender representation was higher for women in the former homelands representing 57% and 66% of the respondent consumers respectively in the former Transkei and the former Ciskei (Figure 8.1). Previous studies example Mutlu (2007) found that women were the predominant purchasers of organic food and responsible for household consumption.

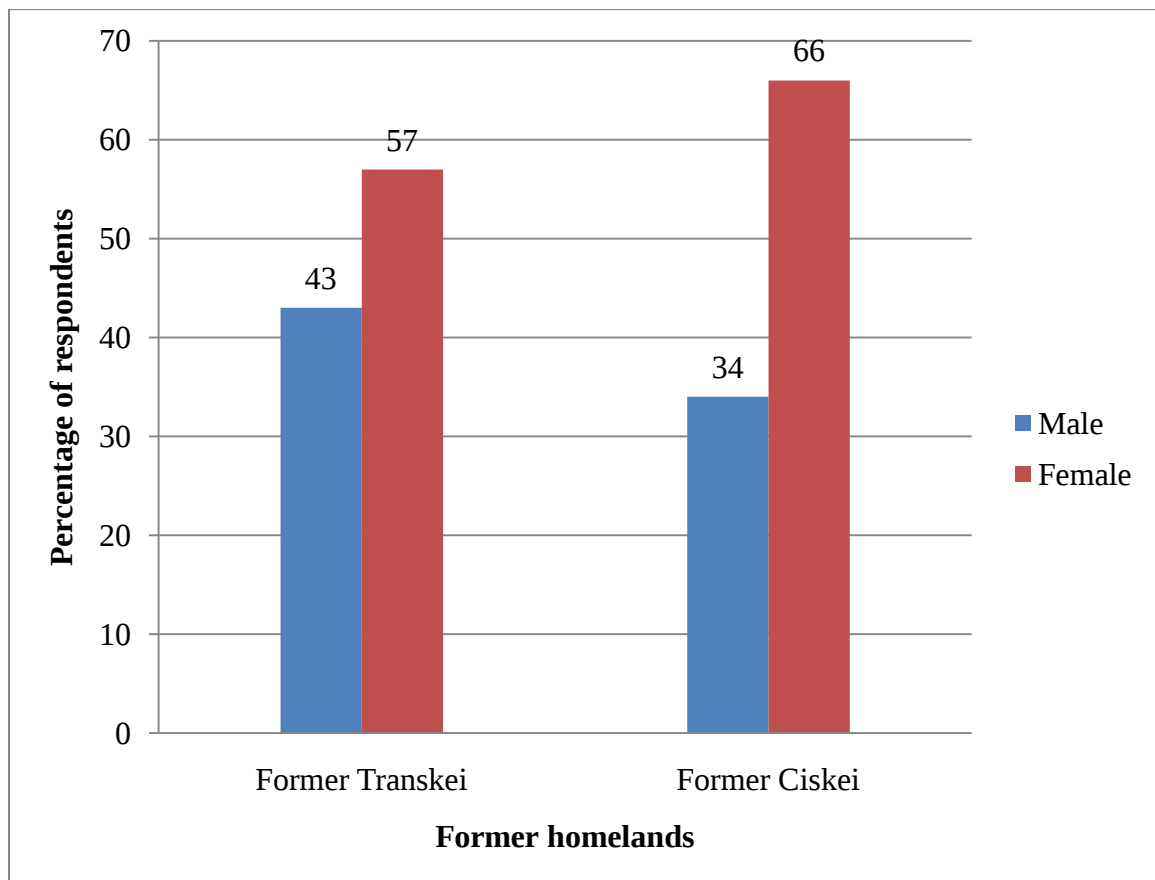


Figure 8.1: Gender representation of consumers in the former homelands

A further analysis across the rural, peri-urban and urban spheres of the study areas confirmed similar trends of high female representation among the respondents. A total of 72% of rural respondents were females (Figure 8.2), 60% of the respondents in the peri-urban areas were females (Figure 8.2), while 56% of the respondent's in the urban areas were female (Figure 8.2).

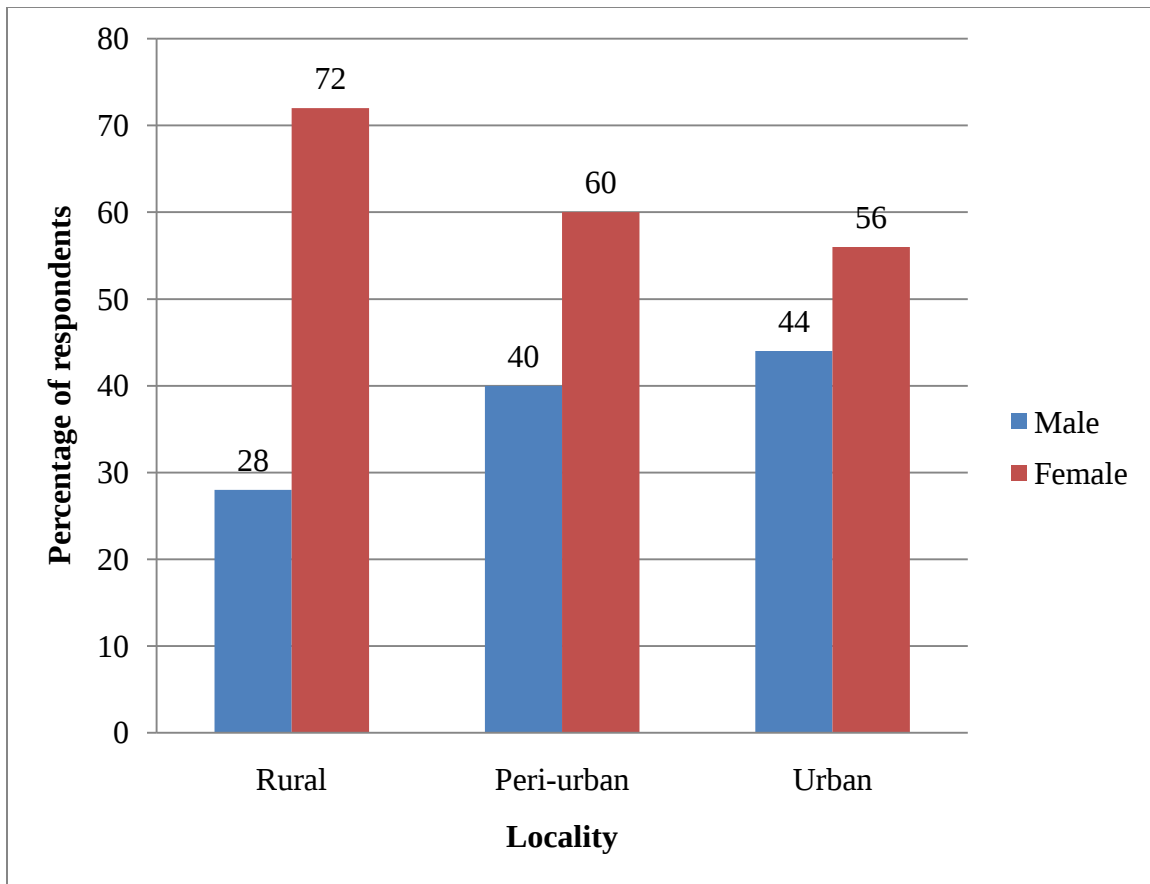


Figure 8.2: Gender representations of rural, peri-urban and urban consumers

8.2.2 Age of consumers

The age of the consumer respondents was classified into five (5) different age groups of 18-24 years, 25-34 years, 35-44 years, 45-55 years and more than 56 years. The age groups can broadly be explained as representing the youth (younger generation of below 35 years), adult (older generation of over 35 years and less than 55 years) and the old age (pensioner generation represented by respondents of over 56 years).

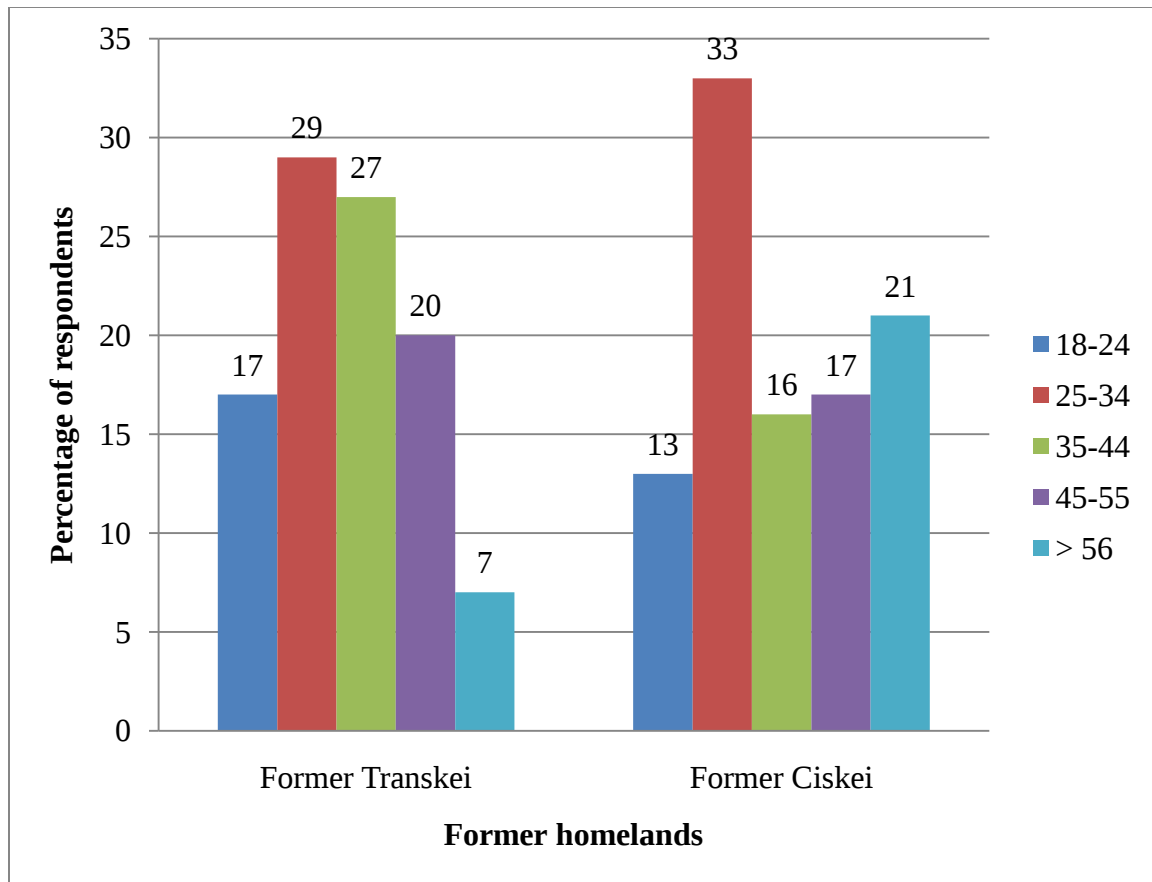


Figure 8.3: Age representation among consumers in the former homelands

According to Figure 8.3 the majority age group of the respondents in the former Transkei is 25-34 years represented by 29% followed by the age group of 35-44 years represented by 27% of the respondents in this study area. These represent the older youth and the younger adult groups. This can be attributed to the fact that these age groups also represent the economically active members of society and may represent an important group to target in advancing the consumer demand for organics. The age group of 45-55 constituted 20% of the respondents, 18-24 years constituted 17% of the respondents and the more than 56 years constituted only 7% of the respondents in the former Transkei (Figure 8.3). Similarly in the former Ciskei, according to Figure 8.3, most of the respondents are within the age group category of 25-34 years representing 33% of the respondents. The age group of more than 56 years represented 21% of the respondents while the 45-55 year age group represented 17% of the respondents. The age group of 35-44 constituted 16% of the respondents and lastly, 18-24 age groups represented 13%

of respondents (Figure 8.3). These findings are consistent with results published in the OR Tambo District Municipality Integrated Development Plan (2011) which established that the economically active part of the population is estimated at 60.5% for the Eastern Cape Province, while 5.9% of the population was older than 65 years.

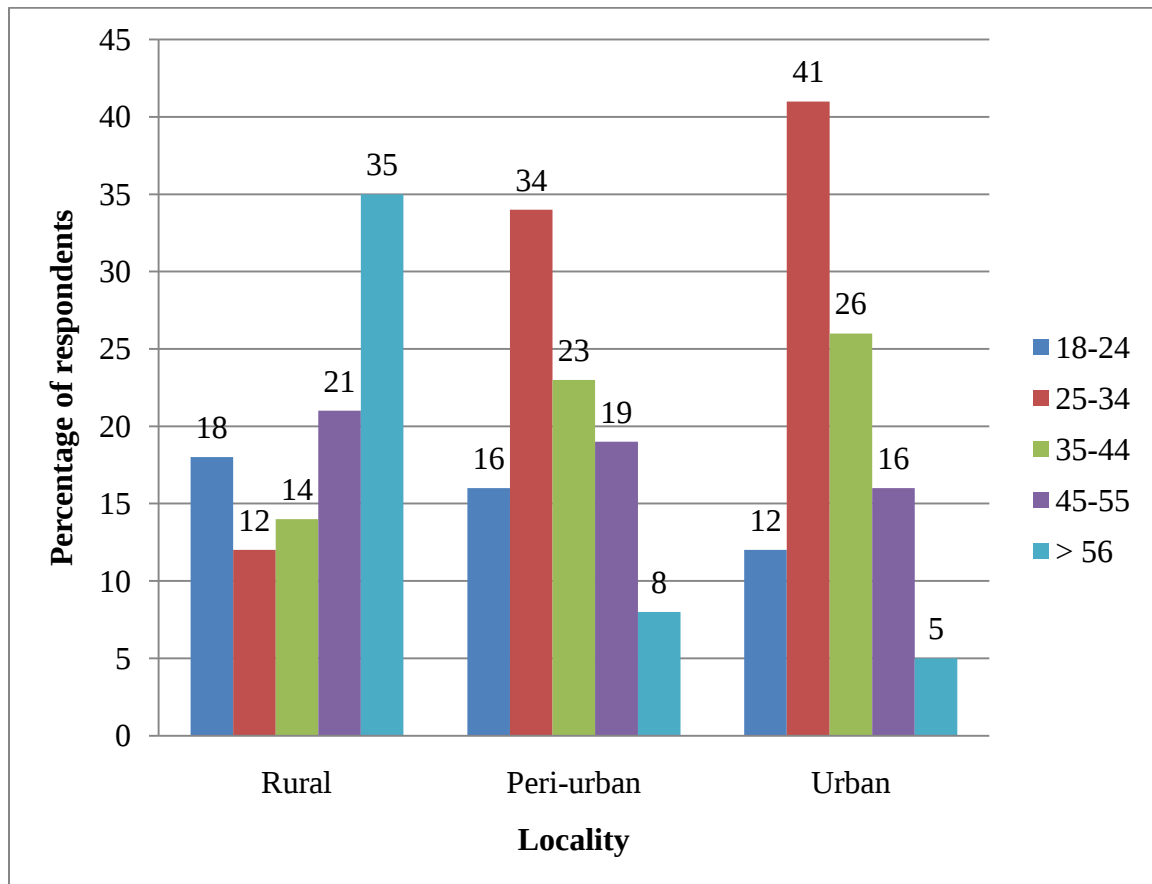


Figure 8.4: Age representation among rural, peri-urban and urban consumers

In Figure 8.4, the age representation among rural respondents' shows that the majority of respondents were represented in the age group of over 56 years, followed by 21% represented by the age group of 45-55 years. The age group of 18-24 represented 18%, while 35-44 years age group was represented by 14% and lastly the 25-34 years represented 12%. This may be explained by the fact that most respondents in the rural areas are older members of society while younger respondents seek wage employment out of the rural areas. This can be confirmed by the fact that the economically active age groups of between 25-44 years represented the lower percentage of respondents in rural areas.

According to the Eastern Cape Socio-Economic Review and Outlook (ECSERO) (2011), South Africa's unemployment rate was forecast to average approximately 24.0 % at the end of 2010 which is obstinately high compared with other emerging market economies. In the Eastern Cape, high levels of unemployment and poverty persist, particularly in the rural areas where two thirds of the population resides. The OR Tambo District Municipality representative of the former Transkei saw the highest unemployment rates averaging 43.8 % in 2009. The Amatole District Municipality representative of the former Ciskei reported an unemployment rate of 30.2 % in 2009 (ECSERO, 2011). This is above the national average of 25.2 % (STATSSA, 2010).

According to the OR Tambo District Municipality Integrated Development Plan (2011) historically there has been an emphasised pattern of migration both from the district to other parts of the country and within the district from rural to urban and peri urban areas. This migration for mainly economic and life style reasons has an important impact on the nature of the district economy and the trajectory for development. While it is estimated that 5.6% of economically active individuals in the Province migrate, it is 6.2% in the OR Tambo District Municipality. Over 80% of migrants from the Province are from rural areas (OR Tambo District Municipality Integrated Development Plan, 2011). This migration appears to have been aimed at the bigger metropolitan areas, especially Cape Town and Johannesburg, rather than local and regional urban centres. Generally the pattern in the Province shows an increase in the flow from rural areas directly to major metropolitan areas. In this respect Johannesburg is more of a metro target for people from the province than the other major cities (Kamman and Bank, 2010).

The scenario in the peri-urban areas differs from that of the rural areas (Figure 8.4). A total of 34% of the respondents constitute the age group of 25-34 years followed by 35-44 year olds who constitute 23% (Figure 8.4). The respondents older than 56 years of age constituted the least percentage of respondents in the peri-urban areas. The latter is expected as most of peri-urban respondents reside in informal settlements closer to the urban centres of Mthatha and King Williams Town, which are closer to their areas of

work. According to Figure 8.4, a total of 41% of the respondents were aged between 25-34 year olds. This is followed by the 35-44 year old age category constituting 26% of the respondents. This represents the young adults most working and living in urban areas of Mthatha and East London. The age group of 45-55 years represents 16%; 18-24 years representing 12% and the over 56 year olds constituting a paltry 5% (Figure 8.4)

8.2.3 Education of consumers

Many of the respondents had high school level of education (Figure 8.5). In the former Ciskei, 39.8% of the respondents had high school education. This was closely similar in the former Transkei where 39% of the respondents had high school level of education. In addition, while 21.4% of the respondents in the former Ciskei had post graduate education, in the former Transkei this was represented by 36% of respondents with post graduate qualification. In the former Ciskei 29.1% of the respondents had primary education compared to 21% from the former Transkei and lastly, while 9.7% of the respondents in the former Ciskei had no formal education, in the former Transkei, respondents with no formal education was 4% (Figure 8.5). The general trend shows that in the former Ciskei, there were more respondents across each education level category except the post graduate level of education compared to the former Transkei (Figure 8.5).

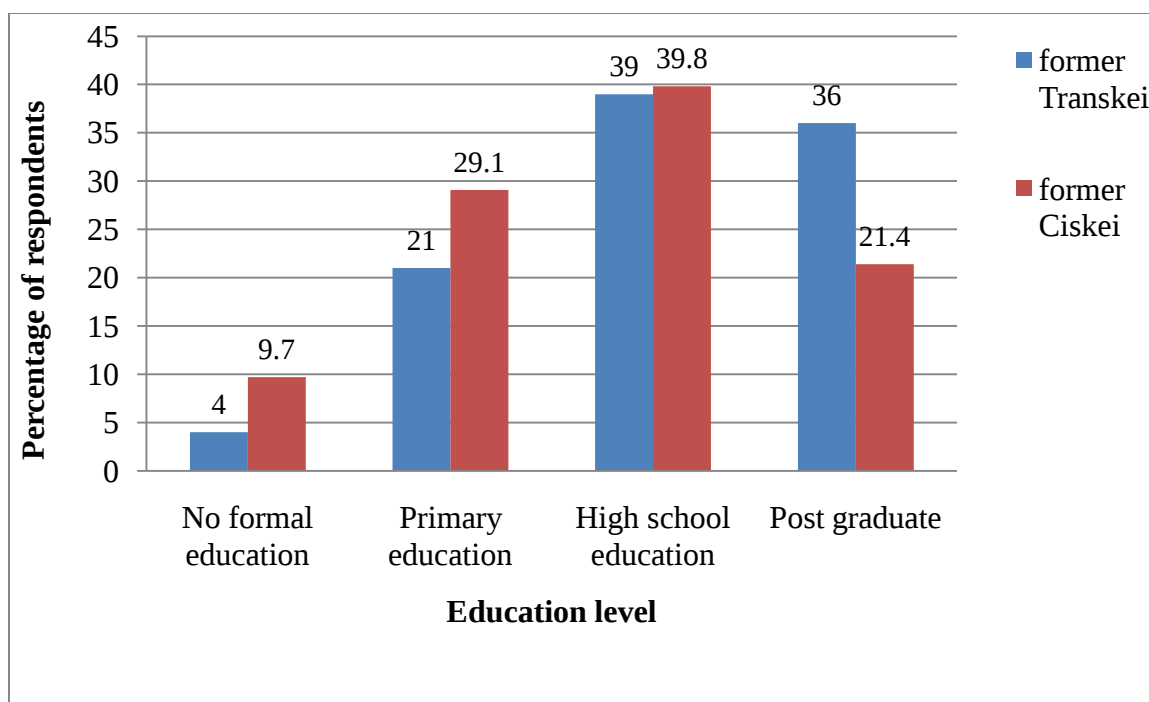


Figure 8.5: Education of respondents in the former homelands

A further analysis of educational level in the rural, peri-urban and urban areas shows as expected that 58.8% of the urban respondents had post graduate level of education compared to 12.9% and 0% for peri-urban and rural areas respectively (Figure 8.6). According to the OR Tambo District Municipality Integrated Development Plan (2011), the province is greatly hindered in economic development by the low levels of formal educational levels of the population. The situation is particularly of concern in the rural areas where none of the respondents had a tertiary level of education. While 34.1% of the respondents in the urban areas had high school education, the peri-urban and rural areas were represented by 48.7% and 37.5% of respondents, respectively. The situation with primary level of education is reversed where 5.9% of urban respondents have primary education, 32.3% of peri-urban respondents have primary education while 46.4% of rural respondents have primary education. A similar trend is recognised in the category of respondents with no formal education (Figure 8.6).

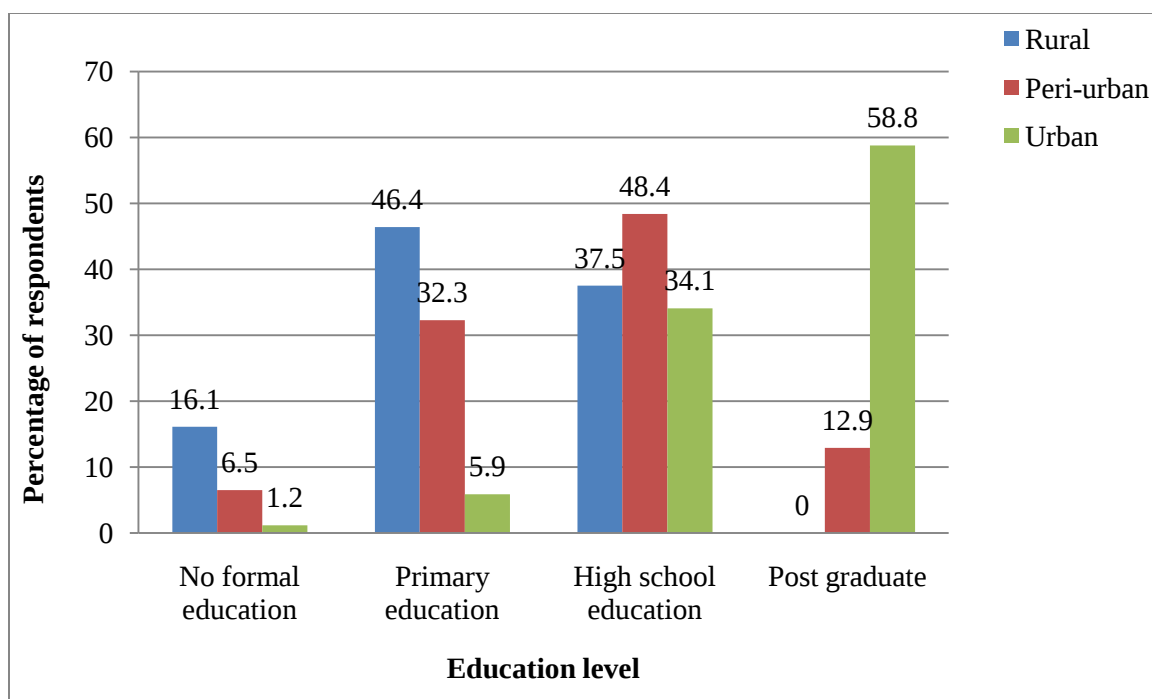


Figure 8.6: Educational level among rural, peri-urban and urban respondents

8.2.4 Employment status of consumers

The occupation is represented by the six (6) categories of: working full time, working part time, retired, housewife/husband, student and unemployed. An analysis of Figure 8.7 shows that 45% of the respondents in the former Transkei were working full time compared to 29.4% of respondents in the former Ciskei. This was followed by the high levels of unemployment represented by 31% of respondents unemployed in the former Transkei compared to 29.4% of respondents in the former Ciskei. This unemployment levels are similar to the national average of 25.2% (STATSSA, 2010). The unemployment rates in the former Transkei and former Ciskei demonstrate a substantial skew of the demographic profile of the districts and high dependency rates of those not economically productively active. It also reflects the levels of out-migration of economically active population from the province to other parts of South Africa. The high unemployment rates in the former homelands necessitate the implementation of strategies by Government and other key stakeholders that seek to address the high unemployment rates in the province. Some of the strategies currently in place are the Extended Public Works Programmes (EPWPs) that seek to create jobs through labour

intensive methodologies. Further research will have to be done to establish to what extent these strategies have been successful to address unemployment.

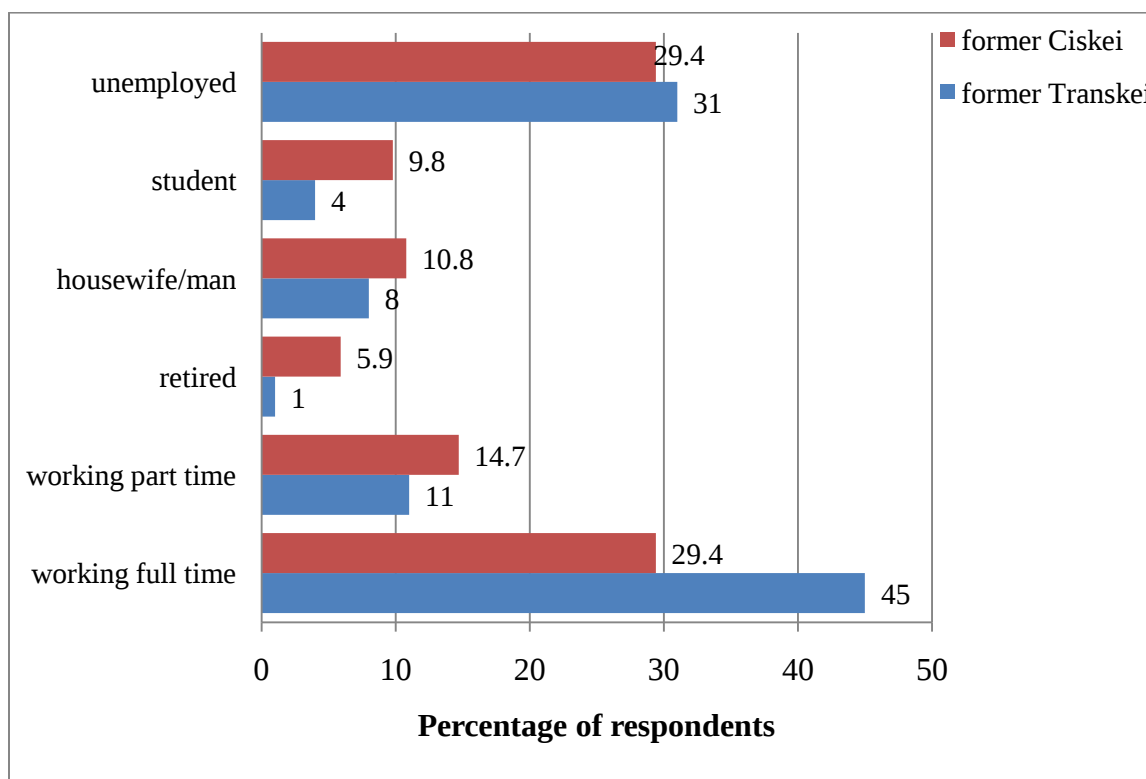


Figure 8.7: Occupation of respondents in the former homelands

Respondents working part time represented 11% and 14.7% for the former Transkei and former Ciskei respectively. Retired respondents represented 1% and 5.9%, housewife/husband represented 8% and 10.8% while students' represented 4% and 9.8% of respondents in the former Transkei and former Ciskei respectively (Figure 8.7). The low levels of retirees can be explained by the fact that most people in predominantly rural areas do not actually retire but go to a life of subsistence farming. Similarly the low percentage of respondents can be explained by the fact that the research was undertaken when schools were on-going with most students in school at that time. In Figure 8.8, the majority of respondents in the rural and peri-urban areas were unemployed. A total of 52.6% of the respondents in the rural areas were unemployed and 48.3% of the respondents in the peri-urban areas were unemployed (Figure 8.8). Unemployment levels were low in the urban areas represented by 2.4% of the respondents. On the contrary, in

the urban areas 72.8% of the respondents were working full times compared to 5.3% in the rural areas and 16.7% in the peri-urban areas working full time. These results suggest the need to spur rural and peri-urban communities to increase economic activity and subsequently employment. The Local Economic Development (LED) initiative by government is aimed at addressing unemployment and dormant economic activity in rural areas. This initiative has been cascaded to local municipal level in order to increase access of support by these rural inhabitants.

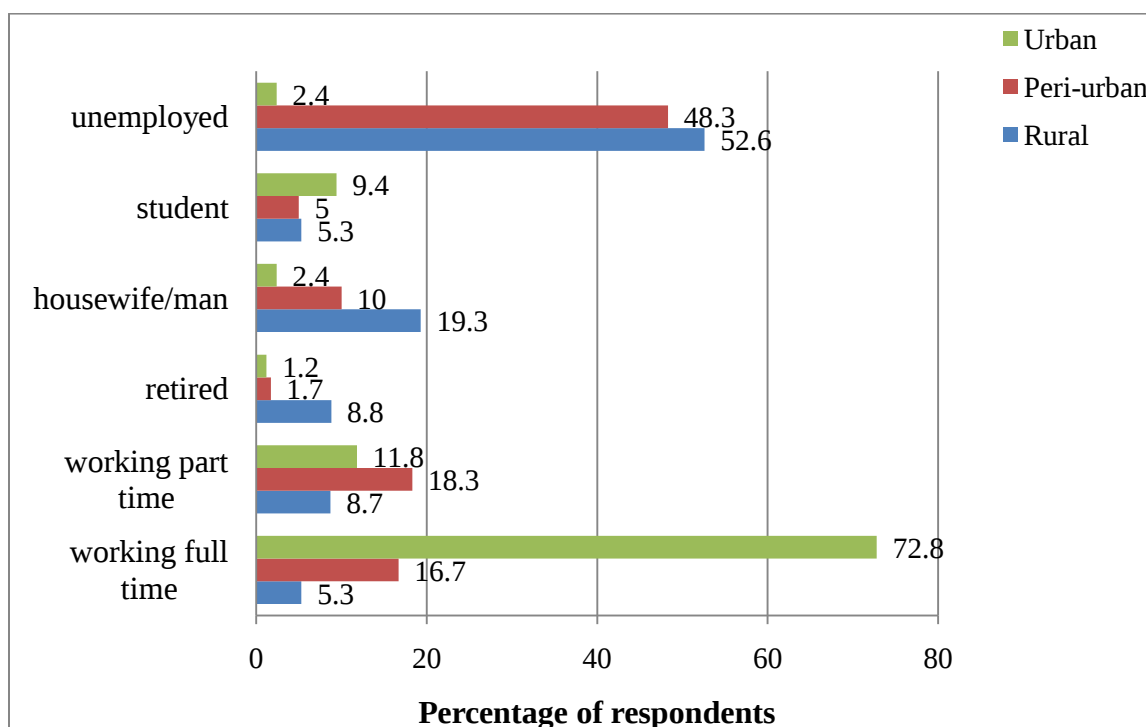


Figure 8.8: Occupation of rural, peri-urban and urban respondents

8.2.5 Income distribution of consumers

The income distribution of the respondents is especially concentrated in the R1000 – R5000/month category (Figure 8.9). In the former Transkei, 30% of the respondents were in the income group of R1000 – R5000/month category while in the former Ciskei this income category was represented by 49% of the respondents (Figure 8.9). It is important to note that social grants allocated to indigent households fall within this category. These results confirm findings by the Community Survey (2007) that confirms income levels in the province are low.

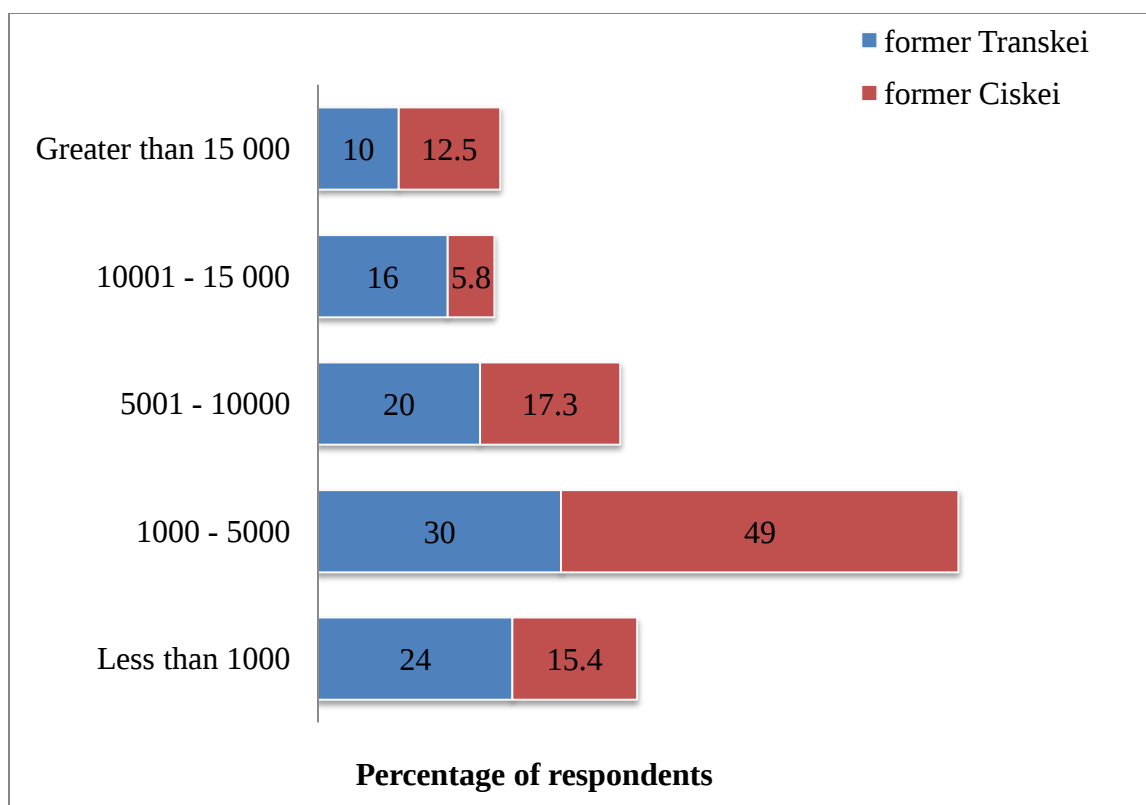


Figure 8.9: Percentage of respondents across income groups: A comparison of the former Transkei and former Ciskei

Figure 8.9 further shows that respondents earning less than R1000/month were represented by 24% in the former Transkei and 15.4% in the former Ciskei respectively. The poverty line in the Eastern Cape Province is R800. The increasing levels of absolute poverty have been recorded in the Eastern Cape and 74% of the people of the Eastern Cape live below the poverty line of R800 or less a month (Community Survey, 2007)). Low income levels are a pre-cursor of poverty which is a precursor of under-development. A total of 20% of the respondents in the former Transkei constituted the income category of R5001-10,000/month while 17.3% of the respondents in the former Ciskei were in this category. The category of respondents earning more than R15,000/month was lowest in both the former Transkei and former Ciskei represented by 10% and 12.5% respectively (Figure 8.9).

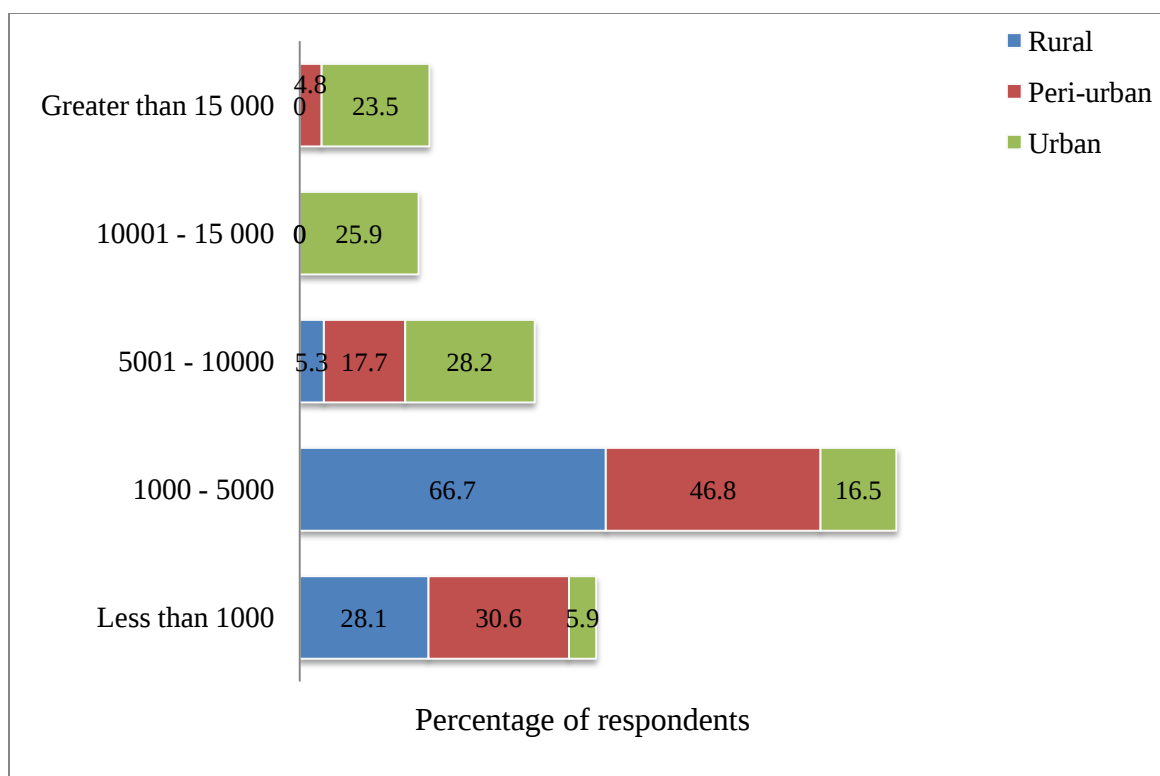


Figure 8.10: Percentage of respondents across income groups: A comparison of rural, peri-urban and urban areas

Similarly to Figure 8.9, the majority of the respondents in the rural, peri-urban and urban areas are within the income group category of R1000-5000/month (Figure 8.10). A total of 66.7% of the respondents in the rural areas were in the income category of R1000-5000/month; 46.8% of the respondents in the peri-urban areas and 16.5% of the respondents in the urban areas. In the income category of less than R1000/month, 28.1% of the respondents in the rural, 30.6% in the peri-urban and 5.9% in the urban areas fall within this category (Figure 8.10). These results show that the majority of respondents in the low income category are within the rural and peri-urban areas and hence validates findings published in the Integrated Development Plans of OR Tambo and Amatole District Municipalities. The low income levels are an indication of poverty levels. The high poverty levels in the province which is largely rural not only poses challenges to the development trajectory for the Eastern Cape but also poses critical challenges to understand the impact of investments in the province over the past 15 years. These include the Industrial development Zones of east London and Coega, four universities and several institutions of higher learning, farmer support programmes among others.

The high income categories of R10,001-15,000/month and over R15,000/month are represented by 25.9% and 23.5% for urban respondents, while for the rural respondents this was 0% for both income categories (Figure 8.10). Bonti-Ankomah (2001) states that location has a close relationship to poverty: provinces that are more rural have a greater proportion of households earning less than R2500 a month relative to more urban provinces.

8.2.6 Household composition of respondents

The average household size for the consumers in the former homelands is presented in Figure 8.11. In the former Transkei, the average household size is 5.2 persons, while in the former Ciskei the average household size is 4.33 (Figure 8.11). Additionally, the findings in the rural, peri-urban and urban areas depict a similar trend. The majority of the respondents in the rural, peri-urban and urban areas have households consisting of 5.18, 4.98 and 4.31 persons, respectively (Figure 8.12). These findings are consistent with results from the study done by the Provincial Decision-Making Enabling (PROVIDE) Project (2009). According to PROVIDE (2009), the average household size in the Eastern Cape is 5.25 while the average household size in the rest of South Africa is estimated at 4.83. Similarly the Human Sciences Research Council (HSRC) (2011) in their study on the socio-economic context of older persons in South Africa found that the average household size in OR Tambo District Municipality is 5.2 while in Amatole District Municipality it is 3.6. Bonti-Ankomah (2001) argues that large rural households are more vulnerable to poverty and consequently food insecurity and need to be targeted for poverty alleviation strategies and nutrition programmes through sustainable food production methods and methodologies. Previous studies have found that household size is positively correlated with the buying propensity for organic food (Kristiansen, Taji and Reganold, 2003).

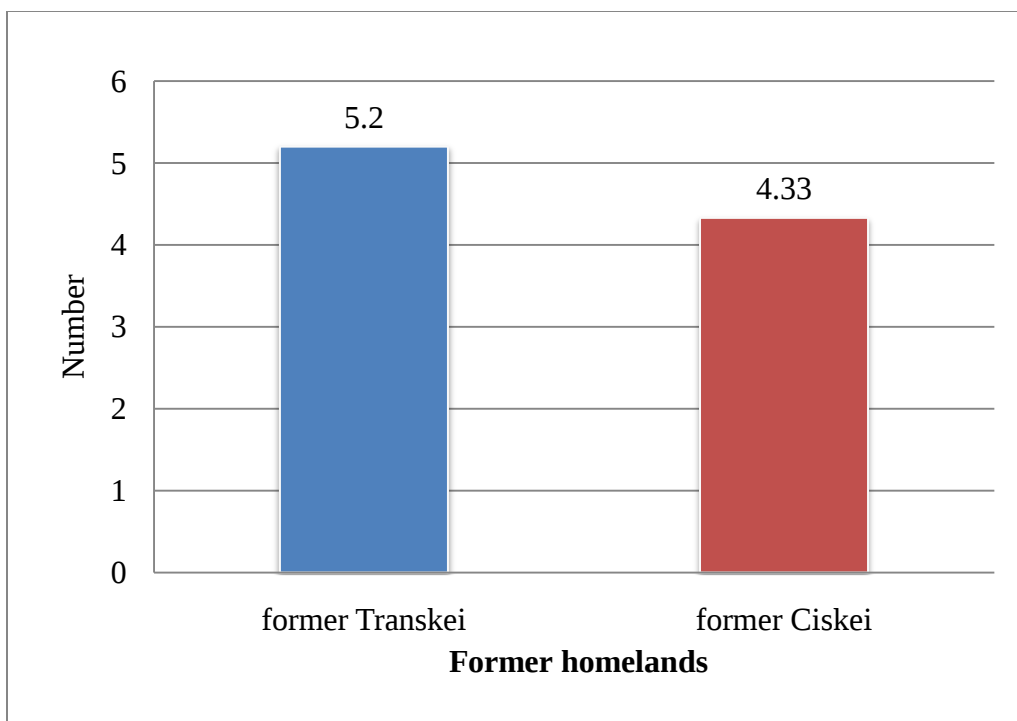


Figure 8.11: Household size of respondents in the former homelands

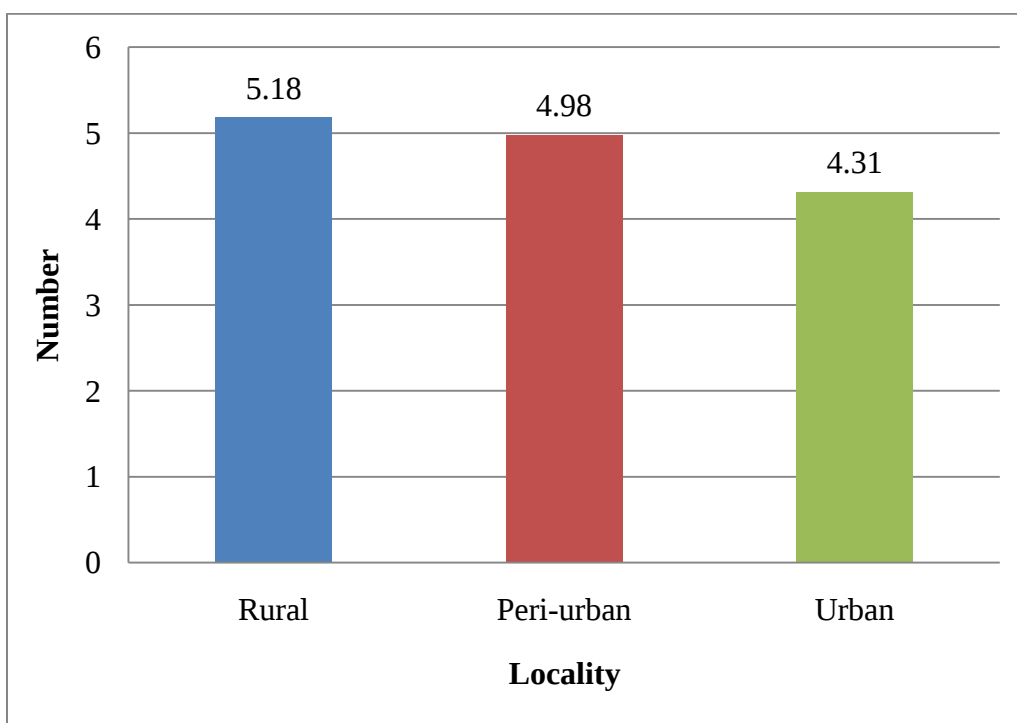


Figure 8.12: Household size of respondents in the rural, peri-urban and urban areas

Analysis of the status of children in the households establishes that a majority of the respondents had children under the age of 18 in the household. A total of 79% of the respondents had children under the age of 18 years in the household in the former Transkei. In the former Ciskei, this was represented 55.8% (Figure 8.13). Kristiansen *et al.* (2003) states that families with smaller children have a higher buying propensity for organic food than those families without children or with teenage children.

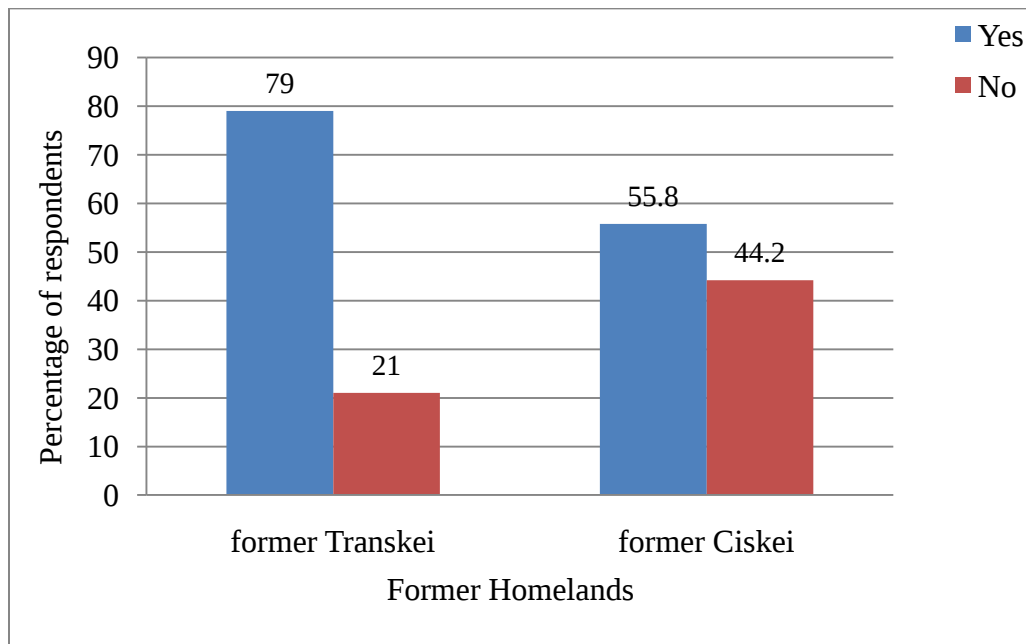


Figure 8.13: Percentage of household with children in the former homelands

Similarly in Figure 8.14 the majority of the respondents in the rural, peri-urban and urban areas had children below the age of 18 in the Households. A total of 71.9% of the respondents in the rural areas had children below the age of 18, while 71% of respondents in the peri-urban areas had children below the age of 18 and 61.2% of the respondents in the urban areas had children below the age of 18 in the household (Figure 8.14). Dettmann (2008) emphasizes that as the organic market grows, a natural question arises: who is buying organic food? Gaining insight into this issue is more than just an intellectual exercise as retailers and members of the organic industry (for example, farmers, processors, distributors) can further maximize profits by understanding who buys their products. According to Thompson and Kidwell (1998) and Loureiro,

McCluskey and Mittlehammer (2001) households with children under 18 were more likely to buy organic produce. A similar conclusion was arrived at by Riefer and Hamm (2011) who stated that children's transition into adolescence often represents a causal condition for a reduction of organic food consumption in families due to juveniles' preferences for conventional food in product categories such as sweets, salty snacks or breakfast cereals.

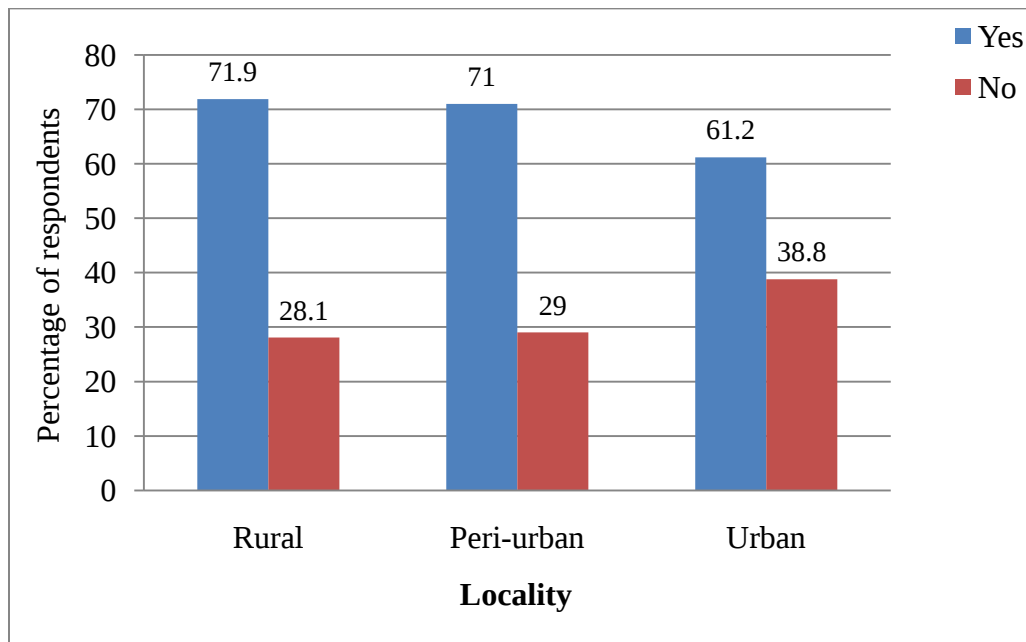


Figure 8.14: Percentage of households with children in rural, peri-urban and urban areas

8.2.7 Distance to the nearest shop

Figure 8.15 shows the distance to the nearest shop for respondents in the former homelands. In the former Transkei the distance to the nearest shop was 6.71 kms while in the former Ciskei the average distance to the nearest shop was 9.63 kms. The presence and access to shops and markets is important in understanding the impact on the local economic development and growth (Carlin and Soskice, 2006; Warsh, 2006). The former Transkei and the former Ciskei being former Bantustan areas have limited access to markets and hence impact on the ability of these consumers to readily access markets and other shops.

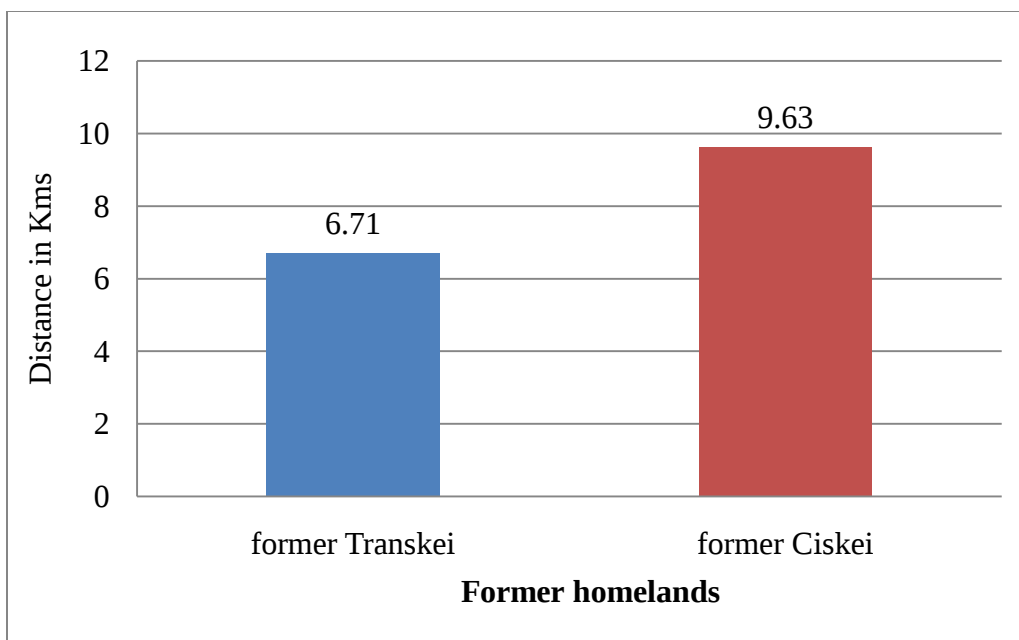


Figure 8.15: Distance to the nearest shop in the former homelands

A further analysis of the distance to the nearest shop among rural, peri-urban and urban respondents showed that the distance to the nearest shop for rural respondents was 12.67 kms, compared to 9.32 for peri-urban respondents and 1.38 for urban respondents (Figure 8.16). These results are consistent with findings by Department of Agriculture, Forestry and Fisheries, (2010c) in its study on the spatial difference of food prices in rural areas of South Africa versus the national average. The study established that most of the stores/shops are located considerable distances away from the rural areas. The study further noted that product prices tend to be higher at rural stores than the national average due to the high transaction costs experienced by rural traders as a result of long distances to major towns and shopping centers (Department of Agriculture, Forestry and Fisheries, 2010c)

Algert, Agrawal and Lewis (2006) defined access to stores selling a variety of produce as a walkable distance of 0.8 km., or about a 15-minute walk. The situation in the Eastern Cape, especially in the rural and peri-urban areas shows that the large distances of 12.67km (rural) and 9.32kms (peri-urban) are a clear indication that households in rural and peri-urban areas do not readily have access to markets and this may limit the demand

for organic food and or products in these areas. The urban situation is different, with most of the respondents having ready and adequate access to shops and markets. This information is important in delineating the target domain for organic food demand as the number of trips made within and outside the village by a rural community depends on its accessibility to the required services, amenities and facilities.

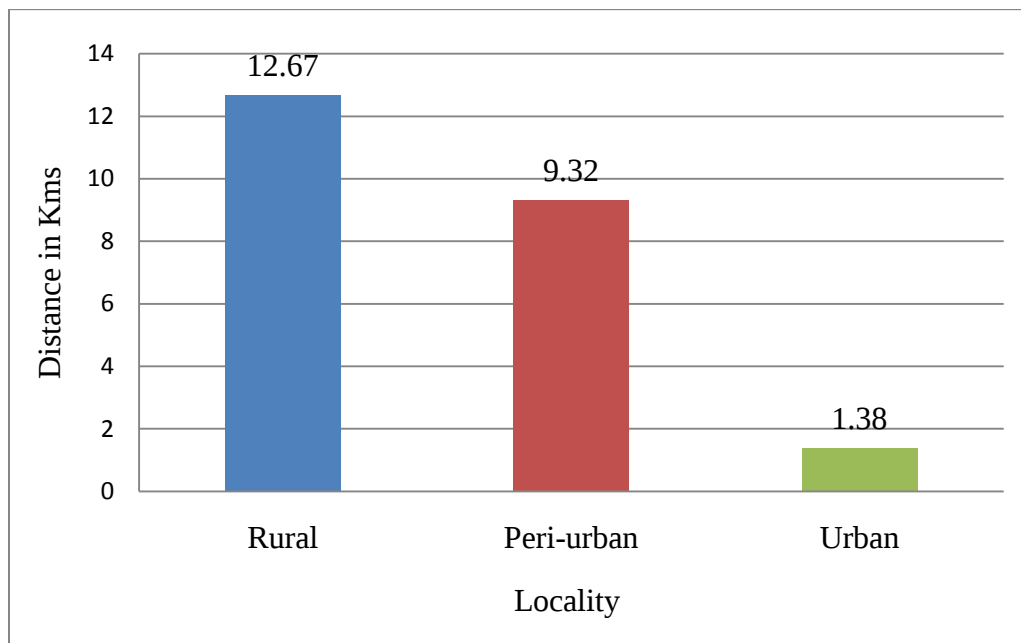


Figure 8.16: Distance to the nearest shop in the rural, peri-urban and urban areas

8.2.8 Traditional food taboos among consumers in the Eastern Cape.

The traditional response to new food and products is informed in part by traditional food taboos that exist in different cultures. The advancement of organic agriculture needs to be considered in respect to the consumption environment that affects acceptance or non acceptance. Organics are coming into an environment in which there are strong views about what may or may not be consumed. Traditional food taboos were not a common occurrence in the study area with less than 5% of the consumers across the various study sites identifying some of the traditional food taboos. On a comparative basis many food taboos seem to make no sense at all, as to what may be declared unfit by one group may be perfectly acceptable to another (Koehler and Leonhaeuser, 2008). On the other hand,

food taboos have a long history and one ought to expect a sound explanation for the existence (and persistence) of certain dietary customs in a given culture. Yet, this is a highly debated view and no single theory may explain why people have special food taboos (Mintz and Du Bois, 2002).

Traditional food taboos are a hindrance to choice variation and lifestyle choices available to consumers who subscribe to these taboos. Traditional food taboos identified in the Eastern Cape during the study were:

- *Ntsangu-Ntsangu* is a weed found in the gardens which looks more like *dagga* ("*ntsangu*" in Xhosa) it is not for human consumption as it is believed that if you eat it you will get mad.
- *Velemampondweni* is another wild plant found in gardens which is believed to have originated from the Pondoland hence the name. It also believed to bring madness to the family when consumed.
- *Dungamzi* is a bad luck plant that no one is allowed to bring it to the house and also not for consumption as it brings a bad omen to the household
- *Mpungempu* similar to *Velemampondweni* but it's a taboo mainly in the former Transkei area.
- *Ntebe* and *Gcamnge* are types of wild weed which are not be eaten and also associated with madness when consumed.
- *Vumbangwe* is a plant not for human consumption but used for dandruff treatment in some areas of Pondoland.
- Young girls and women are prohibited from consuming fresh milk from the Kraal. This refers to animal milk (cow, goat and sheep) especially in rural areas where milk comes from the kraal.
- Eggs should not be consumed by girls in puberty and pregnant women. In the *Xhosa* culture women and young girls were not allowed to eat them in the olden days and some households still practise this today as it is associated with fertility, child birth and enhancing sexual activity.

Food taboos vary among different societies and individuals. Traditional views about food are liable to change under the influence of neighbouring communities, travel and education. Many of these taboos regulate the consumption of protein-rich animal foods, often by those groups of the community most in need of protein. A common taboo in Africa against the consumption of eggs is rapidly disappearing. This taboo usually applies to females, who are said to become sterile if they eat eggs. The psychological connection between human fertility and the egg is obvious. In other places the custom applies to children, perhaps to discourage them from stealing the eggs of setting hens, which would endanger the survival of poultry (Latham, 1997)

Buruiana (2003) argues that food taboos, whether scientifically correct or not, are often meant to protect the human individual and the observation, for example, that certain allergies and depression are associated with each other could have led to declaring food items taboo that were identified as causal agents for the allergies. Moreover, any food taboo, acknowledged by a particular group of people as part of its ways, aids in the cohesion of this group, helps that particular group maintain its identity in the face of others, and therefore creates a feeling of "belonging" (Buruiana, 2003).

8.3 Consumer awareness, knowledge and perceptions of organic products

This section presents findings on consumer awareness about organic, their knowledge of organic products and perceptions. The section commences by presenting the consumers definition of organic foods, their level of understanding of organic products, knowledge of organic labels, systems of verification and certification. The consumers perception of organic products is also discussed and presented as is their level of trust in organic labels,

8.3.1 Defining organic foods

In order to determine the levels of awareness of consumers on organic foods, the respondents were asked “what they understood by the term ‘organic foods’? Seven options were presented to them and respondents had the option of multiple responses. According to Figure 8.17 the three key responses from consumers in the former Transkei were that organic foods are healthy and nutritious (84%); organic foods were associated with traditional and or indigenous methods of production (71%); and that organic foods were free from chemicals (58.6%). In the former Ciskei, consumers responded that their understanding of organic foods are foods that are healthy and nutritious (55.8%); were free from chemicals (47.1%); and were associated with traditional and indigenous methods of production (40.4%) (Figure 8.17).

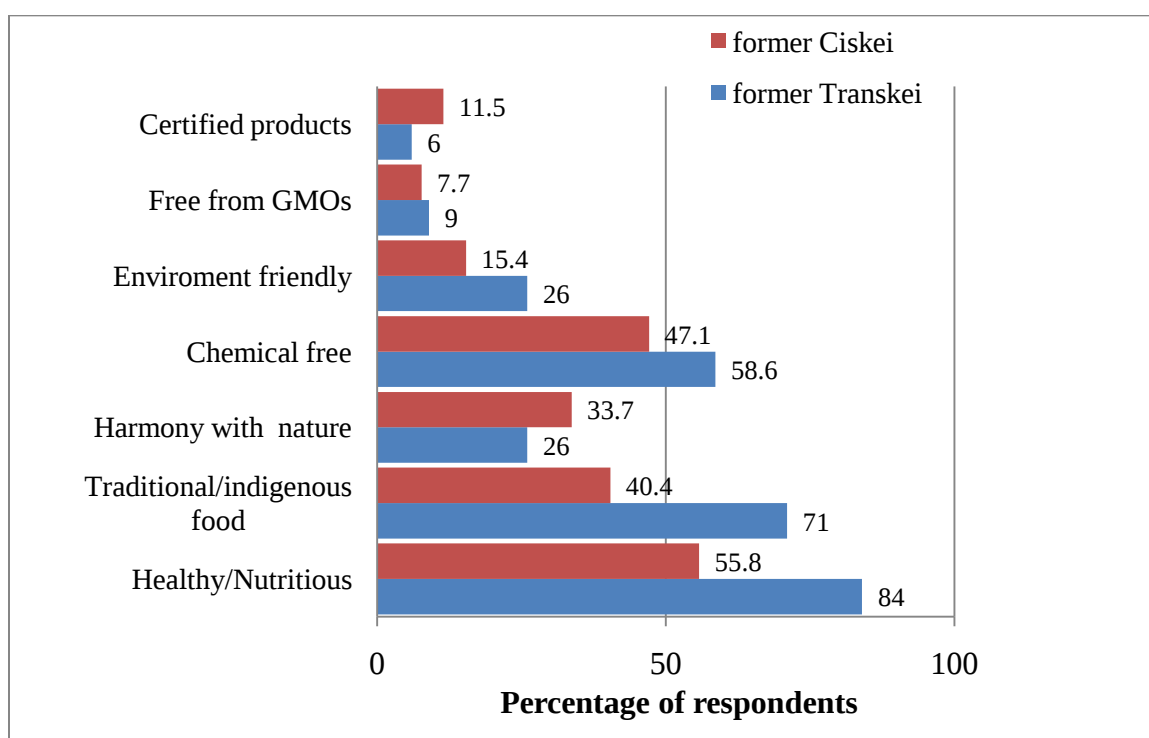


Figure 8.17: Consumer understanding of organics in the former homelands

A further analysis among the rural, peri-urban and urban consumers on their understanding of organic foods showed that among rural consumers organic foods are foods that are traditional or indigenous and produced through indigenous methods (78%); foods that are healthy and nutritious (61.4%) and foods that are free from chemicals

(45.6%) (Figure 8.18). Among peri-urban respondents, the consumers associated organic foods with health and nutrition (69.4%); traditional and indigenous foods (54.7%) and foods free from chemicals (50%). Similar responses were established from urban consumers who noted that organic foods are associated with health and nutrition (75.3%); free from chemicals (59.7%); and traditional and indigenous (40%) (Figure 8.18).

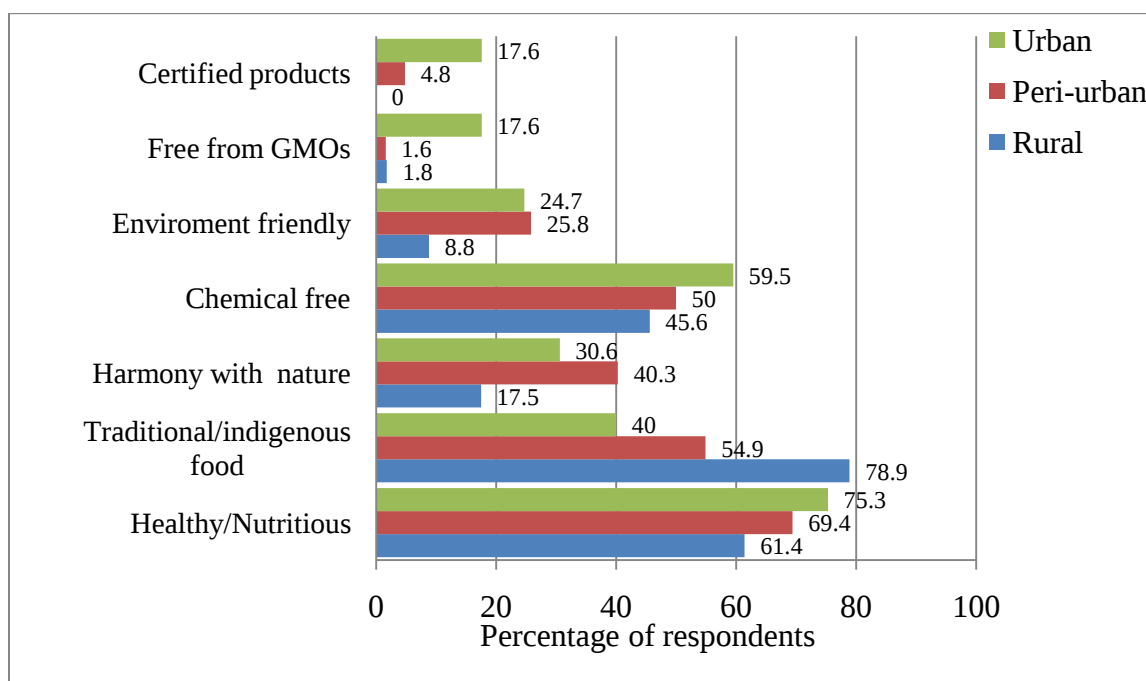


Figure 8.18: Consumer understanding of organic products in the rural, peri-urban and urban areas.

These results show that there is a general understanding of term ‘organic foods’ among consumers. In some instances however, especially in the rural areas respondents were not readily aware of the word ‘organic’. After further explanation, most of these consumers indicated that their traditional methods of production and indigenous foods were produced in line with organic methods. This confirms the fact that many centuries back whereas food was produced using organic methods and principles, the word organic was coined many years later and hence indigenous methods of production are closely associated with organic methods. In recent years consumers and farmers have taken a conscious decision to go organic given the growing trends in certified organic farming

and the growing number of smallholders farmer organisation that are producing organic to tap into the premium price markets.

8.3.2 Understanding of organic products among consumers

Consumers' awareness on certain facts about organic products was also tested. A set of statements was read out to the respondents and they were asked to state whether or not they were aware of this fact. These related to the local standards of organic products, certification bodies for organic products in South Africa, the national organic movement in South Africa and consumers' ability to identify organic logos in the market. The results are presented in Figure 8.19.

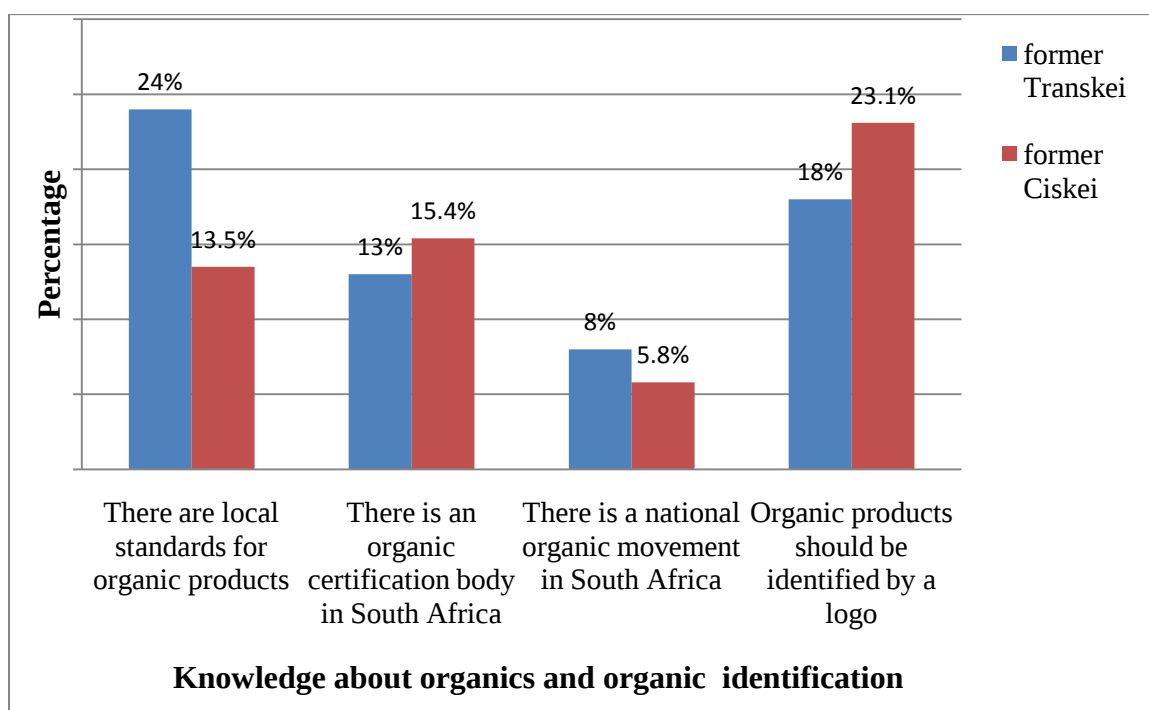


Figure 8.19: Consumer knowledge about organic products and standards in the former homelands

According to the results in Figure 8.19, there appears to be low awareness of organic products in as far as all but these basic facts are concerned both areas. Only 24% of the consumers in the former Transkei were aware that there are local standards for organic products while in the former Ciskei this was 13.5%. A total of 18% of the consumers in the former Transkei and 23.1% of consumers in the former Ciskei were aware of the fact

that organic products should be identified by a logo. While 13% of the consumers in the former Transkei were aware that there is an organic certification body in South Africa, in the former Ciskei 15.4% of the consumers were aware (Figure 8.19). Lastly, only 8% of the consumers in the former Transkei were aware that there is a national organic movement in South Africa while in the former Ciskei, this was represented by 5.8%. Figure 8.20 depicts the consumer knowledge about organic products and standard in rural, peri-urban and urban areas

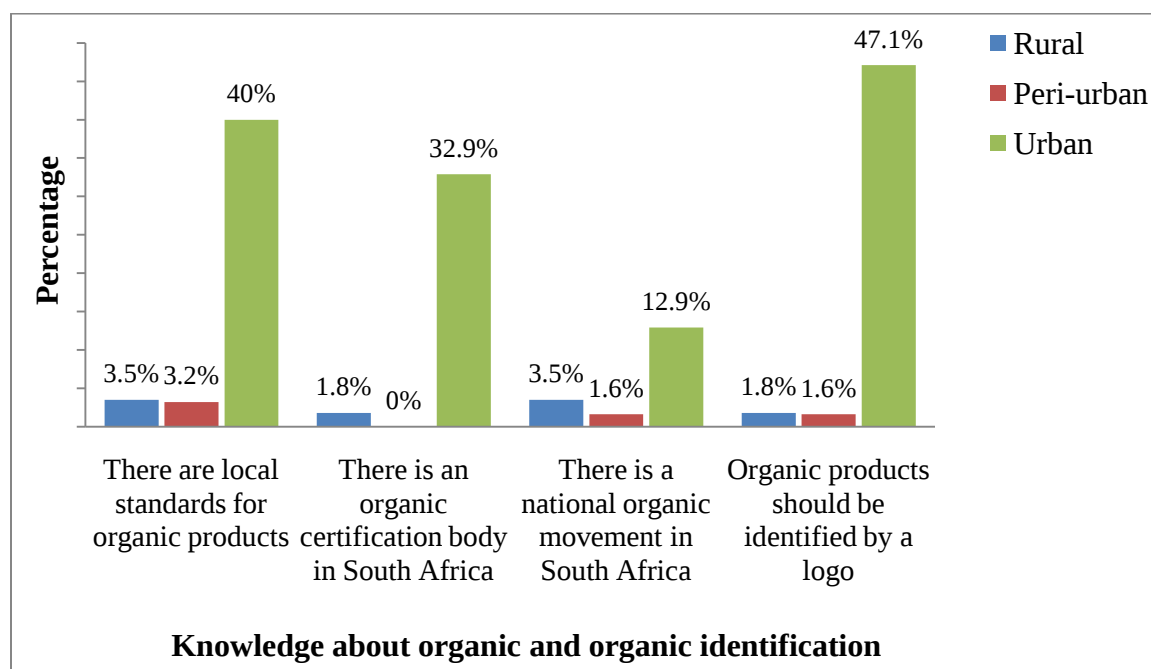


Figure 8.20: Consumer knowledge about organic products and standard in rural, peri-urban and urban areas.

Consumer knowledge and awareness among rural and peri-urban consumers on (i) the local standards of organic products; (ii) certification bodies for organic products in South Africa; (iii) the national organic movement in South Africa; (iv) and consumers' ability to identify organic logos in the market was very low with less than 5% of the consumer aware of any of these facts and information (refer to Figure 8.20). However in the urban areas, there is greater awareness, as 40% of the consumers were aware that there are local standards for organic products, 32.9% of the respondents were aware that there is an organic certification body in South Africa, 47.1% of the consumers are aware that

organic products should be identified by a logo and only 12.9% of the consumers in the urban area are aware that there is a national organic movement in South Africa (Figure 8.20).

8.3.3 Label knowledge among Eastern Cape consumers

Table 8.2 presents the findings of the investigation into consumer's knowledge about logos/labels for organic food or whether their purchase and consumption of organic food is done irrespective of the label. The labels presented in Table 8.2 are that of ECOCERT, FAIRTRADE, AFIT and AFRISCO. These were obtained from web research. **ECOCERT** is an organic certification organization, founded in France in 1991. It is based in Europe but conducts inspections in over 80 countries, making it one of the largest organic certification organizations in the world. This logo is mainly used for organic exports. **FAIRTRADE** is an international label and global movement that aims to improve production and trading conditions to benefit smallholders, farm workers and disadvantaged employees and artisans. By choosing products carrying the FAIRTRADE label, consumers aim to support farmers, their families and communities in receiving more stable and secure incomes, better working conditions, and enhanced investment in quality and local environmental sustainability. The label does not represent organic products or certification.

The Association for Fairness in Trade (**AFIT**) is a membership organisation that aims to provide a platform for better engagement of Fairtrade small-farmer and farm-worker organisations in the system that is supposed to serve Fairtrade beneficiaries. It is a network of which the Environmental Monitoring Group (EMG) acts as secretariat and organiser. The EMG is a not-for-profit non governmental organisation based in Cape Town, South Africa. It does not represent any form of organic products or certification. **AFRISCO** represents Africa's Farms Certified Organic for the South African market. AFRISCO organic certification is accredited by the International Federation of Organic Agriculture Movements (IFOAM), which is the international umbrella body and standard setter for the sector.

Table 8.2: Logo/label recognition by Eastern Cape consumers

Label	Do you know this label?		Does it represent organic products?	
	Former Transkei	Former Ciskei	Former Transkei	Former Ciskei
	Yes...3.1% No...96.9%	Yes...15.4% No...84.6%	Yes...1% No... Don't know...99%	Yes...12.5% No...1.9% Don't know...85.6%
	Yes...1% No...99%	Yes...9.6% No...90.6%	Yes... No...1% Don't know...99%	Yes...3.8% No...4.8% Don't know...91.3%
	Yes...4% No...96%	Yes...8.7% No...91.6%	Yes...4% No... Don't know...96%	Yes...5.8% No...4.8% Don't know...89.4%
	Yes...5% No...95%	Yes...18.3% No...81.7%	Yes...3% No... Don't know...97%	Yes...15.4% No... Don't know...84.6%

According to Table 8.2 the majority of consumers was not aware of the logos or labels and did not know if they represented organic products. Most of the consumers had seen the logo for the first time during the survey. These results suggest that consumers in the Eastern Cape are not readily informed about true organic labels and hence cannot readily identify certified organic products from non certified organics or even conventional products. There may be attributed to non standardization of the national organic labelling

system on products for consistency across the country. Similarly, the results suggest that while awareness about organic products is certainly increasing in South Africa, the understanding of certification and differentiation of organic from conventional products is not quite as advanced. Few would argue that the labelling of products as “organic” has played a vital role in establishing organics in the marketplace in South Africa, let alone the Eastern Cape. There have been some reported incidents in the media where unscrupulous retailers have labelled products still in the conversion phase as “organic”. This may distort the perception of the consumer who unsuspectingly may purchase these products with the understanding they are organic whilst they are not purely organic.

The current knowledge base of consumers is a significantly limits the size of the domestic market. Awareness of organic labels is vital if organic products are to continue to attract market premiums. Organic certification and subsequent labelling address a growing worldwide demand for organic food. It is intended to assure quality and prevent fraud, and to promote commerce. While such certification was not necessary in the early days of the organic movement, when small farmers would sell their produce directly at farmers' markets, as organics have grown in popularity, more and more consumers are purchasing organic food through traditional channels, such as supermarkets. As such, consumers must rely on third-party regulatory certification.

For organic producers, certification identifies suppliers of products approved for use in certified operations. For consumers, "certified organic" serves as a product assurance, similar to "low fat", "100% whole wheat", or "no artificial preservatives". Certification is essentially aimed at regulating and facilitating the sale of organic products to consumers. Individual certification bodies have their own service marks, which can act as branding to consumers - a certifier may promote the high consumer recognition value of its logo as a marketing advantage to producers. Most certification bodies operate organic standards that meet the government's minimum requirements.

8.3.4 System for verification and certification of organic products

According to Table 8.3, the majority of the consumers sampled responded that there is a need for verification and certification of organic products. In the former Transkei, 80% of the consumers alluded to the need for verification and certification of organic products, while in the former Ciskei, 66.1% of the consumers acknowledged the need for verification and certification of organic products. Whereas the majority of the rural consumers (50.8%) did not know about organic product verification and certification, 47.4% of these consumers supported the need for verification and certification of organic products. A total of 70.5% of peri-urban consumers and 91.8% of urban consumers also supported the need for verification and certification of organic products (Table 8.3).

Table 8.3: System for verification and certification of organic products

Verification/certification	Former Transkei (%)	Former Ciskei (%)	Rural (%)	Peri-urban (%)	Urban (%)
Yes	80	66.1	47.4	70.5	91.8
No	2	1.9	1.8	3.3	1.2
Don't know	18	32	50.8	26.2	7.1

Source: Field Data, 2011

A further analysis presented in Figure 8.21 below indicates that the majority of consumers 42.2% in the former Transkei and 44.8% in the former Ciskei conceded that independent companies should be responsible for verification and certification of organic products. A total of 34.9% of the consumers in the former Transkei and 35.8% of the consumers in the former Ciskei conceded that the Government should be responsible for the verification and certification of organic products.

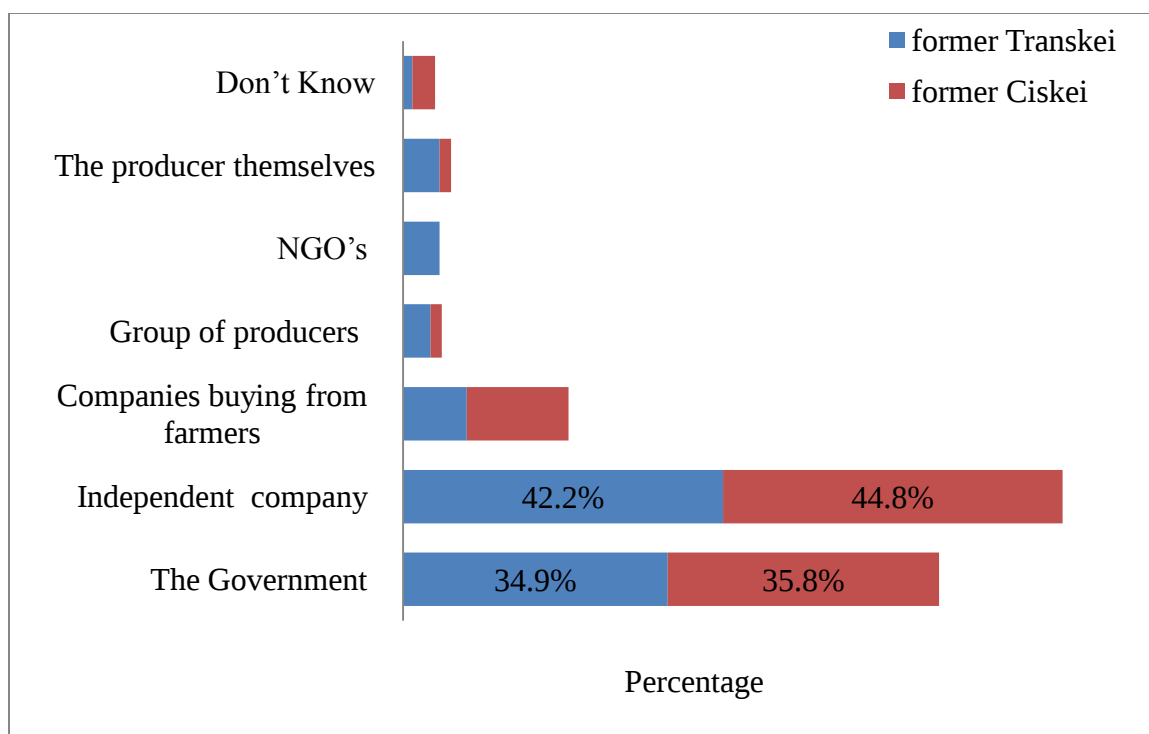


Figure 8.21: Provision of verification/certification services for consumers in the former homelands

Figure 8.22 below, shows that the majority of the consumers among the rural, peri-urban and urban respondents supported an independent company to be responsible for verification and certification of organic products. A total of 43.3% of rural consumers, 44.2% of peri-urban consumers and 42.9% of urban consumers conceded that an independent company should be responsible for certification. While 40% of rural consumers felt the Government should be responsible for verification and certification, 27.7% of peri-urban and 37.7% of urban consumers supported the role of Government to undertake verification and certification of organic products (Figure 8.22).

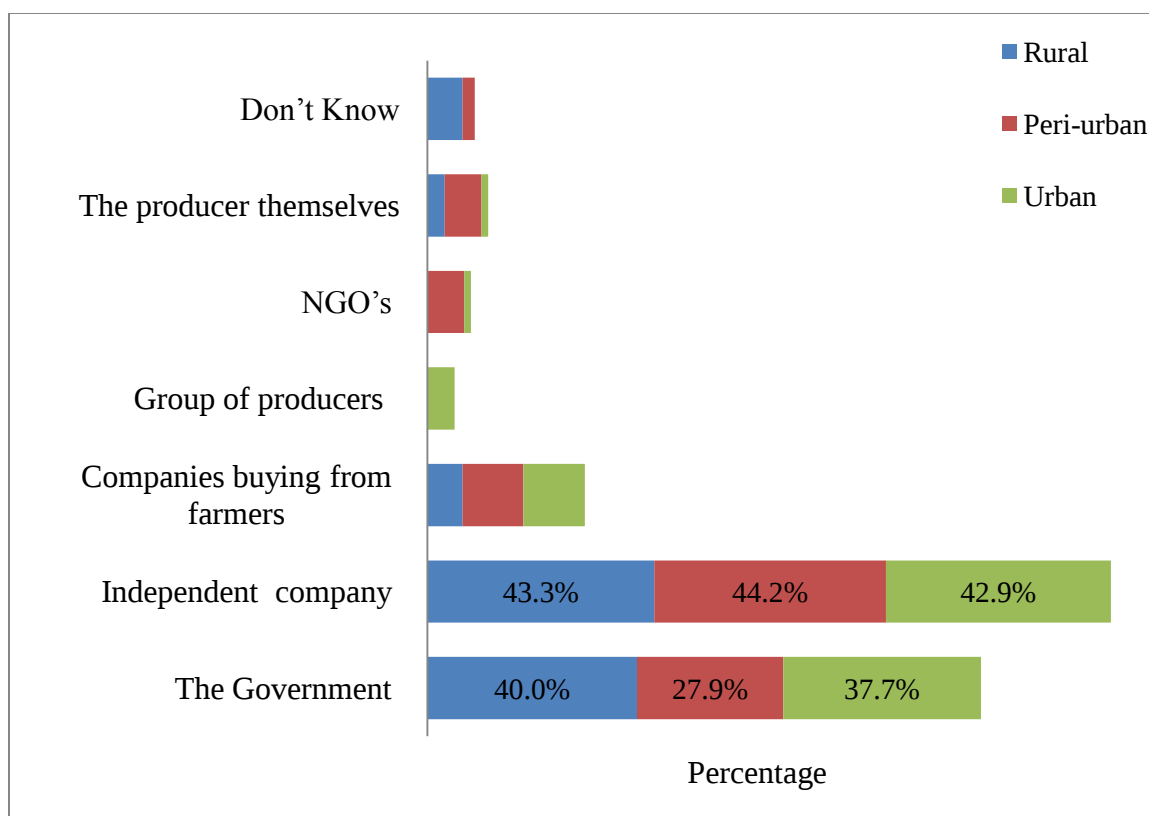


Figure 8.22: Provision of verification/certification services for consumers in the rural, peri-urban and urban areas

With the growth of the organic sector, and with more organic volumes in the market place and greater distance between producers and consumers, a guarantee on the nature of products becomes more and more important. What distinguishes an organic product, thus guiding consumers' choices and market trends, is precisely the organic label. Thus, organic certification is an essential step for the differentiation needed for the growth of organic agriculture and trust in the organic label is key to success. According to Muller (2006), the complexity of entering an organic certification system, let alone its associated costs, are increasingly marginalizing small producers from reaping market benefits. Different countries' regulations and requirements for organic certification bodies are creating trade barriers, especially for developing nations. Furthermore, the certification conditionality on the organic claim is hindering mass farm conversion into more sustainable systems especially in Africa where many organic smallholder organic farms are not certified.

8.3.5 Consumers perceptions on the price of organic products

The perception of consumers about the price of organic products is presented in Table 8.4 and ranged from reasonable to really high. A total of 37% of the consumers in the former Transkei perceived the price of organic products as reasonable while 42.7% of the consumers in the former Ciskei perceived the price of organic products as high (Table 8.4). An analysis among rural consumers revealed that the majority (29.8%) of the rural consumers did not know while 28.1% of the rural consumers perceived the price of organic products as really high. Among the peri-urban consumers, 37.7% perceived price of organic products as high while 52.9% of the urban consumers perceived the price of organic products as high (Table 8.4). The perception of the price of organic products as high is a deterrent to the purchase of organic products and hence the growth of organic industry especially given the fact that the South African organic market is in emerging phase.

Table 8.4: Perception about price of organic products

Perception	Former Transkei (%)	Former Ciskei (%)	Rural (%)	Peri-urban (%)	Urban (%)
Really high	22	18.4	28.1	21.3	14.1
High	31	42.7	12.3	37.7	52.9
Reasonable	37	12.6	19.3	27.9	25.9
Not high	9	1.9	5.3	3.3	7.1
Really not high	1	1.9	5.3	-	-
Don't Know	-	22.3	29.8	9.8	-

Source: Field Data

8.3.6 Consumers trust in labels of organic products

Table 8.4 presents the consumer's level of trust for organic labeled products. In the former Transkei, 51% of the consumer trusted the label on organic products, while only 9% fully trusted the label and 26% somewhat trusted the label. In the former Ciskei,

31.7% of the consumers somewhat trusted the label on organic products, while only 8.7% fully trusted the label and 26% trusted the label. The majority of the consumers in the rural areas (38.6%) did not trust the label while only 5.3% fully trusted the label. Among peri-urban consumers, 32.2% of the consumers trusted the label on organic products, 6.5% fully trusted the label and 37.1% somewhat trusted the label on organic products. The majority of the urban consumers (52.9%) trusted the label of organic products, 12.9% fully trusted the label on organic products and 27.1% somewhat trusted the label on organic products (refer to Table 8.5).

Table 8.5: Consumers' level of trust for organic labeled products

Perception	Former Transkei (%)	Former Ciskei (%)	Rural (%)	Peri-urban (%)	Urban (%)
Fully Trust	9	8.7	5.3	6.5	12.9
Trust	51	26	22.8	32.2	52.9
Somewhat trust	26	31.7	22.8	37.1	27.1
Not trust	11	19.2	38.6	8.1	4.7
Don't know	3	14.4	10.5	16.1	2.4

Source: Field Data

The consumers trust for organic labels confirms the findings in the survey that the most of the consumers (over 90%) are not aware of the organic labels in the market and hence are unable to make informed decisions on the organic status of products in the market. Trust of organic labels can be increased once more information is available to consumers on the various organic labels, their meaning and on the difference between certified and non certified products in the shelves. In the absence of this information, producers and likewise consumers may not get value for money.

To increase the consumption of organic products, it will be important to motivate new consumer segments to buy organic food. Hence trust is a crucial aspect when consumers decide whether to buy or not to buy organic products (Zanoli, 2004). The importance of trust in buying organic foods can be explained by the fact that consumers generally

cannot distinguish organic products from conventional ones by their appearance or taste. Neither before nor after purchase are consumers able to directly discern typical product attributes of organic food such as advantages for the environment, animal welfare or health. When buying organic food, they have to trust in the significance of the organic labels. Trust is a ‘credence attribute’ which is not directly observable by consumers. Enhancing consumers trust on the labels of organic products can be achieved through among others, effective communication strategies on the traceability of organic products and ensuring compliance and adherence by retailers selling organic products to the certification standards and availability of information on the organic status of products.

Some of the reasons advanced in the study to increase consumers trust for organic products is to:

- purchase from specific shops that sell organic
- check for organic certification label
- practice own organic farming

8.4 Consumer preference and consumption of organic products

This section addresses the buying behaviour of consumers in the Eastern Cape, the preference of shopping places, product preference among consumers, consumption of organic food by consumers and considerations consumers take into account when buying organic food.

8.4.1 Buying behaviour of consumers in the Eastern Cape

Food purchasing is an important part of food behaviours. In this study the apportioning, explicitly or tacitly, of the responsibility of household food shopping depends on a number of factors and was established during the survey with results presented in Figure 8.23. In the former Transkei, this responsibility was closely shared among various members of the household. A total of 33% of the respondents were responsible for the household food shopping, 31% of the respondents indicated that other members of the household were responsible for the household food shopping while 36% of the respondents indicated that this was a joint responsibility (Figure 8.23). In the former

Ciskei, a total of 53.8% of the respondents were responsible for household food shopping, compared to 27.9% of respondents who indicated that other members of the household were responsible for the household food shopping. Only 18.3% of the respondents indicated that it was a joint responsibility (Figure 8.23). This information is useful as it is an indication of the reliability and accuracy of the information provided on the organic consumer's awareness, attitude and market potential. The information shows that a majority of the respondents in the former homelands were responsible for the decision making of organic food demand and purchase.

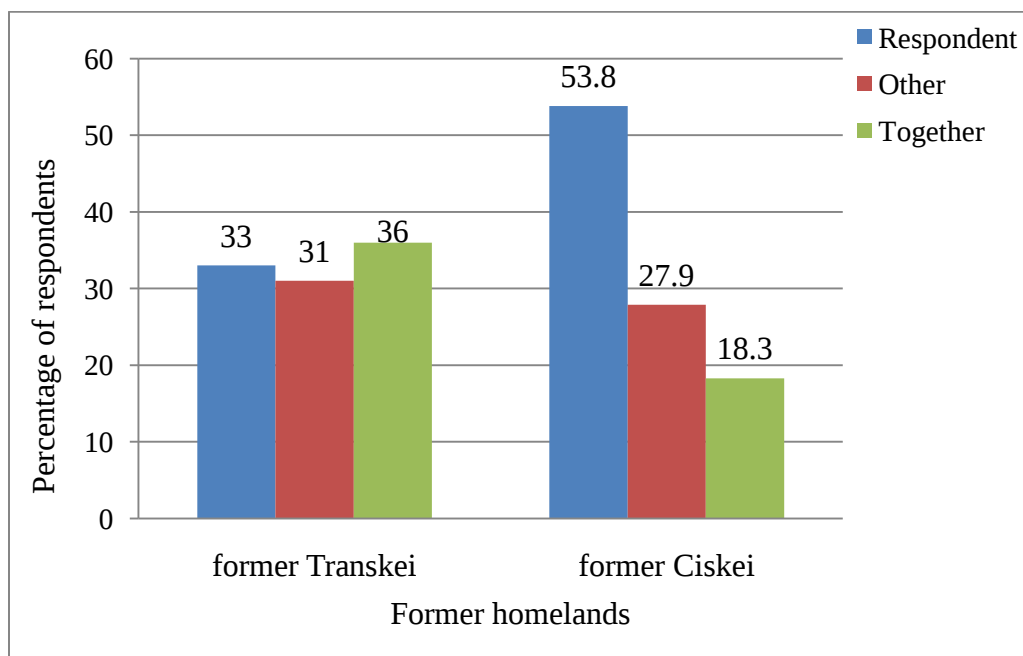


Figure 8.23: Person responsible for household food shopping in the former homelands

Similarly, according to Figure 8.24, the majority of the respondents in the rural and urban areas were principally responsible for household food shopping compared to the peri-urban area. In the rural areas 47.4% of the respondents were principally responsible for household shopping, while 21.2% of the respondents responded that this was done jointly with another member of the household. In the peri-urban areas, the majority of the respondents (43.5%) indicated that other members of the household were responsible for household food shopping, 35.5% indicated that they were principally responsible for household food shopping while only 21% of the respondents shopped with other

members of the household. The scenario in the urban areas shows that the majority of the respondents (47.1%) were principally responsible for the household food shopping, while 35.3% of the respondents shopped jointly with other members of the household compared to 17.6% who indicated that other members of the household were responsible for the household food shopping (Figure 8.24). The general trend is that the respondents had a major role to play in the household food shopping and decision making on the composition of the shopping basket.

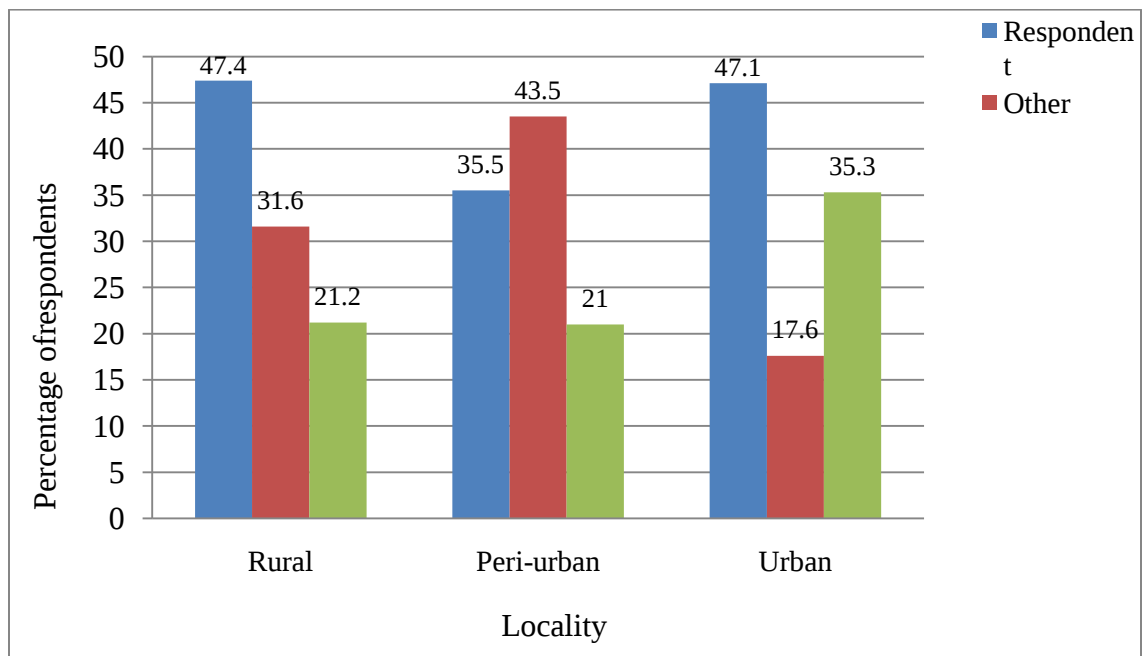


Figure 8.24: Person responsible for household food shopping in the rural, peri-urban and urban area

8.4.2: Preference of shopping places in the Eastern Cape

In order to establish the preferred shopping places for food, consumers were asked to indicate what shop they habitually bought their groceries from. Six places were identified from past research and studies as: supermarket, spaza shops (which are common in rural areas), grocery stores, farmers' markets example Kei Fresh produce in Mthatha or the farmers' market in Wilsonia, East London, Street vendors or the farm gate. Respondents were free to mark all the choices. The majority of the respondents; 96% in the former Transkei and 89.4% in the former Ciskei, indicated that they bought their food from supermarkets (Figure 8.25). In the former Transkei, this was followed by Spaza

shops represented by 56% of the respondents, Grocery stores represented by 38% and Street vendors represented by 21% of the respondents in the former Transkei (Figure 8.25). It is interesting to note that less than 2% of the respondents in the former homelands bought their food from the farm gate. This finding is consistent with information that has established the decline of agriculture generally in the province. In the former Ciskei, the second preference shopping place is the Grocery stores represented by 23.1% of the respondents, followed by Spaza shops represented by 11.5% of the respondents (Figure 8.25)

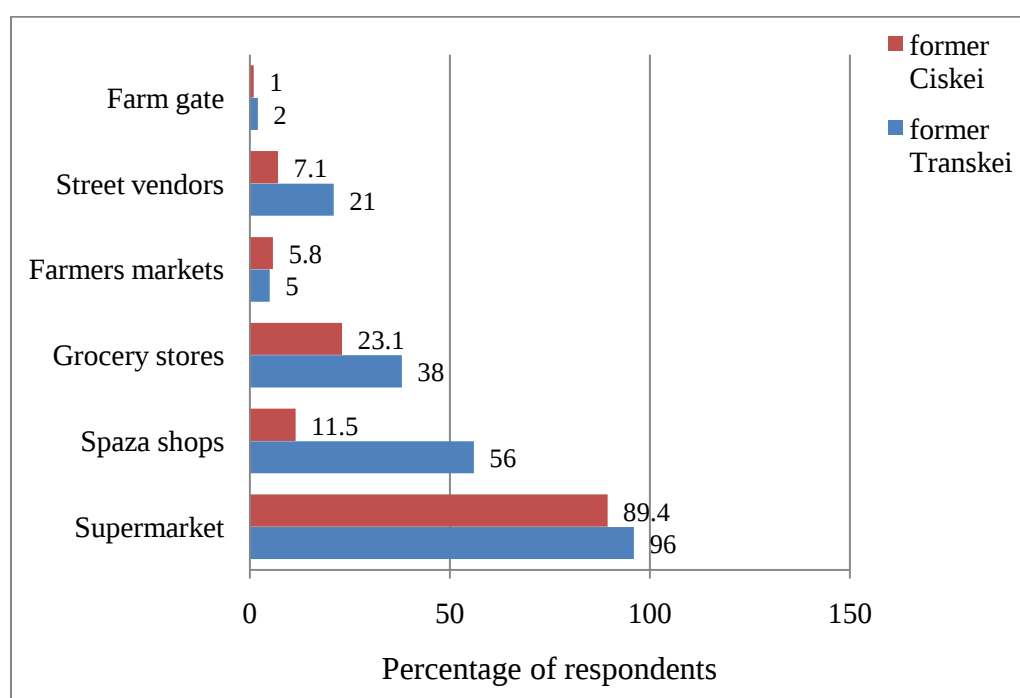


Figure 8.25: Consumers' current shopping place of choice in the former homelands

Figure 8.26 confirms the findings that the supermarket is the most preferred place of choice in rural, peri-urban and urban areas. A total of 91.2% of respondents in the rural areas shopped in supermarkets. In the peri-urban areas, a majority of 98.4% of the respondents shopped in supermarkets while in the urban areas a total of 89.4% of the respondents shopped in the supermarkets. Among rural respondents, the supermarket shopping place of choice is followed by spaza shops representing 56.1% and grocery stores representing 19.3%. The situation in peri-urban areas showed that the consumer's

second preferred shopping place of choice is spaza shops representing 37.1% and followed by street vendors representing 21%. The findings among urban consumers are not starkly different, with 48.2% of consumers shopping in grocery stores and 15.3% shopping in spaza shops (Figure 8.26). The general conclusion is that most consumers shop in supermarkets, grocery stores and spaza shops. The majority of consumers who shop in supermarkets reported that local shops do not provide the services people demand and that food choice and quality are limited. This is coupled with discount promotions common with supermarkets and variety of products. The findings from this study are consistent with findings from the Food Safety Agency (FSA) (2006) that state that a vast majority (92%) of consumers continue to use supermarkets for most of their food shopping. However, local shops play an important role in ‘top-up’ shopping, being used by 75% consumers for some of their food purchases.

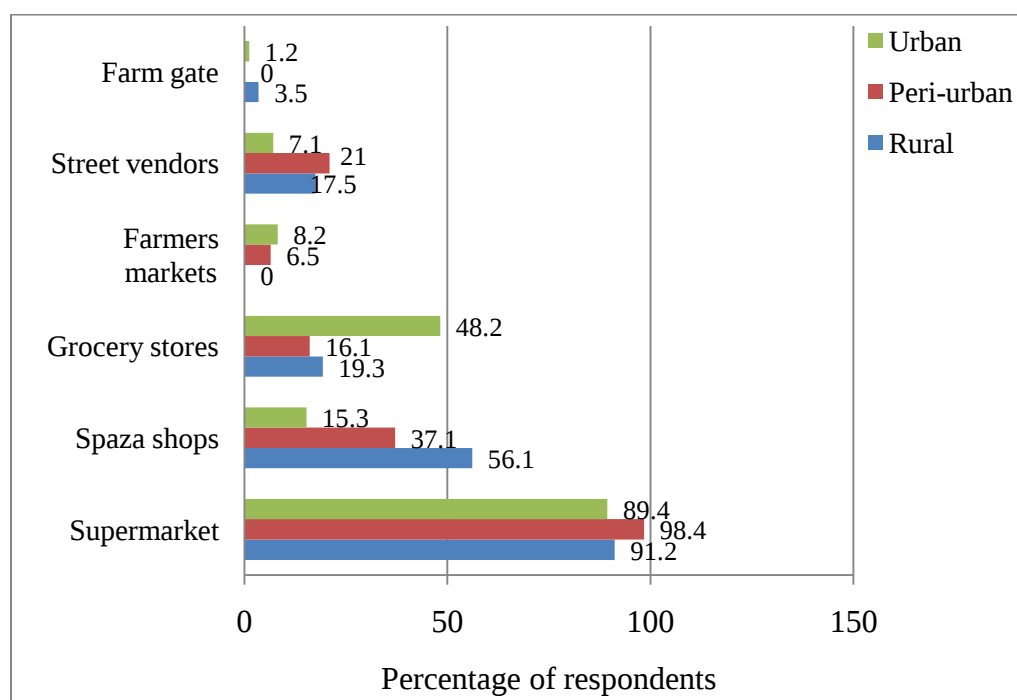


Figure 8.26: Consumers' current shopping place of choice in rural, peri-urban and urban areas

Figures 8.33 and 8.34 represent shopping places where consumers would prefer to buy organic food and shopping places consumers would like to see more in their areas. Interestingly the trend remains the same. Consumers were presented with the choices of

supermarket, greengrocers, restaurants and hotels, open air markets, farm gate and spaza shops. Consumers were at liberty to choose multiple responses. According to Figure 8.27, in the former Transkei in order of preference, consumers would like to buy more organic foods in supermarkets (72.1%), spaza shops/kiosks (43.1%) and open air markets (37.5%) (Figure 8.27). In the former Ciskei, in order of priority, consumers would prefer to buy organic food in the following order of priority: supermarkets (48%), on farm (44%) and spaza shops (38%) (Figure 8.27). Figure 8.28 shows supermarkets and spaz shps are the preffered shopping place of choice for rural, peri-urban and urban consumers. This is an indication once again the Supermarkets remain the preferred shopping place of choice for organic products. The role of spaza shops can also not be ignored as these are common in most locations in the Eastern Cape.

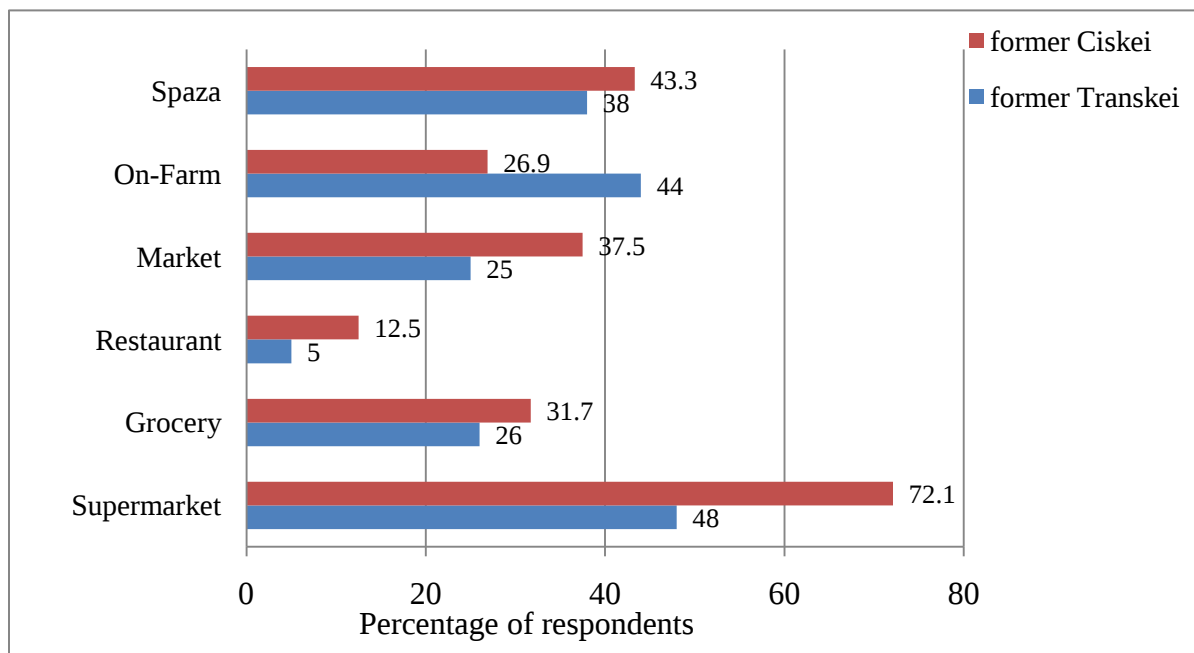


Figure 8.27: Consumers' preferred organic food shopping place in the former homelands

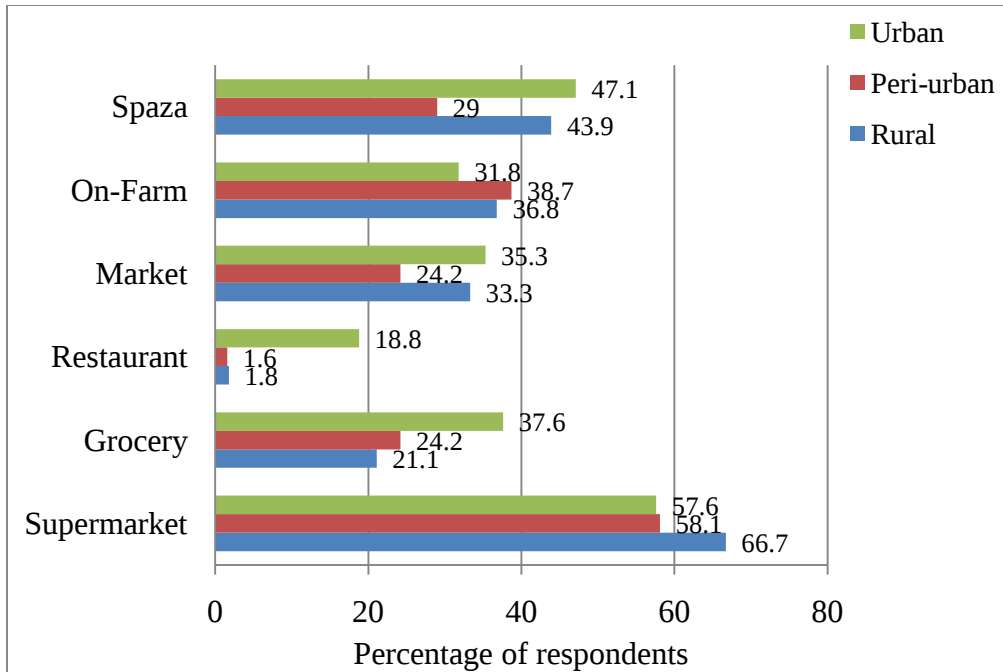


Figure 8.28: Consumers' preferred organic food shopping place in rural, peri-urban and urban areas

8.4.3 Product preference among consumers

Figure 8.29 shows the current organic consumption and demand for organic products. According to Figure 8.29 the majority of the respondents consumed organic fresh vegetables, fresh fruits, meat/meat products and milk/ milk products. In the former Transkei, 98% of the respondents consumed fresh vegetables while 85.6% of the respondents in the former Ciskei consumed fresh vegetables. Similarly 82% of the respondents in the former Transkei consumed fresh organic vegetables while 74% of the respondents in the former Ciskei consumed fresh fruits. The third most consumed organic product is meat and meat products with 76% of the respondents in the former Transkei consuming meat and meat products while 48.1% of the respondents in the former Ciskei consumed meat and meat products. Fourthly while 74% of the respondents consumed milk and milk product in the former Transkei, in the former Ciskei 41.3% of the respondents consumed milk and milk products. The four least consumed products in the former homelands are textile products, baby products, beverages and cereals (Figure 8.29).

The results presented in Figure 8.29 and 8.36 can be explained by the fact that the organic industry in South Africa is relatively new and the domestic market is limited in the variety of organic products available. In South Africa, food retailers have the largest share of the organic industry (Botha and Van Schalkwyk, 2006). Similarly, most products are sold through the export market due to the higher revenue from exports. Irwin (2002) says that South Africa has a favourable position for expansion in the domestic market as a result of the following developments in the organic sector over the past few years:

- establishment of separate organic section in major retail stores
- national regulation/standards for organic products
- establishment of South Africa organic certification bodies
- formation of South African organic associations.

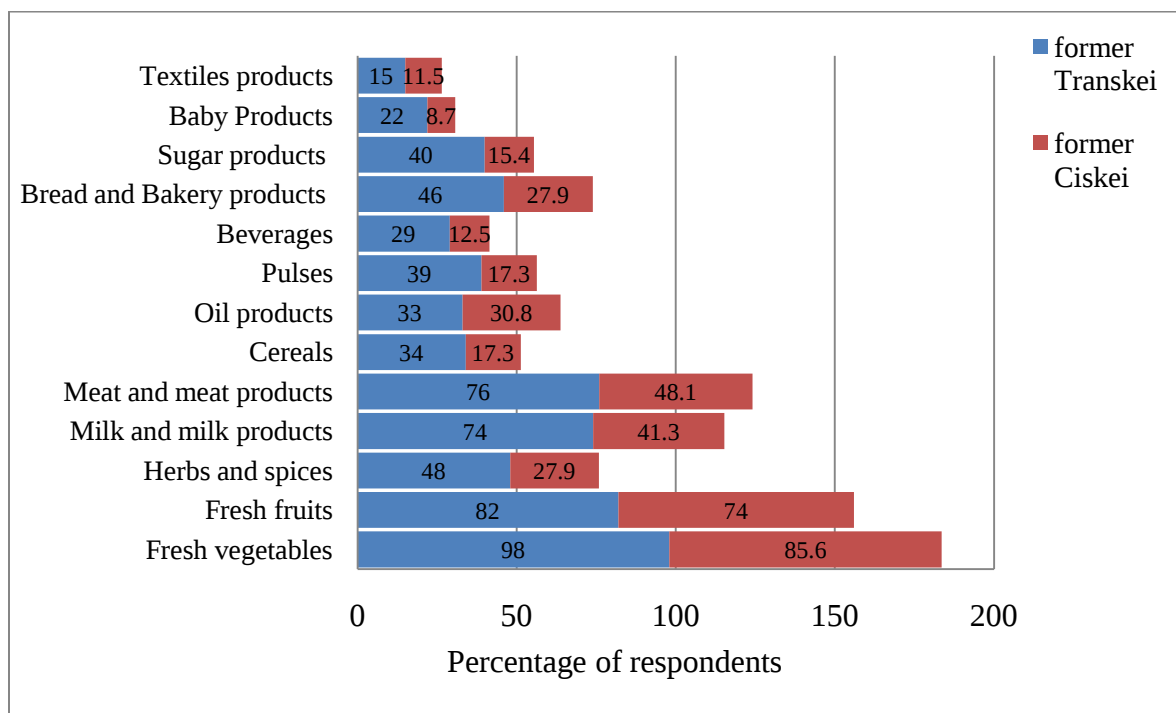


Figure 8.29: Product groups consumed today in the former homelands

The future potential demand for organic products in the former homelands is also shown in Figure 8.30. The trend in Figure 8.30 showed that the four products with the highest potential demand in the former Transkei and the former Ciskei in order of priority are Fresh vegetables (99% and 74% respectively); fresh fruits (90% and 71.2%

respectively); milk and milk products (89% and 67.3% respectively); and meat and meat products (89% and 65.3% respectively). According to Figure 8.30, all the organic products have a potential increase in demand in the future.

There was particularly an increased potential demand in textile products (36% in the former Transkei and 29.8% in the former Ciskei), baby products (56% in the former Transkei and 33.7% in the former Ciskei), beverages (62.2% in the former Transkei and 26% in the former Ciskei) and cereals (70% in the former Transkei and 45.2% in the former Ciskei). Generally the trend in Figure 8.30 shows that there are marked increases in the future demand of all organic products. This augurs well for the growth of the organic industry in the Eastern Cape and in South Africa in General. The findings of this study are consistent with Vermeulen and Bienabe (2007) who stated that a study by Pick'n Pay, one of the major national retail supermarket chains and supporter of the development of the retail organic market in South Africa, on the performance and trends of fresh organic produce showed that fresh produce completely dominated the sales.

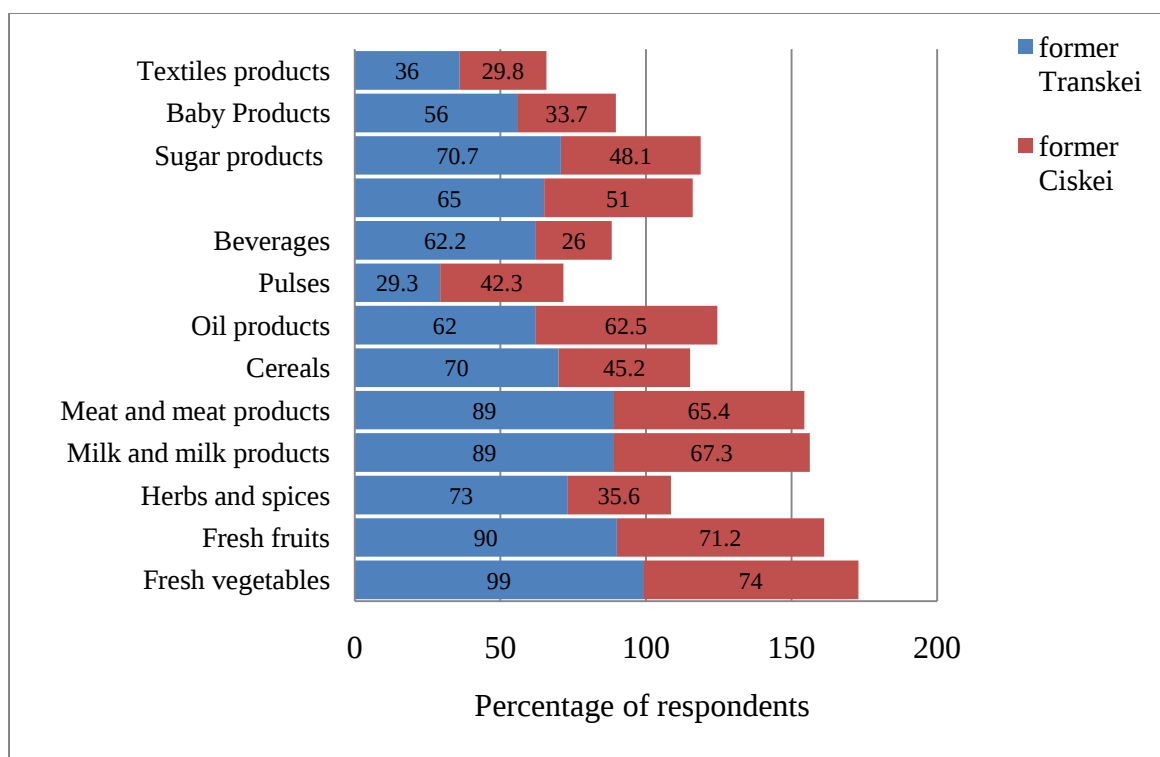


Figure 8.30: Product groups that will have demand in the future in the former homelands

A further analysis of the magnitude of the demand differences between products consumed today and the potential demand for organic products in the former homelands is presented in Figure 8.31 and Figure 8.32. It is evident from Figure 8.31 that there will be a marked increase in demand for fresh vegetables, fresh fruits meat and meat products and milk and milk products in the former Transkei. The trend shows an increase in demand in all the other organic products in future in the former Transkei. Similarly in the former Ciskei as depicted in Figure 8.32, an increased demand is noted for fresh vegetables, fresh fruits, meat and meat products, milk and milk products. The general trend shows that there also will be an increased demand in all other organic products in the future. This is evidence that the market for organic products is becoming mature in the Eastern Cape. According to EPOPA (2006) the growth in the organic sector has been paralleled and promoted by the public's increasing awareness of health and lifestyle issues – for example homeopathy and 'alternative' medicines, including nutritional supplements.

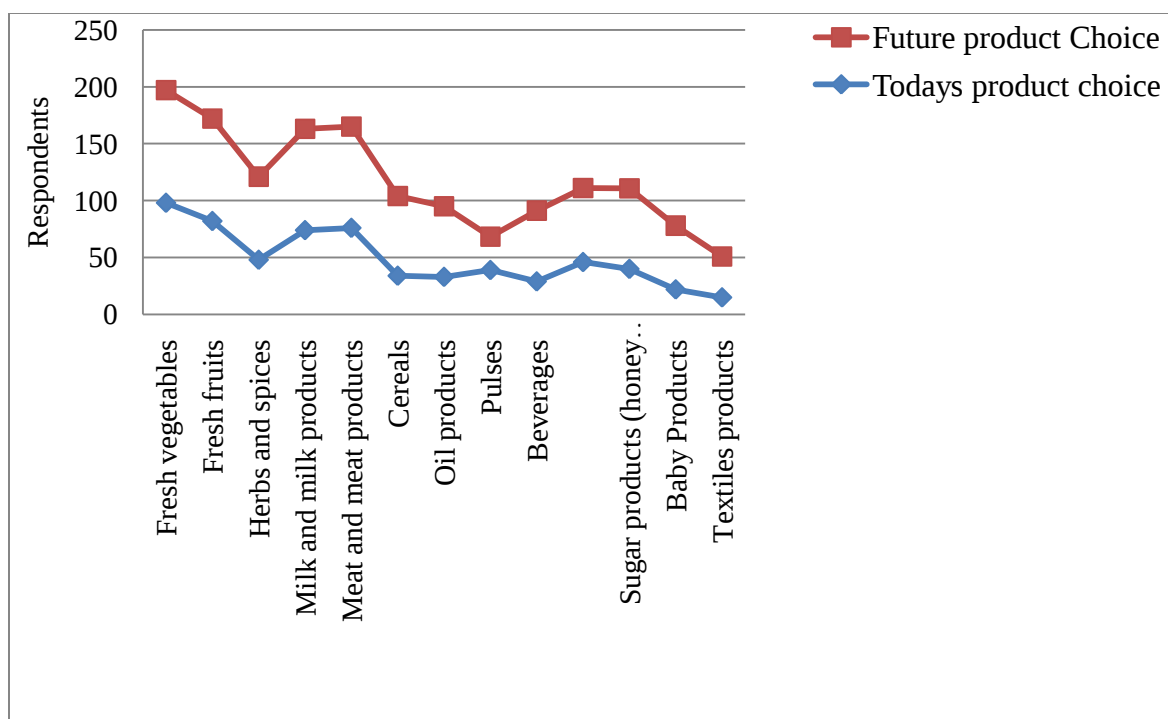


Figure 8.31: Demand difference between organic products today and in the future in the former Transkei

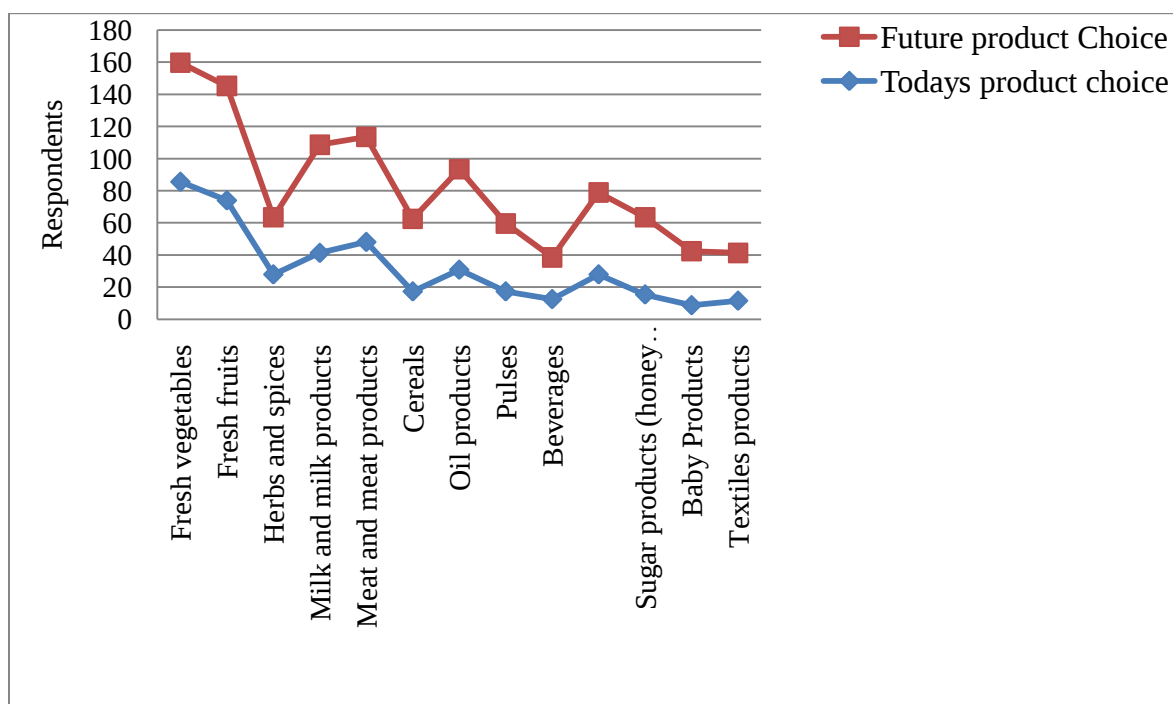


Figure 8.32: Demand difference between organic products today and in the future in the former Ciskei

8.4.4. Consumption of organic food by consumers

The success with organic foods depends on consumer acceptance and use. The study sought to establish the level of consumption and its implication to the growth of the organic market. Consumers were asked to indicate if they had ever consumed organic foods or had considered consuming organic foods and also if the converse was the case. The consumption of organic food is shown in Figures 8.39 and 8.40. According to Figure 8.33, a total of 56% of the respondents have ever consumed organic foods in the former Transkei while 66% have ever considered consuming organic food. A total of 5% of the consumers have not consumed or considered to consume organic food. A total of 29% of the consumers in the former Transkei did not know as they could not differentiate between organic and conventional foods during purchase. In the former Ciskei, the results indicate that 35.6% of the consumers had ever consumed organic food while 61.6% had considered ever consuming organic food. Those who had not consumed or considered consuming organic food constituted 22.1 % (Table 8.39). Furthermore, a total of 15.4% did not know due to their inability to differentiate organic and non organic products during purchase (see Figure 8.33). It is interesting to note that those who had never consumed or never considered consuming organic products, it was now quite important to them to consume organic products after learning about organic products. This is an indication that the consumption of organic products is closely related to consumer awareness and knowledge of organic products. Once again the importance of increasing awareness about organic products to consumers is important to increase the demand.

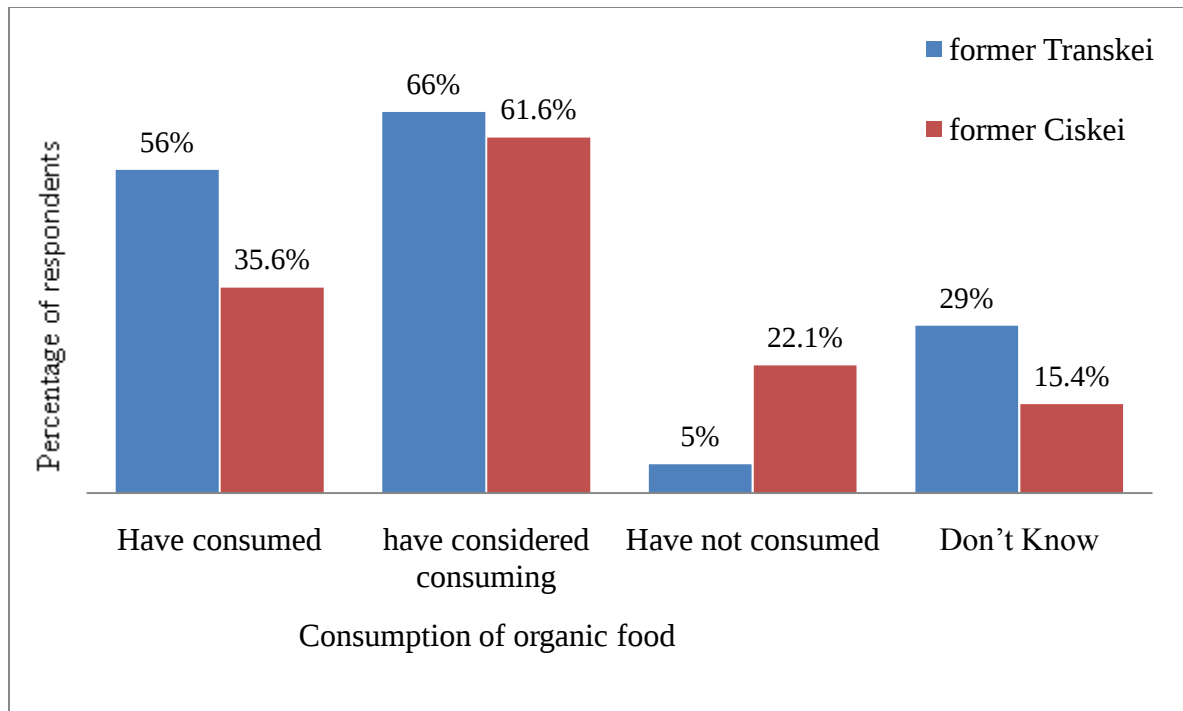


Figure 8.33: Consumption of organic products in the former homelands

Figure 8.34 depicts the consumption of organic foods among rural, peri-urban and urban consumers. While 26% of consumers in the rural areas had consumed organic foods, 52% in the peri-urban areas indicated they had consumed organic food while 54% of the respondents in the urban areas had consumed organic food. Similarly, respondents that had considered consuming organic foods constituted 12% of those in the rural areas 18% in the peri-urban areas and 22% in the urban areas. A total of 18%, 11% and 13% of consumers in the rural, peri-urban and urban areas respectively had never consumed or considered consuming organic food. It is important to note that a large percentage (44%) of consumers in the rural areas did not know (Figure 8.34). This could be attributed to their inability to differentiate between organic and non-organic products.

Briz and Ward (2009) state that consumer awareness of organic foods is the first step in developing demand for organic products. Yet, awareness does not necessarily equate with consumption. While organic refers to the way agricultural products are grown and processed (Organic Trade Association OTA, 2007), interest in consuming organic products may relate to food safety concerns where organic products may be a partial

answer to recent food scares associated with production and handling (e.g., BSE, dioxins, Salmonella, etc.). Food safety issues have driven consumers to search for safer foods whose qualities and attributes are guaranteed (Zalewski and Skawi_ska, 2006).

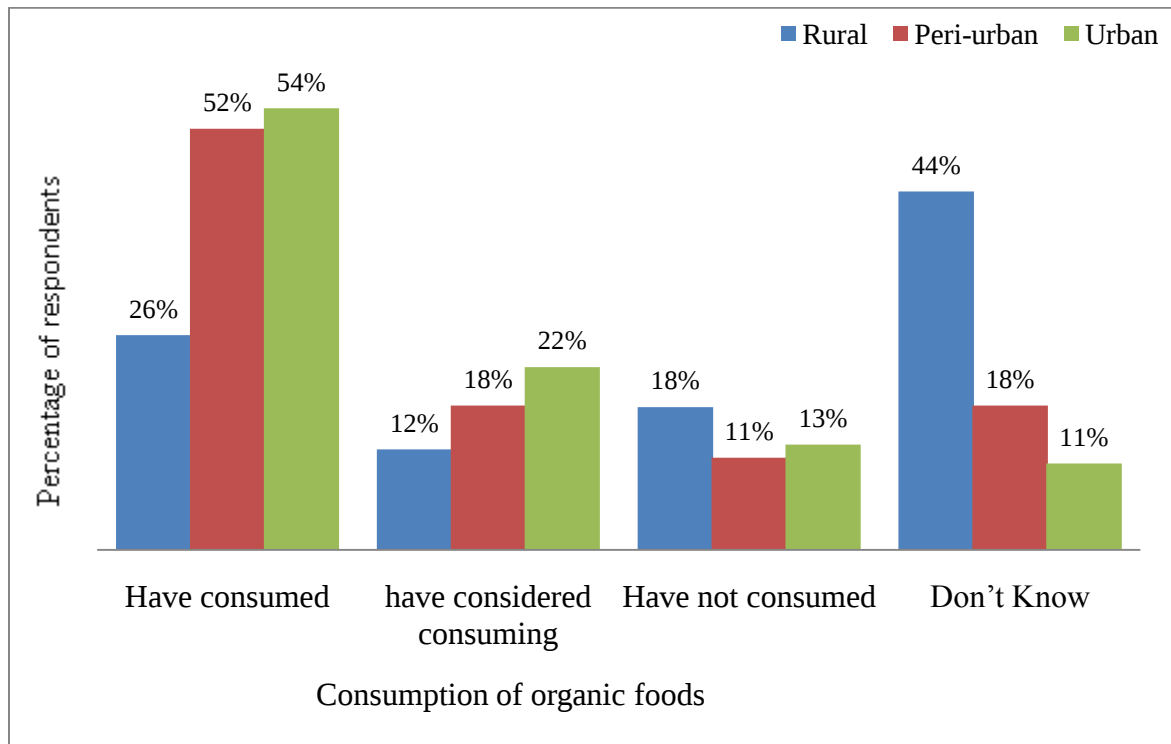


Figure 8.34: Consumption of organic products in rural, peri-urban and urban areas

The success with organic foods depends on consumer acceptance and use. Potential consumers may not even be aware of organic foods or may have the wrong perception even when aware. More knowledge could lead to increased use of organics due to the link between awareness and purchases. Briz and Ward (2009) argue that while awareness is based on consciousness, consumption requires an explicit buying commitment that should be influenced by price and appropriate measure(s) of the organic quality. These may be important attributes to consider increasing organic food consumption.

Table 8.6 presents the distribution of respondents and their reasons for consuming or not consuming organic products. As shown in Table 8.6 below, the four main reasons advanced for consuming organic products in the former Transkei are that they:

- (i) are healthy and nutritious (89.4% of the consumers);
- (ii) have a better appearance and taste (77.3% of the consumers);
- (iii) are affordable (68.2% of the consumers); and
- (iv) are safe to consume (56.1% of consumers).

Table 8.6: Reasons for consuming or not consuming organic products

Reasons for consuming organic products	Former Transkei %	Former Ciskei %	Rural %	Peri-urban %	Urban %
They have better appearance and taste	77.3	30.8	68.2	56.8	47.4
They are healthy/Nutritious	89.4	83.1	86.4	90.9	83.1
They are safe to consume/not contaminated	56.1	27.7	22.7	36.4	52.3
They are affordable	68.2	9.2	54.5	43.2	30.8
I had more income	3	1.5	-	2.3	3.1
They are more accessible to the market	15.2	9.2	4.5	18.2	10.8
They are good for the management of illness	22.7	35.4	27.3	36.4	24.6
They are environmentally friendly	16.7	13.8	-	6.8	26.2
There are more products from the local region	6.1	7.7	9.1	2.3	9.2
There is more trust to the origin/production	9.1	15.4	-	13.6	15.4
Because friends are doing so	7.6	16.9	9.1	9.1	15.4
Because saw it advertised on TV or heard on radio	7.7	27.7	9.5	15.9	21.5
Reasons for NOT consuming organic products	former Transkei %	former Ciskei %	Rural %	Peri-urban %	Urban %
They are not tasty	20	-	10	-	-
They are not healthy/nutritious	-	-	-	-	-
They are unsafe	-	-	-	-	-
They are expensive	60	54.2	20	62.5	81.8
They are not readily available	60	70.8	80	62.5	63.6

In the former Ciskei, consumers noted that the four main reasons for consuming organic products as shown in Table 8.6 below, were that they:

- (i) are healthy and nutritious (83.1% of consumers);
- (ii) are good for the management of illness (35.4% of consumers);
- (iii) have a better appearance and taste (30.8% of the consumers) and
- (iv) are safe to consume (27.7% of the consumers) and
- (iv) saw them advertised on television or radio (27.7% of consumers)

Similar reasons were advanced among rural, peri-urban and urban consumers (see Table 8.6). This is an indication of a convergence on the consumers' knowledge and awareness about organics. Similarly there was a convergence among consumers across the former homelands, rural, peri-urban and urban consumers on the reasons for not consuming organic products. The two main reasons advanced by consumers in the former homelands as well as the rural, peri-urban and urban areas are that organic products are expensive and they are not readily available (see Table 8.6).

8.4.5 Consideration by consumers when buying organic food

The consideration of consumers in buying organic food was noted and these results are depicted in 8.7. Table 8.7 shows that price and subsequently the affordability of organic products was ranked as the most important consideration among all consumers interviewed in the Eastern Cape. There is a general perception among consumers that organic products are expensive and unaffordable. In the former Transkei, health and nutritional value, quality and packaging were ranked 2nd and 3rd respectively. In the former Ciskei, the price was followed by the quality of organic products, health and nutrition, and certification ranked 2nd, 3rd and 4th respectively (see Table 8.7) Table 8.7 further shows that rural consumers ranked in order of priority, price as the most important followed by the quality of organic products, health and nutritional value and packaging/size. For peri-urban consumers, price was also considered the most important factors in buying organic products followed by the quality of the organic products,

packaging/size, health and nutrition. Among the urban consumers price was again highlighted as the main factor followed by health and nutrition, quality of organic products and availability of organic products (Table 8.7).

Table 8.7: Consumers ranking of factors considered in buying organic products

Factors	Former Transkei	Former Ciskei	Rural	Peri-urban	Urban
Price/affordability	1	1	1	1	1
Quality	3	2	2	2	3
Packaging (size)	3	7	4	3	7
Information	7	6	6	6	5
Availability	5	5	5	8	4
Health/nutrition value	2	3	3	3	2
Certification	7	4	6	9	6
Environment	6	7	8	5	7
Support for local Farmers	7	7	8	6	7

These results in Table 8.7 show a similar trend among all the surveyed consumers in the ranking of price, quality, health and nutrition values, packaging/size and availability of organic products as key motivating factors in the purchase of organic products. Interestingly, the support for local farmers was not a major consideration among all consumers as was environmental considerations. This analysis implies that organic food products should be quite popular with consumers given that some of the reasons most people consume them are also some of the key considerations when purchasing food products in general. Noteworthy however that price/affordability is the most important consideration when shopping, hence organic food products need to be perceived as affordable in order to increase consumption by consumers.

8.5 Health and lifestyle conditions of consumers in the Eastern Cape

The health and lifestyle conditions identified among households in the Eastern Cape were hypertension/high blood pressure, cholesterol, diabetes, arthritis, cancer and skin conditions. Health benefits have been reported as a main motive for purchasing organic food (Yiridoe *et al.*, 2005). As consumers become more aware of food safety, nutrition and sustainability, consumer health takes centre stage. Health is the one aspect consumers are least willing to compromise. Figure 8.35 shows the lifestyle conditions that are present among household in the former homelands.

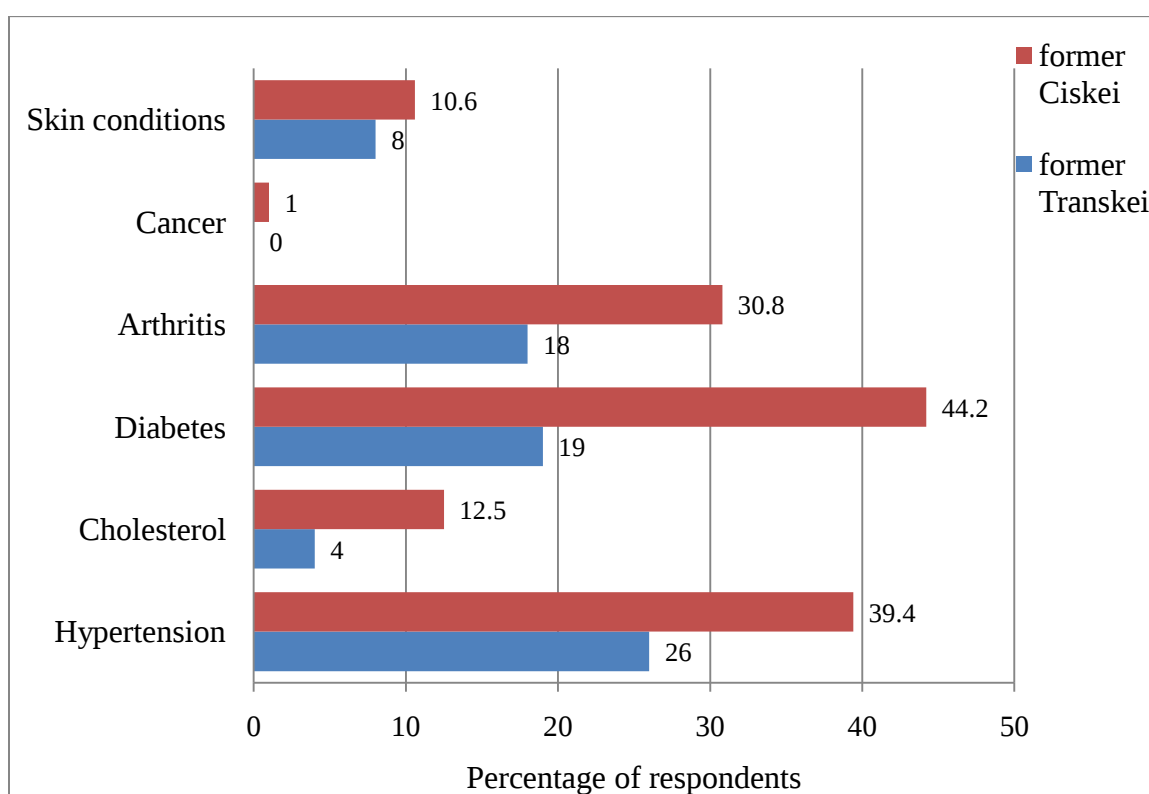


Figure 8.35: Lifestyle conditions present among households in the former homelands

In the former Transkei, the three lifestyle conditions identified among households are hypertension according to 26% of the consumers, diabetes among 19% of the consumers and arthritis among 18% of the consumers (Figure 8.35). Among the former Ciskei respondents, the three main lifestyle conditions identified by the respondents were diabetes among 44.2% of the consumers, hypertension among 39.4% consumers and

arthritis among 30.8% of the consumers (Figure 8.35). There was barely any cancer identified among households in the former homelands. A further analysis among rural, peri-urban and urban consumers shows that 47.7% of the consumers identified hypertension among their households followed by diabetes identified by 44.2% of the consumers and thirdly arthritis among 30.8% of the consumers (Figure 8.36). In the peri-urban area, the main lifestyle condition identified was diabetes among 43.5% of the consumers, arthritis among 37.1% of the consumers and hypertension among 29% of the consumers. In the urban areas, hypertension, diabetes and cholesterol were recorded among 25.9%, 24.7% and 14.4% of the consumers, respectively. Cancer was also barely existent among consumers in the rural, peri-urban and urban consumers (Figure 8.36).

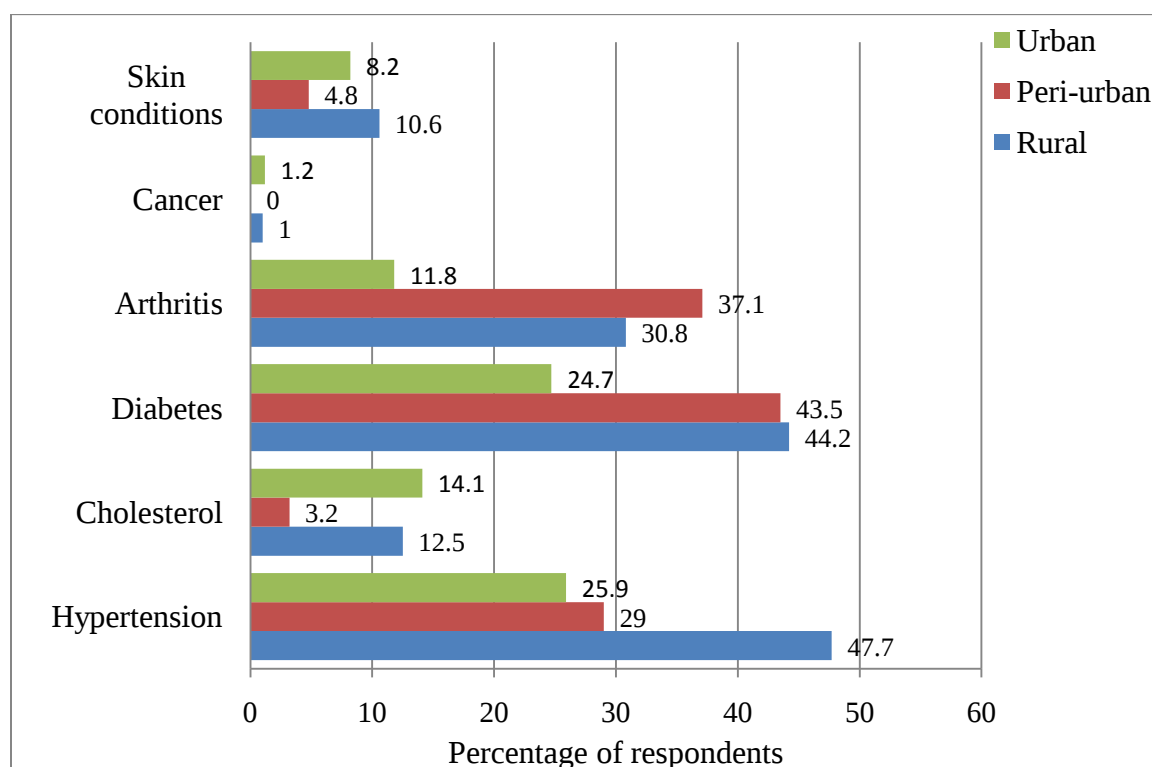


Figure 8.36: Lifestyle conditions present among rural, peri-urban and urban households

Lifestyle conditions that households considered important among respondents in the former homelands were hypertension, diabetes and cholesterol. This was also the case in the rural areas. Whereas in severe cases, medical attention is required to treat these lifestyle conditions, health and lifestyle choices are important for their management.

8.6 Factors affecting the consumer awareness of organic products

The results of the logistic regression that estimates consumer awareness of organic products are presented in Table 8.8 below. The results of the omnibus test of model coefficients were highly significant with p -value <0.001 . The Hosmer and Lemeshow test also supports the model as being worthwhile. Pallant (2007) argues that this test is the most reliable test for goodness of fit in SPSS. The chi-square value for the Hosmer and Lemeshow test is 7.542 with a significance level of 0.479. This value is greater than 0.05 indicating support for the model. The model as a whole explained between 30.5 percent (Cox and Snell R square) and 41 percent (Nagelkerke R square) of the variability in the consumer's awareness status.

The accuracy of classification was estimated at 74.8 % with the sensitivity of the model showing that 64.9 % of the consumers who are aware of organic products being correctly classified while the specificity of the model is 82.1 % (indicating that the consumers who are not aware of organic products have been correctly classified). The positive predictive value indicates that of the consumers predicted to be aware of organic products, the model accurately picked 72.6% (refer to Peat, 2001 and Wright, 1995). According to Table 8.8, the major factors influencing consumer awareness of organic products are: gender, education, employment, location, person responsible for shopping and the price perception.

Gender was statistically significant at 10% and negatively correlated to consumer awareness. These results imply that male were more likely to be aware about organic products than female. This can be attributed to access of information by males compared to females. Briz and Ward (2009) also found that males showed a slightly higher level of awareness than females. Education was positively correlated to consumer awareness and statistically significant at 1% level of probability. This results support previous findings that reported that consumers with higher level of education were more likely to be aware about organic products than those with low levels of education (Gracia and Magistris, 2008).

Table 8.8: Estimation of binary logistic regression for consumer awareness of organic products

<i>Variables</i>	<i>Parameter estimate</i>	<i>Std Error</i>	<i>Wald statistic</i>	<i>P-value</i>	<i>Exp(B)</i>
Age(1)	-.326	.795	.168	.682	.722
Age(2)	-.336	.800	.176	.675	.715
Age(3)	.183	.882	.043	.835	1.201
Gender(1)	-.992	.524	3.587	.058*	.371
Education(1)	2.537	.847	8.976	.003***	12.643
Education(2)	3.726	1.171	10.125	.001***	41.495
Household size	-.055	.100	.298	.585	.947
Children(1)	.913	.632	2.082	.149	2.491
Income(1)	-.327	.754	.189	.664	.721
Income(2)	-.799	.864	.854	.355	.450
Income(3)	-1.062	1.001	1.126	.289	.346
Employment(1)	-1.358	.825	2.711	.100*	.257
Location(1)	-.054	.720	.006	.940	.947
Location(2)	-2.665	1.118	5.685	.017**	.070
Distance	-.067	.090	.549	.459	.936
Person shopping(1)	-1.478	.731	4.089	.043**	.228
Person shopping(2)	.341	.606	.316	.574	1.406
Consumption(1)	-.340	.869	.153	.695	.712
Consumption(2)	-.502	.752	.445	.505	.606
Perception(1)	-.064	.750	.007	.931	.938
Perception(2)	1.385	.781	3.141	.076*	3.994
Trust(1)	-.599	.544	1.214	.271	.549
Constant	1.275	1.653	.595	.441	3.579
Observations:	<i>N</i> = 135				
Correct prediction	74.8	percent			
Cox and Snell R square	0.305				
Nagelkerker R square	0.410				
Hosmer and Lemeshow test					
Chi-square	7.542				
Significance	0.479				

***, **, * represent statistical significance at 1 %, 5 % and 10 % respectively

Briz and Ward (2009) revealed the profound importance of education in the organic food industry. They noted that education and awareness of organic foods showed a close linear relationship where the probabilities almost double between the lowest and highest levels of education. While the purchasing power of lower education level consumers may be limited, the potential payoff from promoting organic foods to the lower educated groups may produce marginal gains incrementally since their percentages are quite low. Employment was statistically significant at 10% level of probability and was negatively correlated to consumer awareness. This result is unexpected and may be explained by the fact that consumers with no employment would most likely use traditional methods of production due to the prohibitive costs of chemical inputs. In this study it was established that most of the consumers especially in the rural areas used traditional methods of production. In many instances, they understood this to be in line with organic farming practices. These consumers were thus more likely to be aware of organic products.

The location of the consumer is significant at 5% level of probability and positively correlated to organic awareness. Rural consumers were less likely to be aware about organic products than urban consumers. This can be attributed to the fact that organic products currently target a niche market which is the upper middle class and the modes of marketing the products through mass media are more accessible to urban consumers than rural consumers. The person responsible for shopping was statistically significant at 5% level of probability and positively correlated to organic awareness. Consumers who shopped jointly with other members' of the household were more likely to be aware of organic products than those who shopped alone. This can be attributed to discussions and sharing of information among shoppers on the different products available in the market. It also increases the chance of a purchase decision being made. The consumer's perception of price was statistically significant at 5%. Consumers who perceived the price of organic products as high were less likely to be aware of organic products than those who did not think the price of organic was high. This can be attributed to consumer's reluctance to consume organics due to perceived high prices and would shy away from organic products.

8.7 Determinants of the consumption of organic products among Eastern Cape Consumers

The results of the discriminant analysis are presented in Table 8.9 below. The estimated Linear Discriminant Function (LDF) coefficients show the relative importance of the independent variables because they are standardized and unit-free (Harris, 1985). The first Linear Discriminant Function (LDF1) in Table 8.9 identifies price perception and age of the consumer as the most important variables distinguishing the consumers who have never consumed organics against those that have consumed organics. This is likely because if the consumer perceives the price of organics as high they are less likely to consume organics. The contrary is true if the consumer perceives the price of organics as not exorbitant but reasonable. Price perceptions have been considered as an important factor in several studies that have been undertaken to determine consumers' willingness to pay for organics (Canavari, Nocella and Scarpa, 2003; Laroche, Toffoli, Kim and Muller, 1996). Some researchers, on the other hand, have found that organic food consumers are less likely to consider price as important compared to those consumers who have never purchased organic products before (Williams and Hammitt, 2000).

Cobo and Gonzales (2001) found that organic consumers were most likely between 25 and 54 years old. Thompson (1998) indicated that the highest percentage of consumers buying organics were aged 18 – 29 and 40 -49 years and the least likely were those over 60 years. This suggests that age is considered important and understanding the age dynamics and consumption of organics will go a long way in influencing the target market and marketing approach to drive the demand of organics. The second Linear Discriminant Function (LDF 2) identified the person responsible for shopping and the location of the consumer as discriminating factors between those who have never consumed organics and those that consider consuming organics. The person responsible for shopping is most likely to make the decision on the composition of the food basket and the location of the consumer will determine accessibility and trends within a given locality and will influence the consumer's decisions.

Table 8.9: Standardized discriminant functions distinguishing between consumers in the Eastern Cape

Discriminating variable	Standardised Coefficient Estimates		Group Means			Univariate F-Value
	Function 1 LDF1	Function 2 LDF2	Never consumed	Considered consuming	Have consumed	
Age	0.535	0.347	2.944	2.849	2.298	5.138***
Gender	0.156	-0.366	1.667	1.485	1.583	0.854
Education	-0.086	0.209	1.944	2.030	2.190	1.035
Household size	0.137	0.048	4.500	4.939	4.869	0.163
Children	-0.232	-0.223	0.611	0.606	0.738	1.252
Income	0.456	-0.064	2.556	2.606	2.583	0.013
Occupation	0.062	-0.016	0.556	0.576	0.595	0.055
Location	0.241	0.416	1.722	1.697	1.357	8.545***
Distance	-0.007	0.311	6.611	7.667	6.571	0.929
Person shopping	-0.188	0.809	1.111	2.030	1.952	9.409***
Awareness	-0.487	0.063	0.056	0.242	0.310	2.561*
Price perception	-0.671	0.042	1.667	1.939	2.333	8.176***
Trust	0.345	-0.063	1.611	1.515	1.345	2.985*
Wilk's lambda	0.583***	0.876				
Canonical correlation	0.579	0.352				
<u>Group centroids:</u>						
Never consumed	1.383	-0.602				
Considered consuming	0.551	0.585				
Consumed	-0.513	-0.101				
<u>Classifications:</u>						
Never consumed		83.3	percent			
Considered consuming		45.5	percent			
Have consumed		71.4	percent			

***, **, * denotes statistical significance at 1, 5 and 10 percent level of probability

The frequency distributions of the estimated discriminant scores for the two linear discriminant functions were all approximately normally distributed (refer to appendix 4), suggesting that the significance tests are reliable and can be accepted with reasonable confidence. The Wilk's lambda⁸ is a measure of the overall statistical significance of the Linear Discriminant Functions (Manly, 1986) and is statistically significant at the 1 percent level of probability for the LDF 1(refer to Table 8.9). This implies that the group means for the independent variables are different on the discriminating function and that the differences in the mean discriminant score are greater than can be attributed to

⁸ Wilks $\lambda_1 = [1 / (1 + \beta_1)]$ and Wilks $\lambda_2 = [1 / (1 + \beta_1)(1 + \beta_2)]$ where β_i is the eigen value

sampling error. The Wilk's lambda is statistically significant by the F-test for the age of the consumer, location, person responsible for shopping, consumer awareness of organics, price perception and label trust (Table 8.9). Further results from Table 8.8 show that the LDF1 accounts for 78.1 percent of the variation between the consumer groups. The group centroids are quite different for the three groups for each lineal discriminant function. The results show reasonable explanatory power, with the percentage of overall correct predictions estimated at 66.7 percent. The percentage of correct classification for each stratum is 83.3 percent for those who have never consumed organic, 45.5 percent for those who have considered consuming organics and 71.4 percent for those that have consumed organics (Table 8.9).

Similarly, according to the results in Table 8.9 the age of the consumer was statistically significant at 1 percent level of probability and positively correlated to consumption. This result indicates that older consumers were more likely to consume organics compared to younger consumers. This may be attributed to the fact that aging populations are more concerned with their health and hence more likely to purchase organics (Padel and Foster, 2005) as organic consumers are mainly those that are health conscious (Baker, Thompson and Engelken, 2004). The results support findings by Tsakiridou, Boutsouki, Zotos and Mattas (2008) who indicated that older consumers were more health conscious and willing to pay an extra price for organics. Clearly for the organic food industry, gains are needed among all age groups but particular efforts among the youngest generation may be incrementally more beneficial since their awareness levels are lower.

The location of consumer was statistically significant at 1 percent level of probability and was positively correlated to the consumption of organic products. The results show that consumers residing in the former Ciskei were more likely to consume or consider consuming organics compared to consumers residing in the former Transkei. The former Ciskei consumer was more readily exposed to organic products compared to the former Transkei consumer due to the cosmopolitan nature of the former Ciskei compared to the former Transkei. While the majority of the former Transkei is classified as rural, the

former Ciskei include economic and industrial hub of the province harbouring the major towns and airports and industrial zones. The provincial headquarters are also based in the former Ciskei. According to Briz and Ward (2009) predominantly rural areas are slightly less likely to be exposed to organic foods. The major organic retail markets are also based in the former Ciskei as are the organic farmer's markets for example Lavender Blue farmers market in East London which is popular with the selling of organic products.

The person responsible for household food shopping was statistically significant at 1 percent level of probability and negatively correlated with the consumption of organic food. The consumer who was personally responsible for the household food shopping was more likely to consume organics than if this was a joint responsibility. This could be attributed to personal consciousness and decision making with less external influence. Consumption of organics is more of an individual choice than a choice made jointly or after consultation. Again this will depend on, among other factors, personal preferences and personal circumstances.

Consumer awareness of organic products was statistically significant and negatively correlated to consumption of organic products. This finding supports several studies that have indicated that while consumer awareness of organic food is the first step in developing demand for organic products, awareness does not necessarily translate to consumption. Briz and Ward (2009) argue that while success with organic foods depends on consumer acceptance and use, potential consumers may not even be aware of organic foods or may have the wrong perception even when aware.

According to Rezai, Mohamed and Shamsudin (2011), more knowledge could lead to increased use of organics as suggested with the link between awareness and purchases. Yet complete knowledge does not assure continued increases in demand since potential consumers may discover attributes that differ little from non-organic alternatives. To the extent that demand for organics is based on credence attributes and consumer emotions, the linkage between awareness and consumption may be nonlinear and for some level of

awareness possibly not even positive (Briz and Ward 2009). That implies that the learning curve about organics may not always lead to increasing demand.

The price perception was statistically significant at 1 percent level of probability and negatively correlated to consumer awareness of organics. Whereas consumers generally conceded that the prices of organic were somewhat high to really high in the Eastern Cape, authors Aryal, Chaudhary, Pandit and Sharma (2009) argue that production and marketing strategies of organic products are determined by the willingness to pay a premium price. Dipeolu, Philip, Aiyelaagbe, Akinbode and Adedokun (2009) and Salleh, Ali, Harun, Jalil and Shahrudin (2010) further also confirmed findings that consumers are willing to pay more for organic foods or what could also be referred to as the ethical premium. This niche consumer is willing to pay an extra price for health and safety, animal welfare as well as the beneficial effect to the environment. Studies where health and environmental benefits were considered as the main factors in the consumption of organics include among others Hill and Lynchehaun (2002), Makatouni (2002) and McEachern and McClean (2002). These studies noted that consumers were willing to pay more for health, safety and environmental consciousness.

There was a positive and statistically significant relationship between consumers who trust organic food labels and the consumption of organic foods. Consumers who fully trusted organic labels were more likely to consume organics than those who were doubtful of organic food labels. Trust was statistically significant at 1 percent level of probability. This result supports findings by Krystallis and Chrysosoidis (2005) as well as Raab and Grobe (2005) who found that trust for regulatory authorities and brand labeling positively impacted on the purchase of organic foods. Trustworthy eco-labels provide consumers with valuable information on environmentally friendly products and thus promote green consumerism (Boström 2006). Boström and Klintman (2008) argue that low governmental involvement increases confidence and trust for eco-labels. In this study, the majority of the consumers responded that they would prefer verification and labelling of organic products to be done by an independent company. This suggests that government should just provide the basic legal framework for eco-labelling and leave the

rest to independents. Nilsson, Tunçer and Thidell (2004) state that independence of the verification and certification of organic products impacts positively on the consumer's confidence of the product and is an indication of the trust of the organic label.

8.8 Chapter summary

The chapter presents results of consumer awareness and market potential for organic products. The descriptive analyses showed that the majority of the consumers were females within 25-34 age category. The level of education was generally low especially among rural respondents. The unemployment rates in the former homelands demonstrates a substantial skewering of the demographic profile of the district and high dependency rates of those not economically and productively active. It also reflects the levels of out migration of economically active population from the province to other parts of South Africa. Unemployment was also lower in urban areas than rural areas. The income distribution of the respondents is especially concentrated in the R1000 – R5000/month category. However the majority of the respondents within this category were in the rural areas. This can be attributed to limited economic activity in rural areas. The household size was within the provincial estimate of 4-5 persons per household (PROVIDE, 2009) with rural households having higher numbers. Majority of the respondents had children under the age of 18 years in the household. The average distance to the nearest shops were estimated at between 6-9kms. In the urban areas however this was reduced to 1.38kms.

While most of the respondents were aware of what constituted organic foods (associating organic foods with health and nutrition, chemical free and produced using indigenous methods of production), there was low awareness of organic products among consumers with little or no knowledge on organic certification and standards. The general perception among respondents was that organic food prices are high but there was reasonable trust for organic labels among consumers. The consumer buying behavior showed that most respondents were responsible for household shopping with supermarkets topping preferred shopping areas due to availability of product variety and discounts. Fresh fruits and vegetables topped product preference among consumers with results indicating

that there is a growing demand for organic products in the future. Many of the respondents had consumed or considered consuming organic food with the main reason being appearance and nutrition. Some of the reasons advanced for not consuming organic foods included the high price and the fact they are not readily available.

The key factors consumers would consider when buying organic food include price, quality, health and nutrition. As consumers become more aware of food safety, nutrition and sustainability, consumer health takes centre stage. The main lifestyle conditions identified included hypertension and diabetes. Traditional taboos were not a common occurrence in the study area. According to the logit model the major factors influencing consumer awareness of organic products are the gender, education, employment status, location, person responsible for shopping and the price perception. The discriminant analysis showed that the consumption of organic products is significantly affected by age of the consumer, location, person responsible for shopping, consumer awareness of organics, price perception and label trust.

CHAPTER 9

SUMMARY AND RECOMMENDATIONS

9.1 Introduction

This thesis is structured in nine chapters that address the introduction and background to the study, literature review that covers the state of agriculture globally and in South Africa, agricultural technology adoption, risk and risk management, methodology, results and discussions and culminates in the summary and recommendations. The chapter begins with a summary of the introduction focusing mainly on the background, problem statement, research objectives and significance of the study. The summary on the state of agriculture underlines the global perspective with reference to the food and agricultural crisis and the response to this crisis. The case for organic farming and organic food is also presented. The summary on agricultural technology adoption in South Africa is also presented covering different adoption related issues. Further to this, an overview of risk and risk management is presented. The methodology has been summarized with regard to the study area, sampling procedure, data collection methods and instruments, variable specification and models for data analysis. The summary on the presentation of the results constitutes the determinants of organic farming adoption among smallholder farmers, risk and risk management by smallholder farmers and consumer awareness and market potential for organic products. This culminates into recommendations that address the policy implications and areas for further research.

9.2 Summary

The summary contextualizes the study by highlighting the state of agriculture, agricultural technology adoption, risk and risk management. Furthermore, it also gives an overview of the methodology used in the study and the results. The results highlight the outcome of analysis for the various models. These establish the determinants of organic farming adoption by smallholder farmers, risk and risk management by smallholder farmers and also present outcomes on consumer awareness and market potential for organic products. The recommendation of the study outlines the policy implications and areas for further studies.

9.2.1 The state of agriculture

The World Bank (2010) noted that food and nutritional security remain an issue of major global concern especially in developing countries. The global food and agricultural crisis which resulted in a sharp rise in food prices in 2007- 2008 further exacerbated the situation of the vulnerable and drew attention to the imperative to examine alternative food production questions. Because this global food crisis was widely attributed to the failure of food supply to meet rising demand, it prompted a number of high profile international initiatives to expand the global supply of food as well as its availability to poorer countries where chronic underinvestment in the agricultural sector has continued (FAO 2009b).

IFAD (2009a) has identified smallholder agriculture as the key to local and global food security and the engine for development and economic growth for most developing countries. Dano (2009) argues for a “truly *green* revolution” in Africa, based on traditional and local knowledge, integrating smallholder’s expertise and needs and taking into account regional diversities. Organic agriculture has been identified as one of the sustainable approaches to farming which offers insights towards a paradigm shift in food and nutritional security (Byerlee and Alex, 2005). The UNEP-UNCTAD, (2007) indicates that organic agriculture offers developing countries a wide range of economic, environmental, social and cultural benefits.

The global markets for organic products have also grown rapidly over the past two decades (Sahota, 2011). Currently 32.2 million ha are being managed organically worldwide by more than 1.2 million producers (Willer and Klicher, 2009). In Africa, South Africa has the third largest area (50,000ha) under organic farming (Willer and Klicher, 2009). Organic production is particularly well-suited for smallholder farmers, who comprise the majority of the world's poor. It builds on and keeps alive their rich heritage of traditional knowledge and traditional land races. It has also been observed to strengthen communities and give youth incentive to keep farming, thus reducing rural-urban migration.

The promotion of organic agriculture does not only constitute an important option for producers but also responds to consumers' desire for higher food quality and food production methods that are less damaging to the environment. The consumers' concerns on food safety, quality and nutrition are increasingly becoming important across the world, which has provided growing opportunities for organic foods in the recent years. The demand for organic food is steadily increasing in the developing countries. The untapped potential markets for organic foods in the countries like South Africa need to be realised with organised interventions on various fronts, which require a better understanding of the consumers' preference for organic food. Therefore, an analysis of consumer's awareness of various aspects of organic products may be considered as important ground to build the markets for organic food in the initial phase of market development. Briz and Ward (2009) indicate that consumer awareness of organic foods is the first step in developing demand for organic products.

The overall objective of the study is to model economic aspects of organic crop production systems, understanding farmers' risk perceptions and consumer awareness for organic products. Specifically the study will pursue the following objectives: (i) to describe the demographic and socio-economic characteristics of organic farmers and consumers; (ii) establish the determinants of farmers' decision to participate in organic farming distinguishing between the fully-certified organic, partially-certified organic and non-organic farmers; (iii) elicit farmers risk preferences and empirically analyse farmers sources of risk and risk management strategies; (iv) explore consumer awareness, perceptions and attitudes regarding organic products; and (v) identify the factors that affect the consumer's preference and consumption of organic products. The outcome of which will inform make policy recommendations that have an implication on technology adoption, increase smallholders capacity to bear risk and enable government and other role players have a clear understanding of consumers' organic food purchase decisions.

9.2.2 Agricultural technology adoption

The literature reviews and summarises the basic concepts and theoretical foundations to technology adoption as well as the factors affecting adoption of agricultural technologies. These include age, gender, education and training, household size, farm size, liquidity and income, land tenure security, location, risk attitudes, extension services, social capital and cooperatives and livestock ownership. The mode and sequence of agricultural technology adoption is presented as is the barriers to the adoption of agricultural technologies. Further information is reviewed on the induced innovation hypothesis and the case of the “green revolution”. Approaches used to model adoption including non parametric and econometric models are reviewed and presented.

9.2.3 Risk and risk management

The study further lays the foundation for risk in agriculture and its importance in agricultural economics research as risk and uncertainty are pervasive characteristics in agriculture and the basis for decision making. A critical analysis is made of the sources of risk in agriculture and management strategies based on empirical studies. The foundation of the expected utility theory as articulated by von Neumann Morgenstern is presented and measure of risk aversion of producers is presented. The latter are the Arrow Pratt Absolute Risk Aversion, Arrow Pratt Relative Risk aversion and the Partial Risk Aversion. The literature behind the importance of adjusting the Arrow Pratt Absolute Risk Aversion is argued in this section. A review is done of the three methods for measuring risk attitudes among agricultural producers. These are the direct estimation of utility function, experimental methods and the observed economic behaviour. Furthermore, studies that elicit and analyse farmers risk preference in developing countries and in South Africa are discussed.

9.2.4 Methodology

The study was carried out in the provinces of KwaZulu-Natal and the Eastern Cape. The selected study area is in the rural Umbumbulu Magisterial District, uMgungundlovu District Municipality, Mkhambathini Local Municipality of KwaZulu-Natal Province in South Africa and the former Transkei and former Ciskei Homelands in OR Tambo

District and Amatole District Municipalities respectively, of the Eastern Cape Province. A total of 400 respondents are surveyed consisting of 200 smallholder farmers in KwaZulu-Natal and 200 consumers in the Eastern Cape Provinces. The KwaZulu-Natal study was conducted earlier and identified lack of consumer awareness on organic products and lack of information among producer about consumer preferences for organic products as a major source of risk. This informed the need to undertake a consumer awareness and preference study with reference to the Eastern Cape in order to inform producers. It was expected that in the intervening period there could have been awareness about the product. An indication of its appeal would not be in the consumption of the product by the people who grow it but by consumers who reside quite some distance away.

The producer survey was conducted in October –December 2004 and the consumer survey was conducted in July-August 2011. The KwaZulu-Natal study was conducted earlier and identified lack of consumer awareness on organic products and lack of information among producer about consumer preferences for organic products as a major source of risk. This informed the need to undertake a consumer awareness and preference study with reference to the Eastern Cape in order to inform producers. Producer and household structured questionnaires were used to record household activities, socio-economic and institutional data as well as household demographics through personal interviews. The Arrow Pratt Absolute Risk Aversion (APARA) coefficient was used to measure the farmer's degree of risk aversion and the experimental gambling approach to establish the risk classification. Consumers were also asked about their awareness and knowledge about organics, attitudes and perceptions towards organics, preference and consumption patterns. Models used in the analysis of data presented theoretically and mathematically were (i) ordered probit model, (ii) principal component analysis, (iii) ordinary least square model, (iv) binary logistic model, and the (iv) discriminant analysis model

9.2.5 Determinants of organic farming adoption among smallholder farmers

The ordered probit model was applied due to the ordered nature of the dependent variable. The analysis was used to empirically analyse the determinants of farmers' organic farming status. The ordered probit model successfully estimated the significant variables associated with the farmer's adoption decisions. These were the farmer's age, household size, land size, locational setting, risk attitude, number of livestock (goats and chicken) and asset ownership. Fully-certified organic farmers were less risk averse than the partially-certified and non-organic farmers. Farmers who reside in the sub-wards Ogagwini, Ezigani, and Hwayi were more likely to be certified organic than those who reside in Numgwane. This suggests the presence of local synergies in adoption which raises the question about the extent to which ignoring these influences biases policy conclusions. The negative correlation between land size and adoption implies that smaller farms appear to have greater propensity for adoption of certified organic farming. This finding is supported by several studies reviewed in the literature that allude to the fact that organic farms tend to be smaller than conventional farms.

The significance of livestock is explained by the importance of manure for organic farming. The study also found that older farmers tend to be adopters supporting findings by Feng and Chenqi (2010). The average age of the farmers in the study area is over 50 years lending credence to the argument that young people tend to shun farming especially in rural areas. When farmers have security of land tenure the propensity to adopt certified organic farming is higher. A larger family size is more conducive to adoption of certified organic farming which is a labour intensive technology (OECD, 2000). The propensity to adopt was also positively influenced by asset index which is a proxy for wealth.

9.2.6 Risk and risk management by smallholder farmers

Farmers' risk preferences were spread across all classes of risk aversion. The majority revealed their preference for prospects representing intermediate and moderate risk aversion alternatives. Non-organic farmers represented the highest percentage of respondents classified as extremely risk averse both within (24%) and across (56%) farmer groups. This may explain why they have not adopted certified organic farming.

despite certification being introduced in the area since year 2000. Comparing the results from this study to the Ethiopian, Zambian, Côte d'Ivoire and Indian experiments, it is found that the proportion of farmers falling in the extreme to severe risk category to be higher in the Ethiopian experiment, but lower in the Zambian, Côte d'Ivoire and Indian case. The results from this study suggest that farm households in KwaZulu-Natal are less risk averse than in Ethiopia, Zambia and Côte d'Ivoire but are much more risk averse than in India and Philippines. The findings are in tandem with findings of the studies done in India, Philippines, Zambia and Côte d'Ivoire where the majority of the respondents are classified as intermediate to moderate risk aversion.

Seven principal components (PCs) that explained 66.13% of the variation were extracted. According to the loadings, the factors 1 to 7 can best be described as 'financial and incentives index', 'input-output index', 'crop production index', 'labour bottleneck index', 'lack of production information index', 'lack of market opportunity index', and 'input availability index' respectively. In general, price, production and financial risks were perceived as the most important sources of risk. Socio economic factors having a significant effect on the various sources of risk are age, gender, education, location, information access and risk taking ability. The most important traditional risk management strategies used by the surveyed smallholder farmers in KwaZulu-Natal are crop diversification, precautionary savings and participating in social network. The findings are consistent with economic theory which postulates that in the absence of insurance markets, poor farm households tend to be risk averse and are reluctant to participate in farm investment decisions that are uncertain or involve higher risk.

9.2.7 Consumer awareness and market potential for organic products

In this study showed that the majority of the consumers were female within the age of 25-44 years. Educational level among most respondents was high school level while the unemployment levels were within the national average of 25.2%. Income levels were low with most respondents receiving between R1000 – R5000 per month. The study found that the household size was also in line with the provincial average of 5.25 persons per household. The distance to the nearest shop averaged at between 6.71- 9.73kms.

The presence and access to shops and markets is important in understanding the availability and demand for organic products. There was general awareness on what constituted organic foods with many consumers associating organic foods with health and nutrition, chemical free and produced using indigenous methods of production. However, there was low awareness of organic products among consumers with little or no knowledge on organic certification and standards. While respondents acceded to the need for the verification and certification of organic products, most conceded that an independent company should be responsible for this. The perception of consumers' about the price of organic products ranged from reasonable to really high. There was general trust for organic labels except in the rural areas where consumers indicated that they did not trust organic labels.

The consumer buying behavior showed that most respondents were responsible for household shopping with supermarkets topping preferred shopping areas due to availability of product variety and discounts. Fresh fruits and vegetables topped product preference among consumers with results indicating that there is a growing demand for organic products in the future. Many of the respondents had consumed or considered consuming organic food with the main reason being appearance and nutrition. Some of the reasons advanced for not consuming organic foods included the high price and the fact they are not readily available. The key factors consumers would consider when buying organic food include price, quality, health and nutrition. As consumers become more aware of food safety, nutrition and sustainability, consumer health takes centre stage. The main lifestyle conditions identified included hypertension and diabetes. Traditional taboos were not a common occurrence in the study area.

The logit analysis established that the major factors influencing consumer awareness of organic products are: gender, education, employment, location, person responsible for shopping and the price perception. Male consumers showed a slightly higher level of awareness than females. Education was positively correlated and statistically significant to consumer awareness as was employment status. Rural consumers were less likely to be aware about organic products than urban consumers. This can be attributed to the fact

that organic products currently target a niche market which is the upper middle class and the modes of marketing the products through mass media are more accessible to urban consumers than rural consumers. Consumers who shopped jointly with other members' of the household were more likely to be aware of organic products than those who shopped alone. Lastly, consumers who perceived the price of organic products as high were less likely to be aware of organic products than those who did not think the price of organic was high.

The determinants of the consumption of organic products was analysed using the discriminant model. The Wilk's lambda is statistically significant by the F-test for the age of the consumer, location, person responsible for shopping, consumer awareness of organics, price perception and label trust. Older consumers were more likely to consume organics compared to younger consumers. This may be attributed to the fact that aging populations are more concerned with their health and hence more likely to purchase organics. The former Ciskei consumers were more readily exposed to organic products compared to the former Transkei consumer and hence more likely to consume organics. The person responsible for household food shopping was statistically significant at 1 percent level of probability and negatively correlated with the consumption of organic food. The consumer who was personally responsible for the household food shopping was more likely to consume organics than if this was a joint responsibility. This could be attributed to personal consciousness and decision making with less external influence. The finding of this study also supports several studies that have indicated that while consumer awareness of organic food is the first step in developing demand for organic products, awareness does not necessarily translate to consumption. Whereas consumers generally conceded that the prices of organic were somewhat high to really high, in the Eastern Cape, consumers were willing to pay the premium price for health and safety reasons. Lastly, consumers who fully trusted organic labels were more likely to consume organics than those who were weary of organic food labels.

9.3 Recommendations

Today, Africa appears to have a monopoly on poverty and hunger. New technologies and access to seeds and inputs and better management practices are critical to changing this situation, but they are by no means sufficient. To unlock the potential of smallholder farmers to fight hunger and food insecurity, and to bring prosperity, these innovations must reach farmers. Investment in research and technology development is critical in transforming Africa's agriculture. From the summary findings presented above policy proposals and areas for further research are presented below.

9.3.1 Policy implications

This study sought to identify among others, independent variables that explain the adoption of organic farming and thereby facilitate policy prescriptions to augment adoption in South Africa and around the world. The technology adoption analysis of the independent variables used in the ordered probit analysis revealed some underlying patterns of influence. Given the limited prospect of identifying such variables through further research, it is concluded that efforts to promote organic farming will have to be tailored to reflect the particular conditions of individual locales. The propensity of adoption decisions by neighbourhoods to affect others must be given due importance, for price marketing, extension delivery and development purposes, while delineating target domains for introducing new technologies especially where resources are limited. An insight into the sources of risk has clear implications as to how the perceived riskiness of organic certification may be reduced, thus increasing the likelihood that relatively more risk averse farmers will adopt certified organic farming.

Nevertheless, the adoption of organic farming technologies, productivity and growth is a dynamic process that requires persistent research and development programmes. Therefore to maintain and further improve productivity and growth, there should be continued investment in agricultural research aimed at generating new and improving old technologies that could shift the production frontiers and improve the efficiency of input use. Research and development programmes can be undertaken by Government,

development agencies and or research institutions. This will provide a basis for knowledge dissemination and documentation.

Identified sources of risk faced by smallholder farmers provide useful insights for policy makers, advisers, developers and sellers of risk management strategies. This information can yield substantial payouts in terms of the development of quality farm management and education programs as well as the design of more effective government policies. New technologies and rural development programs need to be tailored to the risk attitudes of a particular group of farmers if they are going to be effective. Due to the risk aversion nature of these smallholder farmers, policy makers need to develop strategies that enable them better manage and reduce risk while mitigating against the identified sources of risk.

Some of the sources of risk were common across the farmer groups. These include the uncertain climate and lack of cash and credit to finance inputs. This shows that communication and joint-problem solving may help to address some of the challenges. Investment in water harvesting technologies will ensure availability of water through out the growing season and alleviate the risk associated with drought. Agricultural credit should be extended to farmers through service cooperatives and extension programmes. Input credit should be widely applied to enable farmers adopt improved agricultural technologies and more especially organic farming where the provision of cash credit services is limited.

While lack of liquidity may remain a risk in the short and medium-term for rural farmers, alternative sources of fund need to be considered through lobbying government to assist with legislation on the acceptance of Permission to Occupy (PTO) documentation as legitimate proof of ownership. Farmers can also access credit through Small Enterprise Development Agency (SEDA) that funds cooperatives and other legally registered farming organizations. Upgrading storage facilities should start at farm level to retail level to increase the shelf life of the produce and also ensure price stability. Improving

the efficiency of the distribution channels and forward linkages will result in better turn around time for payment.

According to Hough, Thompson, Strickland III and Gable (2008), buyers have a stronger competitive advantage when they can exercise bargaining leverage over price, quality, service or other terms of sale. This component seems to capture risks associated with production and marketing by the organic farmers. These farmers should consider targeting the niche of health conscious consumers in order to obtain premium prices associated with certified organic produce. This will be an incentive for organic production. The organic farmers through their farmer association should exercise their bargaining power as a social network entity in order to influence better prices for producers.

Similarly, contract farming will limit the risk associated with unreliable market and prices for producers while buyers will have a guaranteed supply of organic produce. More information on market and consumer preferences would enable the farmers better understand how to meet market demand. It is important to note that while information on organic production and marketing are readily available at the Department of Agriculture, South Africa and on the internet through various economic bureaus, the challenge remains accessibility, packaging and dissemination to smallholder farmers. This could be addressed through the use of extension agents, farmer field days and forums for information exchange.

The organic farmers could also work with the retailers to identify new organic crops for production in order to increase the opportunity for these farmers to diversify their enterprise mix. The absence of insurance and credit markets has a bearing on the farmers risk behaviour and management strategies. Hence supplementary policy interventions that are aimed at improving access to credit and markets will reduce poverty and impact on risk behaviour of farm households. In the long run, broad based economic development including the development of credit and insurance markets is the most certain way to correct the existing imperfections and reduce the level of risk aversion among farmers.

There is also a need for the development and investment in new technical packages which enable yield to withstand unexpected changes in weather condition and are highly reliable in on-farm practice.

The promotion of organic agriculture constitutes an important option for consumers and represents a sustainable alternative agricultural production system for the more fertile and marginal agricultural areas of South Africa. Public institution and stakeholders' intervention should be oriented to promote organic agriculture in rural areas, identify and interpret the organic demand. Public support should be applied not only through financial facilities and subsidies but also through the implementation of information campaigns, promotion actions and enforcement of control systems. Communication campaigns focusing on the benefits of organic products for the environment and for the consumers' health could stimulate organic product consumption and therefore, the market for organic produce. Furthermore, a control system would regulate the institutional context in which different stakeholders operate. This policy support would reduce the transaction costs originated by asymmetric information between supply and demand, expanding the organic demand.

9.3.2 Further research

Further research on the following aspects is necessary:

The impact of improved organic farming: While organic farming was identified to have improved households incomes, the scope of work could not accommodate its impact. Further research should consider the impact of organic farming on rural livelihoods. This will enable the design of training programmes and packages for adoption. Research on the development of training programmes on ways to improve farming may also contribute to the adoption of organic farming and other agricultural technologies, which should increase the wealth of rural farmers with an accompanying improvement of rural economies. The importance of delineating target domains for technology transfer and adoption process as recommended in this study, need special attention to increase the incentives derived from new technologies.

Formal risk management strategies: The purpose of formal risk-management strategies is to enable investment in more profitable activities through transparent sharing of risk. Most modern risk-avoidance measures are not readily available in developing countries. Hence, farmers in these regions are obliged to adopt traditional informal mechanisms for coping with risk, as was identified in this study. The role of the government to promote insurance provision to the poor through relevant regulatory framework as well as provide credibility to the overall system of social protection should be explored. Research in this area could also include the role of microfinance institutions within a partner-agent setup, smallholder farmers' willingness to take up formal insurance and their insurance purchase decisions as well as the cost effectiveness of these insurance options.

Efficacy of extension services: The role of extension services particularly in rural areas cannot be ignored. Limited extension service in the study area was evident as the main source of information on organic farming is from fellow farmers. An in-depth study on the current state and efficiency of agricultural extension services as well as comparative studies between regions, provinces or even similar communities could be important when advising policy-makers on the approach they can follow in developing rural agriculture in South Africa.

The economical advantages of organic farming: Research on the development of a training programme for organic farmers, which emphasizes the economic advantages and incentives of organic agriculture and technology adoption, is of great importance. This action may contribute towards productivity, improvement and alleviation of poverty in rural areas more so in the face of climate change and growing demand for food globally.

Value chain analysis: The organic market in South Africa is small albeit growing. Consumer awareness and consumption of organic products is low. In order to grow demand for organic products, value chain analysis is essential to an understanding of markets, their relationships, the participation of different actors, and the critical constraints that limit the growth of organic production and consequently the competitiveness of smallholder farmers.

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APPENDIX 1.1
BASELINE QUESTIONNAIRE
CROP PRODUCTION SURVEY, 2004

Interviewer:-----**Date:**-----

Respondent is fully certified?	1=yes 0=no
Respondent is not fully certified?	1=yes 0=no
Respondent is not organic?	1=yes 0=no

The information captured in this questionnaire is strictly confidential and will be used for research purposes only to inform farmers and stakeholders how they might improve their organic farming venture. Respondents do not have to answer questions – answers are voluntary.

INSTRUCTION: *Please ask to speak to the farmer :the person responsible for the day to day activities of the farm*

Respondent's full name		Household number:		GPS coordinate: (sub-ward)	
Respondent's age					
Respondent's gender	0=male 1=female				

- 1 **Crops produced organically** in the season (September – end of August) (Note: some information about crops grown organically has already been gathered, and will be inserted before the interview)

Crops grown	Total area planted	Portion of total area planted that is rented in or borrowed	Sales to packhouse			Sales to non-organic markets ¹	
			Sold to packhouse	Average unit price	Total revenue from sales	Average unit price	Total revenue from sales
	(Specify unit e.g. 1/10 ha)	(Specify unit e.g. 1/10 ha)	(Y or N)	(R/unit)	(Rands)	(R/unit)	(Rands)
Amadumbe							
Potatoes							
Sweet potatoes							
Green beans							
<i>Fallow land</i>							
Totals (for office use)							

Note: ¹ Sales to hawkers, local neighbours, Isipingo direct, etc.

2 **Crops produced inorganically** (i.e. with chemical fertilisers) in the season (September – end of August)

	Planted Y or N	Total area planted	Portion of total area planted that is rented in or borrowed	Average unit price	Total revenue from sales
Crops grown		(Specify unit e.g. 1/10 ha)	(Specify unit e.g. 1/10 ha)	(R/unit)	(Rands)
Amadumbe					
Potatoes					
Sweet potatoes					
Dry beans					
Maize					
Sugarcane					
Bananas					
Chillies					
Other: Please specify					
<i>Fallow land</i>					
Totals (for office use)					

3. Inputs used for organic crops produced in the season (September – end of August)

Input	Quantity used (kg)	Average unit price (R/kg)	Total cost (Rands)	Allocation of input between organic crops				
				Amadumbes	Potatoes	Sweet potatoes	Green beans	Dry beans
Purchased manure								
Own manure								
Own compost								
Purchased amadumbe seed								
Own amadumbe seed								
Purchased potato seed								
Own potato seed								
Purchased sweet potato seed								
Own sweet potato seed								
Purchased green bean seed								
Own green bean seed								
Hired labour								
Family labour								

Hired tractor and equipment								
Own tractor and equipment								
Hired draught oxen								
Own oxen								

4 Rank the following **Sources of risk** from **1 to 3** where **1 is no problem** and **3 is a severe problem** (tick where appropriate):

Constraint	1 No problem	2	3	Constraint	1 No problem	2	3
Livestock damage crops				Inputs not available at affordable prices			
Uncertain climate (e.g. drought)				Tractor is not available when I need it			
Uncertain prices for products sold to packhouse				Cannot find manure to purchase			
Uncertain prices for products sold to other markets				Cannot find labour to hire			
More work than the family can handle				Cannot access more cropland			
Lack of cash and credit to finance inputs				Delays in payment for products sent to packhouse			
Lack of information about producing organic crops				Lack of bargaining power over product prices at the packhouse			
Lack of information about alternative markets				Lack of information about consumer preferences for our organic products			
Lack of proper storage facilities				Packhouse does not reward me fully for my own product			
Lack of affordable transport for products							

Lack of telephones to negotiate sales							
---------------------------------------	--	--	--	--	--	--	--

5 **Participation in EFO** (tick where appropriate):

When did you first become a member of the EFO?	Year	Month
Do you participate in the EFO Executive Committee?	☐ Y ☐ N	
If yes, what is your role in the Executive Committee?	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Do you participate in the EFO Internal Applications Committee?	☐ Y ☐ N	
If yes, what is your role in the EFO Certifications Applications Committee?	☐ 1 ☐ 2 ☐ 3 ☐ 4	
Are you an EFO internal inspector?	☐ Y ☐ N	

6. What **benefits** did you **expect** when you joined the **EFO**?-----

7. What **benefits** do you **actually** get from **being a member of EFO**? Rank the perceived benefits from **1 to 4** -----

8 Non-participation in EFO (tick where appropriate): For non-organic farmers

Have you heard about the EFO?	☐ Y ☐ N	
Have you considered joining the EFO?	☐ Y ☐ N	
If not, why not?	☐ I do not know what the EFO does	
	☐ I do not want to grow organic crops	
	☐ I cannot complete the form that EFO members must submit for certification	
	☐ I do not know how to grow organic crops	
	☐ EFO does not treat its members fairly	
	☐ I don't want to join -	
Explain why if you feel that EFO does not treat its members fairly		

9 Sources of agricultural information

9.1 What is the name of the Department of Agriculture Extension Officer?-----

9.2 Which of the following sources of agricultural information have you used in the past **about organic farming** (tick where appropriate)?

Information source	Used?
EFO farmers	☐ Y ☐ N
University (Dr Modi, students or FSG)	☐ Y ☐ N
Assagay Organics (James's packhouse)	☐ Y ☐ N
Radio	☐ Y ☐ N
Print media (books, pamphlets, newspapers, etc.)	☐ Y ☐ N

Information source	Used?
Department of Agriculture	☐ Y ☐ N
Paeta (Nelly)	☐ Y ☐ N
Rainman Land Care Foundation (Raymond)	☐ Y ☐ N
AFRISCO (certifying body)	☐ Y ☐ N
Private firms that supply inputs	☐ Y ☐ N

9.3 Please estimate the **total** number of hours per week that you spend getting information about organic farming **from all the sources combined** that you use: -----Hours

10. **Literacy** (tick where appropriate):

	Yes	Some	No
Can you read and write IsiZulu?			
Can you read and write English?			

11. If the respondent can read and write at least some English, ask him/her to read the following words and to write their IsiZulu or English equivalents if they are willing to try:

IsiZulu	English
Ukhula	
	Poison
	Manure
Izincingo	
	Date of planting
	Explain how you fertilise your field

APPENDIX 1.2

BASELINE QUESTIONNAIRE

HOUSEHOLD QUESTIONNAIRE, 2004

[illegible]

9. During the past year did any household member earn income through any of the non-farm enterprises listed below? If yes, report the income from each activity.	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
9.1 Hiring out accommodation										
9.2 Hiring out contractor services or equipment										
9.3 Milling grain										
9.4 Baking, brewing or selling meals										
9.5 Building or repairing houses										
9.6 Block making, stone- or metalwork										
9.7 Hawking										
9.8 Shop-keeping										
9.9 Repairs and maintenance of cars										
9.10 Making furniture or handicrafts										

10. Does have a savings account (i.e. bank, post office, stockvel etc)? If yes, please provide the following information:	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y
	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N	☐ N
11 Current level of savings (Rands) 1 = less than R500 2 = R501 – R1000 3 = R1001 – R5000 4 = more than R5001 DK = do not know	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1
	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2
	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3
	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4
	☐ DK	☐ DK	☐ DK	☐ DK	☐ DK	☐ DK	☐ DK	☐ DK	☐ DK	☐ DK

12. Which of the **assets** listed below does the household own (only items in working order)?

☐ Y ☐ N	Land line telephone in the dwelling	☐ Y ☐ N	Motorbike
☐ Y ☐ N	Cell phone	☐ Y ☐ N	Trailer/cart
☐ Y ☐ N	Radio	☐ Y ☐ N	Sewing machine
☐ Y ☐ N	Hi-fi / music centre	☐ Y ☐ N	Motor vehicle in running order
☐ Y ☐ N	Television	☐ Y ☐ N	Generator
☐ Y ☐ N	Personal computer	☐ Y ☐ N	Plough
☐ Y ☐ N	DVD / VCR (video player)	☐ Y ☐ N	Planter, harrow or cultivator
☐ Y ☐ N	Maize mill	☐ Y ☐ N	Wheelbarrow
☐ Y ☐ N	Fridge/freezer	☐ Y ☐ N	Tractor
☐ Y ☐ N	Bicycle	☐ Y ☐ N	

13. Land tenure security

13.1 What rights can the household exercise on its own cropland? (tick where appropriate):

Response	Right	Build structures	Plant trees	Erect fences to exclude others:		Bequeath/leave to children	Lease out	Sell
				Summer	All year			
No								
Yes, with consent from local authority								
Yes, without approval from local authority								

14 Livestock

Livestock and livestock products	Cattle	Goats	Sheep	Pigs	Chickens /ducks	Donkey/ horses	Other: specify
Number currently owned by all household members							
Approximate value of livestock (Rands)							
Number sold during past year							
Total income from animal sales during past year (Rands)							
Animals slaughtered for food in past year							
Animals slaughtered for festivities in past year							
Total income from product sales? Eg eggs, skin, manure, milk (Rands in past year)							

15 Credit and cash loans

Question	Transaction
Amount of cash borrowed or credit used (Rands)	
Main purpose of loan or credit	
Source of loan or credit	
If security was required by the lender, what security was provided	

APPENDIX 1.3

BASELINE QUESTIONNAIRE RISK QUESTIONNAIRE, 2005

RISK QUESTIONS

1. What is your household's approximate annual gross income (i.e., farming income plus wages, pensions, etc.)?

Annual gross income	Tick	Annual gross income	Tick
less than R5000		R25001 – R30000	
R5001 – R10000		R30001 – R35000	
R10001 – R15000		R35001 – R40000	
R15001 – R20000		R40001 – R45000	
R20001 – R25000		Greater than R45000	

2. Compared to other household decision makers in the region, are you more likely, less likely or equally likely to take risks?

☐ Same ☐ Less ☐ Greater.

3. If a new farming technology (e.g., a new variety of seeds) were available, compared to other farmers in this area, would you be an:

☐ early adopter ☐ would you take a wait and see attitude

4. The table below lists six choices, each describing a gamble with an equal chance of realizing the lower or higher payoff. Indicate which of the six choices you most prefer: A, B, C, D, E, or F.

Choice	Payoff 1 (Rands)	Payoff 2 (Rands)
☐ O	100	100
☐ A	90	180
☐ B	80	240
☐ C	60	300
☐ D	20	380
☐ E	0	400

5. If you are faced with an option to take a gamble or the option to receive a sure amount of money, which do you prefer?

← ☐ Option 1: A coin is tossed: TAIL: You win R380 HEAD: You win 20

☐ Option 2 →

R220	R200	R180	R160	R140	R120	R100	R80
------	-------------	------	------	------	------	------	-----

6. If you are faced with an option to take a gamble and the option to receive a sure amount of money, which do you prefer?

← ☐ Option 1: A coin is tossed: TAIL: You win R240 HEAD: You win 80

☐ Option 2 →

R170	R160	R150	R140	R130	R120	R110	R100
------	-------------	------	------	------	------	------	------

7. The table below shows the range in net income per plot per year (total revenue minus own variable input costs, e.g., seeds, manure, and labour) for three crop combinations (A, B and C). Each outcome is equally likely.

	A	B	C
Good year	R135	R145	R175
Average year	R110	R110	R120
Poor year	R85	R75	R65

Do you prefer A or B? ☐

Do you prefer A or C? ☐

Do you prefer B or C? ☐

Have you understood this question clearly? Yes ☐ No ☐

8. The table below shows the range in net income per plot per year for another three crop combinations (D, E and F).

D	E	F
Over three years you will receive:	Over three years you will receive:	Over three years you will receive:
R145 once	R125 twice	R150 once
R100 once	R50 once	R75 twice
R55 once		

Do you prefer D or E? ☐

Do you prefer D or F? ☐

Do you prefer E or F? ☐

Have you understood this question clearly? Yes ☐ No ☐

APPENDIX 1.4

BASELINE QUESTIONNAIRE

CONSUMER AWARENESS, ATTITUDES AND MARKET POTENTIAL FOR ORGANIC PRODUCTS, 2011

General Questions

Name of respondent _____

Interviewers name _____

District Municipality _____

Start Time _____

End time _____

Questionnaire No. _____

Q1 Gender of respondent

Male	
Female	

Q2 Which of the following age groups do you fall in?

18 - 24 years	
25 -34 years	
35 -44 years	
45 - 55 years	
More than 56 years	

Q3 What is the highest education level you have completed?

No formal education	
Primary education	
High school education	
Post graduate	

Q4 What is your occupation?

working full time	
working part time	
retired	
housewife/man	
student	
unemployed	
Old Age/Pension	

Q5 How many people live in your household?

Q6 Who is the person responsible for household food shopping?

Me	
Another person	
Together	

Q7 What shop do you traditionally buy your groceries from?(Multiple responses)

	Yes	No
Supermarket		
Spaza shops		
Grocery stores e.g. fruit and veg city		
Farmers markets e.g. Kei fresh produce		
Street vendors		
Farm gate		

Q8 How far is the nearest shop from your homestead and residence?

kms

Q9 What meat grades do you buy normally?

Young and tender	
Older and tougher	
N/A{do not eat meat}	

What chicken grades do you buy normally?

Free range chicken	
Frozen chicken	
Broilers/layers	

Q10 What is the average monthly income of your family (in rands)?

Less than 1000	
1000 - 5000	
5001 - 10000	
10001 - 15 000	
Greater than 15 000	

Q11 Are any children less than 18 years living in your household?

Yes	
No	

Q12 Could you please tell me what you understand by the term "organic products"?

	Yes	No
Healthy/Nutritious		
Traditional/indigenous food		
Products are grown in harmony with mother nature		
Free from chemicals, pesticides and fertilizers		
Produced from environmentally and animal friendly techniques		
Free from GMOs		

Certified products		
Others (Specify)		

Q13 Did you know that...?

	Yes	No
There are local standards for organic products		
There is an organic certification body in South Africa		
There is a national organic movement in South Africa		
Organic products should be identified by a logo		

Q14 Have you ever consumed or considered consuming 'organic food products'?

Yes - have consumed		Go to Q15
Yes - have considered consuming		Go to Q15
No		Go to Q16
Don't Know		Go to Q17

Q15 Why have you consumed or considered consuming organic products?

	Yes	No	NA
They have better appearance and taste			
They are healthy/Nutritious			
They are safe to consume/not contaminated			
They are affordable			
I had more income			
They are more accessible to the market			
They are good for the management of illness			
They are environmentally friendly			
There are more products from the local region			
There is more trust to the origin/production			
Because friends are doing so?			
Because saw it advertised on TV or heard on radio			

Q16 Why have you never considered consuming organic food products?

	Yes	No	NA
They are not tasty			
They are not healthy/nutritious			
They are unsafe			
They are expensive			
They are not readily available			
Others (Specify)			

Q17 Where do you or would you prefer to buy your organic food products (Multiple responses)?

Supermarket	
Greengrocers	
Hotels or restaurants	
Open air markets	
Farm gate	
Kiosk/spaza shop	
Others (specify)	

Q18 Can you recognize any of the labels? Do you have an idea if they belong to organic products?

Label	Do you know this label?		Does it represent organic products?	
	YES	1	YES	1
	NO	2	NO	2
			DN	99
	YES	1	YES	1
	NO	2	NO	2
			DN	99
	YES	1	YES	1
	NO	2	NO	2
			DN	99
	YES	1	YES	1
	NO	2	NO	2
			DN	99

Q19 Please select organic products in the group that you **Consume Or Would Consider Consuming Today**

Fresh vegetables	
Fresh fruits	
Herbs and spices	
Milk and milk products	
Meat and meat products	
Cereals	
Oil products	
Pulses	
Beverages	
Bread and Bakery products	
Sugar products (honey marmalade, chocolate)	
Baby Products	
Textiles products	

Q20 Which organic products below would you like to **consume or would consider consuming in the future?**

Fresh vegetables	
Fresh fruits	
Herbs and spices	
Milk and milk products	
Meat and meat products	
Cereals	
Oil products	
Pulses	
Beverages	

Bread and Bakery products	
Sugar products (honey marmalade, chocolate)	
Baby Products	
Textiles products	

Q21 What would you consider if you were to buy organic products? [Rank from 1-9 in order of priority]

Price/affordability	
Quality	
Packaging (size)	
Information	
Availability	
Health/nutrition value	
Certification	
Environment	
Support for local farmers	

Q22 How do you/would you know that the food you are buying is organic?

Only purchase from specific shops that I know sell organic	
Check the labels	
Buy from a specific farmer who practices organic farming	
Practice own organic farming	
Only purchase specific brands I know are organic	
Others (Specify)	

Q23 Do you think there should be a system for verification and certification of organic products?

Yes		No		DN		N/A	
-----	--	----	--	----	--	-----	--

Q24 If yes who do you think should be responsible for providing verification?

The Government	
Independent certification company	
Companies buying from farmers	
Groups of producers checking each other	
NGO's working with farmers	
The producer himself	
Don't Know	
Other (Specify)	

Q25 What is your perception about the price of organic products?

Really high	
High	
Reasonable	
Not high	
Really not high	
Do not know	

Q26 What is your perception about trust of organic labeled products?

Fully Trust	
Trust	
Somewhat trust	
Not trust	
Do not know	

Q27 What traditional food taboos exist for respondent's group/tribe/clan

1	
2	
3	
4	
5	
6	

Q28 Does anybody in the household have the following lifestyle conditions?(Yes or No)

Which ones are considered important in the household? (Tick)

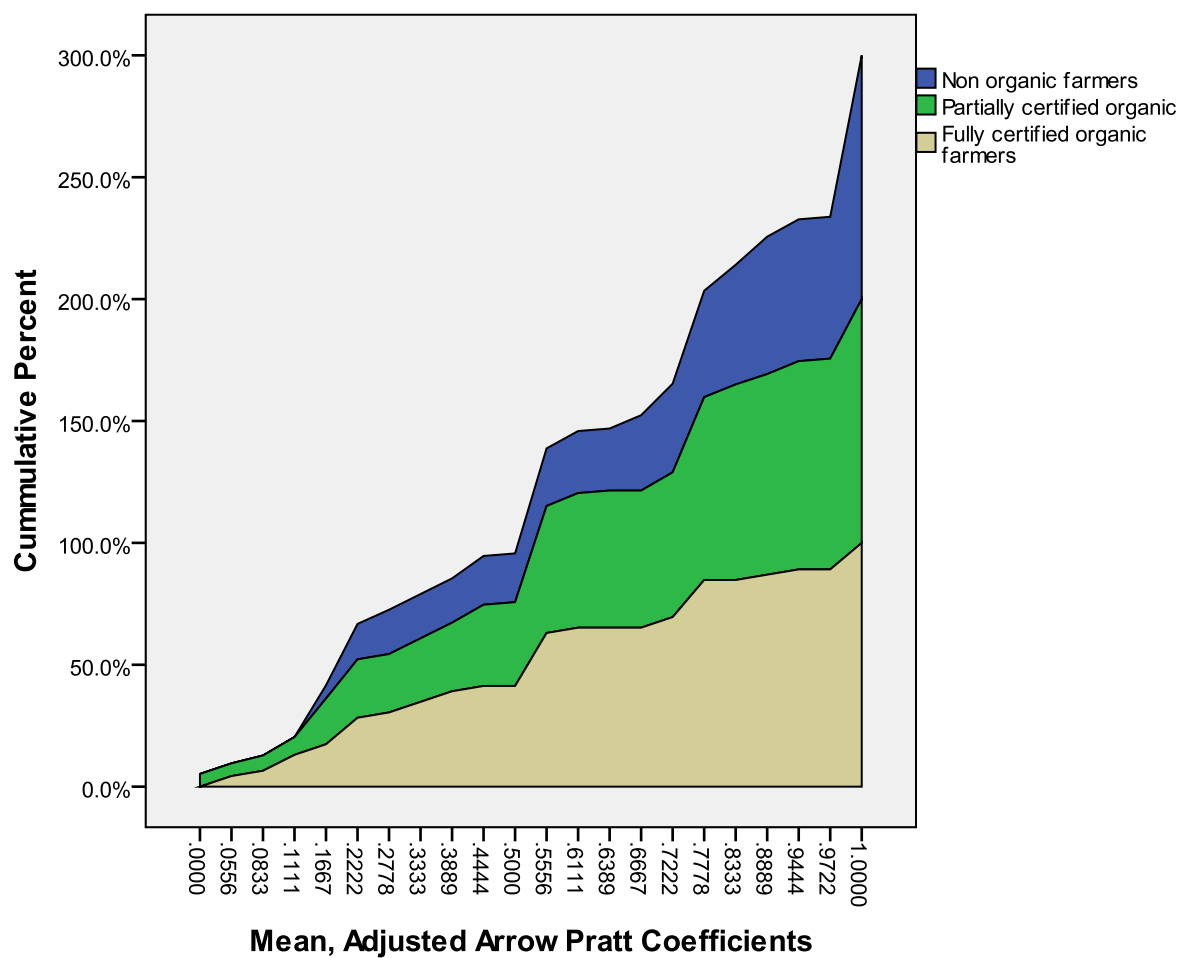
	Present	Important
Hypertension/High blood pressure		
Cholesterol		
Diabetes		
Arthritis		
Cancer		
Skin conditions		
Other(specify)		

Q29 Which assets listed below does the household have?

Asset	YES	NO	Asset	YES	NO
Land line telephone			Car		
Cell Phone			Personal computer		
Radio			Fridge		
Hi-fi music system			Bicycle		
Television			sewing machine		
DVD/VCR (video)			Electricity/generator		
Tractor			Motorbike		

THANK YOU VERY MUCH FOR PARTICIPATING IN THE SURVEY

Appendix 2: Mean, Adjusted Arrow Pratt Coefficients for the Farmer Groups

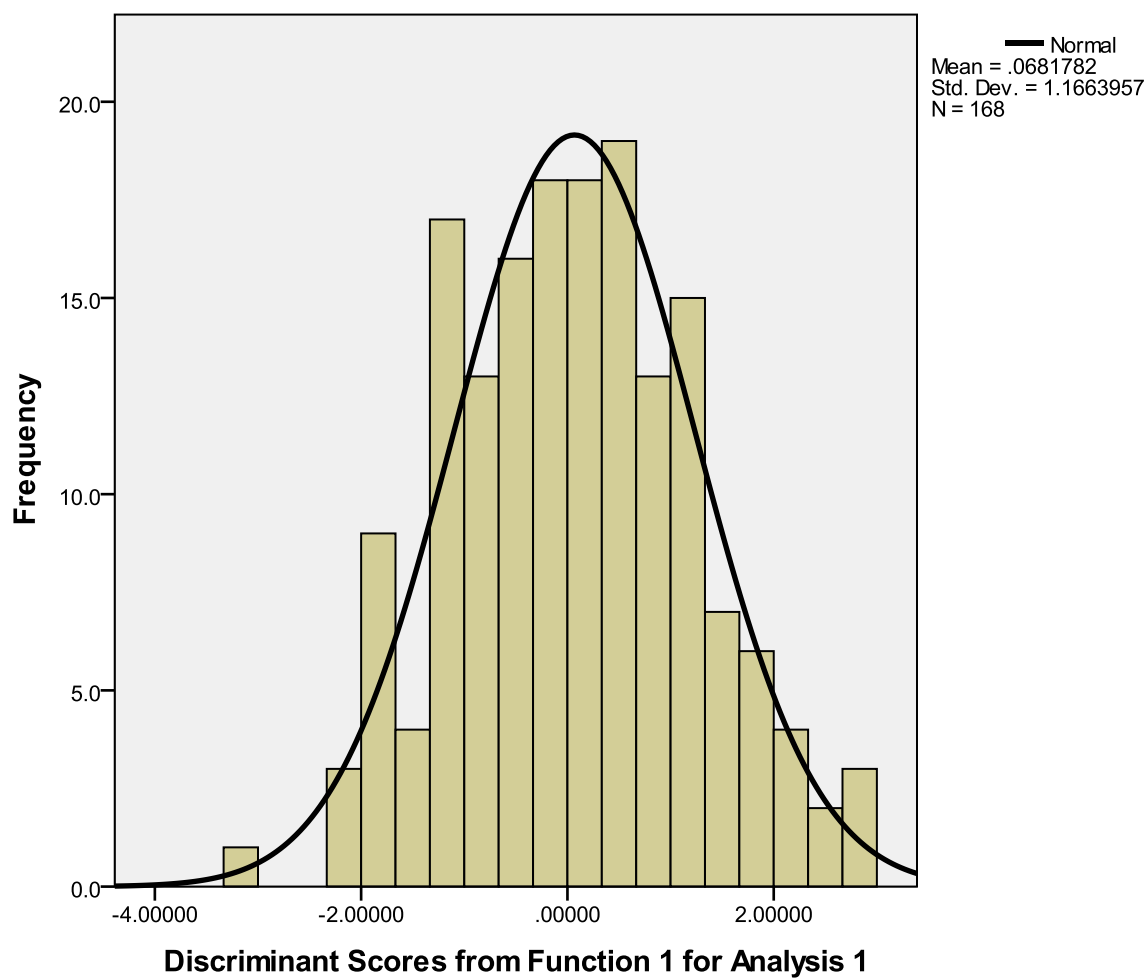


Appendix 3: Correlation Matrix for the 20 Potential Sources Of Risk

	stockdam	uclimate	upricepk	upriceot	morework	lackcash	lackinfo	lackinfo	lackstor	lacktran
stockdam	1.0000									
uclimate	-0.1037	1.0000								
upricepk	-0.0289	0.2903	1.0000							
upriceot	0.1911	0.1458	0.4053	1.0000						
morework	0.2866	-0.1000	0.0816	0.0853	1.0000					
lackcash	0.0747	-0.0311	-0.0644	-0.0836	0.1414	1.0000				
lackinfo	0.1098	-0.0629	0.1233	0.1586	0.0908	0.0000	1.0000			
lackinfo	-0.0673	0.0178	0.2345	0.3966	0.0202	0.0637	0.0935	1.0000		
lackstor	-0.1211	-0.0273	-0.1861	-0.1764	-0.1512	0.3029	0.0997	0.0180	1.0000	
lacktran	-0.0656	-0.0853	-0.0691	0.0506	0.0564	-0.1357	0.1269	0.1874	0.2544	1.0000
lackphon	0.1808	0.0120	0.1575	0.3111	-0.0253	0.0642	0.1708	0.2634	-0.1889	0.0309
inptnaf	0.0189	0.0954	0.0638	-0.0967	0.2876	0.4975	-0.0099	-0.0462	-0.0388	-0.0378
tractna	-0.0739	0.0069	-0.0934	-0.1151	-0.0484	0.2231	-0.0205	0.0107	0.3100	0.1418
nomanure	-0.1412	0.1617	0.0241	-0.0702	0.0768	0.3124	-0.0918	0.1585	0.2774	0.0846
nolabour	0.2459	0.0665	0.3478	0.4718	0.2294	0.0508	0.2473	0.0534	-0.1879	-0.1110
nocpland	0.1053	0.1162	0.0196	0.1486	-0.0835	0.2577	0.0408	0.2546	0.0306	-0.1941
pdelays	-0.0495	0.0304	0.1765	0.0451	0.1624	0.2340	-0.0710	0.2361	0.3334	0.2760
lackbp	0.0331	-0.0161	0.3233	0.4228	-0.0052	-0.0574	0.2057	0.2633	-0.0972	0.0064
lackcpf	0.0941	0.1202	0.2736	0.3549	0.0664	0.0503	0.2179	0.1556	0.0706	0.1199
noreward	0.0711	-0.0296	0.5689	0.3714	0.1417	-0.0555	0.1674	0.1818	-0.1516	0.1703
	lackphon	inptnaf	tractna	nomanure	nolabour	nocpland	pdelays	lackbp	lackcpf	noreward
lackphon	1.0000									
inptnaf	-0.0052	1.0000								
tractna	-0.0286	0.1770	1.0000							
nomanure	-0.1769	0.2758	0.0916	1.0000						
nolabour	0.0929	0.0636	0.0681	-0.0422	1.0000					
nocpland	0.2138	0.1004	0.2578	0.1047	0.2101	1.0000				
pdelays	-0.1547	0.1592	0.1487	0.5808	0.1427	-0.0271	1.0000			
lackbp	0.2322	0.0070	-0.0577	0.0646	0.3461	0.2757	0.2735	1.0000		
lackcpf	0.2593	-0.0276	0.1503	0.0425	0.4033	0.1823	0.3358	0.6135	1.0000	
noreward	0.3739	-0.0832	0.0708	-0.0021	0.3144	-0.0402	0.2154	0.3895	0.4211	1.0000

Appendix 4: Histogram for Discriminant Scores for the Linear Discriminant Functions

Appendix 4.1: Plotting of Discriminant Scores for function 1



Appendix 4.1: Plotting of Discriminant Scores for LDF 2

