VALUE CHAIN ANALYSIS AND DETERMINANTS OF PRODUCTION AND CONSUMPTION OF AFRICAN LEAFY VEGETABLES IN LIMPOPO PROVINCE OF SOUTH AFRICA

By

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PREFACE

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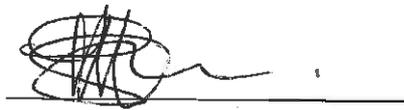
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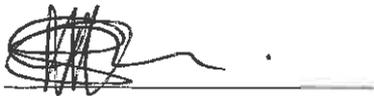
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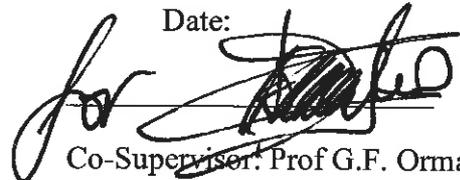
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Date:

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DECLARATION 2: PUBLICATIONS

Chapter 2

Senyolo G.M, Wale E. and Ortmann G.F. (2018). Analysing the value chain for African leafy vegetables in Limpopo Province, South Africa. *Cogent Social Sciences*, 4: 1-16. https://doi.org/10.1080/23311886.2018.1509417.

Chapter 3

Senyolo G.M, Wale E. and Ortmann G.F. (2018). The determinants of farmers' decision to produce African leafy vegetables in the Limpopo Province, South Africa. *African Journal of Science, Technology, Innovation and Development*, 10 (7): 771-778. https://doi.org/10.1080/20421338.2018.1513894

Chapter 4

Senyolo G.M, Wale E. and Ortmann G.F. (*in press*). A double hurdle analysis of consumers' decisions to purchase African leafy vegetables in Limpopo Province. *Journal of Consumer Sciences*.

The data collection, analyses, and discussion of empirical results for all the above-listed publications were conducted in their entirety by G.M. Senyolo with technical advice from Prof E. Wale and Prof G.F. Ortmann. All figures, tables, and graphs were produced by same, unless otherwise referenced in the respective publications.

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ABSTRACT

There has been a decline in the production, utilization and diversity of African leafy vegetables (ALVs) such as cowpea leaves, pumpkin leaves, amaranth, collard greens, mustard greens, etc., which poses a threat to the status of food security and development in the sub-Saharan region. Research has shown that ALVs have high market potential and contribute substantially to household incomes, food security, health and nutrition. However, the scientific and donor communities often give less attention to research on, and development of, these crops. This study focuses on the commercial production of ALVs, a relatively new economic activity, in the Limpopo Province of South Africa that may assist rural, small-scale farmers to diversify, improving their economic independence and livelihoods. In attempting to provide an impetus to the ALV industry, the South African government currently offers free training in ALV production, extension services, free high quality seed, free fertilizers and pesticides. Considering the geographical suitability and the magnitude of investment made towards the ALV development programme, there is a need to understand consumer behaviour towards ALVs, and why many farmers are not participating in the industry. There has also been limited research so far on the challenges and opportunities in producing, value adding, and marketing of ALVs in South Africa. This study is, therefore, an attempt to address these knowledge gaps. It also provides an opportunity to draw relevant policy and management implications to inform future strategies in the industry.

Given this background, the specific objectives of the study were to: (i) analyse the value chain of ALVs in Limpopo Province; (ii) examine the factors influencing households' participation decision in the production of ALVs in Limpopo Province; (iii) determine the factors influencing consumers' purchasing decisions and expenditure levels for ALVs; and (iv) determine socio-economic and perception factors affecting willingness-to-pay.

To analyse the value chain of ALVs in the Limpopo Province of South Africa, prominent value chain actors, institutions governing the chain, infrastructural endowments, key factors and challenges affecting the success or failure of the value chains, were identified. Relationships among the value chain actors were weak, with transactions based primarily on spot markets. While smallholder farmers producing ALVs attain high gross margins, their intention to participate in mainstream markets is impeded by lack of technical knowledge of production, lack of packaging and processing services, poor infrastructure, deficient contractual agreements

between actors, and lack of access to finance. Although producers currently attain relatively high gross margins, more benefits might be realized if government services (such as training, seed production and distribution) could either be decentralized or privatized. Future policy interventions should focus on promoting value addition along the ALV chain, including the provision of cold storage facilities by municipalities closer to smallholder farmers in the rural areas to stabilize farm gate prices to encourage continuation of production.

A double-hurdle model that accounts for whether or not smallholder farmers produce ALVs (decision to participate) and how much land was allocated for ALV production (level of participation) was used to examine the factors influencing households' participation decision in the production of ALVs in the Limpopo Province. Participation and level of participation decisions were analysed using cross-sectional data collected from 126 smallholder farmers in 2013. The empirical results suggest that factors explaining participation decision and level of participation are different. Hence, it is imperative that policies that are aimed at incentivising both participation and level of participation and their impacts on food security and nutrition target different groups of people. Furthermore, the commercialisation of ALVs could also promote rural development in the study area.

Factors influencing consumers' decisions to purchase ALVs in the Limpopo Province were also examined using the double-hurdle model as it accounts for whether or not consumers purchase ALVs and how much they spend on these vegetables. The decision to purchase and the level of expenditure were analysed using cross-sectional data collected from 299 urban and rural households during 2012. The results show that perception factors (such as nutrition) and some socio-economic factors (such as gender, education, marriage and urbanization) influence only purchasing decisions, while other factors such as age and distance to the market influence only the level of expenditure on ALVs. In addition, other perception (perception that ALVs are a relish, tasty and affordable) and socio-economic (dependency on social grants) factors influenced both the purchasing decision and the level of expenditure. Interventions that promote value addition of ALVs through sorting, packaging and processing by commercial processors that reduces pre-cooking preparation time and increases storage can encourage young, male, urban and educated consumers to purchase ALVs. Furthermore, awareness-raising programmes about the nutrition and health benefits of ALVs on media (such as local and national radio and television stations and social media in locally understood languages), might promote the consumption of ALVs by educated and urban households.

Socio-economic and perception factors influencing willingness-to-pay (WTP) for ALVs were also determined. Cross-sectional data were collected from 299 randomly selected households using a contingent valuation questionnaire. The descriptive results revealed that almost 80 percent of respondents would be willing to pay a premium for ALVs. An Ordered Probit model was applied for identification of households' socioeconomic and perception factors that influence WTP. WTP was found to be mainly a function of socio-economic factors, namely gender, urbanization, age, distance to the market, tastes/preferences and availability of ALVs throughout the year. Smallholder farmers of ALVs, plant breeders, marketers and policy makers are encouraged to develop efficient production and marketing strategies. This, in turn, provides a means of improving food security and livelihoods, especially in support of the poor, rural, smallholder farmers.

The study recommends the empowerment of smallholder households and the youth with productive resources such as extension services, technical support and a more secure land tenure system to improve their livelihoods. The commercialisation of ALVs could promote rural development in the study area, as ALVs are indigenous to Limpopo. Understanding the nature of these constraints and how they can possibly be alleviated is very important from a policy perspective, as this process will inform the formulation of improved market access strategies. The study also recommends a strategic awareness campaign to influence the behaviour of producers and consumers and nutrition education to increase knowledge and awareness of the nutritional value of ALVs. Further recommendations are also made towards institutionalising and strengthening collective marketing under different options, which reflect producers' socio-economic status and the prevailing institutional and policy environment in Limpopo Province.

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SERETO SA SENYOLO

Ahee Tau, Sebata, Mothwanapa, motho wa Senyolo kha chipi, malapa letshetshe, motho wa

go boya Mokhotene

Ke nna Senyolo kha tshipi

Malapa letshetshe tshipi ya bokoni ya hata nngwe ya robeha.

Motho wa ha bo Mmasebola kha Mashupi.

Ahee morula chipi wa Senyolo

Ahee Motjelele.

Ahee Moila Motwa.

Ahee Motswaing.

Ke khebataKgomo.

Ke khebata kha Mariri motho wa ho kwa Tswaing.

Re boya Tjelele mokhotene ha mmanaka di a lla

Thaba yesu ha e nemelwe, wa namela ha o boye.

Khaetjedi'abolowane matau ba mo hlanohedhe meloko.

Batho ba o khe naiwe.

Ba naiwa ba nwa.

Ke batho ba ga Sebola Senyolo ba ho se rapele bogadi,

Ba re a bohwe re dho nyaka bongwe.

Bathwanapa weee.

Ke motho wa bo mmaSebola motho yo orego o morumile Tswedha a lala a

boile.

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ACRONYMS

ALVs	African leafy vegetables
ARC	Agricultural Research Council, South Africa
CFF	Crops for the Future
CFFRC	CFF Research Centre
CGIAR	Consultative Group on International Agricultural Research
CVM	Contingent Valuation Method
DAFF	National Department of Agriculture, Forestry and Fisheries, South Africa
DoA	Provincial Department of Agriculture
FAO	Food and Agricultural Organization of the United Nations
FPM	Fresh Produce Market
GFU	Global Facilitation Unit for Underutilized Species
LDA	Limpopo Department of Agriculture
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IPGRI	International Plant Genetic Resources Institute
NUCS	Neglected and underutilized crops
NGO	Non-Governmental Organization
PROTA	The Plant Resources of Tropical Africa
R&D	Research and Development
SGRP	System-wide Plant Genetic Resources Programme
SSA	Sub-Saharan Africa
UNIDO	United Nations Industrial Development Organization
UNMC	University of Nottingham, Malaysian Campus
USAID	United States Agency for International Development
WHO	World Health Organization
WTP	Willingness-to-pay
VCA	Value Chain Analysis
VIFs	Variance inflation factors

CHAPTER 1: INTRODUCTION AND REVIEW OF THE LITERATURE

1.1 Problem statement and justification

Identifying ways to alleviate poverty and hunger does not rely only on scientifically developed, new crop varieties, but also in reigniting an interest in indigenous foods that will improve nutrition, increase income levels, encourage agricultural biodiversity, and preserve local cultures (World Watch Institute, 2011). Interest in neglected and underutilised crops species (NUCS) derives from a number of factors, including their contribution to agricultural diversification, land-use, diet diversification and economic potential. Despite their local importance, there is limited knowledge on their production, consumption, and value chain constraints. This study is an applied economic research to support the effective commercialization of African leafy vegetables (ALVs) as one of the NUCS in the Limpopo Province.

ALVs are either genuinely native to a particular African region, or which were introduced to that region early enough to have evolved in response to regional conditions through natural processes or farmer selection (Jansen van Rensburg *et al.,* 2007). Hart and Vorster (2006) found that farmers are criticised by researchers and extension agents (agricultural advisors) for not controlling the growth of ALVs as they believe ALVs are weeds. In the Limpopo Province of South Africa, agricultural produce from smallholder farmers is often lost after production due to spoilage and inability to access markets. Most smallholder and emerging farmers are faced with a range of technical and institutional factors constraining processing and marketing. In addition to the poor development of marketing infrastructure, smallholder and emerging farmers lack supportive organizations including NGOs, such as Lima Rural Development Foundation, and Development Action Group to represent and serve them. This further weaken smallholder and emerging farmers' incentives to participate in formal markets. A reduction in formal market participation, in turn, makes it difficult for these farmers to shift into commercial farming. Disincentives to farm ALVs combined with the lack of support infrastructure has led to a decline in the production of ALVs by many rural communities in South Africa (Department of Agriculture, Forestry and Fisheries [DAFF], 2013). This decline has contributed to food insecurity, malnutrition, and reduction in income generation for the poor (Magbagbeola *et al.*, 2010).

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In Limpopo Province, ALVs are predominately purchased from informal markets and very few are purchased from formal markets. Cooked and uncooked leaves from ALVs are traditionally consumed together with starchy staple foods. Consumers, however, perceive ALVs to be food for the poor, resulting in lowdemand and consumption in favour of exotic vegetables. However, Tesfay *et al.* (2016) reveal that ALVs are high in micro nutrient and produce high concentrations of antioxidants during the early vegetative growth stage than exotic vegetables. According to Churchill (1983), attitude strongly influences consumers' behaviour and directly affects purchasing decisions. Consumers' negative perceptions of ALVs and low awareness of their nutritional value limits demand for ALVs (Ojiewo *et al.*, 2013). Thus, understanding and influencing consumer perceptions of ALVs is key to increasing demand and consumption, and improving nutritional outcomes. Not much research has so far been conducted to investigate the decision to purchase and the willingness-to-pay (WTP) for ALVs in the Limpopo Province. Therefore, this study has been aimed at closing the existing gap in knowledge of purchasing decisions and the WTP for ALVs in the Limpopo Province.

Promotion of ALVs as major sources of food in agriculture will depend not only on the availability of information about consumer demand, but also product supply in the market. Unfortunately, a number of challenges hamper the growth of the ALV sector in sub-Saharan Africa (SSA): lack of high quality seeds; high spoilage and post-harvest losses; unavailability of market infrastructure; weak or missing linkages between value chain actors (i.e., input suppliers, producers and markets); lack of mechanisms to set prices (ALVs are normally sold by farmers not on the basis of production costs or supply and demand conditions, but on "cost of living"), resulting in low bargaining power; and ineffective institutional policies to enhance trade within and between regions and countries (Lenné and Ward, 2010; Lyatuu *et al.,* 2009). This is particularly because many smallholder farmers are confronted with technical and institutional challenges affecting agricultural marketing. These farmers lack organizational support due to the poor development of market infrastructure which decreases their chances of participating in formal markets, and their capacity to become commercial farmers. Value chain analysis (VCA) of the ALVs offers the opportunity to assess the efficiency of value-added operations/services as well as systemic competitiveness along the chain to increase production, trade and the income-generating potential of farmers and other actors.

ALVs are characterized by limited research efforts, breeding efforts, and germplasm characterization; little research knowledge on species distribution and production levels, and

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poor representation in ex situ collections (Galluzzi, 2014). It is evident that the ALV industry in Limpopo Province is confronted with several challenges that require research-based, informed decisions. Economic knowledge of ALVs from production, consumption and value chain in the Limpopo Province is limited, a gap that this study was designed to fill. The overall study's contribution extends beyond the provision of policy recommendations for Limpopo Province, as the results could have an important bearing on the promotion of smallholders' participation in the production and marketing of ALVs in other provinces and developing countries. The aim and specific objectives of the study are presented in the following sections.

1.2 Research objectives

The aim of the study was to analyse the value chain and to determine factors influencing production and consumption of ALVs in the Limpopo Province of South Africa. This was achieved through the following specific objectives:

- To analyse the value chain of ALVs in the Limpopo Province;
- To examine factors influencing households' participation decision in the production of ALVs in the Limpopo Province;
- To determine factors influencing consumers' purchasing decisions and expenditure levels for ALVs; and
- To determine socio-economic and perception factors influencing WTP for ALVs in the Limpopo Province.

1.3 Neglected and underutilized species (NUCS)

Padulosi (1998) describes NUCS as species cultivated in local production systems, in which they are adapted to several ecological niches, while International Plant Genetic Resources Institute (IPGRI), (2002) records that they are often considered 'minor crops' because they are less important than staple crops and agricultural commodities in terms of global production and market value.NUCS are different from other crops because their economic potentials have been poorly addressed. As a result, their role is only limited to traditional or local uses. Jaenicke (2006) defined NUCS as those species, which have been overlooked by scientific research and development workers. NUCS have commanded less interest from national and international organizations dealing with the development, utilization, and conservation of plant genetic

resources because they are mainly confined to smallholder farming areas (Azam-Ali, 2010).These species risk falling into disuse, yet they have the potential to play a vital role in food and nutrition security, income generation, and the retention of peoples' culture in rural areas. Unfortunately, their neglect means that their potential value is underexploited, and they are in danger of continued genetic erosion, leading, ultimately, to extinction.

Unlike major commodity crops, NUCS do not attract sufficient interest from policy makers. Although their contribution at a global scale may be limited, they are particularly important in improving income, food secirity and nutrition in local rural households, as their cultural importance is high. According to Prohens *et al.* (2003) and Padulosi *et al.* (2002) , there is high competition between NUCS and exotic major crops with regards to the provision of nutrients, health attributes, generation of income, adaptability to marginal lands, and environmental changes. Williams and Haq (2002) also added that contributions to agricultural diversification, broadening of diversity in agro-ecosystems, reduction of imports and self-reliance enhancement in agricultural production systems are mainly indirect benefits of these species.

1.4 The benefits of investing in ALVs

ALVs hold several benefits over many exotic vegetables that dominate supermarkets shelves. The following are the benefits of investing in ALVs:

1.4.1 Economic benefits
ALVs are significant in the agricultural development of a state and country. They are a major source of income among smallholder farmers who engage in its farming. The Green Revolution confirmed how much development can be made by enhancing plant productivity and its impact on an area's productiveness. According to Altieri (2002) and the Food and Agricultural Organization (FAO) (2011), the neglect of a large number of crops that are needed in marginal environments was brought about by the fact that production is mainly focused on a few crops (e.g. wheat, rice). External drivers, including world financial markets and biofuel production on agricultural land, are key determinants of food prices. In turn, the unrest in some Asian and African countries in 2008 was directly linked to an increase in staple food prices. Dependence on a handful of food crops is one of the reasons for the food price hike and lack of food price stability, *i.e.* whatever unforeseen demand or supply side shock happens to those handful of crops, the outcome is often sharp increases and greater volatility in food prices. If there was

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adequate research and development (R&D) investment in ALVs and if countries were more dependent on a more balanced portfolio of food crops, these problems could be mitigated. Production and consumption of ALVs can enhance market stability, although there is an increasing production of exotic crops and other related shocks affecting the livelihoods of millions of people (Kahane *et al.*, 2013).

Applying appropriate production, processing, marketing and postharvest methods, value addition guarantees high quality produce that will reach the market and fulfil consumer expectations and preferences. Studies on the purchase and consumption of ALVs in Nairobi, Kenya, found that urban households care about the nutritional aspect of the products, and consumers were willing to pay more for quality ALVs (Ngigi *et al*., 2011). Padulosi *et al.,* (2013) reports an increase of production and sales of amaranthus, which leads to an increase of smallholder farmers' income level. In addition, the production of wild fennel increased household's income by 75%.

With regard to ALVs, Wemali (2014) found that they are a source of income for farmers in Kenya, contributing between 51-70% of household income. Adebooye and Opabote (2004) also found that ALVs play a role in income generation and household consumption. For instance, in South-West Nigeria, ALVs are reported to generate income for smallholder farmers because during dry seasons, they are sold at higher prices than exotic leafy vegetables (Adebooye and Opabote, 2004). In addition, African eggplant also represents the main source of income for many rural households in the forest zone of West Africa (Horna *et al*., 2007; Owusu-Ansah *et al.,* 2001; Danquah-Jones, 2000). However, Vorster *et al.* (2007) reported that in Limpopo, KwaZulu-Natal and Eastern Cape Provinces, ALVs are sold more cheaply than exotic leafy vegetables.

According to Shin *et al.* (2015), it is estimated that the consumption of NUCS in countries such as India provides more than 10 million people per year with employment. This may lead to poverty reduction. Also, a survey by Abukutsa-Onyango (2003) showed that because ALVs require minimal capital investment, they offer an opportunity for the poor people in Western Kenya to earn a living. Consequently, these vegetables provide employment opportunities for those who are outside the formal sector (Adebooye and Opabote, 2004).

1.4.2 Environmental/ecological benefits

ALVs are well-adapted to local growing conditions. Although climate change and water availability remain a major constraint for agricultural production across SSA (Adhikari, 2015), most ALVs are adapted to a range of ecological niches, low input agriculture and, in some cases, tolerate biotic and abiotic stresses, they are mostly described as "drought tolerant" (Zeven, 1998); therefore, they might prove important in fighting food insecurity and "hidden" hunger. This could make them important future crops for rural households based on marginalised lands, particularly under water-scarce conditions. Cowpea are also reported to be drought tolerant (Modi and Mabhaudhi, 2013).

ALVs such as amaranth are known to be tolerant to adverse climatic conditions (Grubben, 2004; Maundu and Grubben, 2004). Amaranth has been discovered to be drought tolerant (Modi and Mabhaudhi, 2013; Akashi *et al.,* 2001), and under changing climate conditions, it is an appropriate crop for abiotic stress situations (Wang and Ebert, 2013). Alemayehu *et al.* (2014) reported that due to its drought tolerance, promoting the cultivation of amaranth could be crucial in reducing food and nutrition insecurity under climate change. A number of underutilized cucurbits and solanaceous vegetables such as melons (*Cucurbita spp.*) possess considerable potential towards resistance against biotic and abiotic stresses and can be utilized as rootstocks (Pandey *et al.,* 2014). Also, wild watermelon (*Citrullus lanatus* L.), a leafy crop of southern Africa, keeps its photosynthetic apparatus intact during prolonged drought (Miyake and Yokota, 2000).

1.4.3 Agrobiodiversity and crop diversity

Introduction of ALVs to crop rotation increases plant biodiversity, nutritional and health value of food. They are rich in amino acids, antioxidants, minerals, stimulators and other usable compounds, which are limited in main commodities crops produced globally. Cultivation of ALVs could help to reduce plant diseases, predators, and produce pesticide-free crops (Bavec and Bavec, 2006).

Several studies have highlighted the function of agrobiodiversity in the context of sustainable production (FAO/PAR, 2010; Altieri, 2002), provision of nutritional benefits (Yenagi *et al.*, 2010), provision of environmental benefits (Jackson *et al.*, 2007), enhancement of smallholder

farmers' livelihoods (Jackson *et al.*, 2010) and high climate change resilience (Ortiz, 2011; Guarino and Lobell, 2011). Although research and development funding for agriculture is basically focusing on internationally well-researched staple crops, crop diversification and crop varieties play a significant role in agrobiodiversity (Ortiz, 2011). In the early 2000s, there was an increase in interest in crop diversification and sustainability of agrobiodiversity.

According to Kahane *et al.* (2013), agricultural production should employ techniques beyond exploiting the 'Green Revolution' technologies of genetic development and higher inputs. The yields of key staple crops (such as maize, rice and wheat) increased due to the use of these technologies to combat world hunger. However, the costs incurred include inappropriate and excessive use of agrochemicals, wasteful usage of water, reduction of crop diversity and loss of beneficial biodiversity (such as pollinators, soil fauna, etc.). The International Plant Genetic Resources Institute (IPGRI) (2002) records that ethnobotanic surveys confirm that hundreds of NUCS represent an enormous wealth of agrobiodiversity that has the ability to contribute to improved incomes, food security, and nutrition, although they are frequently neglected by science. Khanal *et al.* (2014) also agree that ALVs are one alternative for conservation of agrobiodiversity, while improving food sufficiency and the economic well-being of poor farmers.

Plant biodiversity is rich and comparable with natural systems. This is why some ALVs play an important role in organic farming. Dixon *et al.* (2007) reveal that ALVs bring diversity into crop rotations and also provide new possibilities for soil cultivation. According to Wemali (2014), the cultivation of ALVs contribute to agro-biodiversity in Kenya through preservation of genetic material in species that belong to seven families: *Amaranthaceae, Solanaceae, Capparaceae, Cruciferae, Curcubitaceae, Leguminosae, and Tiliaceae*.

1.4.4 Agronomic benefits

ALVs have advantages and values that include several agronomic advantages. ALVs have been found to be well adapted to the low-input environment of smallholder agriculture (Keller *et al.*, 2006). Their period of growth is short, some are harvested within 3-4 weeks; they can produce their own seeds; they grow better when organic fertilizers are used; and they are able to tolerate both biotic and abiotic stress (Abukutsa-Onyango, 2007). In many traditional farming systems,

ALVs have been grown organically by the use of farm manure and there is a potential for commercially producing them (Mwai *et al.,* 2007). Most of them are cultivated in mixed cropping systems that have advantages with regards to land productivity, soil fertility, sustainable production and crop diversification (Backeberg, 2013; Keller *et al.,* 2006).

ALVs have also been found to be adapted to many tropical conditions and are able to resist pests and diseases. This makes them the best sources of genes for genetic improvement of other grown crops, particularly in the area of pests and disease resistance (Adebooye and Opabote, 2004). They also produce seed under tropical conditions, whereas exotic species often fail to do so. They have potential for income generation and self-employment and are suited to environmental-friendly farming systems such as inter-cropping and organic farming (Habwe *et al.,* 2009; Vorster *et al.,* 2007; Abukutsa-Onyango, 2003). For example, spider flower (*Cleome gynandra*) has insect repellent properties which is important in inter-cropping systems (Padulosi *et al.,* 2002).

1.5 Perception/stigma attached to ALVs

Perceptions of ALVs are associated with consumers' knowledge, awareness, and the level of consumption. Even though many people are aware about the benefits of ALVs, the literature indicates that they share negative perceptions about them. Typically, the literature indicates that positive perceptions about ALVs are more prevalent among older and rural consumers while younger and urban consumers view ALVs more negatively (Vorster *et al.*, 2007).

ALVs have been treated as weeds for a very long time (Jansen van Rensburg *et al.* 2007), which resulted in South African researchers and policy makers ignoring them and promoting increased production of exotic vegetables (Department of Agriculture [DoA], 2004). This negatively influenced the production of ALVs since farmers are advised to control or eradicate this weed population. Jansen van Rensburg *et al.* (2007) also reports that ALVs are regarded as food in African smallholder farming systems. Female farm workers are able to distinguish between weed species that are hoed or pulled out and ALVs species during weeding, and those ALVs are left undisturbed for consumption purposes.

The labelling of ALVs as "weeds" has earned ALVs a reputation as food for the poor (Shava *et al.*, 2009; Jansen van Rensburg *et al.* 2007). For this reason, many young and urban people are reluctant to consume ALVs. However, Kepe (2008) argues that, the fact remains that during famine, ALVs play an important role as food for all. For poor people, these foods play an integral part of their diets that even though as situations get better, their attachment to this food does not vanish.

Kuznesof *et al.* (1997) report that ALVs are also perceived to be "old fashioned food". It is believed that older people prepare and consume these specific foods because they have the knowledge, skills and time to prepare such products. That is why the promotion of ALVs to urban and young consumers is challenging as studies show that ALVs are overlooked by young people. The reason might be that young people have more diverse food purchasing and consumption patterns, that is, a preference for novelty and convenience foods. Moreover, the large-scale urbanization of African consumers has further contributed to the cultural change underpinning the perception of these specific crops (Puoane *et al.*, 2006).This has resulted in most people not producing and consuming ALVs for fear of being described as old fashioned (Jansen van Rensburg *et al.,* 2007).

ALVs contain high levels of various nutrients that are important for human health (Mulokozi, 2007; Muchoki, 2003) which can supplement the nutritional needs of rural households (Mwai *et al.,* 2007). Smith and Eyzaguirre (2007) and Abugre (2011) also recorded that ALVs are human immune system boosters that prolong life expectancy, and they act as a digestive cleansing agent. Taruvinga and Nengovhela (2015) reveal that the consumer perception that ALVs are healthy has a positive relationship with the consumption of ALVs. Countries with a high consumption of ALVs are much less affected by cardiovascular diseases, diabetes and other complications related to the changing dietary lifestyles (John and Sthapit, 2004). Acheampong *et al.* (2012) noted that consumers in Ghana purchase ALVs if they look fresh and they are perceived to be more nutritious and easier to prepare than exotic vegetables. Tumwet *et al.* (2014) and Kimiywe *et al.* (2007) also found that the reason for the consumption of ALVs is that consumers believe ALVs are nutritious.

Studies suggest that ALVs are perceived to be tastier than exotic leafy vegetables (Taruvinga and Nengovhela, 2015; Voon *et al.* 2011; Vorster *et al.,* 2007), and are easier to cook (Taruvinga and Nengovhela, 2015), making them a preferred daily dish in rural homes. However, the

majority of consumers in Maroyi's research (2011), did not enjoy the flavour of ALVs, and did not consume ALVs. For example, *B. pilosa* is less likely to be consumed because of its bitter taste. Panmanee *et al.* (2013) interestingly concurred that negative perceptions of the taste of ALVs reduced consumption.

1.6 The importance of ALV production in South Africa

ALVs form part of the daily staple diet of many South Africans and are rich in nutrients such as vitamin A and iron. Most of these crops are currently wild-harvested, while a few are cultivated. However, awareness of these vegetables is not high and they are perceived by many South Africans as "food for the poor" (Venter *et al.,* 2007). The use of leafy vegetables during off-season helps to address food shortages. Almekinders and de Boef (2000) argue that the revival of the use of ALVs within communities will also ensure a focus on the conservation of these crops and ensuring the availability of diverse genetic material for future needs.

According to Modi *et al.* (2006), the decline in the production and consumption of ALVs is caused by limited knowledge of the nutritional content of ALVs, the loss of indigenous knowledge, the association of consumption of ALVs with poverty, and low esteem among rural communities. This decreased utilization and cultivation of ALVs necessitates the exploration of consumers' perceptions of these vegetables. Njume *et al.* (2014) suggest a need to create an atmosphere of awareness that would encourage consumption of ALVs in a bid to curb the high level of malnutrition and food insecurity in South Africa. Table 1.1 shows a list of common ALVs consumed and produced in the Limpopo Province.

Table 1. 1 List of common ALVs produced and consumed in the Limpopo Province of South Africa

Domesticated			Undomesticated		
English name	**Sepedi name**	**Botanical name**	**English name**	**Sepedi name**	**Botanical name**
Collard greens	Phophorokha	*Brassica carinata*	Jews mallow	Lekoshe/Telele	*Corchorus olitorius*
Mustard greens	Mochaina	*Brassica juncea*	Amaranthus	Theepe	*Amaranthus spp*
Pumpkin leaves	Dithaka	*Cucurbita pepeo*	Black jack	Moshitsi	*Biden pilosa*
Cowpea leaves	Monawa	*Vigna inguiculata L.*	Spider flower	Leroto	*Cleome gynandra*

Source: Jansen van Rensburg *et al.* (2007)

1.7 Nature of consumption of ALVs in Africa

Few studies have examined the association between the gender of the household head and consumption patterns of ALVs. According to Tumwet *et al.* (2014) and Kimiywe *et al.* (2007), women play an important role in the purchasing and consumption of ALVs as vegetable preparation is deemed to be "women's work". According to Kimiywe *et al.* (2007), more children in the household consume ALVs, while Taruvinga and Nengovhela (2015) found that older people are mainly the consumers of ALVs. Taruvinga and Nengovhela (2015) found that education negatively impacts on the consumption of ALVs in the Eastern Cape of South Africa. Kimiywe *et al.* (2007) found that only a small proportion (34%) of urban households consumes ALVs. In addition, the size and type of the ALVs market are important, yet policy makers often overlook their significance. According to Taruvinga and Nengovhela (2015), availability of ALVs in the market positively influences the consumption of ALVs. As with education, the level of income of the consumer influences the consumption of ALVs negatively (Kimiywe *et al.* 2007). ALVs are more commonly consumed in households with lower incomes.

Public perceptions of ALVs appear to be associated with knowledge about them, as obtained through research, as well as the extent of their consumption. Despite many people being aware of the benefits of ALVs, the literature suggests that many people hold largely negative perceptions about these vegetables. Generally, the literature suggests that positive perceptions about ALVs are more among older and rural consumers while negative perceptions are more common among younger and urban consumers (Vorster *et al.*, 2007). The literature suggests that ALVs are perceived as tasty as compared to exotic vegetables (Vorster *et al.*, 2007), capable of boosting the human immune system, acting as a digestive cleansing agent, and improving health.

Few studies have examined the relationship between awareness and consumption of leafy vegetables. According to FAO (2003), increasing public consumption of vegetables remained a challenge despite the high awareness levels. However, Agbelemoge (2014) found that consumer awareness/knowledge about ALVs has a positive impact on consumption. Raising peoples' interest is likely to spur them into taking conscious and favourable actions towards vegetable consumption.

1.8 Socio-economic roles of ALVs

1.8.1 Food security

The world passed an unfortunate milestone - there are now more than one billion undernourished people in the world (Garrity *et al.*, 2010). With the global population predicted to increase to 9 billion by 2050, addressing international food security is more pressing than ever (International Food Policy Research Institute, 2002). Food security is defined as the state of having both physical and economic access to sufficient food to meet the dietary needs for a healthy and productive life (United States Agency for International Development, 1992). Addressing this issue will require increasing both the quantity of food available and equitable access to it. Production of agricultural products must be improved, especially in resource-limited conditions. However, the main driver of food insecurity, poverty, must be considered in solutions that address the economic forces that keep undernourished people in cycles of hardship. Most of the world's food insecure people are concentrated in SSA, where one in four people is chronically hungry (FAO, 2014).

ALVs have the potential to address many of the issues of food security facing SSA. ALVs are already widely consumed, with more than one thousand species of leafy greens consumed in traditional diets across SSA (Muhanji *et al.*, 2011), but these species have often been ignored at the expense of introduced vegetables such as kale and cabbage (Adeka *et al.*, 2009; Omiti *et al.*, 2005; Okeno *et al.*, 2003). ALVs include both wild and domesticated leafy greens such as amaranth, nightshade (*Solanum spp.*), spider plant (*Cleome gynandra*), cowpea (*Vigna unguiculata*), and jute mallow (*Corchorus olitorius*). ALVs require fewer inputs and are better adapted to local agro-ecological conditions (Ekesa *et al.*, 2009), which make them ideal for further research and investment to address the challenges of creating climate-resilient agriculture, fighting food insecurity, and developing sustainable food systems.

1.8.2 Income generation

ALVs are also particularly important to women, who are involved in all aspects of the ALV supply chain (Weinberger *et al.*, 2011; Dolan, 2001). Women dominate intermediary and retail activities as well as ALV production, each of which can provide an important income generating opportunity (Weinberger *et al.*, 2011). This may have important implications for

household economic decisions because female-controlled income is more likely to be spent on education and child welfare than male-controlled income (Quisumbing and Maluccio, 2000; Kennedy and Peters, 1992).

1.8.3 Health and nutrition

In addition to their importance to traditional diets, ALVs, which tend to have high concentrations of vitamins A and C as well as calcium, zinc, and iron, can also address micronutrient deficiencies (Uusiku *et al.,* 2010; Orech *et al.,* 2007). These are some of the most common micronutrient deficiencies around the world (WHO and FAO, 2006), and ALVs are a reliable source of many critical micronutrients in Kenya (Uusiku *et al.,* 2010; Orech *et al.,* 2007). Finding ways to improve nutrition is important in an area of the world where the daily intake of fruits and vegetables is well below dietary recommendations, and where the affordability of vegetables remains a pervasive problem (FAO, 2012). It was found that households benefiting from traditional vegetable promotion and demand creation activities had significantly higher dietary diversity for children and women in reproductive age.

1.9 Outline of thesis structure

The thesis is organised into six chapters. This includes the introduction, four empirical chapters, and a concluding chapter. The introductory chapter has provided the problem statement, objective of the study, and literature on the benefits of investing on NUCS, perception attached to ALVs, importance of producing ALVs, and roles of ALVs. The chapter concludes with an outline of the thesis structure.

Chapter 2 explores the value chains for ALVs in the Limpopo Province. Factors affecting the value chain of ALVs are presented and evaluated.

Chapter 3 examines the factors influencing households' participation decision in the production of ALVs in the Limpopo Province of South Africa. A double-hurdle model was used in this chapter to analyse the perception and socioeconomic factors influencing smallholder farmers' participation in production and level of participation on ALVs.

Chapter 4 studies the factors influencing consumers' purchasing decisions and expenditure levels for ALVs. The chapter discusses factors affecting the consumption of ALVs and presents the results from a double hurdle model on the socioeconomic factors influencing the consumers' purchasing decision and level of expenditure on ALVs.

Chapter 5 determines socio-economic and perception factors influencing WTP for ALVs. Contingent Valuation and the Ordered Probit model were applied; results are presented and discussed.

Chapter 6 offers recapping of the purpose, conclusions, policy recommendations, and suggestions for further research.

CHAPTER 2: ANALYSING THE VALUE CHAIN FOR AFRICAN LEAFY VEGETABLES IN LIMPOPO PROVINCE, SOUTH AFRICA[1]

2.1 Introduction

ALVs are known by many names such as indigenous leafy vegetables (Neugart *et al.,* 2017), wild vegetables (Nesamvuni *et al.,* 2001), and traditional leafy vegetables (Vorster *et al.*, 2008; Odhav *et al.,* 2007). Due to different languages in South Africa, they are called *imfino* in Nguni languages (isiZulu and isiXhosa), *morogo* in Sotho languages (SeSotho, Setswana, and Sepedi) and *miroho* in tshiVhenda (Maunder and Meaker, 2007). Jansen van Rensburg *et al*. (2007) defined ALVs as "plant species which are either genuinely native to a particular region, or which were introduced to that region for long enough to have evolved through natural processes or farmer selection". Asfaw (2001) defines them as "edible plants that are biologically indigenous to an area, while introduced vegetables are those vegetables that have been introduced into a particular area and have not physiologically adjusted to the local conditions and subsequently require many agricultural inputs". They have their natural habitat in sub-Saharan Africa while some of them were introduced over a century ago and, due to long use, have become part of the food culture in the sub-continent. The Plant Resources of Tropical Africa (PROTA) reported an estimated 6,376 useful indigenous African plants of which 397 are vegetables. In the same reference, it is indicated that information is available on cultivation practices for 280 indigenous ALVs (PROTA, 2004).

According to Chweya and Eyzaguirre (1999), ALVs have long played an important role in the nutrition and diet of sub-Saharan African people. They are indispensable ingredients of soups or sauces that accompany carbohydrate staples. The utilization of ALVs in South Africa is as old as the history of modern man (Jansen van Rensburg *et al.,* 2007). According to Parsons (1993) and Fox and Norwood-Young (1982) the native people of southern Africa, Khoisan people, who lived for at least the past 120 000 years, relied on gathering plants for consumption from the wild to survive. Bundy (1988) also added that the Bantu people, who started to settle in South Africa about 2 000 years ago, also collected ALVs from the wild. When crops had

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failed or livestock herds had been decimated, they depended on hunting and collecting edible plants (Peires, 1981). Collecting and cultivating ALVs continues to be widespread among African people in SSA (Husselman and Sizane, 2006; Modi *et al.,* 2006; Jansen van Rensburg *et al.,* 2004) even though western influences have considerably modified their food consumption patterns.

In the Limpopo Province, the agricultural sector is an important source of employment of rural people and it plays a significant role in the alleviation of poverty and food insecurity (Baloyi, 2010). Due to its employment abilities and its reputation as a source of income for smallholder farmers, farm workers, and street vendors/hawkers, agriculture is an engine of economic growth. It is estimated that some 8.5 million people in South Africa are directly or indirectly dependent on agriculture for their employment and income (Brand South Africa, 2018). Machethe *et al.* (2004) also revealed that agriculture is one of the greatest contributor to household income in the Limpopo Province, although, smallholder farmers' participation in commercial agriculture is a major cause for concern. Majority of the smallholder farmers are mostly excluded from high-value markets due to a number of socioeconomic and institutional challenges. Commercial farmers in the Province mostly sell their products through formal markets (such as fresh produce markets and supermarkets) by formal contract agreements, however, most smallholder farmers sell their products through informal markets (such as street vendors/hawkers and door-to-door sellers).

The number of ALV species in Africa is far greater than exotic ones and are environmentally adapted to the area better than the introduced exotic vegetables. They are also the provider of low-cost quality nutrition for many households in rural and urban areas (Chweya and Eyzaguirre, 1999). Despite their nutritional benefits, ALVs remain underutilised crops in Limpopo Province (van Jaarsveld *et al.*, 2014).

According to Njume *et al.* (2014), ALVs are an important source of nutrition in the diet of rural South Africans. However, most of the species are not well known or are used only locally. Little or no attention has also been given to these ALVs by local, national and international research institutions. There is little research and development investment in the production, processing, and marketing of ALVs and their products. There is hardly any research on the challenges and opportunities of integrating ALVs into mainstream agricultural value chains. Not much is known about the prominent value chain actors and institutions governing the ALV chains. Thus,

it is timely to undertake value chain analysis to generate information for all actors to assist them to better organize the chain. Kaplinsky and Morris (2001) described a value chain to be a process by which products are conceived, through the different stages of production and transformation, made up of a number of actors from input suppliers, farmers and processors, to exporters and consumers/buyers engaged in the activities required to bring agricultural product from its conception to its end use. An interesting feature of a value chain analysis is that it is holistic and looks at all the processes, institutions, actors, connections, value adding and constraints occurred along the value chain.

Most agricultural produce including ALVs are sold unprocessed because of the absence of agro-processing industries in the Province. Smallholder farmers in the Province are mainly faced with obstacles such as lack of access to agricultural support services (i.e. access to credit and extension services). Even if many of them are highly motivated to become commercial farmers, unless they are incorporated alongside the value chain and get access to credit, the dream of revitalising, increasing and strengthening the sub-sector will continue to be unachieved (Nesamvuni *et al.,* 2003).

Along the ALV value chain, various problems (such as poor infrastructure, lack of financial assistance, etc.) hinder the possible benefits that the value chain actors might have attained. Therefore, the investigation of ALV value chain analysis is crucial in this study area. Few programmes promoting ALV production exist, such as Ilima/Letsema in Limpopo Province. The Ilima/Letsema programme was specifically targeted at increasing food production to fight poverty (DAFF, 2012). However, no study has examined the impact and challenges of the programme as yet.

Very few studies have been conducted to investigate ALV value chains and related subjects in Southern Africa (e.g. Bidogeza *et al.,* 2016; Chagomoka *et al.,* 2014; Weinberger *et al.,* 2011; Lenné and Ward, 2010; Shackleton *et al.,* 2010). The studies have mostly investigated issues on production system characteristchics of ALVs, nutritional attributes of ALVs, the nature of ALV marketing outlets, and women participation in the production and marketing of ALVs, but have hardly looked at the entire value chain, particularly from seed production and distribution through to produce marketing except for Chagomoka *et al.* (2014). In South Africa, little research has been done to assess and investigate the relationships between the value chain

actors along the ALV value chains. This study is using a value chain approach (VCA), which reflects on the various activities from production to the delivery of ALVs to final consumers. The VCA makes it possible to discover unexploited possibilities and prioritise interventions that might enhance operations at various levels of the whole chain (Chitundu *et al.,* 2009). Thus, this study aims to analyse the value chain of ALVs in the Limpopo Province with a special emphasis on value chain actors, institutions governing the chain, and the infrastructural endowments. This was done by identifying the value chain actors and mapping out the value chain interventions that are needed to improve the production, processing, and marketing of ALVs in the Province and beyond.

This chapter undertakes value chain analyses of ALVs in the context of Limpopo Province and presents and discusses the empirical results. The rest of the chapter is organised as follows: Section 2.2 outlines the ALV marketing and value chain challenges. The value chain approach and some success stories therein are discussed in section 2.3. Section 2.4 outlines the methodology, which constitutes the study area, sampling and data. Section 2.5 presents the empirical results and discussion, while section 2.6 closes the chapter with a brief summary.

2.2 ALV marketing and value chain challenges

Osano (2010) reported that although ALVs are a crucial source of food, feed, natural medicine, and other products of socioeconomic value, they are also a vital element in the livelihood of people worldwide. Due to the low competitiveness of the value chain actors along the chain, ALVs are untapped for different reasons, from input suppliers all the way to the retailers. Also, the private and public service providers are still quiet about the promotion of appropriate technology packages for ALVs. Agriculture and rural development policies and programmes are mostly focusing on a few commodities. There is always mistrust amongst value chain actors, and also between private and public stakeholders. No one takes responsibility for the lack of services that smallholder farmers receive (such as agricultural extension and agricultural credit), which is due to institutional failures. Infrastructural endowments (or their lack thereof), value chain governance issues, and challenges of consistent supply of acceptable quality products are the key challenges determining the success (or otherwise) of producing, processing and marketing ALVs.

According to Boateng *et al.* (2016), the lack of storage facilities is one of the constraints that

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militate against the marketing of ALVs. This enforces most traders to purchase ALVs in smaller quantities to be sold in a day or few days. As ALVs are highly perishable, this leads to spoiling, particularly at the retailer point. Lack of suitable street vendor/hawkers infrastructure (such as shade) to publicly show or display the produce on the marketplace for sale increases spoilage, which leads to lower prices and sales. Chagomoka *et al.* (2014) also recorded that excessive perishability of ALVs is a serious challenge in the marketing and distribution of the produce. Will (2008) also reported that the perishability of ALVs causes them to lose quality drastically after harvest up until consumption. This poses major challenges in distribution and marketing. In addition, Boateng *et al.* (2016) records that lack of financial access is one of the constraints ALV farmers and traders face as it prevents them from producing on a larger scale and purchase the produce on a larger scale for sale, respectively.

Other challenges for ALV marketing involve product bulkiness, which makes it expensive to transport, store, handle and process in fresh form. These factors lead to large losses if they are left unsold. The processes of washing, cooling, and proper management are important from the time of harvest until the products are put on display. According to Nonnecke (1989), leafy vegetables need to have a longer shelf life and remain attractive to the consumer after having been purchased. ALVs have a lower level of demand as compared to exotic vegetables leading to lower sales and thus attract lower prices leading to reduced returns (Boateng *et al.,* 2016; Lenné and Ward, 2010; Lyatuu *et al.,* 2009). Onyemauwa (2010) also found the same results that limited supply, insufficient capital and spoilage are major challenges facing the management of ALV value chains from the smallholder perspective.

Osano (2010) also reported that inadequate skills affect both production and marketing of indigenous vegetables. In addition, poor infrastructure such as bad roads, which are difficult to use during the rainy seasons, hinder timely transportation of ALVs to the market. Moreover, alternative product forms and markets can hinder the availability of vegetables since different breeds and qualities can be cultivated for the fresh and processed markets.

2.3 The value chain approach and some success stories

Kaplinsky and Morris (2001) describe a value chain as a range of activities, which are required to bring a product or service from conception, through the different phases of production,

transformation and delivery to final consumers. Value chain analysis seeks to characterize how chain activities are organised, costs incurred, value created and benefits shared among chain participants. It also deals with the institutional arrangements governing the activities, actors, their relationships, the linkages and market prices in and out of each actor in the chain. The costs incurred, the values added and the benefits accrued by each actor in the value chain are the outcomes of these governing institutions. United Nations Industrial Development Organization (UNIDO, 2009) describes a value chain as "a set of businesses, activities and relationships involved in creating a final product or service". It builds on the idea that a product is rarely consumed in its original form but becomes transformed, combined with other products, transported, packaged, and marketed until it reaches the consumer. In this sense, a value chain describes how producers, processors, buyers, sellers, and consumers separated by time and space gradually add value to products as they pass from one link in the chain to the next. In a typical agricultural or food value chain, the chain actors who actually transact a particular product as it moves through the value chain include input (e.g. seed) suppliers, farmers, traders, processors, transporters, wholesalers, retailers and final consumers (Figure 2.1).

Input suppliers ⟶ Farmers ⟶ Traders ⟶ Processors ⟶ Exporters/importers ⟶ Retailers ⟶ Consumers
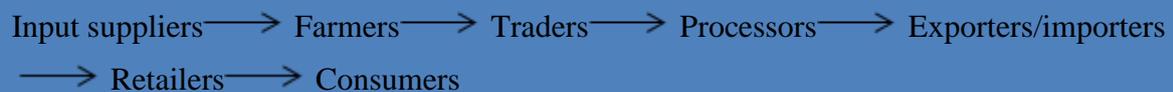
Figure 2. 1 A simplified agricultural value chain

However, in reality, value chains are more complex than the above example. In many cases, the input and output chains comprise more than one channel and these channels can also supply more than one final market. The channel also could branch at any stage as there are multiple options (or actors) at each stage of the chain. A comprehensive mapping, therefore, describes interacting and competing channels (including those that perhaps do not involve smallholder farmers at all) and the variety of final markets through which they interact.

In South Africa, an indigenous underutilized crop, green rooibos tea was first marketed in 1904 in its fermented form, which recently is a new product on the market. Its use has moved beyond a herbal tea to intermediate value-added products such as extracts for the beverage, food, nutraceutical and cosmetic products (Joubert and de Beer, 2011). Rooibos tea is gaining popularity with consumers and it is known to originate from South Africa and to have high

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antioxidant potential. According to Jones *et al.* (2015), a droëwors (dry traditional South African sausage) formulation using a combination of game meat and beef fat with the addition of rooibos tea extract is a successful addition to the processed meat market. In addition, rooibos is also used as the main ingredient for haircare products, products for anti-acne, baby care products, aftersun products, and skin care products (Tiedtke and Marks, 2002) sold around the world.

In the case of sweet piquanté peppers, a cultivar of chilli pepper known as peppadews, they are mainly produced, processed, distributed and exported from the Limpopo Province (Uys, 2017). The Piquante Pepper fruit is processed for removal of the seeds and reduction of the heat of the pepper to more palatable levels and is then pickled and bottled. It is mainly sold by large supermarkets such as Pick'n Pay, Woolworths, and Checkers in South Africa. It is also exported to countries such as the Americas and Europe. The following are different products processed from peppadew: goldew peppers range, jalapeño peppers range, pickled onions range, atchar range, pasta sauce range, relish range, cream cheese range, roasted peppers range, and splash-on sauce range (Peppadew, UN).

Amaranth is an under-exploited and under-utilized plant in South Africa with an exceptional nutritive value. Only its leaves are consumed in South Africa. However, in Kenya, through extensive research, grains from amaranth crop are used as food ingredients (Emire and Arega, 2012) and can also be processed into oil (Otieno, 2011). Its grains are also utilized in several ways: cooked as a cereal, ground into flour, popped like pop corns, sprouted, toasted, cooked with other whole grains, and added into stir fry or soups and stews as a nutrient dense thickening agent. The flour can be used to prepare porridge, pizza, pasta, pancake, flat bread, and Ugali (pap/porridge in South Africa), among others. He and Corke (2003) also revealed that amaranth grain produces oil, which is considerably higher in squalene compared to other cereals. A study by Beswa *et al.* (2016) suggested that the addition of amaranth leaf powder to provitamin A-biofortified maize snacks had a significant effect on their nutritional attributes. The nutrient content (including essential amino acids, provitamin A and Fe) of the snacks was significantly improved by the addition of Amaranth leaf powder. Value addition on amaranth in Kenya has improved the livelihoods of farming households.

2.4 Methodology

2.4.1 Study area

The study was conducted in three district municipalities of the Limpopo Province (see Fig. 2.1) namely, Capricorn, Vhembe, and Mopani districts. Most of the area in the districts is drought-prone, however, some of the areas have a better rainfall distribution. These districts have a significant number of rural households engaged in agricultural production and are among the poorest in terms of average household incomes (Stats SA, 2012). The Limpopo Province, which is characterized by high poverty levels and lack of economic opportunities, particularly in rural areas, has been used by the ARC of South Africa for pilot projects of ALV production. The district municipalities were also selected because of its proximity to the capital city, Polokwane, and towns such as Tzaneen, Giyane, Makhado, and Thohoyandou, where there is a potentially large lucrative urban market for ALVs, as there is for maize, dairy and horticultural products, amongst others. Maize (Zea mays) is the primary staple in Limpopo Province; it is prepared as a paste called porridge or pap and served with dark green leaves (mainly ALVs), and/or beans as well as meat. Faber *et al.* (2010) reiterate that ALVs have always been part of Limpopo peoples' diets even in urban areas such as Polokwane, Tzaneen, Giyane and Thohoyandou. In addition, they also note that although leafy vegetables are produced everywhere in the Province, the study areas are the major leafy vegetable producing locations.
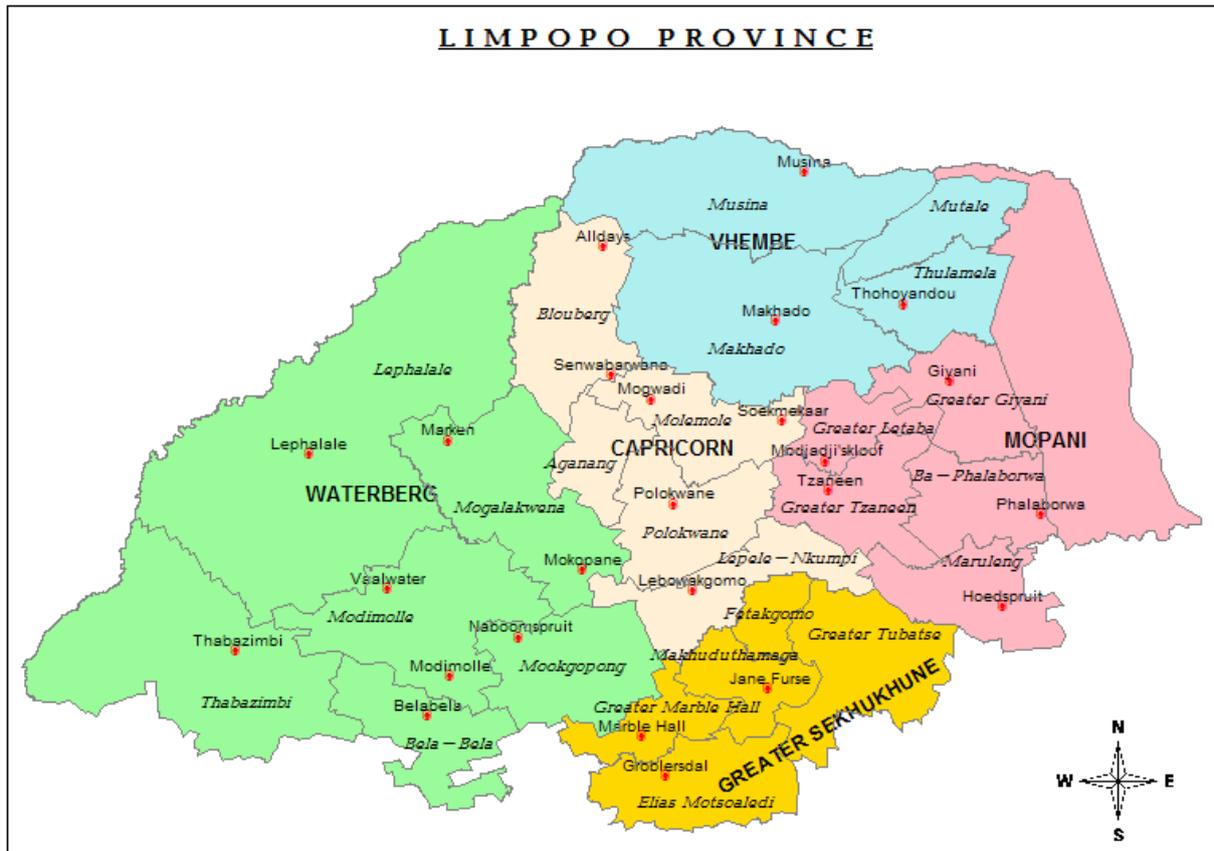
Figure 2. 2 Map of Limpopo Province showing the position of district municipalities and towns
Source: Stats SA (2016)

2.4.2 Sampling and data

Initially, data were collected from ALV producers who identified input sources and other value chain actors. Simple random sampling was used to collect data from farmers. A list of farmers from the three districts was obtained from the Limpopo Department of Agriculture (LDA) offices in the Limpopo Province. With the help of the district managers, enumerators were directed to the selected farmers' homesteads. A total of 126 households were randomly selected from those districts. Data were collected between June and July 2013 using a structured questionnaire. The questionnaire was pretested and administered by trained enumerators who had good knowledge of the rural farming systems and who could speak the local languages, i.e. Sepedi (Capricorn district), TshiVenda (Vhembe district) and XiTsonga/Sepedi (Mopani District). The questionnaire included, amongst others, information on basic household head characteristics, perception on ALVs and household income sources. It also captured farmers'

membership of associations as well as their access to institutional support such as market access and extension services.

Futhermore, data were also collected from the buyers/consumers. Cross-sectional data were collected from a sample of 299 consumers in January 2012. One rural and one urban area were selected from each of the three districts. A meeting was held with the chief/leaders of these areas for permission to collect data, and it was granted. Households were selected conveniently from both rural and urban areas, and the head of the household was interviewed. Data were collected by using a structured questionnaire. The questionnaire was pretested and administered by trained enumerators who could speak the local languages, i.e. Sepedi (Capricorn district), TshiVenda (Vhembe district) and XiTsonga/Sepedi (Mopani District). Household heads were interviewed about their level of awareness regarding ALVs and their perception towards ALVs. Only one questionnaire was excluded due to missing data.

After the farmers and consumer surveys, a snowball sampling method by Goodman (1961) was used for data collection from various ALV value chain actors. Bearing in mind what the value chain analysis data were collected in December 2015 in each district using formal interviews at producer level and informal interviews at input, processor and distributor levels. Interviews with identified actors such as input suppliers and market intermediaries led to them identifying other actors and institutions having an influence in the ALV value chain. Questions for the value chain actor survey were structured in such a way that the data and information generated were in harmony with the period when producers were interviewed. Each discussion lasted about 30-40 minutes, covering various roles that each participant played in the ALV value chain, the challenges faced by the value chain actors, and on potential areas for improvement.

2.5 Empirical results and discussion

Table 2.1 shows the list of value chain actors interviewed and their location. NTK, supermarkets (such as Shoprite), and other smallholder farmers were identified as actors who supply inputs. The ARC, Mayford seeds, and Starke Ayres (all based in Gauteng Province) including LDA were also identified as input suppliers. Smallholder farmers from the three selected districts were involved. Traders identified were supermarkets (such as Pick 'n Pay, Shoprite, OK, Spar, Boxer, Woolworths, Food Lovers Market and Goseame open market) as well as street

vendors/hawkers. Consumers were also identified as actors in the value chain. There was an absence of processing, wholesalers, and export actors along the ALV value chain.

Table 2. 1 List of interviewed value chain actors in ALVs, 2015

Activity	Actors	Location in Limpopo Province
Input procurement	NTK (4)	Tzaneen, Giyane, Thohoyandou, Polokwane
	Supermarkets (4)	Tzaneen, Giyane, Thohoyandou, Polokwane
	Limpopo Department of Agriculture (LDA) (3)	Mopani, Vhembe, and Capricorn districts
	Other smallholder farmers	Mopani, Vhembe, and Capricorn districts
Growing/producing	Smallholder farmers (126)	Located in the 3 districts of Limpopo
Traders	Shoprite (4)	Tzaneen, Giyane, Thohoyandou, Polokwane
	Pick 'n Pay (2)	Tzaneen, Polokwane
	Spar (2)	Tzaneen, Polokwane
	Woolworths (2)	Tzaneen, Polokwane
	Food Lovers' Market (2)	Tzaneen, Polokwane
	Goseame open market (1)	Polokwane
	OK (1)	Giyane
	Boxer (1)	Tzaneen
	Street vendors (4)	Tzaneen, Giyane, Thohoyandou, Polokwane
Consumption	Consumers (299)	Located in the 3 district of the Limpopo Province

Source: Survey data

2.5.1 Value chain analysis of ALVs

The value chain of ALVs in the Limpopo Province is simple and undeveloped with no infrastructure. The main actors on the value chain were input suppliers, smallholder farmers, traders (such as retailers, street vendors/hawkers) and consumers. The first marketing channel was from the smallholder farmer to consumers. The other marketing channel was from farmer to retailer and then to consumers. Other smallholder farmers sold directly to the middlemen (collectors/distributors) who took their ALVs to retailers and then to consumers. The final end market of ALVs was domestic consumption.

Input suppliers

Currently in the Province, there are very few input suppliers for ALV production. This lead to lack of access to inputs. Local input companies (such as NTK, Mayford seeds and Starke Ayres) and retailers (such as Shoprite/Checkers, Pick 'n Pay, SPAR) take the responsibility to offer smallholder farmers with agricultural inputs, however it is difficult to supply inputs for ALVs production. For the few who supply smallholder farmers with ALV inputs, this has compelled smallholder farmers to walk and also drive long distances to purchase inputs from the local dealers and towns within a radius of 10-20 km. Inputs for production purposes (such as seeds, agro-chemicals, and farm implements) were sold by NTK situated in towns (such as Tzaneen, Giyane, Thohoyandou, and Polokwane city). Inputs such as seeds supplied by NTK are imported from Mayford seeds and Starke Ayres located in Gauteng Province. Other inputs are imported from the international suppliers. Supermarkets such as Pick 'n Pay and Shoprite/Checkers sell ALV seeds supplied by Mayford seeds and Starke Ayres, though they do not sell ALVs at the moment. In addition, LDA district offices under the Ilima/Letsema programme provided inputs (such as seeds, fertilizers and pesticides) to smallholder farmers in the Province. The ARC also provided information through research and development on seed and production to the LDA, then information was transferred to smallholder farmers in the Province. Among the ALVs produced, mustard green and collard green seeds were the most traded. Some smallholder farmers also acted as input dealers by buying inputs in large quantities from NTK and selling, and also by collecting seeds from healthy and disease-free plants.

Producers

From the study area, ALVs were mainly produced by smallholder farmers, most of them on less than a hectare of land. ALVs produced included mustard greens (*mochaina*), collard greens (*phophorokha*), cowpea leaves (*monawa*), and pumpkin leaves (*dithaka*). Smallholder farmers did not use good agricultural practices (such as integrated pest management practices as well as drip irrigation) but used the traditional production practices for ALV production. Seeds for mustard greens and collard greens were the only seeds commercialized. ALVs such as cowpea leaves and pumpkin leaves among others, were produced using local landraces. Some smallholder farmers were involved in supplying inputs such as seeds, which they harvested from the crops they grew.

The average age of interviewed producers was estimated at roughly 55 years, and the majority (69%) were women. The producers reported to have approximately 15 years of ALV farming experience and 31% of smallholder farmers did not have a formal education. They also have limited access to formal markets to sell their produce as only 42% reported to have access to these markets. Given the relatively high perishability of leafy vegetables, producers are at times compelled to sell their produce immediately after harvest, which leads to low farm gate prices. Most producers (76%) were not part of farmers' organizations. However, most smallholder farmers involved in farmers' organizations were able to access technical production services and seeds from the LDA. Due to the lack of improved ALV cultivars as well as technologies, ALV yield levels were low as compared to exotic leafy vegetables.

However, there are no linkages between the smallholder farmers and processors, wholesalers and export markets. If these three missing linkages can be established through the formation of both public and private processing, and wholesale companies and identifying export market opportunities, smallholder farmers will most likely benefit.

Traders

Traders are people who purchase products from producers and then resell them to consumers. The main functions of these actors in Limpopo included collection of ALVs, maintaining product quality until they are transferred to the next agent, hawker, and door-to-door marketing. Household consumption and income generation were the main aims for producing and marketing ALVs by value chain actors. Besides home consumption, ALVs were only sold fresh in traditional fruits and vegetable markets and streets without any value added on them.

Large retailer (supermarket) chain stores such as Pick 'n Pay, Shoprite/Checkers, and OK explained that they have contract agreements with their approved suppliers and distributors who meet their quality standards. Shoprite/Checkers through their distributors, Fresh Mark, buy their vegetables from smallholder farmers. They do not have a direct relationship with farmers, so, any potential supplier approaches Fresh Mark instead of Shoprite/Checkers directly. Fresh Mark indicated that they had never bought ALVs but would be willing to try them in the future; results in Chapter 5 indicated that there is a guaranteed and increasing demand for ALVs in the Limpopo Province. However, some supermarkets such as SPAR, Boxer, and franchised Shoprite had a direct relationship with smallholder farmers, and they sell their ALVs. OK

supermarkets situated in the nearest towns closer to the villages bought ALVs from the smallholder farmers to sell to the local consumers. All these supermarkets trade with smallholder farmers with no formal contracts. If the quality of the product is acceptable, they buy on the spot. The Goseame open market is operating successfully in Polokwane, and it buys ALVs directly from farmers. Just like with supermarkets, there is no formal contract between this open market and the farmers. Food Lovers' Market does not currently sell ALVs but is willing to consider selling in the future.

The only municipality fresh produce market (FPM) that was located in Polokwane was no longer in operation. Now smallholder farmers have to send their produce to Tshwane FPM and Johannesburg FPM in the Gauteng Province. An opportunity exists to establish a municipal FPM in the capital city of Polokwane with the intention to consolidate and collect products being supplied to various markets. This will benefit both black smallholder farmers and emerging farmers in the Province.

Processing of ALVs (such as canning and branded packaging) to meet the young and urban dwellers' needs and preferences is not practised in the Limpopo Province. Smallholder farmers use the old way of sun-drying ALVs, and young and urban dwellers do not consume such ALVs. Pumpkin leaves and cowpea leaves were sundried after cooking and/or blanched, then preserved for home consumption during off-season. However, during the off-season, the processed ALVs might be sold to interested buyers in the rural areas. Regarding the exporting of ALVs by smallholder farmers, currently, there were no export activities for ALVs in the Limpopo Province. ALVs are currently only sold locally. Linkages between the traders and processors as well as the export market could most likely benefit both the traders and the smallholder farmers. The inclusion of wholesalers, hotels and restaurants will also strengthen the value chain of ALVs. Hotel and restaurants will come up with new sophisticated ways of preparing ALVs that will be included in their menus to attract urban dwellers and the rich consumers who view ALVs as food for the poor.

Consumers

In the three districts surveyed, the average household head was 44 years old, with an average family size of four members. Approximately 42% of the respondent were males and resided in the urban areas (47%). Ninety-six percent of the sampled households were aware of ALVs, and

it took them an average of about 7 km to reach the ALV market. Consumers scored ALVs in terms of Taste and Nutrition on average 3.59 and 4.36, respectively, on a scale of 1-5 (where 1 was low and 5 was high), reflecting the importance of these attributes among the sample consumers. In addition, an average low score of 1.86 for ALVs in terms of Availability was recorded, which implies that ALVs are not available throughout the year. The reason might be that ALVs are seasonal. Older consumers in the urban areas far from the ALV markets indicated that they were not willing to purchase for ALVs. ALVs were mainly consumed by illiterate, older people based in rural areas, who are aware of ALVs and having a belief that ALVs are tasty and nutritious.

2.5.2. Relationships amongst ALV value chain actors in Limpopo Province

There is a relationship amongst the value chain actors, and this was established based on spot markets (actors negotiate on price, quantities, and other requirements directly at the point of transaction). Figure 2.3 shows a summary of the ALV value chain actor linkages in the study area based on spot market relationships.
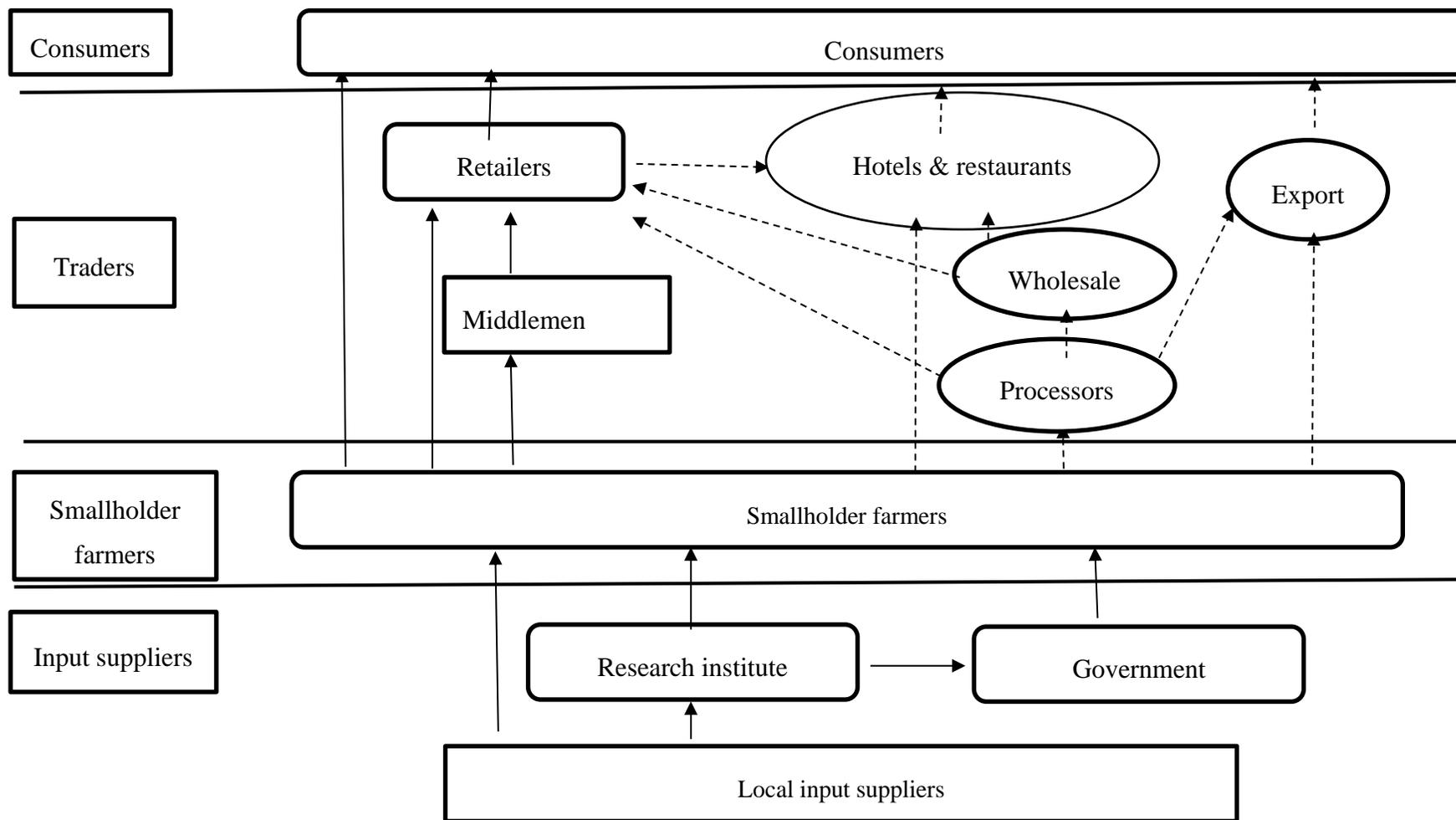
Figure 2. 3 Linkages of ALVs value chain actors in the Limpopo Province
Source: Author's presentation (2015) ——→ Current chain -------→ Missing link/actors

Local input suppliers usually produced their seeds, pesticides, etc. while smallholder farmers purchased from them. Government R&D divisions, such as the ARC, develop more breeding lines and technology to be used by smallholder farmers. Smallholder farmers considered access to financial services, availability of quality ALV cultivars, or good infrastructure as crucial factors to improve efficiency. Middlemen located in towns (collectors/distributors) obtained ALVs from smallholder farmers and sold to traders. Traders such as supermarkets and street vendors/hawkers directly sold their produce sourced from smallholder farmers to consumers.

As processing activities of ALVs in the Limpopo Province are currently absent, there is a potential linkage between smallholder farmers and the agro-processing industry that is expected to benefit all actors in the value chain. Processors could sell their produce to traders and also to the export market to realize higher profits. This would also benefit smallholder farmers due to higher volume demand by hotels, supermarkets and other retailers. In addition, smallholder farmers could also link with the export market.

2.5.3 *Distribution of gross margins along alternative ALV marketing channels*

In general, ALVs are mainly marketed through three channels: 1 smallholder farmers sell directly to consumers; 2 smallholder farmers sell to retailers; and 3 smallholder farmers sell to middlemen (collectors). Table 2.2 shows the estimated gross margins for market participants in different ALV marketing chains. The description of the activities done by the value chain actors from the farm to the consumers were used to estimate the variable costs and returns. Computations were perfomed on a per unit basis (bundle of fresh ALVs). A single production cycle takes about three to four months, and in this period, ALVs were regularly harvested, with the amount produced decreasing over time.

In marketing channel 1, after the production stage, labour is required for harvesting and packaging in bundles and selling ALVs to community members. Smallholder farmers (44%) sell their products at the farm gate and have no transportation cost as consumers buy ALVs from where they are produced at an average price of R7.00/bundle. Considering the cost of production inputs, the variable marketing cost at the farm gate was estimated at R0.50/bundle.

In marketing channel 2, the average producer price for the retail market was R8.40/bundle. Visual inspection for freshness and colour are performed by supermarkets to assess ALV

quality at the receiving point. Producers who sell to the retail market travel between 10km to 40km with an average distance of 20.6km. These smallholder farmers rely on their own transport. The number of trips to the market is dictated by the quantity harvested and the demand. On average, producers made ten return trips per cycle, each covering about 70km using own transport. Marketing cost was estimated at R1.50/bundle. The average consumer price from supermarkets was R10/bundle of the equivalent product with variable marketing costs averaging R0.50/bundle. Variable marketing costs for retailers consisted mainly of labour costs for receiving, screening, and pricing. In supermarkets, ALVs are displayed in open baskets and generally sold out within a day. The cost of electricity for storage costs was zero because the ALVs are not refrigerated but sold fresh after harvest.

Table 2.2 Estimated gross margins for market participants in different ALV marketing chains, Limpopo Province, 2015

Marketing channel	Market participants	Production and marketing costs	R / Bundle	Ratio of gross margin to consumer price^(GM/CP)*100
1	Producers	Production variable cost (PVC)	2.00	64%
		Marketing cost (MC)	0.50	(Producers)
		Consumer price (CP)	7.00	
		Gross margin (GM) = CP - (PVC + MC)	4.50	
2	Producers	Production variable cost (PVC)	2.00	
		Marketing cost (MC)	1.50	
		Selling price to retailer (SP)	8.40	58%
		Gross margin (GM) = SP - (PVC + MC)	4.90	(Producers)
	Retailers	Purchase price (PP)	8.00	
		Marketing cost (MC)	0.50	
		Consumer price (CP)	10.00	15%
		Marketing margin (MM) = CP - PP	2.00	(Retailers)
		Gross margin (GM) = MM - MC	1.50	
3	Producers	Production variable cost (PVC)	2.00	
		Marketing cost (MC)	1.60	50%
		Selling price to middlemen (SP)	7.20	(Producers)
		Gross margin(GM) = SP - (PVC + MC)	3.60	
	Middlemen	Purchase price (PP)	7.20	
		Marketing cost (MC)	0.30	
		Selling price to retailer (SP)	8.00	6%
		Marketing margin (MM) = SP - PP	0.80	
		Gross margin(GM) = MM - MC	0.50	(Middlemen)
	Retailers	Purchase price (PP)	8.00	
		Marketing cost (MC)	0.50	
		Consumer price (CP)	10.00	15%
		Marketing margin (MM) = CP - PP	2.00	(Retailers)
		Gross margin (GM) = MM - MC	1.50	

Source: See Table 2.1

Notes: Channel 1: Producers → Consumers

Channel 2: Producers → Retailers → Consumers; and

Channel 3: Producers → Middlemen → Retailers → Consumers.

^Gross margin ratio to consumer price measures how much out of every R1.00 of sales to consumers a market participant earns in the respective channels.

In marketing channel 3, middlemen buy the already packed ALVs from producers at an average price of R7.20/bundle of the equivalent and sell at an average price of R8.00/bundle to retailers.

Estimations indicate that middlemen spend an average of R0.30/bundle on marketing costs. Smallholder farmers who sell through channel 3, do not have to depend on the number of buyers turning out like with the farm gate option, although there are no written contracts and they have less bargaining power in setting prices. Worth noting is that the percentage of benefits (gross margin) received by middlemen is far less as compared to other actors in the value chain. This may be a reason why retailers have no incentive to buy their supplies at prices much higher than those offered by the smallholder farmers.

Table 2.2 indicates that producers enjoy higher gross margins; however, the proportion reduces with an increase in the marketing channel's number of participants. The estimations indicate that smallholder farmers earn relative gross margins of about 64% from selling directly to the consumer, 56% from selling directly to the retailers, and 50% from selling through middlemen. Even though the gross margins are lower from selling through the middlemena large quantity of the ALVs was traded through this channel as middlemen, as well as street vendors/hawkers, offer a comparatively higher price and a relatively more dependable market by buying in bulk. Quaye and Kanda (2004) also reported the same results.

Other than the absence of written contract agreements between the actors and having less bargaining power in setting prices, smallholder farmers who sell thorugh the farm gate channel rely on the number of buyers buying. However, the middlemen provide an important linkage between some smallholder farmers and consumers, where a large quantity of ALVs was traded through channel 3. These findings concur with Mabuza *et al.* (2014) and Bwalya (2014). This might be because middlemen hardly add any value from what they buy from their smallholder farmers. They supply their market immediately to avoid spoilage.

2.5.4 ALV value chain constraints

Constraints identified by value chain actors, including the smallholder farmers, in the course of the field survey are summarized in Table 2.3. Constraints regarding input supply were low input demand because most ALVs are produced by smallholder farmers and not large commercial farmers, and the lack of good quality seed. These constraints offer opportunity for numerous interventions which includes alternatives to improve input markets, provision of good quality seed, regulation and control input prices to guarantee fair prices for high quality seed. The results concur with Padulosi *et al.* (2013), who reported that lack of propagation materials and

seeds, poor seed supply systems, poorly trained human capacity, and lack of agrochemicals are challenges faced by the input supply of ALVs.

On the production side, the common constraints mentioned were lack of technical advice, the absence of contractual agreement with buyers, and lack of access to finance. Chadha *et al.* (2003) also reported the same production constraints. The constraints suggested the following interventions: promote and disseminate information on production techniques; training on business and contract negotiations management, and promote tailor-made finance sources to ALV smallholder farmers. Pudasaini *et al.* (2013) argue that one of the aims of smallholder farmers is to make ALV production cost effective. However, quality inputs (such as fertilizers, seeds, and agro-chemicals) are hardly developed and promoted. Attention is on locally available seeds, compost, manure and locally produced technologies to ensure the availability of inputs, including safe and healthy food for households.

Table 2. 3 Key constraints faced by actors of the ALV value chain in Limpopo Province, 2015

Actors	Challenges	Potential interventions required
Input suppliers	Low input demand	Awareness of ALV production to commercial farmers
	Low quality of ALV seeds	Agribusinesses to develop new quality varieties
Producers	Lack of production technical advice	Promote and disseminate information on production techniques
	No contractual arrangement with buyers	Training on business and contract negotiations management
	Lack of access to finance	Promote tailor-made finance sources to ALVs smallholder farmers
	Poor infrastructure	Invest in the improvement of infrastructure
	Low market price	Inform consumers about the health and environmental benefits of ALVs
Retailers	Poor infrastructure	Public and private sector invest in infrastructure
	Low quality ALVs and inconsistent supply by farmers	Production of quality ALVs and creation of strong farmer associations for consistent supply
	Lack of processing and packaging services	Training and skills in processing and packaging of ALVs by public and private sectors
Consumers	Unavailability of ALVs all year round	New varieties to be produced all year round
	Unavailability of ALVs at supermarkets	Encourage all actors to participate in marketing of ALVs
	ALVs not processed to meet the standard required by consumers	Encourage public and private sectors to invest in processing activities

Source: See Table 2.1

The absence of processing and packaging services of ALVs was identified as constraints in the value chain. Nenguwo (2004) suggested that the training and skills in processing and packaging of ALVs by public and private sectors might be a desirable alternative. Even though there is a potential increase in growing of ALVs in Limpopo Province, smallholder farmers are facing high postharvest losses. The results are consistent with Ngugi *et al.* (2007) and Chagomoka *et al.* (2014) where it was reported that the supply of ALVs failed to meet the demand by formal market. Smallholder farmers are facing difficulties in accessing high value markets, such as supermarkets, and they are regularly exploited by the middlemen. They are not able to supply the agreed quantity and quality consistently. These present opportunities for agribusinesses and other middlemen to add value and upgrade existing value chains of ALVs.

In addition, retailers/traders noted the inability of smallholder farmers to supply the required quantity of ALVs on time when on contract. This led to formal markets not making deals with smallholder farmers. The challenge is that many smallholder farmers own a small portion of land which means little marketable surplus, which in turn, results in low and inadequate supply to the market. If smallholder farmers form and manage collective action organisations (such as cooperatives to supply ALVs), the problem of insufficient and poor quality supply could be addressed.

The other value chain constraint is the procurement models of supermarkets in retail outlets such as Shoprite/Checkers, Pick 'n Pay, and Woolworths. This has a negative impact on smallholder farmers. Large supermarkets prefer to do business with largescale farmers and believe that it is risky and costly to deal with smallholder farmers. In addition, there is no link between the smallholder farmers and the wholesalers and FPM and these are important access points for smallholder farmers. Large supermarkets also manage to take over the markets of those small retail outlets that purchase from smallholder farmers. The transaction cost of dealing with many smallholder farmers is usually too high for suppliers of such services, and hence most of them do not have any incentive to deal with these farmers. This transaction costs are worsened by factors such as low production, low levels of education, lack of physical infrastructure, poor communication systems, and low density of economic activity in the poor rural areas. Smallholder farmers are unable to supply their produce regularly and in time, in particular, when the quality is specified, and in responding quickly to the changing buyer's preferences.

2.6 Summary

This chapter aimed to identify the value chain actors and factors hampering (or otherwise) ALV value chains in Limpopo Province. The following actors were identified along the ALVs value chain: input suppliers, smallholder farmers, traders, and consumers. ALVs are currently not exported and smallholder farmers have not yet engaged in any form of processing. Smallholder farmers trade their ALVs through three channels identified as: (1) the farm gate; (2) retail market; and (3) middlemen. Among these three channels, the retail market is currently the most favoured because it offers a stable market and a relatively high producer price, however, many producers do not have access to this market channel. Although smallholder farmers currently make high gross margins as compared to other participants along the value chain, more returns

can be realised if government services (such as training, seed production and distribution) could either be decentralised or privatised. In addition, policy and investment interventions are required in the promotion of processing ALVs for value addition, provision of cold storage facilities closer to the smallholder farmers in rural areas and closer to the urban consumers, and to encourage continuation of production by stabilizing farm gate prices.

Among the important findings in this chapter is that all value chain actors face different challenges according to their roles. Input suppliers face challenges such as low input demand and low quality of ALV seeds. There is a need for the development of quality seeds by agribusinesses to increase demand. In addition, smallholder farmers' plans to expand production capacities are hampered by the lack of production technical advice, no contractual arrangement with buyers, lack of access to finance, poor infrastructure, and low market price. Most farmers produce below capacity in relatively small piece of land and they apply relatively primitive methods to produce ALVs. These constraints are partly responsible for the extremely low produced volumes and inconsistent market supply, prompting local traders to lose interest in selling ALVs. Traders face challenges such as poor infrastructure, low quality ALVs and inconsistent supply by farmers, and lack of processing and packaging services. Investment in infrastructure by both the public and private sectors will lead to the production of quality ALVs and a consistence supply to traders. Consumers also face challenges such as unavailability of ALVs all year round due to their seasonality and in formal supermarkets. Production of new quality varieties to be produced all year round by agribusinesses is encouraged, and this will lead to their availability in supermarkets. More details on the conclusions and policy implications of the empirical results of this chapter are contained in Chapter 6. The next chapter deals with the factors that influence farmers' decisions to participate and the level of participation in ALV production in the Limpopo Province.

CHAPTER 3: DETERMINANTS OF FARMERS' DECISION TO PRODUCE AFRICAN LEAFY VEGETABLES IN LIMPOPO PROVINCE, SOUTH AFRICA[2]

3.1 Introduction

ALVs are indigenous or traditional vegetables whose leaves, young shoots and flowers are consumed. As indispensable constituents of human diets, they have provided food and nutritional security to various communities in Africa (Grubben and Denton, 2004). Limpopo Province in South Africa boasts abundant agricultural resources and is one of the nation's prime farming areas noted for the generation of domesticated animals, fruits and vegetables, grains and tea (Limpopo Department of Agriculture (LDA), 2008). Agriculture is a critical economic sector in the Province in terms of its contribution to the economy and the number of employment opportunities it creates to local communities. Despite the decline of the agricultural sector, it contributes approximately 2.2% to the provincial GDP (Pfunzo, 2017). This decline is due to the prolonged severe drought in the Province that affected the horticultural crops and animal production (Limpopo Provincial Government, 2017).

Dweba and Mearns (2011) recorded that more than 100 different species of ALVs are reported in South Africa alone. Among poor households in remote rural areas, the use of these types of leafy vegetables is still common, yet nationwide there is evidence of decline, especially in urban areas. Cultivation of ALVs is restricted to a narrow group of primarily indigenised species in South Africa. Over the years, foreign or exotic vegetables (such as Swiss chard, also known as spinach in South Africa) have been introduced. This led to an introduction of a number of programmes promoting ALV production and consumption exists such as Ilima/Letsema in Limpopo Province.

ALVs are well known in the rural and peri-urban areas as a reliable source of micronutrients for the poorest African societies in such regions as Limpopo Province (Oelofse and Van Averbeke, 2012). Many African communities had depended on ALVs for survival before

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[2] This chapter gave rise to the following publication: Senyolo G.M, Wale E. and Ortmann G.F. (2018). The determinants of farmers' decision to produce African leafy vegetables in the Limpopo Province, South Africa. *African Journal of Science, Technology, Innovation and Development* 10 (7): 771-778.

the introduction of exotic crops. The use of ALVs during the off-season helps to address food shortages (Venter *et al.*, 2004). Production of ALVs is female-oriented and mainly for home consumption. Most of them grow on soils of limited fertility, are relatively drought tolerant, provide good ground cover, and can be harvested within a brief period of time (Shiundu, 2002). Given that most vulnerable groups living in rural areas are women, children and the economically disadvantaged, increasing the production of ALVs that are well adapted to the agro-ecology of Limpopo Province and that are easy to grow and require low inputs, could greatly help to solve the malnutrition problem. When considering the capacity of leafy vegetables to result in high yields in a relatively short growing period, as compared to cereals, their potential to play a key role in fighting hunger in highly populated countries becomes evident (Watson and Eyzaguire, 2002).

It was found that consumers are willing to pay for ALVs and their WTP mainly depends on socio-economic factors such as income, age of children, access to information of food safety (Chelang'a *et al.,* 2013; Ngigi *et al*., 2010). Also, it was indicated that the availability of ALVs throughout the year was one of the dominating factors determining the WTP a higher price and enables the organised mass production and a market chain for ALVs (Chelang'a *et al.,* 2013).

There is an undervalued reservoir of the diversity of these ALVs. They are extremely important for food security, nutrition and poverty alleviation throughout Africa. However, the reservoir is under threat because the vegetables are being displaced in many areas by exotic species. There is a decline in the production, utilisation and diversity of these vegetables (Maseko *et al.,* 2018). The decline will have a significant impact on the nutritional status of households and incomes of women farmers who are the primary producers, processors and sellers of these crops (Chweya and Eyzaguirre, 1999). In light of the above, a need emerges to contextually determine factors influencing the production of ALVs and farmers' level of participation in ALV production.

This chapter analyses the factors that influence farmers' decisions to participate and the level of participation in ALV production and presents the empirical results and discussion. The rest of the chapter is organised as follows: Section 3.2 outlines the methodology, which constitutes the study area and data discussed in Chapter 2, the conceptual framework, and the double-

hurdle model. Section 3.3 presents the empirical results while section 3.4 concludes the chapter with a summary.

3.2 Research methodology

The description of the study area, sampling and data were discussed in Chapter 2, Section 2.1 and paragraph 1 of Section 2.4, respectively.

3.2.1 Conceptual framework

The study focused on smallholder farmers' participation in ALV production and was conceptualized as a technology adoption study. Agricultural production was defined in terms of the degree of participation in production. This can be measured in terms of the total land allocated to a specific crop. Therefore, the choice depends on the maximum utility that technology gives to the adopters and the incentive created by participating in production. Adoption proceeds only when the incentives dominate the disincentives, meaning that the returns are higher than the total costs. However, technology adoption is influenced by numerous factors. Therefore, identifying those factors that impede adoption is important. This is done through different theoretical frameworks. For instance, Leagans (1979) highlighted that choosing to adopt an innovation will depend on how a decision maker behaves vis-à-vis a set of alternatives and constraints. These alternatives and constraints are assumed, in this study, to be different factors that may be influenced by the smallholder farmers' decision. Table 3.1 shows the variables that were considered in the study and their descriptions.

The table presents the household head demographics (household size, age, and gender), farm characteristics (farm labourers, use of manure, etc.), human capital (farming experience), social capital (farmer group membership), farmer support services (access to extension and markets) and perception (perception that ALVs are food for the poor, tasty, and nutritious) that were included in the model.

Table 3. 1 Description of variables included in the model.

Variable	Description of variables	Unit	Expected sign	Participation variables	Level of participation variables
Dependent variables					
PART	1 if the household participates in ALV production, 0 otherwise	Dummy			
LEVP	Proportion of the land allocated to ALVs	Ha			
Independent variables					
HHLS	Size of the household	Number	+	X	X
AGE	Age of the household head	Years	+ -	X	X
AGE^2	Age of the household squared	Years	+	X	X
GEN	1 if the farmer is male, 0 otherwise	Dummy	+	X	X
SOCG	1 if the household receives social grant, 0 otherwise	Dummy	+	X	X
EXP	Number of years in farming (experience)	Years	+	X	X
NLAB	Number of farm labourers on the farm	Number	+	-	X
MANU	1 if the farmer uses manure as an input, 0 otherwise	Dummy	+	-	X
MAKT	1 if the farmer has access to ALV output market, 0 otherwise	Dummy	+	X	X
EXT	1 if the farmer has access to extension services, 0 otherwise	Dummy	-	X	X
ORGN	1 if the farmer is a member of an organization, 0 otherwise	Dummy	+	X	X
FOSE	1 if the farmer believes that ALVs contribute to household food security, 0 otherwise	Dummy	+	X	X
TAST	1 if the farmer believes that ALVs are tasty, 0 otherwise	Dummy	+	X	-
NUTR	1 if the farmer believes that ALVs are nutritious, 0 otherwise	Dummy	+	X	-
CHEA	1 if the farmer believes that ALVs are produced cheaply, 0 otherwise	Dummy	+	X	-

3.2.2 The double-hurdle model

The double-hurdle model was used to analyze factors influencing smallholder participation in ALV production and the amount of land allocated to ALV production. The double-hurdle model, initially formulated by Cragg (1971), is designed to deal with survey data, which have many zero observations on a continuous dependent variable (Gao *et al.*, 1995). Zeros could be either corner solutions as in a Tobit model or abstentions as in the selection model (Quattri *et al.*, 2012). The double-hurdle model is similar to the Heckman procedure in that two sets of parameters are obtained in both cases. However, drawbacks of Heckman's procedure are that it produces a less efficient estimator than the maximum likelihood (ML) Tobit estimator and performs poorly when the normality assumption is violated (Yen and Huang, 1996).

The double-hurdle model has been widely adopted in the consumption literature (Zhang *et al.*, 2006; Aristei and Pieroni, 2008; Yen and Huang, 1996). The model assumes that households make two decisions with regard to production, each of which is determined by a different set of explanatory variables. For each decision process in the double-hurdle model, a different latent variable is used: a Probit model is used to determine the likelihood of participating in ALV production by a household, while the truncated regression model is used to determine the intensity of participation.

The decision to participate in ALV production:

$$U_{i1}^* = Z_i'\gamma + \mu_i$$

$$U_i = \begin{cases} 1 & U_i = 1 \ if \ U_i^* > 0 \\ 0 & U_i = 0 \ \text{otherwise} \end{cases}$$

The level of participation after participation decision:

$$U_{i2}^* = X_i'\alpha + \varepsilon_i$$

$$U_i = X_i' + \varepsilon_i \ if \ U_{i1}^* > 0 \ and \ U_{i2}^* > 0$$

where U_{i1}^* is a latent variable relating to a household's participation decision, U_{i2}^* a latent variable relating to the use intensity of adoption (or area farmland devoted to ALV production), and U_i is the observed farmland area devoted to ALV production (dependent variable). Z_i and X_i are vectors of explanatory variables relating participation and use intensity respectively, γ

and α are the parameter vectors to be estimated, while μ_i and ε_i are the respective error terms assumed to be independent and distributed as $\mu_i \sim N(0,1)$ and $\varepsilon_i \sim N(0, \sigma^2)$.

Permitting for heteroscedasticity and a non-normal error structure (Yen and Jones, 1997; Jensen and Yen, 1996), the empirical model is estimated using maximum likelihood of the form:

$$\text{Log } L = \sum_0 \ln \left[1 - \varphi(X_i'\alpha)\varphi\left(\frac{Z_i'\beta}{\sigma}\right) \right] + \sum \ln \left[\varphi(X_i')\frac{1}{\sigma} \varphi(y_2 - Z_i'\beta)/\varphi \right]$$

In this chapter, the choice of the double-hurdle model was motivated by the fact that factors influencing the decision whether or not to produce ALVs are different from factors influencing the level of production. In such a case, the Tobit model presents weaknesses of inseparability of decision of participation and decision of the proportion of land allocated to ALV production. The main issue is how a variable like household size, age, and non-farm income, can affect the participation decision in the same way it affects the proportion of land under ALV when smallholder farmers are affected by land fragmentation. Therefore, the study adopted the double-hurdle model.

3.3 Empirical results and discussion

Because of minor heteroskedasticity problem, the variance was estimated using robust standard error estimation. To check multicollinearity problems variance inflation factors (VIFs) and contingency coefficients were computed for continuous and categorical variables respectively. For continuous variables the VIF values shown in Table 3.2 indicate that all the continuous explanatory variables have no serious multicollinearity problem. Similarly, contingency coefficient computed for categorical variables were less than 0.75 (Table 3.3). Hence, there is no serious collinearity problem among the categorical variables used.

Table 3. 2 Variance inflation factors (VIFs) for multicollinearity test

Variables	VIF	1/VIF
AGE	1.34	0.743528
EXP	1.34	0.745938
HHLS	1.02	0.982372
NLAB	1.01	0.988102
Mean VIF	1.18	

Source: Survey data, 2013.

Table 3. 3 Contingency coefficients for dummy explanatory variables

Variables	GEN	EXT	ORGA	FOSE	SOCG	TAST	NUTR	CHEA	MAKT	MANU
GEN	1									
EXT	0.012	1								
ORGA	0.055	0.247	1							
FOSE	-0.183	-0.087	0.190	1						
SOCG	0.041	-0.069	-0.080	0.149	1					
TAST	0.087	0.013	0.137	-0.158	-0.024	1				
NUTR	0.068	0.121	0.127	-0.211	-0.079	0.236	1			
CHEA	0.150	0.099	0.240	-0.108	0.019	0.362	0.342	1		
MAKT	0.051	0.193	0.049	-0.266	0.138	0.122	0.229	0.213	1	
MANU	-0.119	-0.254	-0.118	0.348	0.012	-0.224	-0.178	-0.222	-0.141	1

Source: Survey data, 2013

3.3.1 The characteristics of farmers cultivating ALVs

The descriptive statistics of selected variables according to producers and non-producers used in the double-hurdle model are presented in Table 3.4. The t-test was done to investigate mean comparisons of variables used in the study. The results of this test show that these two groups only differ significantly with regard to seven of the investigated socioeconomic household characteristics. While some of the variables are generally the same, the results show significant differences in the following variables: household size, age, farming experience, social grant, number of labourers and food security between producers and non-producers.

The households had bigger families (HHLS), bigger than the average sizes reported for the Limpopo Province in the 2016 census by Stats SA (2016). However, it is consistent with the figures reported by several studies (Ramoroka, 2012; Baloyi, 2011). Household head interviewed are older (AGE) and few of them are male. It was expected in this study that older people would likely participate in ALV production compared to young people. Very few

households (16%) of the sampled households received social grants (SOCG) from the government.

On average, the sampled farmers had farming experience of at least 15 years. If a farmer followed a farmer group learning approach, increased in experience was expected to lead to increased participation and intensity of participation. On average, five workers are employed per farm. Labour force was expected to positively impact on the likelihood of the participation in ALV production because a family endowment of labour can relatively easily be used in farming operations. Very few smallholder farmers used manure for the production of ALVs.

Table 3. 4 Characteristics of ALV producers in the Limpopo Province, 2013 (*N*=126)

Variables	Producers (*N*=87)	Non–producers (*N*=39)	Pooled sample (*N*=126)	T test
HHLS	6.22	5.57	6.02	
	(2.48)	(2.09)	(2.38)	-6.42***
AGE	54.28	56.59	54.99	
	(14.76)	(16.55)	(15.31)	2.23**
AGE^2	3187.86	3495.84	3283.18	
	(1642.85)	(1777.60)	(1684.61)	43.02***
GEN	0.30	0.32	0.31	
	(0.46)	(0.47)	(0.46)	0.23
EXP	15.19	16.41	15.56	
	(14.48)	(16.34)	(15.00)	-10.92***
SOCG	0.11	0.26	0.16	
	(0.32)	(0.44)	(0.38)	2.46**
NLAB	5.47	2.95	4.87	
	(13.63)	(2.52)	(11.98)	-12.30***
MANU	0.26	0.18	0.24	
	(0.44)	(0.39)	(0.43)	0.04
MAKT	0.40	0.49	0.42	
	(0.49)	(0.51)	(0.50)	0.45
EXT	0.37	0.30	0.35	
	(0.49)	(0.47)	(0.48)	0.27
ORGA	0.26	0.20	0.24	
	(0.44)	(0.41)	(0.43)	-0.07
FOSE	0.50	0.12	0.24	
	(0.46)	(0.33)	(0.43)	-1.75*
TAST	0.62	0.64	0.63	
	(0.49)	(0.49)	(0.49)	0.20
NUTR	0.63	0.50	0.59	
	(0.49)	(0.51)	(0.49)	-0.86
CHEA	0.51	0.58	0.53	
	(0.50)	(0.50)	(0.50)	0.21

Numbers in parentheses are standard errors

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

Source: Survey data, 2013

The results show that producers earn more from farming than non-adopters and have more off-farm income. ALV producers were less experienced in farming and employing more labourers that non producers. There were no significant differences between producers and non-producers in terms of their use of manure, access to market, extention services and membership of farming orgazation. However, these comparisons do not control for other factors. The next

section investigates the impact of social grants on the adoption and intensity of chemical fertiliser use, controlling for other relevant factors.

Communities share different perceptions of ALVs. Farmers held stronger beliefs that ALVs are tasty, nutritious and cheap to produce. They also held stronger beliefs than non-farmers that ALVs contribute to household food security and nutrition. Regarding farmers' perceptions towards ALVs, few smallholder farmers believed that ALVs contribute to household food security. More than 50% of smallholder farmers in both groups believed that ALVs are tasty, nutritious and less costly.

3.3.2 Determinants of farmers' participation and level of participation in ALV production

The empirical results of the double-hurdle model estimations of the factors influencing the decision to participate in ALV production and the level of participation are presented in Table 3.5. The value of the Pseudo R^2, the log-likelihood, and the LR Chi^2 (significant at the 1% level) indicate that the specifications for the two models provide a good fit to the data and that the explanatory variables used in the models collectively explain farmers' decision to participate in ALV production and their level of participation in the study area.

The estimated coefficient of household size (HHLS) was positive and significant at the 10% level in influencing a farmer's decision on the level of participation. This implies that larger households tend to allocate more land to ALV production than smaller households. This may be because larger households depend on ALV production as their primary food source. Although the results did not show any significant relationship between household size and participation, Enete and Okon (2012) found that household size positively influences the decision to produce ALVs. Usually, household size would be expected to determine the labour force available to produce ALVs as well as household consumption requirements. If ALVs are produced mainly for household consumption, this will induce households to produce them on a larger scale (i.e. allocate more land to their production).

Table 3.5 Factors influencing the decision and intensity of participation of ALVs: The double-hurdle model results ($N = 126$)

Variables	Participation Coefficient	Std error	Level of participation Coefficient	Std error
HHLS	0.302	0.226	1.922*	1.065
AGE	-0.991*	0.590	0.600	0.662
AGE^2	0.007*	0.005	-0.008	0.006
GEN	-1.358	1.507	-5.336*	2.770
SOCG	-4.761*	2.461	-6.657**	3.151
EXP	0.048	0.037	0.410***	0.136
NLAB	-	-	1.283***	0.074
MANU	-	-	8.369	6.107
MAKT	2.285*	1.363	-1.558	2.541
EXT	3.421*	2.017	7.699**	3.657
ORGN	-0.344	0.912	-7.897**	3.366
FOSE	3.370*	1.851	1.863	3.965
TAST	3.860	2.630	-	-
NUTR	3.631*	2.141	-	-
CHEA	8.804**	4.346	-	-
_cons	29.457*	17.750	-41.496*	24.869
Sigma			2.925***	0.629

***, ** and * denote significance at the 1, 5, and 10% levels, respectively.

Note: Wald $\chi2$ (23) = 231.42***; Pseudo R^2 = 0.45; % correctly classified = 81.

The results also indicate that the relationship between the age of the farmer (AGE and AGE^2) and the decision to produce ALVs is non-linear. This means that with the increasing age of the household head, up to a certain age, he or she is less likely to increase participation in ALV production. However, after the farmer reaches a particular age, participation is more likely to increase. This can be explained in terms of ALV perceptions. Young people do not consume ALVs or participate in their production because of a fear of being described as old fashioned (Maseko *et al.*, 2018). In this respect, only middle-aged and older people participate in ALV production which, in turn, influences quantities produced. However, overall, age did not significantly influence the level of participation.

The estimated coefficient of gender (GEN) was negative and significant at the 10% level in influencing a farmer's decision on the level of farm size allocated to ALV production. The

estimated negative coefficient implies that female-headed households are more likely than male-headed households to allocate additional farm land to ALV production. This result is consistent with the results of Gotor and Irungu (2010) and Vorster *et al.* (2008). The expectation was that female-headed households would be more likely to produce ALVs and allocate more land, as it had been reported that women were the main producers of ALVs. The results however showed no significant relationship between gender of the farmer and the decision to participate in ALV production.

The variable, social grants (SOCG), was associated with decreasing probability of participation in the production of ALV. In other words, households who receives social grants were less likely to participate in ALV production. Also, SOCG was negative and significant, at the 1% level, in explaining how much land farmers decided to allocate to ALV production. This implies that smallholder farmers allocate less land to ALV production if they receive social grants. The results support evidence from reports by Mabugu *et al.,* (2014) and Tshuma, (2012) that have reported a potential disincentive effect of social grants on smallholder commercialisation. A number of people in the village were no longer reliant on farming activity for their economic security but rely more on money from social grants and from their adult children working in the cities.

The number of years in farming (EXP) was positive and significant, at the 1% level, in explaining to which extent farmers decided on the level of land under ALV cultivation. An increase in the number of years in farming contributes, other factors remaining constant, to the resource requirements and to a better management decision for the household farm; in turn, this would certainly promote farmers' incentives to increase the size of land under ALVs. Therefore, more experience influences the increase in land under ALVs. The results concur with Genereuse (undated), who records a positive relationship between experience and agricultural production. The estimated coefficient of number of workers on the farm (NLAB) was positive and significant at the 1% level in influencing a farmer's decision on the farm size allocated to ALV production. This implies that a one-person increase in the number of workers increases the likelihood of increasing land allocated under ALVs by 1.3%.

The estimated access to market (MAKT) coefficient is positive and significant at the 10% level to farmers' decisions on the production of ALVs. This implies that farmers with access to markets for their produce are more likely to produce ALVs in the Limpopo Province. The

results concur with Stoeva (2012) that factors affecting the production of ALVs include farmers' lack of market access for ALVs. Access to extension services (EXT) has a positive and significant effect on farmers' decisions to produce ALVs. This implies that farmers with access to extension services are more likely to produce ALVs in the Limpopo Province. This result, however, does not supports findings by Mavengahama *et al.* (2013) and Vorster (2007) that extension officers discourage farmers from producing ALVs as they call them weeds, not food. In South Africa, ALVs are mainly produced for household consumption and not for commercial purposes (Vorster, 2007). These results support findings by Balogun *et al.* (2015) and Mwaura *et al.* (2013), who found that access to extension services positively affects the decision to produce ALVs. These findings support the positive role played by agricultural extension officers in Limpopo Province in educating and encouraging farmers to produce ALVs by giving them inputs such as seeds, fertilizers and information through the Ilima/Letsema initiative by the LDA. This initiative also encourages smallholder farmers to allocate more land to production of ALVs. In addition, membership of farmer based groups/associations or co-operatives is statistically significant but negatively related to the amount of land allocated to ALVs. This suggests that group membership plays a less significant role as a channel of information exchange. This is consistent with previous studies such as Alene *et al.* (2008). However, Masuki *et al.* (2005) and Anigbogu *et al.* (2015) suggested that membership of farmers' associations increased the probability of participation in agricultural production.

With reference to the belief that ALVs contribute to household food security (FOSE), the results show a positive influence towards production. The implication is that the continued existence of this belief will further encourage the production of ALVs. Even though ALVs carry a negative belief tag for some groups, the fact remains that ALVs are an important last resort during famine. Mabhaudhi *et al.* (2017) record that ALVs are also called a poor man's crop, as they are an alternative source of food proteins for rural communities and sometimes act as a means of survival when there is drought induced famine. Perceptions related to the nutritional value of ALVs (NUTR) and that ALVs are cheap to produce (CHEA) positively influenced participation in the production of ALVs. These findings, therefore, suggest that there may be sufficient evidence to claim that ALV production may be positively supported as long as rural households continue to share positive nutritional production beliefs regarding ALVs. In light of this, the association may be based on the assumption that production is driven by the desire to address nutritional deficiencies, as recorded by Engle and Altoveras (2000).

3.4 Summary

There is a decrease in the production, utilisation and diversity of ALVs. The main objective of this chapter was to identify the determinants of farmers' participation in ALVs production using cross-sectional data from the Limpopo Province. A double-hurdle model was employed to determine factors influencing production decision and the level of participation in ALV production. The chapter indicate that farmers who are older, with non-farm income and having access to market and extension services are likely to participate in ALVs production. Other farmers who are likely to produce ALVs are those who have positive perception towards ALVs. Farmers' positive perceptions towards ALVs were found to be mainly influenced by the belief that ALVs are nutritious and cheap to produce.

Land is one of the important factor in farming. With regards to the level of participation, the empirical findings indicate that household size, gender of the farmer, level of experience in farming, non-farm income, number of workers, access to extension services and membership in farmers' groups were the key determinants of how much land farmers choose to allocate to ALVs. Given these findings, it seems that farmers' decisions to participate are influenced by both socio-economic, institutional and perception factors. More details on the conclusions and policy implications of the empirical results of this chapter are contained in Chapter 6. The next chapter deals with the factors affecting consumers' decisions to purchase ALVs in the Limpopo Province.

CHAPTER 4: A DOUBLE HURDLE ANALYSIS OF CONSUMERS' DECISIONS TO PURCHASE AFRICAN LEAFY VEGETABLES IN LIMPOPO PROVINCE[3]

4.1 Introduction

South Africa possesses a huge diversity of indigenous food crops, which includes grains, leafy vegetables and wild fruit types. These crops are produced and found growing in the country under various weather conditions. Their production within the rural farming communities is on small scale and is mainly for subsistence purposes (DAFF, 2013). The World Health Organization (WHO) recommends the consumption of more than 400g of fruit and vegetables per person per day to reduce the chances of malnutrition diseases (WHO, 2003). This recommended intake is approximately double the amount of fruit and vegetables consumed by the average South African (Ronquest-Ross *et al.,* 2015; Backeberg, 2014; Rose *et al.*, 2002;). An increased intake of vegetables and fruit is therefore needed. However, rural and urban South African women consider affordability, and to a lesser extent availability, to be major constraints in the consumption of vegetables and fruit (Love *et al.,* 2001). In this study, ALVs are defined as cultivated leafy vegetables native to a particular region, or having been introduced a long time ago and started to evolve through natural processes (Jansen van Rensburg *et al.,* 2007).

In South Africa, ALVs are part of the day-to-day staple diet of many households, particularly in rural areas, and offer a rich source of iron, vitamin A and other nutrients. Although some ALVs are cultivated, most of them are non-cultivated. However, awareness about these vegetables is still poor and perceived by many South Africans as "food for the poor" (Cloete and Idsardi, 2013; Venter *et al.,* 2007). During periods of food shortages, one of the coping strategies that consumers apply is the use of ALVs. Almekinders and De Boef (2000) argued that the revival of communities' utilisation of ALVs might ensure conservation thereof. Moreover, the consumption of ALVs can significantly contribute to dietary requirements in terms of human health and food security (Zoro *et al.,* 2014).

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[3] This chapter gave rise to the following publication: Senyolo G.M, Wale E. and Ortmann G.F. (*in press*). A double hurdle analysis of consumers' decisions to purchase African leafy vegetables in Limpopo Province. *Journal of Consumer Sciences.*

Despite reports that ALVs contribute to health, food security and nutrition at household level in South Africa, research by Faber *et al.* (2007), Mbhenyane *et al.* (2005) and Nesamvuni *et al.* (2001) reported that the production and consumption of these vegetables had declined over time. The decline was influenced by the negative attitudes toward ALVs, constraining efforts that focused on enhancing the consumption thereof (Matenge *et al.,* 2012). Negative attitudes likely stem from certain crops being considered weeds (Vorster and Jansen van Rensburg, 2005), poor handling, unhygienic display at retail outlets (Amaza, 2009), and contradictory information about production sources (Yadav and Sehgal, 2004). This is especially true among the youth and modernised members of the community. Yet, many rural people are unable to afford exotic leafy vegetables, as they are somewhat expensive in comparison with ALVs. Results from a study by Bichard *et al.* (2005) suggest that consumer's negative perceptions are the ones that may be driving an upward trend in the consumption of ALVs in the 21st century in Limpopo Province. This implies that people are turning back to the consumption of ALVs for health and cultural reasons.

The frequency of vegetable consumption depends upon the frequency of meals. However, frequency of consumption of ALVs has decreased over the years, probably because they are often considered to be inferior in their taste and nutritional value compared to exotic vegetables such as spinach and cabbage (Weinberger & Msuya, 2004). Consumption of ALVs is variable in South Africa, with some households consuming them daily, but others only every few days (Shackleton *et al.,* 1998). Nevertheless, several studies in South Africa reported that consumption of ALVs has declined (Mbhenyana et al., 2005; Modi, 2003; Nesamvuni et al., 2001; Labadarios et al., 2000). One other reason for the decline in consumption of some ALVs was the unfamiliarity with and unavailability of certain crops (Cloete and Idsardi, 2013).The National Food Consumption Survey (NFCS) of 1999 showed that green leafy vegetables were the 16th most frequently consumed food item for one-to-nine year-old South African children (Labadarios et al., 2000).

Despite an abundance of literature on consumer behaviour, very few studies (e.g. Gido *et al.,* 2017; Fungo *et al.,* 2016) in SSA have been conducted simultaneously on the decision to consume and the level or intensity thereof. In addition, the few studies that had indeed investigated the determinants of SSA consumers' decision to purchase or consume relied on limited analytical approaches. For example, Fungo *et al.* (2016) relied on multinomial logistic regression analysis, whereas Gido *et al.* (2017) used a binomial regression model. The present

study relies on the double-hurdle model, an econometric model that is popular in studies on the decision to consume (Aristei and Pieroni, 2008; Yen and Huang, 1996; Gao *et al.* 1995; Yen, 1993). This study distinguishes itself from other studies in the literature on the decision to purchase by using the double-hurdle model to determine factors influencing both the decision to purchase and the level of expenditure. To the author's knowledge, no study had yet examined the factors influencing the decision to purchase and level of expenditure in South Africa.

ALVs are cheap and thus affordable, and rich in the micronutrients that lack in exotic vegetables and simplified urban diets, hence their importance. However, their consumption shows a decrease. Awareness of ALVs is required to encourage the consumption thereof and reduce food insecurity and malnutrition in South Africa (Njume *et al.,* 2014). The objective of this chapter is to determine factors affecting consumers' purchasing decisions and expenditure level of ALVs in the Limpopo Province of South Africa. Understanding the factors that influence those decisions can inform policy decisions regarding required interventions to create and enhance value chains for the future of ALVs in South Africa. In addition, this chapter will highlight gaps in nutrition interventions, policies and programmes aimed at combating food and nutrition security.

The rest of the chapter is organised as follows: Section 4.2 discusses factors affecting consumer's purchasing and expenditure decision. Section 4.3 outlines the methodology, which constitutes the study area, sampling, and data collection (discussed in Chapter 2) and analytical model used in the study. Section 4.4 presents the empirical results and discussion, while section 4.5 provides a brief summary.

4.2 Hypothesised factors affecting the purchasing and expenditure decision

The question of how socio-economic and perception factors influence consumer behaviour is important to all actors involved in the ALV value chain, as insights in consumers' purchasing decisions will inform the stakeholders and guide actions to enhance the role of ALVs. This section provides an overview of the socio-economic and perception factors affecting the demand for ALVs, drawing from the limited available literature. The literature categorises factors that influence consumption into socio-economic and perception-based factors.

Research has determined socio-economic factors that influence the consumption of ALVs. Only a few studies have examined the association between the gender of the household head and

consumption patterns of ALVs. Women play an important role in the purchasing and consumption of ALVs as vegetable preparation is mostly considered as their job (Tumwet *et al.,* 2014; Kimiywe *et al.,* 2007). Regarding age, children (Kimiywe *et al.,* 2007) and older people (Taruvinga and Nengovhela, 2015) are also consumers of ALVs. However, ALVs are not particularly consumed by the younger generation because of their unfamiliar tastes, or ignorance in preparing them (Orech *et al.,* 2005). Education has a negative impact on the consumption of ALVs in the Eastern Cape of South Africa (Taruvinga and Nengovhela, 2015). In addition, a small proportion of urban households consume ALVs, and the level of income negatively influences the consumption of and purchasing behaviour in terms of ALVs. In comparison, the lower income groups are the consumers of ALVs as opposed to the higher income groups (Kimiywe *et al.,* 2007). Studies examining the relationship between awareness and consumption of ALVs are scarce. Raising peoples' interest is likely to spur them on into taking conscious and favourable action towards vegetable consumption. Agbelemoge (2014) confirmed this for ALVs by showing that consumer awareness/knowledge about ALVs has a positive impact on consumption.

Public perceptions of ALVs appear to be associated with knowledge about the product gained through research, as well as the extent to which it is consumed. Despite many people being aware of the benefits of ALVs, literature suggests that a large number of consumers hold mostly negative perceptions about these vegetables. Generally, literature suggests that positive perceptions about ALVs are more prevalent among older and rural consumers, while negative perceptions are more common among younger and urban consumers (Vorster *et al.,* 2007). According to Vorster *et al.* (2007), ALVs are tastier than other vegetables, and capable of boosting the human immune system, hence extending life expectancy. They also act as a digestive cleansing agent. Acheampong *et al.* (2012) recorded that the majority of consumers in Ghana purchased ALVs because they believed that they are more nutritious than conventional market vegetables and easier to prepare. Tumwet *et al.* (2014) and Kimiywe *et al.* (2007) also found that the reason for consumers purchasing ALVs is that they believe them to be nutritious.

4.3 Methodology

The description of the study area, sampling and data were discussed in Chapter 2 and paragraph 2 of Section 2.4, respectively.

4.3.1 Analytical model used in the study

A double-hurdle model, proposed by Cragg (1971), was utilised to determine consumers' purchasing decisions and expenditure level in terms of ALVs, using the Software for Statistics and Data Science (STATA 15) software. The Tobit model might also have been considered as an option to address the issue, but this model is very restrictive. Both the Yes/No responses and continuous aspects are assumed to be explained by the same set of explanatory variables (Greene, 2008), an assumption which may not be true. The double-hurdle model relaxes this assumption (Yen, 1993).

Various studies conducted in the past on consumption and food expenditure revealed that the double-hurdle model is a better option in comparison with the Tobit model (e.g. Cragg, 1971; Keelan *et al.,* 2009). It is assumed that consumers make two decisions regarding the purchase of ALVs. Firstly, a Probit model is used to determine whether consumers decide to purchase ALVs or not. The second stage decision for those who decide to purchase is to determine how much to spend on ALVs. The model permits separate stochastic processes for the Yes/No variable and for continuous decisions explained by different sets of explanatory variables. The model can be defined as:

$$y_{i1}^* = w_i'\alpha + v_i \qquad \text{Decision to purchase}$$
$$y_{i2}^* = x_i'\beta + \mu_i \qquad \text{Expenditure decision}$$
$$y_i = x_i'\beta + \mu_i \qquad \text{If } y_{i1}^* > 0 \text{ and } y_{i2}^* > 0$$
$$= 0 \qquad \text{Otherwise}$$

where y_{i1}^* is a latent variable explaining consumers' dichotomous decision whether or not to purchase ALVs; y_{i2}^* is a latent variable explaining household consumption of ALVs; w_i' is a vector of variables explaining the purchasing (Yes/No) decision; while x_i' is a vector of factors explaining the expenditure decision; and v_i and μ_i are the error terms assumed to be independent and distributed as $v_i \sim N(0,1)$ and $\mu_i \sim N(0, \sigma^2)$. Table 4.1 shows the description of the variables used in both the purchasing decision model and the level of expenditure model.

Table 4.1 Definition and expected signs of variables included in the analysis, Limpopo Province, 2012

Variable	Description of variables	Purchasing decision model	Expenditure level model	Unit
AGE	Age of the household head	+	-	Years
AGE^2	Age squared	+	+	Years
GEND	1 if the household head is female, 0 otherwise	+	+	Dummy
EDUC	Number of years household head spent in school	-	-	Years
MARR	1 if the household head is married, 0 otherwise	+	+	Dummy
WOG	1 if the woman often does grocery shopping, 0 otherwise	+	+	Dummy
SOCG	1 if the household receives on social grants, 0 otherwise	+	-	Dummy
URBA	1 if the household is located in the urban area, 0 otherwise	-	-	Dummy
NEAT	Number of people in the family eating ALVs		+	Number
AWAR	1 if the respondent is aware of ALVs, 0 otherwise	+	+	Dummy
DIST	Distance to where ALVs are sold/bought?		-	Kilometres
RELI	1 if ALVs are perceived by the household to be served as relish, 0 otherwise	+	+	Dummy
TAST	1 if ALVs are perceived by the household to be tasty, 0 otherwise	+	+	Dummy
EASP	1 if ALVs are perceived by the household to be easy to prepare, 0 otherwise	+	+	Dummy
AFOD	1 if ALVs are perceived by the household to be affordable, 0 otherwise	+	+	Dummy
NUTR	1 if ALVs are perceived by the household to be nutritious, 0 otherwise	+	+	Dummy
MEDI	1 if ALVs are perceived by the household to be medicinal, 0 otherwise	+	+	Dummy

Note: [1] R1 = $US0.118 (2012

4.4 Results and discussion

A check for the possible presence of multicollinearity of all the variables in the estimated models was conducted by means of a variance inflation factor (VIF). The results presented in Table 4.2 shows that the highest value is 2.86, implying that multicollinearity is not a concern in the estimated models.

Table 4. 2 VIFs for the variables considered

Variable	VIF
TAST	2.86
EASP	2.78
AFOD	2.27
NUTR	1.90
RELI	1.60
URBA	1.53
AGE	1.47
EDUC	1.41
MEDI	1.27
DIST	1.27
NEAT	1.17
WOG	1.11
MARR	1.09
AWAR	1.07
GEND	1.07
SOCG	1.07
Mean VIF	**1.56**

Source: Survey data, 2012

4.4.1 Descriptive statistics analysis

Table 4.3 shows the descriptive statistics of socio-economic and perception factors of the sampled households. Sample statistics of the independent variables used in the analysis showed that 73% of the respondents purchased ALVs, when they are in season, at an average expenditure of R17.02 per week. The t-test was done to investigate mean comparisons for continuous variables while the $\chi 2$ test was done to measure associations for categorical variables. The results of this test show that these two groups only differ significantly with regard

to twelve of the investigated socioeconomic household characteristics. While some of their demographics are generally the same, the results show significant differences in some socioeconomic (age, marital status, social grant, urbanization, number of people eating ALVs, and awareness of ALVs) and perception (relish, taste, easy to prepapre, sffordable, nutritious, and medicinal) factors between purchasers and non-purchasers.

In the sample, the average household head was approximately 44 years old. About 42% of the household heads were males, 47% resided in urban areas, and the average school education was 10 years. On average 44% of the respondents were married and household grocery shopping was mostly done by women (59%). Approximately 15% of the households depended on social grants as their main source of income. Most of the respondents (96%) were aware of ALVs and travelled an average of 6.5 km to buy them from the market. The descriptive results revealed that more than 50% of the respondents consumed ALVs as relish and believed that ALVs are nutritious, while less than 50% of the respondents believed that ALVs are tasty, easy to prepare, affordable and of medicinal value.

Table 4. 3 Socio-economic and perception characteristics of the sampled households, Limpopo Province, 2012

| Variable | Purchasers of ALVs (N=218) | | Non-purchasers of ALVs (N=81) | | Pooled sample (N=299) | | T-test |
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	T-test
AGE	44.53	14.853	41.18	16.222	43.65	15.269	-1.66*
AGE^2	2211.2	1400.99	1930.44	1501.84	2136.4	1431.32	-1.48
GEND	0.43	0.496	0.38	0.489	0.42	0.494	-0.75
EDUC	10.14	4.711	10.4	5.634	10.21	4.973	0.40
MARR	0.39	0.49	0.56	0.50	0.44	0.497	2.51**
WOG	0.60	0.492	0.59	0.494	0.60	0.492	-0.06
SOCG	0.13	0.335	0.21	0.41	0.15	0.358	1.75*
URBA	0.40	0.492	0.65	0.479	0.47	0.500	3.95***
NEAT	3.60	1.437	0.00	0.00	3.35	1.562	-4.61***
AWAR	0.98	0.135	0.90	0.30	0.96	0.197	-3.18***
DIST	6.41	8.56	0.00	0.00	6.47	8.524	0.93
RELI	0.79	0.409	0.07	0.264	0.60	0.492	-14.64***
TAST	0.44	0.498	0.05	0.218	0.33	0.473	-6.83***
EASP	0.52	0.501	0.04	0.19	0.39	0.488	-8.42***
AFOD	0.50	0.501	0.07	0.264	0.39	0.488	-7.32***
NUTR	0.69	0.464	0.14	0.345	0.54	0.499	-9.75***
MEDI	0.15	0.36	0.01	0.111	0.11	0.318	-3.43***

Source: Survey data, 2012

4.4.2 Factors affecting sample households' ALV purchasing and expenditure decisions in Limpopo Province

Table 4.4 shows the maximum likelihood estimates of the double-hurdle model in terms of the decision to purchase ALVs, as well as the relevant expenditure level. The value of the Pseudo R^2 (55%), the log-likelihood (-719.978), and the LR Chi^2 (significant at the 1% level) indicate that the specifications of the two models provided a good fit to the data. In addition, the explanatory variables used in the models collectively explain consumers' decision to purchase ALVs, as well as the expenditure level in the study area. The results show that ten factors influenced the purchasing decision, while eight influence the level of ALV expenditure. Factors that only influenced the purchasing decision but not the level of expenditure were socio-economic characteristics (GEND, EDUC, MARR and URBA) and perception factors (NUTR). Moreover, factors that only influenced the level of expenditure but not the purchasing decision were AGE and DIST. Factors that influenced both the purchasing decision and the level of expenditure were the socio-economic factor (SOCG) and perception factors (RELI, TAST and AFOD).

The age variable (AGE) only affected the level of expenditure on ALVs but did not have any influence on the decision on whether or not to purchase ALVs. The results imply that younger respondents were less likely to spend more on ALVs in comparison with older ones. Older people had local knowledge of ALVs having nutritional and health benefits (Oniang'o *et al.,* 2004). Jansen van Rensburg *et al.* (2007) also noted that young people in South Africa had hardly consumed ALVs because they did not want to be described as old fashioned and poor. In this respect, only middle-aged and older people participated in the consumption of ALVs (Mayekiso *et al.,* 2017). Regarding the gender variable (GEND), the decision to purchase ALVs was negatively significant. This implies that households headed by females were more likely to purchase ALVs in comparison with their male counterparts. Hart and Vorster (2006) also confirmed that ALVs were regarded as a food mainly consumed by females. The dummy variable, marital status (MARR), affected the decision to purchase ALVs significantly negative, but not that of the level of expenditure. This implies that married people were less likely to purchase ALVs and less likely to spend more on ALVs. The reason may be that men, who happened to be the husbands, were less likely to consume ALVs, therefore, there was no reason for married women to purchase and prepare ALV dishes.

Table 4.4 Parameter estimates of the double-hurdle model for ALVs expenditure in Limpopo Province, 2012

Variables	Purchasing decision		Expenditure decision	
	Coef.	Std. Err.	Coef.	Std. Err.
AGE	0.087	0.04	-0.012**	0.437
AGE^2	-0.001	0	0.002*	0.005
GEND	-0.163***	0.235	0.318	2.313
EDUC	-0.013***	0.028	-0.282	0.283
MARR	-0.153**	0.247	0.117	2.342
WOG	0.014	0.24	0.56	2.333
SOCG	-0.219**	0.29	-0.383**	3.343
URBA	-0.735***	0.267	-2.276	2.757
NEAT			1.135	0.821
AWAR	0.831*	0.659	13.571*	8.404
DIST			-0.266*	0.165
RELI	1.994**	0.301	5.579*	3.398
TAST	0.335**	0.409	6.642*	3.731
EASP	0.522	0.386	0.751	3.576
AFOD	0.028***	0.388	9.474**	3.481
NUTR	0.955***	0.295	3.651	3.224
MEDI	-0.196	0.56	2.301	3.414
Cons	-3.419	1.22	36.665	14.994
Sigma	-	-	12.371	1.02

Prob > chi^2	0.000***
Log-Likelihood	-719.978
Wald chi^2(15)	35.46

Notes: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Source: Survey data, 2012

Meanwhile, the respondents' level of education (EDUC) affected the purchasing decision negatively, but not the level of expenditure. This implies that families headed by relatively educated people were less likely to purchase ALVs, thus, higher education levels reduced the acceptance of ALVs as a food choice. These results concur with Taruvinga and Nengovhela (2015) who reported that education had a negative impact on the consumption of ALVs in the Eastern Cape. This may be attributed to the fact that not much information regarding ALVs' health and nutrition benefits had been made available and accessible to the consumers in general (Smith and Eyzaguirre, 2007) and also the perception that ALVs are food for the poor.

The variable, social grants (SOCG), was associated with a decreasing probability of both the decision to purchase ALVs and the level of expenditure. In other words, households who receive social grants were less likely to purchase ALVs and also less likely to spend more on these foods. One reason may be that the grant received is mainly spent on staple foods rather than on ALVs, as the grants may be inadequate to cover both, while another may reason may be that some ALVs can be freely harvested from the wild. Although the main purpose of the social grants programme is to help the poor meet their basic needs, some beneficiaries such as young mothers had been reported to use the money on items such as luxury foods, clothes and gambling (Nkuna, 2008), rather than on affordable nutritious indigenous goods. They do this so as not be perceived and classified as poor by their friends and neighbours.

Regarding the urban variable (URBA), the results show that urban consumers were less likely to purchase ALVs in comparison with rural respondents. The results show that urbanisation played a significant role in determining the likelihood of purchasing ALVs. Local knowledge of ALVs is likely higher in rural areas in comparison with urban areas. The rates of malnutrition among urban children were increasing faster than urbanisation itself and more than half of these children were malnourished (FAO, 2012). Awareness about the nutritional content of ALVs, access to urban markets and increasing production could benefit farmers as well as nutritional security among urban low-income households. The consumption of ALVs by urban households ought to increase by promoting value-added activities such as arranging/sorting, packaging, and canning of the product before marketing. In both rural and urban areas, integration of ALV products into the diverse food systems may encourage non-purchasers to buy and consume ALVs. This will also help to reduce the price of exotic leafy vegetables.

The significant effect of household awareness (AWAR) on both the decision to purchase ALVs and the expenditure level were positive. These results suggest that respondents were more likely to purchase ALVs and spend more when they were aware of ALVs. These results concur with Agbelemoge (2014) in that consumer awareness/knowledge about ALVs had a positive impact on the consumption of ALVs. Interventions that would promote the transfer of information regarding ALVs to male and younger decision-makers may increase the likelihood to purchase and consume ALVs. Distance to ALV markets (DIST) determined consumer ease of accessing these products. In this study, this variable significantly and negatively influenced the level of households' ALV expenditure. These findings further reinforce the notion that ALV consumption moved more towards being market driven, suggesting that consumers were likely

to consider ALV consumption if markets selling them were closer. Longer distances to markets constrained access to food commodities due to high transportation costs (Vorster *et al.,* 2007).

The relish variable (RELI) significantly affected both the purchasing decision and the level of expenditure positively. This implies that the relish attribute increases the probability of purchasing ALVs and the level of expenditure. According to Vorster *et al.* (2002), the tender leaves and flowers of ALVs are normally boiled and consumed as a relish throughout sub-Saharan Africa. The cooked ALVs are then enjoyed with a stiff porridge. This is a nourishing dish for many poor households who cannot often afford meat. Respondents' perception that ALVs were tasty (TAST) positively and significantly affected both the decision to purchase and the level of expenditure. The results concur with those of Vorster *et al.* (2007) that the taste of ALVs increased the probability of the purchase decision. Taruvinga and Nengovhela (2015) also found that households believed that ALVs were tasty and easy to cook, which made them a preferred daily dish in rural areas.

The results from the survey furthermore suggest that the consumption of ALVs is driven by affordability.Consumers who perceived that ALV prices were affordable (AFOD) were more likely to purchase and spend more on them. Price perception has several roles in the pr ice-quality association, prestige sensitivity, price consciousness and value consciousness of consumers, but they may change over time based on how they influence consumers' purchasing behaviour (Sternquist *et al.,* 2004; Fatih, 2014). Like other agricultural products, market prices for ALVs fluctuate across seasons, making them less affordable among poor households, especially during dry seasons (Amaza, 2009). Consumers who are adequately informed about the importance of ALVs in a diet have a higher willingness to pay premium prices when purchasing these vegetables (Chelang'a *et al.,* 2013). Affordability poses great potential for successful interventions to stimulate the production and consumption of ALVs in the fight against food insecurity.

The model results confirmed a significant positive association between the perception that ALVs are nutritious (NUTR) vegetables and the decision to purchase. This implies that consumers who perceived ALVs to be nutritious were more likely to purchase them. These findings, therefore, suggest that there may be sufficient evidence to claim that ALV production may be positively supported as long as rural households continue to share positive nutritional

beliefs regarding these vegetables. In light of this finding, the observed association may be based on the assumption that production is driven by the desire to address nutritional deficiency. Tumwet *et al.* (2014), Acheampong *et al.* (2012) and Kimiywe *et al.* (2007) reported similar results.

4.5 Summary

The main objective of this empirical chapter was to examine the factors affecting consumers' decisions to purchase ALVs using cross-sectional data from the Limpopo Province. This was done by using the double-hurdle model that explain the decision of whether consumers purchase ALVs or not and also to determine how much to spend on ALVs. The chapter indicate that farmers who are female, uneducated, based in the rural areas, and heavily dependent on social grants are likely to purchase ALVs. In addition, other consumers who are likely to purchase ALVs are those who have prior knowledge about these vegetables and the perception that ALVs are nutritious. Consumers' positive perceptions towards ALVs were found to be mainly influenced by the belief that ALVs are nutritious and affordable, and also that ALVs are tasty and can be used as relish.

With regards to the level of expenditure, the chapter indicate that age of the consumer, dependency on social grant, and prior knowledge on ALVs and distance to the market were the key determinants of how much to spend on ALVs. In addition, consumers' perceptions towards ALVs were found to be mainly influenced by the belief that ALVs are used as relish and are also affordable. Factors that influence both the purchasing decision and the level of expenditure were socio-economic factors (dependency on social grants) and perception factors (perception that ALVs are relish, tasty and affordable). More details on the conclusions and policy implications of the empirical results of this chapter are contained in Chapter 6. The next chapter discusses the consumer's WTP for ALVs and explores the socio-economic and perception factors influencing WTP for these ALVs.

CHAPTER 5: SOCIO-ECONOMIC AND PERCEPTION FACTORS INFLUENCING WTP FOR AFRICAN LEAFY VEGETABLES IN SOUTH AFRICA

5.1 Introduction

In most parts of the developed world, indigenous leafy vegetables amongst others are regarded as weeds. But in Africa and other developing countries, these plants form part of the daily diets of many rural households. The oldest inhabitants of South Africa have harvested indigenous leaves from wild and cultivated plants to supplement the meat from hunted animals (Jansen van Rensburg *et al.,* 2014). The use of green leafy vegetables continues to spread in South Africa, although Westernisation has decreased its overall use. The parts of the leafy vegetables which are mostly used are young leaves, succulent stems, flowers and very young fruit. Vegetable dishes may be prepared from single plants or a combination. In Sesotho and sePedi they are called morogo, or imifino in isiZulu and isiXhosa (Jansen van Rensburg *et al.,* 2007). The food consumption patterns of leafy vegetables of the households is highly variable and depends on factors such as poverty status, degree of urbanisation, distance to fresh produce markets and time.

ALVs has become daily food in places like Limpopo (Vorster *et al.,* 2007), but generally the knowledge of indigenous food has been lost in many South African communities (Lwoga *et al.,* 2010), owing to factors such as politics, changes in lifestyle, and stigma associated with the use of indigenous food (Musinguzi *et al.,* 2006). The dietary shift from ALVs to cash crops and exotic plant food sources increases the risk of malnutrition and other nutrition-related non-communicable diseases, especially in poor rural communities. Farm communities in South Africa have been associated with poor nutritional status and extreme poverty. ALVs have been found to be affordable sources of several micronutrients. However, knowledge of and the use of these plants are declining (Van der Hoeven, 2013). They have long been regarded as minor crops and thus have attracted little marketing attention, most research and development effort going to major and cash crops (Lyatuu *et al.,* 2009).

ALVs as a group of crops from the horticultural category have wide importance both as a source of food and health care (Faber, 2010). However, their level of consumption is very low for reasons of unavailability and imperfect market. Even with limited areas of production, the

products suffer from low prices and lack of markets. However, Backeberg (2013) argued that these leafy vegetables have advantages (such as drought and heat tolerance, ease of production, usually requiring less resources such as water, and are rich in micronutrients such as iron and Vitamin A) over exotic and local vegetable species that currently dominate supermarket shelves.

According to Chelang'a *et al.* (2013), ALVs would fetch a higher price at supermarkets than in open air markets (informal markets). One possible reason is that supermarkets are patronised by a more nutritionally aware clientele with higher incomes, who are more conscious of their health and are willing to pay extra to obtain these nutritional benefits. It is also possible that the atmosphere in supermarkets has an effect on prices and WTP a premium as they employ modern retail technology in terms of storage, display and packaging. These factors were also reported by Kimemia and Oyare (2006) to be responsible, at a national level, for WTP a premium.

There is scarcity of studies on the economics of ALVs, especially in South Africa. Even though there is no organised market for ALVs in Limpopo, some anecdotal evidence suggests that there is a rising interest to buy among households. As information collected during small research within a specific area cannot be generalised to the entire South African population, the objectives of paper was to empirically examine consumers' WTP for ALVs and to explore the socio-economic and perception factors influencing households' WTP for ALVs in the Limpopo Province. The results are expected to provide some important information to promote the production, value addition and consumption of ALVs, and may provide retailers with important information about the main socio-economic factors affecting household food consumption decisions regarding ALVs.

This chapter analyses socio-economic and perception factors influencing WTP for ALVs and presents the results and related discussion. The rest of the chapter is organised as follows: Section 5.2 explains the determinants of WTP, drawing from the literature. Section 5.3 presents the methodology, which constitutes the study area, sampling, and data collection (discussed in Chapter 2) and the conceptual framework and model. Section 5.4 presents the empirical results and discussion while section 5.5 concludes the chapter with a summary of the findings.

5.2 The determinants of WTP for ALVs

Consumer WTP studies are often used in determining the market potential for products. In most of these studies, researchers have hypothesized that consumers' WTP is influenced by socio-demographic factors like age, education, income, gender, marital status and number of children in the family (Xia and Zeng, 2008). In addition, consumer perceptions and knowledge are also important factors influencing WTP. According to Ariyawardana *et al.* (2009), many studies have shown that women are willing to pay a premium for organic ethnic produce, and so are better educated and high income groups.

Haghjou *et al.* (2013) reports that factors such as income, family size and consumers' awareness of the products' characteristics significantly increase consumers' WTP a premium for organic food products. Also, married consumers as well as women were willing to pay a higher premium. In addition, those who had children younger than 10 years old, the elderly, or people with family members having special diseases were willing to pay a higher premium price for these products. A factor that was found to discourage WTP was lack of advertising.

In addition, WTP is mainly affected by income and information (Boccaletti and Moro, 2000). . Boccaletti and Nardella (2000) also records that the high income group was willing to pay a premium for pesticide-free produce, male respondents and those with a university degree were less likely to pay a premium for pesticide-free produce. According to Ngigi *et al.* (2010) on the assessment of urban consumers' WTP for quality leafy vegetables in Kenya, using contingent valuation and the payment card method in eliciting consumers' WTP, the study found that WTP for quality was higher among high income consumers. It also found that age of children the consumer has and access to information about food safety are among the significant drivers of consumers' WTP for quality leafy vegetables. Another survey conducted by Chelang'a *et al.* (2013), among urban consumers in Kenya, to determine the WTP a premium for ALVs and the underlying determinants using the semi-double bounded contingent valuation choice and logit models, discovered that consumers generally preferred ALVs to exotic leafy vegetables and were willing to pay an average premium of 79% for them: 88 % and 70 % in open air and supermarkets, respectively. The WTP premium was positively influenced by age, presence of children in the household, years of schooling of the household decision maker, and the number of years the consumers had been consuming ALVs.

Alphonce and Alfnes's (2011) reported that, on average, consumers are willing to pay a premium for inspected and organically produced food. In addition, consumers have a strong preference for domestically produced food and do not neglect produce coming from areas associated with poor agricultural practices. Acheampong *et al.* (2012) reports that, to ascertain consumer perceptions, purchasing behaviour and WTP for safe vegetables in Ghana, labelling, visual appearance, freshness and availability had a significant influence on consumers' WTP higher prices for safe vegetables.

5.3 Methodology

The description of the study area, sampling and data were discussed in Chapter 2 and paragraph 2 of Section 2.4, respectively.

5.3.1 Conceptual framework and model

WTP for a product may be defined as the amount of money an individual or household is willing to pay for purchasing a product given her/his income, risk preferences and other characteristics (Ramasubramanian, 2012). WTP is generally analysed using the contingent valuation method (CVM) and it helps to estimate the value an individual places on a good, usually an intangible good. The CVM was originally designed to value goods and services the market fails to value. This is mainly the case for public goods, the environment and health care programmes (Blumenschein *et al.,* 2001). However, CVM is now increasingly being used to value private market goods and services (Lusk and Hudson, 2004); it also has been applied to value organic food products (Boccaletti and Nardella, 2000; Gil *et al.,* 2000; Fu *et al.,* 1999), and indigenous vegetables (Weinberger and Msuya, 2004).

CVM is often referred to as a stated preference model, in contrast to a price-based revealed preference model. Typically, the survey asks how much money people would be willing to pay (or willing to accept) to use (or be compensated for the loss of) organic food product features, such as environmental benefits. Indeed, CVM permits a direct estimation of WTP by means of different elicitation techniques (Boccaletti and Nardella, 2000). Consumers simply indicate their WTP without purchasing the hypothetical product. As explained, the CVM relies on directly asking individuals about their WTP for a specific commodity. The most important part

in applying CVM is to choose appropriate survey and elicitation methods to reach the most accurate data. Various survey methods and questionnaire formats are possible for collection of data. In-person interviews are usually held to produce the highest-quality WTP data, although telephone and mail surveys have been applied in a number of studies (Haghjou *et al.,* 2013).

There are various techniques for eliciting consumers' WTP. For instance, in a dichotomous-choice format, the respondent is given a question to indicate if he would pay Rx (R=Rand) for the good, or not. Use of open-ended questions about a consumer's WTP is another technique. An alternative method is to present a number of possible WTP values on a card to the respondent, called a "payment card". The respondent would then choose the nearest quantity to his WTP among others written on the card. The chosen amount can be taken as the consumer's WTP. Since a payment card is simple, and it enlightens an unaware respondent's picking options by giving him a range of predesigned price premiums, it is an appropriate approach in some studies (Boccaletti and Nardella, 2000). In this chapter, in-person interviews using a dichotomous-choice format through ranking, where the respondent is given a question to indicate if she/he would pay a specific percent for the good, or not were applied to investigate factors affecting consumer's WTP for ALVs.

The data applied in this paper were collected through a contingent valuation survey. Household WTP for the ALVs was considered a dependent variable in this paper. Households in the Limpopo Province purchase ALVs either from the farms or informal markets. Respondents were presented with the following WTP question: Suppose your favourite ALV has a price premium, would you pay more for ALVs? Respondents were asked to choose from five classes of WTP (see Table 5.2)**.**

As this response variable assumes ordinal ranking of the WTP variable, an Ordered Probit regression is the natural choice (Greene, 2008). The model is set up around a latent regression that begins with the following equation:

$$WTP^* = X'\beta + \varepsilon \tag{1}$$

Where WTP^* is the WTP, X' are a vector of explanatory variables, β are a vector of coefficients, ε is the error term. WTP^* is unobserved, and what can be observed is:

$$y = \begin{cases} 0 & if & y \le \mu_1 \\ 1 & if & \mu_1 \le y \le \mu_2 \\ 2 & if & \mu_2 \le y \le \mu_3 \\ & & . \\ & & . \\ & & . \\ j & if & \mu_{j-1} \le y \end{cases} \qquad (2)$$

Model 2 is a form of censoring and the μ's are unknown parameters to be calculated with β. It is presumed that ε is normally distributed across observations. By normalizing the mean and variance of ε to zero and one, respectively, the following probabilities are obtained:

$Prob(y = 0|X) = F(-X'\beta)$

$Prob(y = 1|X) = F(\mu_1 - X'\beta) - f(-X'\beta)$

$Prob(y = 2|X) = F(\mu_2 - X'\beta) - f(\mu_1 - X'\beta)$

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$$Prob(y = J|X) = 1 - F(\mu_{J-1} - X'\beta) \qquad (3)$$

Because all probabilities must be positive, the following condition should be established:

$$0 < \mu_1 < \mu_2 < \ldots < \mu_{J-1}$$

In this model, the coefficients are not necessarily equal to the marginal effects of regressors X on the probabilities. Yet, the marginal effects of changes in the regressors can be calculated as follows:

$$\frac{\partial Prob(y=0|X)}{\partial X_i} = -F(-X'\beta)\beta$$

$$\frac{\partial Prob(y=1|X)}{\partial X_i} = [F(-X'\beta) - F(\mu_1 - X'\beta)]\beta$$

.

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$$\frac{\partial Prob(y=J|X)}{\partial X_i} = F(\mu_{J-1} - X'\beta)\beta \qquad (4)$$

The aim of model estimation was to identify the relevant factors to explain consumers' WTP for ALVs. The final model, chosen to interpret the dependence of WTP on explanatory variables, was specified as follows:

$WTP_i = \beta_0 + \beta_1 HHLD + \beta_2 GEND + \beta_3 AGE + \beta_4 URBA + \beta_5 INCO + \beta_6 AWAR + \beta_7 DISM + \beta_8 TAST + \beta_9 AVAI + \beta_{10} NUTR + \mu$ $\qquad (5)$

Stata Version 13 software was used to estimate the regression. Model significance was verified by computing the Chi-square (χ^2) statistics, calculated from the restricted and unrestricted log-likelihood function ((2) x (Log likelihood ratio) $=\chi^2$). It should be noted that the variables of model 5 are presented in the following section.

5.4 Results and discussion

5.4.1 Descriptive results

Description and sample statistics of the independent variables used in the analysis are reported in Table 5.1. Some of them are continuous variables (HHLD, AGE and DISM), some are Likert scales (TAST, AVAI and NUTR) and the others are nominal (GEND, URBA, AWAR and INCO).

In the sample, the average household head was 44 years old, with an average family size of four members. About 42% of the consumers were males and few of them (47%) resided in the urban areas. Close to 33% of the households have an income of less than R2000 per month. Most of the consumers (96%) were aware of ALVs; and it takes an average of almost 7 km to reach the ALVs market.

The results also revealed that consumers score ALVs in terms of Taste and Nutrition, on average 3.59 and 4.36, respectively in a scale of 1-5, reflecting the importance of these attributes among

the sample consumers. In addition, an average low score of 1.86 of ALVs in terms of Availability was scored, which implies that ALVs are not available throughout the year.

Table 5. 1 Descriptive statistics of the variables used in the analysis, Limpopo Province, 2012 (*N*=299)

Variables	Description	Mean	SD
HHLD	Number of people in the household (Number)	4.23	0.089
GEND	1 if the household is male, 0 otherwise (Dummy)	0.42	0.494
AGE	Age of the household (Years)	44	15.974
URBA	1 if the household resides in the urban area, 0 otherwise (Dummy)	0.47	0.029
INCO	1 if household income is less than R2000/month, 0 otherwise (Dummy)	0.33	0.473
AWAR	1 if the household is aware of ALVs, 0 otherwise (Dummy)	0.96	0.197
DISM	Distance to the market (Km)	6.79	8.834
TAST	Consumer perception on taste (1-5 Likert scale)*	3.59	1.484
AVAI	Consumer perception on availability (1-5 Likert scale)*	1.86	1.119
NUTR	Consumer perception on nutrition (1-5 Likert scale)*	4.36	1.258

Source: Survey data, 2012; *Likert scale: 1= Totally Disagree…5= Totally Agree

Table 5.2 shows the distribution of WTP for ALVs in the Limpopo Province. According to the WTP sample distribution, most respondents (almost 80 percent) were willing to pay a premium for ALVs. For those who wre willing to pay a premium, a larger number was willing to pay less that 5% premium, while very few were willing to pay 11% to 15% premium.

Table 5. 2 Distribution of WTP for ALVs, Limpopo Province, 2012 (*N*=299)

WTP category	Frequency	Percent
Not willing to pay a premium	63	21.1
Willing to pay less than a 5% premium	118	39.5
Willing to pay a 6 to 10% premium	40	13.4
Willing to pay a 11 to 15% premium	25	8.4
Willing to pay more than a 15% premium	53	17.7
Total	299	100

Source*: Survey data, 2012

5.4.2 Factors influencing WTP of ALVs

Parameter estimates of the Ordered Probit model are presented in Table 5.3. As mentioned, the Ordered Probit model is non-linear, therefore, the estimated coefficients are not marginal

effects. As such, coefficient estimates and marginal effects are discussed separately. The estimated model has a pseudo R^2 of about 0.60. Of the 10 estimated coefficients, six are significant.

The results reveal a significantly positive relationship between being Male and WTP, explaining that male consumers are more likely to pay higher prices for ALVs as compared to females. This could mean that women are not willing to pay higher prices as they are the main producers of leafy vegetables. Moreover, rural women are relatively poor with marginal access to livelihood assets. However, some studies reported the opposite (Haghjou *et al.,* 2013; Ariyawardana *et al.,* 2009; Govindasamy and Italia, 1999).

The variable Age had a significantly negative effect on consumers' potential WTP for ALVs. This indicates that age itself is an influencing factor on consumer's tendency to pay a higher price for ALVs. The younger generation is more willing to pay more for ALVs. Some other studies found opposite results (Chelang'a *et al.,* 2013; Cranfield and Magnusson, 2003), whereas Boccaletti and Nardella (2000) found no significant effect of age on WTP.

The variable URBA had a significantly negative effect on WTP for ALVs, meaning households in the urban areas are not willing to pay higher prices for ALVs. The reason could be that rural households are more knowledgeable about ALVs as compared to urban households who do not have information and experience about ALVs. Boccalletti and Nardella (2004) did not find any relationship between place of residence and WTP. Fox and Norwood Young (1986) have claimed that city dwellers have less knowledge about ALVs compared to their rural counterparts. The urban environment, with its array of supermarkets, offers a range of non-local food products from which the consumer can choose, at the expense of indigenous foods.

Table 5.3 Estimates of the Ordered Probit model for households' WTP for ALVs, Limpopo Province, 2012

Variable	Coef.	Std. Err.	z	P>z
HHLD	0.054	0.077	0.7	0.483
GEND	0.457**	0.227	2.02	0.044
INCO	0.375	0.269	1.4	0.163
URBA	-1.341***	0.295	-4.54	0
AGE	-0.013*	0.007	-1.7	0.089
AWAR	0.765	0.656	1.17	0.244
DISM	-0.308**	0.129	-2.39	0.017
TAST	0.578***	0.128	4.52	0
AVAI	0.538***	0.119	4.52	0
NUTR	0.119	0.121	0.98	0.328

Observations = 299

Log likelihood = -382.646

Pseudo R-squared = 0.60

Note: *, **, and *** shows significance at the 10%, 5%, and 1% levels, respectively

Source: Survey data, 2012

The variable DISM has a negative and significant estimated coefficient, indicating that distance to the market has a negative impact on WTP for ALVs. The further the consumer is from the market, the less the likelihood to purchase ALVs. However Nouhoheflin (2004) reported the opposite results. Most ALVs are produced in the rural areas and may not easily be accessible by households in the urban areas.

The empirical results also indicate significant positive relationship between consumers' belief about the desirable taste attributes of ALVs and the WTP premium. The findings concur with Voon *et al.* (2011) that positive perception towards the tastes of food impacts willingness to purchase. Owusu and Aniforib (2013) and Nouhoheflin (2004) also found the same results. Availability of ALVs throughout the year was found to be a factor in WTP a higher price and it provides an opportunity for promoting local production and a retail chain for ALVs. Acheampong *et al.* (2012) and Nouhoheflin *et al.* (2004) found the same results.

All other things equal, a one unit change in the explanatory variable will result in an increase or decrease in the predicted probability equal to the size of the marginal effect (Gunduz and Bayramoglu, 2011). Nevertheless, for a binary variable, the marginal effect indicates change in the predicted probability based on whether the respondent falls into the category or not. Finally,

the marginal effects show the change in the predicted probability for different classes of WTP regarding a household, concerning the particular variable. The marginal effects of explanatory variables on WTP probabilities are shown in Table 5.4.

The marginal effects for the GEND dummy variable were negative for the first two classes of WTP (i.e. for the "not willing to pay" and "WTP less than 5 percent" premium), whereas it was positive for the next three classes. This indicates male respondents are more likely to pay a premium of six percent or more (relative to female respondents). The marginal effects of URBA were positive for the first two classes of WTP, whereas it was negative for the next three classes. This suggests that residing in urban areas increases the probability of being unwilling to pay a premium and the probability of being willing to pay a modest premium (i.e., less than five percent). However, residing in rural areas increases the probability of WTP a premium of six percent or higher.

Table 5. 4 Marginal effects after estimation of Ordered Probit model

	WTP=0	WTP=less than 5%	WTP=6%-10%	WTP=11%-15%	WTP=more than 15%
HHLD	-0.008	-0.005	0.004	0.003	0.006
GEND	-0.062	-0.046	0.028	0.024	0.056
INCO	-0.05	-0.039	0.023	0.019	0.046
URBA	0.192	0.11	-0.08	-0.065	-0.158
AGE	0.002	0.001	-0.001	-0.001	-0.002
AWAR	-0.131	-0.027	0.054	0.035	0.07
DISM	0.043	0.029	-0.02	-0.016	-0.036
TAST	-0.08	-0.055	0.037	0.03	0.068
AVAI	-0.074	-0.051	0.035	0.028	0.063
NUTRI	-0.016	-0.011	0.008	0.006	0.014

Source: Survey data, 2012

A marginal increase in DISM variable decreases the probability of willingness to pay higher premiums (more that 15%) by 3.6% and for the lowest price it increases by 2.9%. Households closest to the market are more likely to pay higher premiums as compared to those who are further away from the market.

The marginal effect for the variable TAST indicated that households who believe that ALVs are tasty were more likely to be willing to pay higher premium prices. The probability of being willing to pay more than 6% premium increased, while the probability of the first two

mentioned classes of WTP declined. In addition, the marginal effects for the variable AVAI attributes belief indicated that households who believe that ALVs are unavailable throughout the year were more likely to be willing to pay a higher premium price. This implies that if ALVs are available throughout the year, most consumers are willing to buy.

5.5 Summary

This chapter contributes to the limited knowledge about consumers' WTP for ALVs. Insights about the socio-economic and perception with respect to ALVs and their importance in the intention to purchase or willingness to pay these vegetables are obtained. The main objective of this chapter was to determine consumer's WTP for ALVs and to explore the socio-economic and perception factors influencing WTP of ALVs. The chapter revealed that most of the households are willing to pay a premium for ALVs.

The chapter also indicated that WTP was found to be mainly a function of socio-economic factors, namely, gender, urbanization, age, and distance to the market. Households also have a positive general attitude towards ALVs as they believe that ALVs are good tasting, and nutritious. Although they believe that ALVs are not available the whole year, they are willing to pay a premium if they are made available. Demand and preference for ALVs were found to be high as they have been historically important food security crops to rural households.

CHAPTER 6: RECAPPING THE PURPOSE, CONCLUSIONS, RECOMMENDATIONS AND FUTURE RESEARCH DIRECTIONS

6.1 Recapping the purpose of the study

At the national level, South Africa is food secure but food insecure at the household level. ALVs, widely perceived to be drought and heat resistant and offering substantial nutritional benefits, could increase food security in drier areas of the country. While a wide range of literature explored various dimensions of the production and consumption of ALVs, the literature exploring the economics of ALVs with regard to production, consumption and value chain analysis in South Africa is scarce. Only anecdotes and descriptive reports are available which have reported that rural households are not much involved in the consumption and production of ALVs because ALVs are perceived as food for the rural poor. According to these reports, urban dwellers and individuals in higher income households hardly consume ALVs.

The data comes from survey of producers, middlemen, and consumers of ALVs in Limpopo Province. The overall objective of this doctoral research was to explore and obtain a better understanding of households' production and consumption behaviour of ALVs, and analysing the features of ALVs value chains. To this end, a value chain approach was used in chapter 2 to study the underlying ALV production and market access constraints. The value chain approach was found to be appropriate as it was able to reflect on the various activities from production to the delivery of ALVs to final consumers. It also enabled the study to better identify unexploited opportunities and prioritise interventions that could improve operations at various stages of the entire chain.

The factors and the level of production influencing the decision to produce ALVs were empirically explored in Chapter 3. A double-hurdle model was employed on 126 sampled households. The first hurdle employed the Probit model to assess the factors affecting participation in ALV production. The second hurdle used the truncated regression model to evaluate the determinants of the intensity of smallholder farmers' participation in ALV production. This chapter was based on the theoretical foundations of adoption studies by hypothesizing that the decision to grow ALVs can be likened to the adoption of agricultural technology. Similarly, the decision on how much land to plant to ALVs was similar to analyzing the intensity of adoption of a particular agricultural technology. A consumer questionnaire-based survey was used in Chapter 4 determine the impact of socio-economic and perception

factors influencing consumers' purchasing decisions and expenditure levels for ALVs. Chapter 5 has examined consumers' willingness-to-pay (WTP) for ALVs in the Limpopo Province of South Africa.

6.2 Conclusions

6.2.1 The value chain analyses of ALVs in the Limpopo Province

The following actors in the ALVs value chain were indentified: inputs suppliers, smallholder farmers, traders, and consumers. Although smallholder farmers currently make high gross margins in comparison to other participants in the value chain, higher returns can be realised if government services (such as training, seed production and distribution) were decentralised. In addition, policy and investment interventions are required in the promotion of processing ALVs for value addition, provision of cold storage facilities nearer to the smallholder farmers in rural areas and nearer to the urban consumers, and to encourage continuation of production. Agro-processing should also be encouraged along the value chain of ALVs to provide smallholder farmers with market opportunities and reduce the postharvest losses. This could also involve processing ALVs from formally contracted smallholder farmers for higher value markets, distributors and wholesalers. There could be a possibility to produce solar dried vegetables for local as well as export markets. This will ensure availability for and accessibilityto consumers in urban areas. The re-establishment of the Polokwane FPM may be necessary for market access and this will benefit smallholder farmers in the Province. Smallholder farmers' plans to expand production capacities are hampered by the inability to access quality inputs such as seeds and financial support. These constraints are partly responsible for the extremely low-produced volumes, poor quality of ALVs and inconsistent market supply of ALVs, prompting major ALV traders (e.g. supermarket chain stores) and other traders not yet ready to sell them at all. The formation of farmer groups, capacity development, and value addition through processing, infrastructural development and stronger linkages among value chain players is necessary.

6.2.2 Factors influencing households' participation decision in the production of ALVs in the Limpopo Province

Households depending on social grants were less likely to produce. This suggests that social grants are reducing recipient households' incentive to engage in income-generating farming

activities, such as the production of ALVs. The execution of social welfare programmes such as social grants in South Africa may negatively affect the drive to increase production of ALVs, which could hamper agricultural and rural development. The chapter also suggests that female-headed households should be encouraged to play a role in the production of ALVs. Although there are concerns that women are likely to remain subsistence farmers because of their exclusion from the market, the potential to reverse this trend exists if women are encouraged to produce ALVs. Perceptions that ALVs contribute to household food security was identified as capable of promoting production. The significance of technical support and access to extension services for the cultivation of ALVs has been clearly shown in the study. There is a need, therefore, for more government involvement in disseminating this valuable information. There is also a need for more NGO involvement to ensure increased ALV production, by young farmers particularly, in the advent of hard economic times characterized by high unemployment in South Africa. However, for this to be effective, the role of the private sector cannot be overemphasized, particularly in the production and marketing of ALVs and interventions in the value chain. Thus, the promotion of ALV production may require a supportive market platform and increased educational awareness campaigns.

In this regard, continuous awareness campaigns by the Limpopo Department of Agriculture's Ilima/Letsema programme through extension services are necessary as they can increase the probability of producing ALVs. Also, health practitioners should share nutrition education on ALVs with consumers to dispel fears and myths about ALVs. Positive perceptions of ALVs among farmers present an opportunity for rural development stakeholders (research, government, private sector and NGOs) to repackage and reconsider ALVs as a potential rural household food security policy intervention. Awareness campaigns, more research and documentation of ALV literature that provides increased and clear information on production techniques, creation of local seed banks, post-harvest handling strategies, and nutritional and medicinal values, and targets especially young and educated communities may promote increased production and consumption of ALVs. In addition, further scientific research on the nutritional benefits of ALVs is required to improve the perceptions of the nutritional value of ALVs among consumers.

6.2.3 Factors influencing consumers' purchasing decisions and expenditure levels for ALVs

ALVs are more commonly purchased and consumed by poorly educated older women based in the rural areas. ALVs were also shown to be more consumed by those who were aware of them

but less consumed by the educated respondents.Interventions such as awareness about the health and nutrition benefits of ALVs might help to promote the consumption and purchasing of ALVs amongst educated, young, male, and urban dwellers. Strategies to enhance value addition, and sensitization of consumers to traditional knowledge regarding ALVs, as well as their nutritional importance to the human diet are required.

Understanding the changing perception factors of consumers that impact on the decision to purchase and the expenditure level on ALVs is crucial. Interestingly, increasing levels of dependency on social grants was associated with decreasing level of expenditure on ALVs, suggesting that increasing income from social grants entrenches a culture of dependency and entitlement. This suggest that the influence of social grants on the purchasing decision and level of expenditure is not a question of whether or not a household is a social grant beneficiary but the level of household dependency on social grant income. The study stresses the need to find strategies integrating awareness programmes on media (such as national and local radios, television stations, newspaper and social networks) where consumers are informed about the nutrition and health benefits of ALVs in languages they understand, may promote the consumption of ALVs by educated and urban consumers.

There is a need to develop the food supply chain from rural to urban areas to meet the needs of a rapidly urbanizing population. Other strategies that could promote and increase urban households' ALV consumption include value-adding activities such as canning, cutting, and quality packaging. These presentations will require traders and retailers to become involved by stocking them. Consumers who buy these products will need less time to prepare the ALVs before cooking. This will encourage time poor households to consume ALVs.

6.2.4 Socio-economic and perception factors influencing WTP for ALVs in the Limpopo Province

The socioeconomic and perception factors influencing WTP for ALVs were identified. Most respondents (almost 80 percent) were willing to pay a premium for ALVs, which is consistent with other similar studies in other regions. This suggests a high potential demand and WTP a premium for ALVs by households in the Limpopo Province. Thus, ALVs might gain a larger market share in Limpopo Province than exotic leafy vegetables, such as cabbage, swiss chard, and lettuce. Empirical analysis was used to indicate socio-economic and perception factors that

influenced WTP for ALVs in the Limpopo Province. The chapter showed that differences among ALV consumers related to the gender of the household-head, the perception that ALVs are tasty, and the availability of ALVs throughout the year. However, older consumers located in the urban areas far from the ALV market indicated that they are not willing to pay a premium for ALVs.

6.3 Policy recommendations

Policy implications from this doctoral research extend to various actors along the ALVs value chain who could benefit from improvements in ALV production, consumption behaviour and practice. These include farmers, retailers and marketers of ALVs. The insights obtained from this research are also pertinent to agricultural organisations and research institutes involved in the production and processing of ALVs.

Policies aimed at reducing both fixed and variable transaction costs (e.g. institutional support like extension, training and organizing farmers into groups) should be prioritized to increase both rates and levels of smallholder participation in the ALVs markets. The significance of technical support and access to extension services for the cultivation of ALVs has been clearly shown by the empirical findings. There is a need, therefore, for increased government involvement in disseminating this valuable information. There is also a need for wider NGO involvement to promote ALV production by especially young farmers, during times of economic insecurity and high unemployment in South Africa. However, for this to be effective, the role of the private sector is key, particularly in the production and marketing of ALVs and interventions in the value chain. Thus, the promotion of ALVs production may require a supportive market platform and increased educational awareness campaigns.

Continuous awareness campaigns by the Limpopo Department of Agriculture's Ilima/Letsema programme through extension services are necessary as they can increase the probability of production of ALVs. Also, health practitioners should share information with the public on the desirable nutritional qualities of ALVs with consumers to dispel fears and myths about ALVs. Positive perceptions of ALVs among farmers present an opportunity for rural development stakeholders (research, government, private sector and NGOs) to repackage and reconsider ALVs as a potential rural household food security policy intervention. Awareness campaigns, more research and documentation of ALVs literature, providing increased and clear information on production techniques, creation of local seed banks, post-harvest handling strategies, and

nutritional and medicinal values that targets especially young and educated communities may promote increased production and/or consumption of ALVs. Further scientific research on the nutritional benefits of ALVs is required to support nutritional perceptions of ALVs if these perceptions are to be shared with the wider community as an awareness strategy to gather support for the production of ALVs.

Strategies that promote awareness programmes to consumer segments that are unaware of ALVs and their benefits (such as youth, male, and urban households) might increase the consumption of ALVs. Integrating awareness programmes on media, such as national and local radios, television stations, newspaper and social media platforms, where consumers are informed about the nutrition and health benefits of ALVs in languages they understand, might promote the consumption of ALVs by educated and urban consumers. Other strategies that could promote ALVs include value addition activities such as canning, cutting, and quality packaging, which could increase the consumption of ALVs by urban households. This should involve traders and retailers to stock ALVs already sorted, packaged and canned, thereby reducing the time required for preparation before cooking.

This understanding may assist policy makers to implement agricultural and food policies related to the ALV industry to address the food security, nutrition and health nexus. Future breeding and value addition activities to enhance taste are necessary to encourage the consumption of ALVs. All such initiatives will have another positive societal value of reducing dependence on a handful of crops for food and nutrition security. This will also contribute towards stabilizing food commodity prices as food product markets will become more resilient as their product portfolio expands.

Public awareness through media can help increase demand particularly for male consumers and urban dwellers, but the research also identified the need for more work at the supply end of the market chain. Smallholder farmers should have access to formal markets including fresh produce markets in order to sell their produce. The wholesale marketing structure for vegetables includes linkages between groups of producer-oriented, consumer-oriented, and redistribution markets. This would make the exploration of both local and international markets possible.

Rural producers, breeders/researchers and policy makers, by making use of the value chain analyses information, would be able to identify ways of developing rural areas as the major

source of the ALVs and ALVs products. At the same time, it could promote further development of the ALVs subsector, while encouraging sustainable utilisation of resources for conservation purposes in Limpopo and other Provinces with similar production circumstances. Promoting the production and consumption of ALVs also contributes to agrobiodiversity conservation which contributes to sustainable farming.

Agro-processing should also be encouraged by the increased in consumer demand along the value chain of ALVs for providing smallholder farmers with market opportunities, which would help reduce post-harvest losses. This could also involve processing ALVs from formally contracted smallholder farmers for higher value markets, distributors and wholesalers. In addition, solar dried vegetables could be produced for local and export markets. This will ensure availability for and accessibility by consumers in urban areas. In addition, the re-establishment of the Polokwane FPM may be necessary for market access and this will benefit smallholder farmers in the Province. The findings also suggest that smallholder farmers' plans to expand production capacities are hampered by their inability to access quality inputs such as seeds and financial support. These constraints are partly responsible for the extremely low volumes produced, poor quality and inconsistent market supply of ALVs, prompting major ALVs traders (e.g. supermarket chain stores) not to sell them at all. The study recommends the formation of farmer groups, capacity development, and value addition through processing, infrastructural development and stronger linkages among value chain players.

6.4 Recommendations for further research

The following are recommendations for further research:

a) Considering ALVs as one homogenous product is one of the limitations of the current study. When assessing consumers' general attitude and attribute beliefs, and the impact of social influences and socio-demographic characteristics on ALVs, the research focused on ALVs as one single product category, without differentiating between specific vegetables (e.g. collard greens, mustard greens, cowpea leaves, jute leaves, pumpkin leaves, and amaranth). Consumer beliefs and attitudes as well as the effect of social influences and socio-demographics on consumption might differ according to the specific ALVs

considered as to their nutitional qualities. Future research has to account for the heterogeneity of ALVs products and generate information on their respective specifc desirable and undesirable attributes.

b) Further (quantitative) validation and confirmation of the obtained insights would be relevant and interesting. The findings would benefit from further substantiation based on larger and more representative consumer samples from a wider geographical area, and focused on a more specific product. Cross-cultural validation could be a topic of further research to explore similarities and differences with respect to perceptions and consumption behaviour of ALVs among consumers across South African Provinces, disaggregated by age, rural/urban, poverty status and so on.

c) Familiarity/awareness is found to heavily influence consumers' likelihood to purchase and accept ALVs. Future research could focus on understanding the factors affecting consumers' familiarity with ALVs. It could investigate the 'mere-exposure' effect or the effect of repeated exposure to ALVs' flavours on the evaluation and acceptance of ALVs.

d) Consumers are heterogenous, holding different views on food products and with a variety of preferences and tastes. Further research could focus on identifying consumer segments with similar preferences for ALVs. Identification of such consumer segments in terms of socio-demographic characteristics, background attitudes, beliefs, perceptions and behavioural intentions could yield valuable insights for future market targeting and product positioning.

e) The use of panel data would be beneficial in future to study the poverty and food security impacts of the commercial ALVs enterprise in Limpopo Province. In addition, as an enterprise primarily targeted to improve rural livelihoods, it would also be important to study the role of the ALVs towards advancing the empowerment of women.

f) The study also recommends that future research should conduct a proper cost benefit analysis along the value chain actors to identify who benefits the most. Lastly, the data analysed in this study was from only one province in South Africa. Even though it has been indicated that the data is comparable to that in other rural areas across the country, it is not

nationally representative. It is recommended that a more nationally representative study be conducted to provide further evidence.

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APPENDIX A: ALV CONSUMER SURVEY QUESTIONNAIRE (2012)

UNIVERSITY OF
KWAZULU-NATAL

The Department of Agricultural Economics, University of KwaZulu-Natal is requesting a few minutes of your time to complete a questionnaire. We are busy conducting a study on the economics of underutilized leafy vegetables in the Limpopo Province.

The information captured in this questionnaire is strictly confidential and will be used for research purposes towards Ms Grany Mmatsatsi Senyolo's PhD thesis.

Definition of African Leafy Vegetables (ALVs): seasonal vegetables with under-exploited potential for contributing to food security, health (nutritional/medicinal), income generation, and environmental services.

Name of the enumerator	
Name of the village/township	
Rural/urban	
District	
Date	
Name of the respondent	
Contact details of the respondent (tel number)	
Questionnaire number (Do not fill this in)	

Part 1: Socio-demographics

1. Household member roster: list all household members (begin with the respondent)

Household member	Age	Gender		Marital status 1=single, 2=married 3=divorced 4=widow 5=widower	Relationship with the head 1=wife/husband 2=son/daughter 3=father/mother 4-brother/sister 5=grandchild 6=other: specify	Responsibility in the household (1 if working, 0 if not working)	Type of income 1=salary 2=child grant 3=old age grant 4= self employment 5=farm income 6=other: specify	Level of education (last class attended)
		M	F					

2. Household head (manager of resources): Man……Woman…….Child (in case of both parents deceased)……

3. Who does grocery shopping? Father….. Mother…..Working eldest….. Granny….. Other (specify)………..

4. How much is your expenditure on groceries per month?............................(estimate)

5. How much is your household income per month? Less than R2000........ R2000 to R4999….. R5000 to R9999……… R10 000 to R15 000…….. more than R15 000...................

6. Which category do you think fits your household: Very poor…... Poor….. Self-sufficient……Rich…...Very rich……

Part 2: Purchasing behaviour of consumers

7. Are you aware of ALVs that are found in this Province? Yes…... No…...

8. If yes, which ALVs?
   ………………………………………………………………………………………
   …

9. Which leafy vegetables do you normally buy?..

10. At what price price/bundle? R……………………………………………….

11. How many times per week do you buy?..

12. Distance to the market (Km)………………………………………………………..

13. Do you buy ALVs as long as they are available? Yes……. No……….

14. Where do you normally buy the following leafy vegetables? (Tick all that applies)

Family farm	
Other farms	
Street vendors	
Door to door sellers	
Retailers (Shoprite, Spar, etc)	
Other: Specify	

15. Of those vegetables you regularly purchase, why was the vegetable purchased?

    (Tick all that apply)

Relish	Taste	Ease of cooking	Lower Price	Nutritious	Medicina l	Other (specify)

16. Do you buy dried leafy vegetables? Yes…………No………………

17. If yes, which one did you buy dried?..

18. If "No", why don't you buy them?

    …………………………………………………………………………………………

Part 3: Household consumption behaviour regarding leafy vegetables

19. How long has your family been eating the following leafy vegetables and how many days

    per week?

How long (years)	Number of days per week

20. Do you like eating ALVs? Yes……No……..

21. If yes, why?

    …………………………………………………………………………………………
    …………………………………………………………………………………………

22. If no, why?

    …………………………………………………………………………………………
    …………………………………………………………………………………………

23. What foods do you like serving/mixing when eating leafy vegetables? (Tick all that apply)

Porridge/pap	
Stew	
Potatoes	
Rice	
Stamp	
Bread	
Other: specify	

24. Challenges faced with consumption of ALVs (Tick all that apply)

Not available all year round	
High price	
Not tasty	
Poor road condition to the market	
Irrigated by waste (dirty) water	
Other: specify	

Part 4: Attitudes and beliefs, familiarity, influences, and purchase intentions regarding the underutilized vegetables

Beliefs

25. Compared to other ALVs, I consider ALVs (Scale, 1 = Totally disagree, 5 = Totally Agree)

Cheap	
Easily available all year round	
Good in quality	
Safe	
Nutritious	
Healthy	
Good in taste	
Attractive	

Social influences

26. To what extent do the following influence your decision to eat ALVs?

(Scale, 1 = Strong inhibiting factor, 5 = Strong stimulating factor)

Partner	
Children	
Family	
Friends	
Colleagues	

Purchase intention

27. Scale (1 = strongly disagree to 5 = strongly agree)

I intend to purchase	
I am expected to purchase	

Part 5: Product acceptability

28. Are underutilized ALVs available all year round? Yes …… No……

29. If no, would you like to access them all year round? Yes……No…..

30. Please rank the following ALVs in terms of the degree of likeness and preferences (Mark only once with an X)

Like Extremely	Like Slightly	Neither	Dislike Slightly	Dislike Extremely

31. Will you recommend these ALVs to someone you know? Yes…….No…….

32. Do you want farmers to produce ALVs all year round? Yes…….No………

33. Which ALVs should they produce all year round? ……………………………………

34. Suppose your favourite ALV has a price premium, would you pay more for ALVs?

Not willing to pay a premium	
Less than a 5% premium	
6 to 10% premium	
11 to 15% premium	
More than a 15% premium	

35. Are you willing to buy ALVs from the farmers if they produce all year round?

Yes…………..No…………..

36. If yes, how would you want to buy them and at what price?

Fresh (R)	Dried (R)	Canned (R)

37. Some ALVs cost R5 to R15 a bunch in retail stores all year round: are you willing to buy ALVs in retail stores? Yes…………..No…………..

38. If yes, how would you want to buy them and at what price?

Fresh (R)	Dried (R)	Canned (R)

39. Any comment to the farmers about ALVs

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

40. Any comment to the retailers about ALVs

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

Thank you so much for your time

APPENDIX B: ALV PRODUCTION QUESTIONNAIRE (2013)

UNIVERSITY OF
KWAZULU-NATAL

The Discipline of Agricultural Economics, School of Agriculture, Earth and Sciences, University of KwaZulu-Natal is requesting a few minutes of your time to help us complete a questionnaire. We are busy conducting a study on "The economics of underutilized leafy vegetables in the Limpopo Province".

The information captured in this questionnaire is strictly confidential and will be used for research purposes towards Ms Grany Mmatsatsi Senyolo's PhD thesis.

Name of Enumerator	
District	
Municipality	
Date of interview	
Name of the respondent	
Contact details of the respondent (Tel number)	
Questionnaire number (Do not fill this in)	

PART 1: DEMOGRAPHIC INFORMATION

1. Fill in the relevant information and where possible mark with an X

Gender		Marital status				Language				Age	Family size
M	F	Single	Married	Widow	Divorced	Pedi	Tsonga	Venda	Other		

2. What is your highest educational level? (Mark with an X)

High school	No formal education	Primary school	College	University	Other (specify)

3. Indicate the number of employees who assist with farm work

Type of employee	Full time	Part time	Unpaid family members	Total
Number				

4. What income do you or your family receive not related to farming activities per month?

Type of income	Net Salary	Pension	Social grants	Remittances	Business	Other (specify)
In Rand						

5. What is you farming status and under how much income does your farm make per year?

Employment status		Income (R)
	Tick	
Full time farmer		
Part time farmer		

6. Number of years in farming (years) …………………………………………..

PART 2: FARM CHARACTERISTICS AND PRODUCTION OF LEAFY VEGETABLES

7. What type of a farmer are you?

Smallholder farmer – subsistent, mainly producing for the market	
Smallholder farmer – subsistent, mainly producing for the household	
Large commercial farmer	

8. What type of farming are you running and indicate the amount of land use?

Type of farming	Crops and vegetables	Tree farming	Animals
Land in hectors			

9. If crop and vegetables, mention them

………………………………………………………………….………………………...

…………………………………………………………………………………………

10. Indicate the land tenure system on the land and how you acquired it

Land tenure system							How you acquired the land			
Communal	Own	Rental	State	Family	Municipal	Project	Bought	Inherited	Gov	Other (specify)

11. If you do not own land, are you satisfied with the arrangement on the land that you are using?

Explain……………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

12. Which leafy vegetables are you growing now in your farming operations? (You can tick more than one)

Cabbage	Spinach	Lettuce	Motshaina	Phophorokga	Monawa	Dithaka	None	Other (specify)

13. For those you are not growing, why are you not growing? Explain

……….……………………………………………………………………………………

…………………….………………………………………………………….…………

…………………….………………………………………………………………………

14. Farmer's rating regarding leafy vegetables attributes (1= Very poor, 2= Poor, 3=Neither, 4=Good, 5=Very good, 6 = Do not know)

	ALVs
Desirable production attributes	
Tolerance to drought	
Performance in bad season	
Early maturity	
Bunch size	
Plant height	
Performance with poor soils	
Resistant to nematodes	
Can be produced all year round	
Easy to transport	
Cheap inputs	
Easy to produce/plant	
Any other desirable input (Please specify)	
Desirable consumption attributes	
Taste	
Texture (softness) when cooked	
Colour when cooked	
Relish/seshebo	

Longer storage capability after harvest	
Nutritious	
Freshness	
Cheap	
Safe	
Any other (Please specify)	

15. What do you like or not like about leafy vegetables? (1) Strongly agree; (2) Agree; (3) Neither (4) Disagree; (5) Strongly disagree

	ALVs
Stable in terms of yield	
Needs more labour	
Require fertilizer	
Needs better management	
Fetches higher price	
Disease resistant	
Any other attribute (Please specify)	

16. What inputs do you buy for the production of leafy vegetable?

Inputs	Input market (where do you buy the inputs?)	Distance to the market (Km)

17. If you grow leafy vegetables, how are the prices and costs of production (2011 cropping season)?

	ALVs
Yield (Bundle/ha)	
Price (R/bundle)	
COSTS	
Water (R/ha)	
Land (R/ha)	
Seeds (R/ha)	
Fertilizer (R/ha)	
Pesticides (R/ha)	
Manure (R/ha)	
Any other inputs (please specify)	
Labour	
Hired labour (R/ha)	
Family labour (R/ha)	
Ploughing (R/ha)	
Equipment (rented) (R/ha)	
Transport costs (R/ha)	
Any other costs (please specify)	

PART 3: INFRASTRUCTURE AND EQUIPMENT

18. What type of road do you use to go to the market?

Gravel	Tarred	Both

19. In your opinion, how do you rate the road?

Poor	Reasonable	Good

20. Are you satisfied with the total number of roads that link you to the market? Yes…….

No………..

21. Do you have fencing around your farm? Yes……………. No……………………

22. What is the primary water source that you use for your leafy vegetable farming?

Borehole	Well	Dam	Tap	River	Fountain	Rainwater	Other (specify)

23. How is water taken from the source to the farm?

Furrows	Irrigation system	Own pump	Canal	Rain water	Wind mill	Go fetch	Other (specify)

24. Do you have access to an irrigation system? Yes……… No……………

25. Indicate the type of infrastructure you have access to

Infrastructure	Conditions		
	Bad	Fine	Good
Value adding machinery			
Telephone			
Electricity			
Computer			
Water			
Other (specify)			

26. Do you have your own equipment/implements to farm with?

Have own, don't borrow/hire	
Have own, borrow/hire some	
Don't have, borrow/hire	
Don't use equipment	

27. If you borrow/ hire equipments/ implements, what equipments/ implements do you borrow/hire?………………………………………………………………………………
……………………………………………………………………………………………….

PART 4: PROCESSING OF LEAFY VEGETABLES

28. Do you process your leafy vegetables? Yes…….. No………

29. If Yes, which ones do you process and what is the final product?

………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………

30. If No, why not? …………………………………………………………………..

……………….………………………………………………………………………
………………………………………………………………………………………

31. Would you want to process leafy vegetables in the future? Yes…….. No………

32. How would you want to sell your leafy vegetables in the future?

Fresh	
Dried	
Canned	
Other (specify)	

33. Which companies deal with processing of leafy vegetables? …………………………
…………………………… ………………………………………………………..

34. Have you ever thought of selling your leafy vegetables to them for processing?
Yes……….No………

35. If Yes, are you selling to them? Yes…... No……

36. If No, why?

....…......................
....

37. What do you regard as the main hampering/restricting factors for you to process underutilized leafy vegetables? (Please present in order of importance)

....

...........................……………………………………………………………………...........

PART 5: MARKETING OF LEAFY VEGETABLES

Output market

38. How difficult is it to look for buyers?

Easy	Fair	Difficult

39. Which markets do you usually use for selling your products?

Market	Reason
Formal market	
Informal market	
I do not sell	

40. Where do you sell your ALVs?

	% of produce sold	Price per head or bunch (Rand)	Distance to the market (Km)
Family and friends			
Street vendors/hawkers			
Wholesalers			
Direct to the public / consumers			
Local fresh produce market			
Supermarkets/retailers/spaza			
Hospital/schools/hotels			
Processor (if any)			
Cooperative			

41. Do you always find market for all of your produce?

Yes………………No…………………..

42. If no, what happens to the unsold produce?

Lose to spoilage	Eat (family and friend)	Sell at low price	Store and sell later	Process it

43. How is price set during sales?

I set the price	We negotiate	It is market driven	It is dictated by the buyers	Other (specify)

44. Are you in a contract with any of your output markets? Yes ………. No……….

If yes, which output market?...

Is the contract verbal or written? ……………………………………………………

Are you satisfied with the agreement done? Yes……….No……

If No, why not?...

Were you able to meet the demand of the output market you have a contract with?

Yes…….No……..

If No Why? …………………………………………………………………………..

45. If No contract, Why? ....

…………………………………………………………………………………………..

Transportation

46. Do the buyers come to you or you take the produce to the buyers?

Buyers come to the farm	I deliver to the buyers

47. If the buyers come to the farm, what is the farm gate price/bundle (2011)? ....

48. If you deliver to the buyers, what is the market price /bundle (2011)?................................

49. How do you transport your leafy vegetables?

Do not transport	
Own transport	
Friend's transport	
Group of farmers	
Customer collects	
Animal traction	
Hire a truck/contractor	
Any other (please specify)	

50. How often do you transport and how many percentages of your leafy vegetables to markets?

Everyday	
Once a week	
Once in 2 weeks	
Once a month	
Once is six months	
Once a year	
Never (customer collects)	
Varies when necessary	

51. How do you go about marketing your ALVs to ensure better prices?

Advertisement	
Market self/word of mouth	
Make goods slightly cheaper	
Self at auctions	
Sell along the road	
Price set by coop.	
Agent does marketing	
Any other (please specify)	

52. What do you regard as the main hampering/restricting factors for you to improve your marketing of ALVs? (Please present in order of importance)

....

..................…………………………………………………………………...........

....

PART 6: ACCESS TO AGRICULTURAL SERVICES FOR ULVS

Access to information

53. Do you have access to relevant agricultural information concerning ULVs?

Yes……..No……

54. If yes, what type of information do you get?

Prices	Production	Consumer needs	Technology	Other (specify)

55. What is the source of that information? (rank in terms of importance, 1=more importance to 7= least important)

TV	Newspaper	Radio	Extensionist	Relatives	Local association	Other (specify)

Access to financial services

56. Do you receive any financial service for your leafy vegetable farming? Yes……No …

57. If yes: from where?

Government	Banks	Cooperatives	Agric association	Other companies

58. How much credit did you obtain in the last two years? R………………………

59. For how long have you been using credit (years)?

........................…………………………

60. Was the credit received in time? Yes…….. No…….

61. How long did it take you to pay back the credit?...............................

62. What did you use the credit for? …………………………………….……………

…………… ....…………………………………………………… ....

63. Were you able to pay back the credit? Yes………..No………

Access to agricultural extension services

64. How do you rate the services provided by extension officers in your area?

Unavailable	Not helpful	Helpful

65. Do you contact extension officers during marketing period? Yes ……… No………..

66. What services are provided by extension officers (rank according to importance, 1 good to 4 bad)?

Advice on marketing	Advice on production	Advice on record keeping	Advice on processing	Other (specify)

67. Are the extension officers always available when you need help?

Never available	Sometimes available	Always available

68. How much time do you need to travel on foot to reach the agricultural extension centre (in minutes)? …………………………

69. List the problems that you face in contacting extension officers.

………………………………………………………………………………………………

………………………………………………………………………………………………

Institutional support services

70. Are you aware of the role played by organizations in marketing?

Yes…………….No……………..

71. Do you think that the public institutions (such as local administration, national government, public organizations) are willing to help and support your farm business? Explain

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

72. Are you a member of any organization?

No	Reasons for not joining	Yes	Reasons for joining

73. If you are a member, how does the organization help you/

Provides market information	Have a life insurance	Lobby with policy makers	Other (specify)

74. Do you promote the production of underutilized leafy vegetables in the group/ association? Yes …… No……..

75. If yes, how?

……………………………………………………………………………………

76. Does the group/ association have any influence on your leafy vegetable choice decision?

Yes…….No…….

77. If yes, how? Explain …………………………………………………………… ………

………………………………………………………………………………………………

78. What benefits do you obtain from the association/group?

Extension support	
Inputs such as improved seeds	
Access to markets and marketing info	
Any other (please specify)	

79. How do you assess the legal system in your area?

	Good	Fair	Bad
Legal protection of farmers against crime			
Reinforcement of property rights			
Transparency of Law			
Consistency and enforcement of Law			

80. What are the main challenges that you face in running your farming business?

	Major	Minor
The search of information		
Lack of support by the government		
Lack of trust in the institutions		
Bureaucracy		
Financial		
Problems associated with crime		
Uncertainty of property rights		
Corruption problems		

81. In which of the following sections do you think that lobbying towards your government would bring an improvement in the performance of your farm business?

	Important	Not important
Raise the prices of your produce		
Import tax and other barriers		
Encourage society to consume ULVs		
Other (specify)		

82. Before making a major decision, do you consult or seek advice from your family/friends? Explain………..
....
....

83. What influence do traditions have on your farming activities? Explain
……………………………………………………………………………………………
……………………………………………………………………………………………

84. Do you use farming and marketing advice that is given by non-family members?
……………………………………………………………………………………………
……………………………………………………………………………………………
………………...

PART 7: WILLINGNESS TO PRODUCE AND SELL

85. Underutilized leafy vegetables are normally seasonal. Which of the following are you **willing to produce all year round** if it is possible, just like cabbage and spinach?

Motshaina	
Phophorokga	
Monawa	
Dithaka	

86. If no, why?

    ....

    ......…………………………………………………………………………………………

87. Why are these leafy vegetables underutilized?

Seasonal	People don't buy	Expensive	Food for the poor

88. These vegetables are regarded as food for the poor. Do you believe that?

    Yes…….No…….

    Why?

    …………………………………………………………………………………………….

89. Can they be produced the whole year? Yes…….No……..

    If No, why?..

90. What do you regard as the main hampering/restricting factors for you to improve your

    production of underutilized leafy vegetables? (Please present in order)

    ....

    ....…………………………………………………………………………..........

    ....

91. If consumers and retailers are willing to buy underutilized crops out of season, are you

    willing to produce and sell them?

		Motshaina	Phophorokga	Monawa	Dithaka
Consumers	Yes/No				
	How much?				
Retailers	Yes/No				
	How much?				

92. What could be the main factors that would affect the production of underutilized leafy

    vegetables out of

    season?...

93. What can be done to solve that problem?

....

....………………… …………………………………………………………………………………

…….

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If you have any other additional point/issues/problems/suggestions please let us know.

…………………………………………………………………………………………………

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THANK YOU FOR YOUR CO-OPERATION

The Department of Agricultural Economics, University of KwaZulu-Natal is requesting a few minutes of your time to complete a questionnaire. We are busy conducting a study on the economics of underutilized ALVs in the Limpopo Province.

The information captured in this questionnaire is strictly confidential and will be used for research purposes towards Ms Grany Mmatsatsi Senyolo's PhD thesis.

1. What is your main activity?

Middlemen	Retailer	Input supplier	Other:

2. What type of establishments do you buy leafy vegetables from?

Farmers	Collectors	Wholesalers			

3. Do you sell leafy vegetables? _____ yes _____ no

4. Do you sell ALVs? _____ yes _____ no

5. If no, would you want to sell ALVs in the future? _____ yes _____ no

6. Type of value addition you do

Packaging	Transportation	Processing	Branding	Other:

7. Which of the value chain actors do you have a relationship with?

Foreign seed companies	Local seed companies	Farmers	Collectors	Wholesalers	Consumers
Transporters	Supermarket	Retailers	Other:		

8. How would you describe the mode of delivery of ALVs?

	Km from the seller
Own collection	
Delivered by seller	
Use contractor	
Other:	

9. Who set the buying price of ALVs?

Buyer	Seller/producer	Both

10. Consumer preference information on important trait (on a scale of 1-5 where 1 is less important, 5 is more important)

TRAITS	Input company	TRAITS	Middlemen	Retailers
Germination		Colour		
Physical quantity		Price		
Price		Shape		
Packaging		Size		
Analytical quality		Freshness		
Wide variety		Origin of crop		
Proximity of the seller to the farm		Food safety		
Advises given by seller		Fertilizer residues		
Seed company extension services		Pesticides residues		

Produce yield		Certification scheme		
Produce price		Sorting		
Produce size		Grading		
Produce colour		Packaging		
Produce colour				

11. What type of ALV do you buy and sell?

Type of ALV		Form	Source of supply	Buying price	Processing activities (list)	Selling price	How would you rate demand? 1=very high 2=High 3=moderate 4=low 5=very low	Required quantity of supply	How would you rate the supply? 1=very high 2=High 3=moderate 4=low 5=very low	Quantity supplied per week
	1=Cultivate 2=Wild	1=Fresh 2= Dried	1=Local 2=Import	R/ton		R/ton		Tons		Tons

12. Monthly ALVs sales for (Rand/ton):

Type of ALV	J	F	M	A	M	J	J	A	S	O	N	D

13. Perception towards farmers and ALV market

(SD=strongly Disagree, D=Disagree, NS= Not sure, A=Agree, SA= Strongly Agree)

	SD	D	NS	A	SA
Dependence on ALVs:					
1. We can easily get other farmers should the present ones decide to terminate their contract.					
2. If the farmers can stop growing ALVs, retailers will be in serious trouble as it would be short of ALVs.					
3. We can buy ALVs from any other farmers they want even though they have signed contract with other farmers.					
4. Our output can be affected if farmers are not contracted to produce ALVs.					
Certainty:					
1. We are assured of constant supply of ALVs.					
2. We are assured of good quality ALVs from the farmers.					
3. We have all technical know-how on growing ALVs.					
4. We can always get technical know-how of growing from the extension officers whenever they need it.					
Opportunistic behavior:					
1. Farmers try to cheat retailers to get higher prices pay.					
2. Farmers try to delay harvest in order to make supply low					
3. Farmers honour their supply quota as per their contract.					
4. Farmers do not care whether they meet their quota, as long as they make profit.					
Trust on farmers:					
1. We have relative trust on the farmers.					
2. There is a mutual understanding between us and farmers.					
3. We can rely upon farmers as faithful and just.					
4. Farmers try to cheat to get higher prices pay.					
5. One has to monitor and double check whatever information farmers could claim to have about the horticulture industry.					

Commitment:					
1. Given a chance, we would cancel ALVs contract supply with some farmers.					
2. We have invested a lot of capital in the establishment of the contract with the farmers.					
3. We do not care whether farmers meet their quotas or not.					
Cooperation:					
1. Us and farmers' activities are well coordinated.					
2. We plan production and delivery schedule with the farmers.					
3. We take farmers' concern very seriously.					
4. We seek farmers' opinion whenever it considers implementing changes that will affect farmers as well.					
5. Farmers are very much cooperative.					
Influence by partner:					
1. Farmers try to dictate terms to us.					
2. We can make buying decision independently of the farmers.					
3. Farmers should take whatever retailer says because they do not have bargaining power.					
4. We have more bargaining power than farmers.					

	Very much dissatisfied	Dissatisfied	Not sure	Satisfied	Very much satisfied
1. Quality of ALVs from the farmers					
2. Freshness of ALVs from the farmers					
3. Quantity of ALVs from the farmers					
4. Delivery of ALVs from the farmers					

5. Colour of ALVs from the farmers					

14. What do you regard as the main hampering/restricting factor for you to sell underutilized leafy vegetables?

....

Thank you so much for your time