Assessment of Entrepreneurial risk and Water Quality in Urban Agriculture

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ABSTRACT

Urban agriculture (UA) serves diverse purposes in various societies. However, there are many difficulties that urban farmers must overcome in UA, as it is a risky industry like any other sector. The limited availability of natural resources such as land and water, present production risk for the farmers as they are subjected to production on small areas of land available. The practice of agricultural production further depletes the water supplies that are accessible. Urbanization is predicted to lead to a decline in water quantity and quality because agriculture uses a big portion of the water supply and population increase. Measures, such as water resource management, drip irrigation, and wastewater re-use, are taken to manage the deterioration of water quality, as they affect how money and decisions are made. Factors such as production, pricing (market), and human, financial, and institutional risk are all risk concerns for farmers as they affect their "entrepreneurial spirit" and willingness to take on any risk. Over the years, research has addressed risk variables that influence smallholder and commercial farmers in rural regions; however, there has been little research on the risk factors that affect entrepreneurship in UA. Furthermore, the presence of risk in agriculture also presents food and nutrition insecurity as farmers tend to be risk averse.

The study aimed to evaluate the risk factors on decisions making by urban farmers and the effects on income generation, while also reviewing the literature on the water policies on access, use and quality, and the farmer's perception of the use of WW in UA and the role of UA in food and nutrition security. The study's methodology was a mixed-method approach, employing both qualitative and quantitative data collection and data analysis methods. A multistage sampling technique was used to randomly select 78 urban households. The sample included 48 urban farmers and 30 non-urban respondents who were purposefully selected to be part of the study. The selection was complimented through a structured questionnaire survey complemented by observations and focus group discussions. For data analysis of the qualitative and quantitative results, the study made use of a thematic and content analysis of the policies; the study also employed Principal Component Analysis (PCA) and logistic regression analysis of the results. This study employed a review of literature on the policies in place that govern water access, use and quality in South Africa.

The socio-demographic results from the study show that the respondents were mostly females; with the mean age of 58, and only a few of the respondents were classified as youth between the ages 18-40. The findings revealed that there are policies in place that govern water access and use, and quality. However, the findings show that there are no policies that are specific to water access, use and quality in urban agriculture. Moreover, it was found that there are guidelines relating to water quality as urban farmers have been found to use WW due to the water shortages in cities. To cover the shortfall, the farmers, use other sources of water such as rainwater, river, dam and wastewater. The results on farmer perception revealed that the majority of the farmers were not open to using WW even though they were aware of its use in agriculture. The findings further revealed that the respondents are somewhat aware of the risk factors in UA and how they impact their income generating capacity. It was found that factors such as age, education, water quality, entrepreneurial risk factors like (production risk and price risk) and psychological capital, were found to be statistically significant and have the potential to influence the risk factors of the respondents and subsequently increase urban agriculture participation ultimately leading to increased incomes. The study results also show that majority of the respondents were farming to ensure food and nutrition security at a household level due to food and economic hardships, while only a few of the participants were farming to sell at

the market. Even with those who were selling at the market, they found that the costs outweighed the benefits and were somewhat not motivated.

The study, therefore, concluded that farmers need more information on the safe use of WW in agriculture. There is also a need for the farmers to develop their risk awareness in UA, and how to better manage the risk. Enhanced risk management strategies will ensure continued income generation and also invoke the "entrepreneurial spirit" necessary to become a successful entrepreneur. The study further concludes that youth involvement in UA is essential as the majority of the participants were elderly, who are mostly subsistent farmers, while young farmers weren't motivated enough to go into agriculture.

Key words: urban agriculture, entrepreneurial risk, water polices, water quality, food security, principal component analysis, entrepreneurship, logit regression.

DECLARATION-PLAGIARISM

I **Sinethemba Z. Ndwalane** declare that:

1. The research reported in this dissertation, except for where otherwise indicated is my original research.

2. This dissertation has not been submitted for any degree or examination at any other university.

3. This dissertation does not contain other persons' data pictures, graphs or other information unless specifically acknowledged as being sourced from other sources.

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As the research supervisor(s), I agree to the submission of this dissertation for examination:

Signature: …….. **Date**: …….

Prof. Joyce Thamaga-Chitja

PREFACE

The research contained in this dissertation was completed by the candidate while based in the School of Agricultural, Earth and Environmental Sciences under the college of Agriculture, Engineering and Science at the University of KwaZulu Natal, Pietermaritzburg Campus South Africa, under the supervision the supervision of Prof J. Chitja and Dr T. O. Ojo.

The contents of this work have not been submitted in any form to another university and except where the work of others is acknowledged in the text, the results reported are due to investigation by the supervisor.

Signature: ..[redacted]..... **Date**: …13 December 2022……

Sinethemba Z. Ndwalane (Candidate)

As the supervisors of the candidate, we agree to the submission of this dissertation

Signature: …….. **Date**: ……

Prof. Joyce Chitja (Supervisor)

Signature: …….. **Date**: ……

Dr. Temitope O. Ojo (Co-Supervisor)

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

List of Figures

List of Tables

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DEDICATION

This work is dedicated to my mother and grandmother (Mrs Mbeje God rest your soul) for always being supportive of me during the course of my studies and for your prayers even during the most difficult periods of my life.

LIST OF ABBREVIATIONS

ACRONYMS

AMU	Agricultural Management Unit
DARD	Department of Agriculture and Rural Development
DWAS	Department of Water and Sanitation
COVID-19	Coronavirus Disease
DAFF	Department of Agriculture Forestry and Fisheries
DD	Demand
DUCT	Duzi Umngeni Conservation Trust
DWAF	Department of Water Affairs
EWS	Water and Sanitation Unit in eThekwini Municipality
FAO	Food and Agriculture Organisation
FC	Faecal Coliform
FGD	Focus Group Discussions
FNS	Food and Nutrition Security
GDP	Gross Domestic Product
GHG	Greenhouse gas
GMO	Genetically Modified Organisms
HGUA	Home Gardens and Urban Agriculture
HH	Household
HIV	Human Immune Deficiency Virus
KMO	Kaiser-Meyer Olkin
MIS	Marketing Information Systems
NGO	Non- Governmental Organisation
PCA	Principal Component Analysis
PESTEL	Political, Environmental, Social, Technological, Economical, Legal
PHA	Philippi Horticultural Area
PsyCap	Psychological Capital
PPE	Personal Protective Equipment
RSA	Republic of South Africa

SA-GAP	South African Good Agricultural Practice
SDG	Sustainable Development Goals
SHF	Smallholder Farmers
SLF	Sustainable Livelihood Framework
SS	Supply
STATSA	Statistics South Africa
TEA	Total Entrepreneurial Activity
TWW	Treated Wastewater
TRA	Theory of Reasoned Action
TPB	Theory of Planned Behaviour
UA	Urban Agriculture
UMEDA	uMgungundlovu Economic Development Agency
UPA	Urban-Peri Agriculture
VIF	Variance of Inflation
WHO	World Health Organisation
WRC	Water Research Commission
WUA	Water User Associations
WW	Wastewater

CHAPTER 1: GENERAL INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The role of agriculture can be noted in its job creation, ensuring food security in rural and urban communities in a country, it is also evident in its Gross Domestic Products (GDP) contribution in the economy (van Veenhuizen, 2014); Feola *et al.,* 2020). Moreover, a country is regarded as developed when agriculture contributes less (1-10%) towards the GDP; and where it contributes more (>10%), then that country is considered to be developing (Food and Agriculture Organisation (FAO), 2016). South Africa can therefore, be regarded as a developing country as its agricultural contribution to its GDP is well above 10% (12.2% in Q4 of 2021). This is also highlighted on how high agriculture limits the diversification of the African economies (FAO, 2016 & StatSA, 2021). It is therefore, not surprising that migration from rural areas to urban areas for better employment opportunities has introduced numerous ways of survival such as urban agriculture (UA), a means to eradicate poverty at a household level. As UA is said to play a significant role in the urban communities even though its contribution GDP is relatively small. But it also meets a large part of the urban demands for certain kinds of food such as fresh vegetables, poultry, potatoes, fish, eggs among others (Danso *et al*., 2014). The UA share of world food production is said to have increased from 15 to 33%; while the share of fresh vegetables, eggs, meat fish and meat consumed in cities had increased from 30 to 50% (Baumgartner & Belevi, 2001). Furthermore, UA is already producing about 15 to 20% of the world's food supply, and this plays a critical role in ameliorating food insecurity during a global crisis created by the COVID-19 virus, (Lal, 2020).

The cities were not previously known for having agricultural activities (Thomas, 2012). There were expectations of the metropolitan regions surpassing the rural areas with population density, making poverty a reality by the year 2005 in urban areas which had been previously associated with the rural areas (FAO, 1997). Migration from rural to urban areas does not always yield the intended benefits, as the mining and industrial hub are the main jobs migrators would engage in (Ratshitanga, 2017). The decline of such opportunities further introduced other means (such as UA) of generating incomes and food provision by the urban residents, (Baumgartner & Belevi, 2001; Ratshitanga, 2017). The term urban agriculture is associated with the farming activities that take place in urban areas as people see it as a source of livelihood (Cofie *et al.,* 2003). The term is defined by van Veenhuise (2014) as "the growing of plants and the rearing of animals for food and for sales within and around cities and towns, and related activities such as the production and delivery of inputs and the processing and marketing of products". Incongruous to high-income (global north) households; where it is a tool for ensuring a more environmentally friendly way of food production and an investment (Lupia & Pulighe, 2015). The agricultural activity is done on very small plots of land mainly for food production (and to sell) for survival purposes (Prian & Zeeuw, 2007). UA increases the use of vacant spaces to enforce food production in green spaces in the cities where farming was a distant concept (Lupia & Pulighe, 2015; Ghaleh, 2019). The farmers also bring about different social, physical and economic functions on land around the home to supplement the supply of fresh food at the household level (Lal, 2020). The food supplied is however, not sufficient due to water shortages in the cities, as a results farmers opt for other sources of water; such as wastewater, rainwater harvesting and greywater.

Wastewater reuse is an ancient practice, it is used to irrigate and fertilize agricultural fields with crops and orchards, and it has not been properly managed or met the quality standards (Jaramillo & Restrepo, 2017). The reduced water capacity globally, specifically in urban areas has somehow resulted in wastewater becoming the next best option for farmers (Pulighe *et al.,*

2020). This has been the case in developing countries such as China and Mexico, with the water scarcity in the arid and semi-arid areas, some of which have urban farmers who are faced with production risks caused by factors such as climate change which led to droughts (Cirelli *et al.,* 2012; Pulighe *et al.,* 2020). In South Africa treated municipal wastewater (TMWW) is said to be a source of water that is almost always readily available for crop irrigation, due to the inefficient water distribution networks and water quality degradation has aggravated the water demand (Cirelli *et al.,* 2012). Moreover, some countries do not treat wastewater as it is costly and the water is therefore dumped, untreated into water bodies, or onto land (Buechler *et al.,* 2006). Further exacerbating the issue of reduced water quality in areas where wastewater is left untreated. Further raising the concerns on food hygiene where water is scarce and wastewater is used in for irrigation in food production (Antwi-Agyei *et al.,* 2016).

Water access and affordability are some of the challenges that individuals face be it in a rural or an urban setting, due to the lack of governance mechanisms and investments in water technologies and infrastructure for the growing need for water shortage (Pulighe *et al.,* 2020) Cities like Johannesburg have noted the role played by wastewater for the urban farmers as the area lacks freshwater facilities, Ratshitanga (2017). Consequently, farmers in urban areas opt for the use of wastewater for irrigation as it has been practised for many centuries, but only gained momentum due to the water scarcity being witnessed across the globe (Elamin, 2019). While it is cost-effective to use wastewater for irrigation purposes rather than freshwater due to the scarcity of water in urban areas; it is still imperative to note the risks relating to the health of the farmers and those of the consumers (Pulighe *et al.,* 2020). Urban farmers should also pay close attention to other risks relating to agriculture be it in a rural or urban setting as the challenges are somewhat similar and can have a detrimental effect on the business if not accounted for accordingly. Such risk factors include financial risk, institutional risk, as well as market risk (Korir, 2011; korir *et al*., 2014). All of these can be referred to as entrepreneurial risk factors which have been evaluated in agriculture and other industry sectors, however, there are limited studies on the nexus of entrepreneurial risk factors and UA. As the ability of urban farmers to be successful entrepreneurs is dependent on several factors which can influence the farmer's decision, depending on the level of risk they are willing to take, that is, entrepreneurial risk.

The entrepreneurial risk was first distinguished by Cantillon in 1755, where he noted that both farmers and most urban entrepreneurs (that is, manufacturers, wholesalers and retailers, homeowners, and artisans) operate in conditions of uncertainty (Pinkovetskaia *et al.,* 2019). The concept was further investigated by Knight (2012), who investigated the relationship between risk, uncertainty and profit of an enterprise, and put forward a concept that profit is viewed as the gain for the risky situation (Pinkovetskaia *et al.*, 2019). Urban agriculture is also found to have risk factors that affect profitability and production yield and quality. There are five currently known risk factors in agriculture that impact production yield and quality, such include production risk, price/market risk, financial risk, institutional risk and human or personal risk (ERS, 2020; Komarek *et al.,* 2020). Urban farmers are faced with the above-mentioned risk factors, which can affect the farmer's profitability and food security status. Hence, the necessity for urban farmers to become risk managers, considering the vital role they play in urban societies, in providing social and physical and economic functions (Lal, 2020; Komarek *et al.,* 2020). The farmer's perception and attitude toward risk are also what make them good risk managers that is implementing risk management strategies (Kahan, 2013). This is an important assessment in households irrespective of where they live and are being encouraged to practice agriculture as a means of food security and income generation. Risks in agriculture can discourage farmer's practising agriculture making the assessment of risk factors an important endeavour. Similarly, the assessment of water quality is also an important element

both in terms of food safety and clean water for drinking. The remaining section will therefore outline the research problem, the research questions and the study limitations.

1.2 RESEARCH PROBLEM

The rate at which the population is rising in cities puts a severe strain on the freshwater resources available, thus resulting in the use of wastewater from city sewers for irrigation (Florke *et al*., 2018). The rise in population, climate change, and competition for water by industries, households and agriculture have led to reduced availability and quality deterioration, further, increasing the risk of use of untreated wastewater (WW) (Gemma & Schmidt, 2010; Saldias *et al*.,2016). With South Africa being a water scarce country, there is a lot of uncertainty for the farmers to succeed as entrepreneurs. The role of water in terms of allocation policies is therefore, vital and can be noted as the current policies in place and are exclusively directed to smallholder and commercial farmers, but none are inclusive of urban farmers. Even though, the urban farmers play a vital role in tackling food insecurity at a household level, there are still no policies in place for water allocation in UA. There are only policies strictly directed to water allocation for human consumption, which leads to the use of water allocated to the household (HH) for agricultural purposes. Regardless of the tremendous growth in UA over the years, there is still a struggle for the urban farmers to be recognised by city authorities, making them vulnerable to food insecurity and water scarcity. This is because the UA activity is not recognised as one of the survival strategies for urban dwellers (van Veenhuizen, 2014). As a result, there is limited support from the policymakers, in terms of financial support, market information, and governance, which are among other instances of uncertainty for the farmers, making it very difficult for the farmers to perform at optimal without fear of land and water insecurity.

Furthermore, the lack of support is found to be mostly emanating from the public entities, the non-governmental organisation (NGO's) has been found to more supportive of the urban farmers through educational programs. For instance, farmers in the Cape flats are primarily supported by NGOs, and only to some extent by the local municipality (Battersby & Marshak, 2013). Similarly, this was noted in areas like Durban and Johannesburg; regardless of the support from other government entities, some local government entities in other provinces still do not see the value and the importance of UA, as they view the practice as the main source of social and physical capital, and not so much the financial capital (Olivier, 2015). Studies have endorsed UA entrepreneurship, they however also note the challenges that urban farmers face and such include the lack of land, water and input resources (Olivier, 2015; Ratshitanga, 2017). These studies are indicative of the level of uncertainty (risk), that the agriculture sector entails. Additionally, the research on risk over the years has been concentrated on the other risk factors faced by commercial and smallholder farmers in rural areas, none of which have evaluated UA risks. Furthermore, studies (Hovorka, 2004; Ratshitanga, 2017) have evaluated entrepreneurship as a means of eradicating poverty and ensuring food security; while other studies (Chaminuka *et al*., 2017; Kamarek *et al*., 2020) have looked at the role of UA in addressing food security as a response to natural/production risk, as well studies on risk factors impacting agriculture in smallholder farmers.

There are limited studies on the entrepreneurial risk effects of UA and the effects on water quality, use and access in UA. While recent studies have focused on human and financial risk, production risk and less concentration have been put on the "easy" risk factors such as price and institutional risk. While some studies have evaluated the water quality in UA (studies by Amoah, 2008; Saldias *et al*., 2016 & Vilakazi *et al*., 2019), others are on UA entrepreneurship and food security (studies by Hovorka, 2004; FAO, 2007; Zezza & Tasciotti, 2010 and Ratshitanga, 2017). However, there is a dearth of knowledge on the nexus between entrepreneurial risk, urban agriculture, and water quality and food security. This study, therefore, aims at filling the knowledge gap through the linking of entrepreneurial risk and water quality in urban agriculture, while also evaluating the entrepreneurship in UA and the risk management strategies available, influenced by positive psychological capital that is, farmer's perception and attitude toward risk. This will be achieved through answering the subsequent research questions emanating from the specific objectives below.

1.3 RESEARCH OBJECTIVES & QUESTIONS

The general objective of the study is to investigate the entrepreneurial risks that relate to urban agriculture and the role of water policies in terms of access, use and quality in urban agriculture. The specific objectives are:

- To analyse the relevant policies affecting water access, use and quality in urban agriculture, and WW reuse perception.
- To determine the entrepreneurial (financial, production, human, market and institutional) risk factors associated with engagement in urban agriculture and their effects on water quality and use.
- To investigate the implications of urban agriculture and entrepreneurial risk on food and nutrition security in low-income households

Research questions:

- What effect do the existing policies on water use, access and quality have on urban agriculture, and WW reuse perception?
- What are the entrepreneurial risk factors associated with engaging in urban agriculture, and how do they affect water quality and use?
- What are the implications of urban agriculture and entrepreneurial risk on food and nutrition security in low-income households?

1.4 HYPOTHESIS

H_1: The policies on water access, use and quality are expected to positively influence the use of wastewater perception in urban agriculture.

H_2: The entrepreneurial risk factors associated with urban agriculture engagement and water quality and use effects are expected to have a negative coefficient.

H_3: An increase in urban agricultural yield is expected to positively influence the food and nutrition security and income generation capacity in low-income households.

1.5 STUDY LIMITS

The limits in the study would be the unwillingness of urban farmers to participate in the study due to personal reasons or conflicts of interest, as well as the fear of eviction from the currently occupied land. The limited number of respondents during the time of COVID-19 (Coronavirus Disease) pandemic as human interaction was to be minimised as much as possible due to health risks. The sample selected was not be a true representation of the population, as various methods of farming implemented by individuals. The lack of governance presented a challenge in obtaining real data values (that is, income per capita at a household level, market access, and financial access) of the respondents. The limit was also in assessing the profitability and sustainability of engaging in urban farming due to lack access to financial assistance and credit reserves. Land and water rights tend were a real issue for urban farmers making it difficult to ensure that the farm will remain part of the study until completion. The other limitation was the food security indicators not used in the study, as the study only used livelihoods proxy as measure of food security. Another limitation was the time frame of the research period.

1.6 ASSUMPTIONS

- It was assumed that respondents will give truthful information (as anonymity and confidentiality are guaranteed)
- Each urban farmer had unique characteristics that may impact or cause bias to the outcome variable and needs to be controlled
- Individual urban markets are assumed to be randomly unique for each farmer
- Each urban farmer had the potential to become a successful entrepreneur, depending on the incentive to engage and a positive mind-set

1.7 SUMMARY

The section gave a background and introduction to the study by review of literature. There was a further outline of the research problem, noting the knowledge gap and the importance of the study. The research objectives were outlined and the hypothesis to be tested in the study were stated. The study limits and assumptions of the study were outlined. The following subsequent sections will outline the review of literature in chapter 2, chapter 3 will include the research methodology and chapters 4, 5 & 6 will have the results and discussion of the study. Chapter 7 will have the conclusion as well as policy recommendations on the topic and other areas of further research.

CHAPTER 2: REVIEW OF RELATED LITERATURE

2. INTRODUCTION

The rate at which urban population growth is occurring has ultimately resulted in the rise of malnutrition cases and unemployment (Eisazadeh *et al*., 2015). As a result, entrepreneurship has introduced another source of continued livelihood for urban dwellers in a time of urban growth and increased unemployment rate, which is currently 35.3%, which is an all-time high since the 2008 recession (StatSA, 2021). Entrepreneurship is believed to be a factor in creating and developing occupation opportunities, while also reducing unemployment as a remarkable index of development (Eisazadeh *et al.,* (2015). Entrepreneurship plays a significant role in economic development and cultural improvement; however, it also entails a certain level of uncertainty (risk) that needs to be known and understood. Urban agriculture plays a significant role in providing job opportunities, feeding the city's poor and poverty alleviation, as well as creating entrepreneurs (Ratshitanga, 2017). Urban agriculture presented some opportunities for the unemployed and those who want to invest in greener cities to accumulate other sources of income by becoming entrepreneurs (Thomas, 2012). However, the concept of farmers becoming entrepreneurs needs a thorough understanding as entrepreneurship is said to be two parts. The first part is the managerial skills required to run a profitable farm enterprise; the second part is the "entrepreneurial spirit" (Kahan, 2013). Farmers may have the managerial skills but lack the "entrepreneurial spirit" and vice versa, bringing about a loss of harmony in the two working together.

Urban agricultural entrepreneurs are relatively different from the family commercial farmers, in that they mainly depend on salaried labour, and they sometimes lack an agricultural background (van Veenhuizen, 2014). Entrepreneurial urban agriculture projects, have different characteristics: some grow food in the soil, while others use hydroponic (non-soil) techniques to produce food, and some are located in greenhouses, and old warehouse facilities in industrial areas, as well as residential areas (Kaufmann & Bailkey (2000). Cities have urban land that could be used for horticultural production but is used by other industries and infrastructure or is diverted to housing for the urban dwellers (Thomas, 2012). Even though evidence shows that large areas could be zoned for horticultural production, for example, in Kigali, Rwanda, where 15 000 ha of agricultural land and wetlands were reserved and in Lagos, Nigeria, where 4 400 ha of land is suitable for UA (Thomas, 2012); land availability remains an issue for urban farmers. In South Africa there is land in cities for UA, for example, in Cape Town, there is 1200 ha of land suitable for food production of the 3000 ha of land in the area; however, there is still competition for land and water with industries (Haysom *et al*., 2012). Furthermore, there is a critical need for farming techniques such as green roof technology and vertical gardening due to factors such as limited land available, noise pollution in cities, urban waste (wastewater and organic waste) and natural degradation of the environment in Johannesburg (Ratshitanga, 2017). This chapter outlines the synthesis of related literature to the study and the empirical evidence.

2.1 The Entrepreneurial Risks Associated with Urban Agriculture:

Entrepreneurship can be defined as the activity of setting up a business and taking on financial risk in the buoyancy of profit. Pinkovetskaia, (2019) notes how the risk is driven by the profit (reward), and the greater the reward the more willing the farmer is to take on the risk. The risk in entrepreneurship in the agriculture sector is found to relate to personal, financial, production,

price and production risk (ERS, 2020; Komareka *et al.,* 2020), all of which affect production quantity and quality. Urban farmers are also faced with the above-mentioned risk factors, which can affect the farmer's profitability, productivity and food security status. Hence, the necessity for urban farmers to become risk managers, considering the vital role they play in urban societies, in providing social and physical and economic functions (Lal, 2020). Moreover, the farmer's perception and attitude toward risk are what make them good risk managers, that is, implementing risk management strategies (Kahan, 2013).

According to Eisazadeh *et al.,* (2015), in many developed and developing countries entrepreneurship is regarded as key to many problems and internal crises, while also trying to maintain the oil price fluctuations in the international markets, motivating policy planners to find other sources of income. This resulted in the emergence of livelihood techniques such as urban agriculture (that is, vertical, hydroponics, rooftop gardens etcetera) as a means to alleviate poverty and create employment in the cities (Ratshitanga, 2017). Urban farmers as entrepreneurs face a lot of uncertainty as to any other farmer, and risk management skills are an essential feature of the farming business. The risks stem from weather patterns, production yields, market prices, government policies, global markets, and other factors that can significantly affect the farmer's income (Eisazadeh *et al.,* 2015). Thereby, making risk management strategies an essential to reduce the financial burden that comes with such uncertainties. Furthermore, Gerasymenko & Zhemoyda (2009); highlight the types of risks that farmers face in the market as business people; such hazards include markets/price risk, financial risk, and production risk, amongst others. Urban farmers face many threats which can be mitigated with proper risk management, entailing knowledge of risk management, and knowledge of the type of enterprise to engage in, which holds lesser uncertainty while maintaining profitability and sustainability (Korir, 2011; Kahan, 2013).

The following section, has an in-depth review of the risks that urban farmers face every day, and such include: human (personal) risk, production (environmental) risk, market (price) risk, financial risk, and legal (institutional) risk; however, the list of the risks as mentioned above are not limiting.

2.1.1 Production (Environmental) Risk Relating to Urban Agriculture

The cities are gradually being affected by both acute shocks and chronic stresses which are intensified by climate change and exacerbated by uncontrollable urban growth (Dubbeling *et al.,* 2019). The authors (Dubbeling *et al*., 2019) further illustrated the vulnerable cities as those in arid areas and water-stressed countries, island states, and less developed countries as well as coastal and low-lying areas. According to Ghaleh (2019), UA plays a significant role in environmental restoration; it also benefits the environment as there is a production of different products meaning there is an interaction between unique products. For example, an interaction between bees, bats, and birds which act as the pollinators of crops, with wildflowers is one of the benefits of greening cities (Steel, 2017). The different products play a role in ensuring the continued protection of endangered or scarce species, fruits, vegetables, flowers, and shrubs; proper planning and suitable integration with urban design can provide pleasant spaces for citizens (Ghaleh, 2019).

Agriculture plays a dual role in contributing to greenhouse gas (GHG) emissions, impacting climate negatively, while also affecting the ecosystem positively. For example, the forestry industry ensures a reduced amount of greenhouse gas emissions due to the respiration cycle of forests (FAO, 2007). An example of a negative impact: is in the Cape Flats Aquifers, where human activities contaminate the water resources through a combination of pesticides,

fertilisers from the agriculture sector, water-treatment plants, waste disposal sites, and informal settlements lacking adequate sanitation, (Haysom *et al.*, 2012). However, Steele (2017), illustrates the role of UA in supporting biodiversity, reducing storm-water run-off and improving air quality, as well as mitigating urban heat island effects; in the case of organic farming, it eliminates the use of herbicides, pesticides, and synthetic fertiliser use. A perfect example of the positive impacts of UA is at Umgibe Farming Organics and Training Institute (UFOTI) which uses as little water as possible, has no chemical fertilisers, and diverts more than 10 000 plastics from landfills and uses them for growing plants. They further avoid CO^2 emissions by reducing transport activity in the local food production area. Moreover, Hallett *et al.,* (2016), illustrate the role played by UA as an alleviator of the effects of climate change noting the part of beans grown which resulted in a reduction of greenhouse gas emissions. In contrast, the contrary occurred in strawberry production. Furthermore, Khalil & Kakar, (2011); and Khalil & Najar (2012) highlighted the role of strawberries grown in greenhouses contributing more to greenhouse gas emissions, and its water consumption is 1500 m3/dunam/yr. Thereby, making crop selection and technique for growth purposes a vital aspect of decision-making in terms of improving sustainability and profitability by urban farmers, while also reducing the uncertainty.

2.1.2 Financial Risk Relating to Urban Agriculture

Urban farmers tend to have no access to financial facilities due to the level of risk they possess. Korir (2011); Hardker *et al.,* (2004) explain that financial risk results from the way the firm's capital is financed, the interest rates, on borrowed capital fluctuations which can lead to cash flow problems due to insufficient funds to repay the creditors, resulting in a high probability of capital loss. They are more likely not to have any assets that could be pledged as collateral: such include land, machinery, and retained earnings, which smallholder and commercial farmers are more likely to have (Kerr & Nanda, 2009; Kahan, 2013). Urban farmers are thus, vulnerable to financial risk. Financial risk occurs when money is taken to finance the business with future interest rates, lender's willingness and ability to continue fund provision when needed (Nugent, 2000). The farmer's ability to generate income for loan repayments yields uncertainty, generally referred to as risk (Kahan, 2013). For financial institutions to take on the risk there is a need to effectively estimate the amount of risk involved in an investment based on the calculations and estimated impact loss, reinsurance companies, and banks; to assess the implied risk profile for insurance contracts and financial instruments (Gerasymenko & Zhemoyda, 2009).

Eisazadeh *et al.,* (2015), note how UA does not require much financing as it is done on a small scale and has no need for advanced or modern equipment. Agricultural bank organisation can offer financial support, for the essential features and initial equipment for the producers, (Eisazadeh *et al*., 2015). However, commercial and smallholder farmers then have a greater chance of having access to financial services from institutions such as banks, farmers' associations, and micro-finance institutions (FAO, 2007; Kahan, 2013; Eisazadeh *et al.,* 2015). Moreover, urban farmers rarely have access to such credit services. According to Kerr and Nanda (2009), the lack of assets to pledge as collateral against the loans, a lack of financial history, and retained earnings for partial funding bring about a disadvantage for emerging entrepreneurs. The willingness or the lack thereof to fund urban farmers stems from gender bias as well as the type of business they are in. Even though, women tend to be more involved in UA, and some institutions are only willing to lend males money; as a result, they go to the

informal sectors that are eager to assist (FAO, 2007). Battersby *et al.*, (2015) also attest to this occurrence of urban residents (women) going to informal lenders to access credit which is at a higher interest rate which leads to household debt trap and continuous borrowing of funds to fulfil household expenditure expenses.

2.1.3 Market (Price) Risk Relating to Urban Agriculture

The fluctuation of prices in the market can significantly affect the consumer as well as the producer. Gerasymenko & Zhemoyda (2009) define price (market) risk as a contract between independent producers and other businesses, and such agreements reduce the risk for producers. According to Kahan (2013), the price of a product is affected by the supply of products; the demand for a product, and the cost of production. The demand for the product is said to be affected by consumers' preferences, level of income, and the strength of the general economy; as well as the supply and price of the competing products (Kahan, 2013). Furthermore, the supply of the product is said to be affected by several factors; including production decisions made by farmers as a collective and by the weather patterns and the cost of production depending on input cost and yields (Kahan, 2013). According to the FAO (2007), the cost of supply and distribution of food from rural to urban areas, or import food for the cities is rising continuously, and distribution within cities is uneven. Consequently, the supply and demand factors affect farmers' ability to become profitable as consumers will always opt for the option that cost less to them; as a result, farmers become price takers in the market as the buyers have the option to buy from other producers.

Urban farmers form an essential part of society; as they provide these services at a reduced cost; due to the low transaction costs involved. The produce is sold at the farm gate, by cart in the same or different neighbourhood(s), in local shops, in local farmers' markets or to intermediaries and supermarkets (FAO, 2007). All of which are in close proximity to the consumers and the producers, thus reducing the transaction costs. For instance, the farmers in Cape Town who were involved with the Philippi Horticultural Area (PHA); they could sell their produce to the Cape Town Fresh Produce Market, major retailers, wholesalers, informal traders, and other interested buyers such as restaurants, and select stores, allowing for market participation and job creation in the community (Haysom *et al.*, 2012; Sonday, 2019). However, market access is not without its risks, such as price fluctuations and production uncertainty, difficulties to enforce a contract, insufficient number of middlemen, cost of putting quantities of produce together, and the inability to meet the market standards (Ngqangweni *et al.*, 2016).The authors (Ngangweni *et al.*, 2016) further explained how the households that farm for the household and only sell the surplus (varying production quantities) face problems in accessing the markets, due to the surplus not meeting the market demand. Furthermore, the surplus production may not meet the market standards and requirements leading to failure to access the market (Ratshitanga, 2017). The market standards for the formal markets include food safety, consistency in food supplies, and environmental management post-production which smallholder farmers in South Africa require training in, (Ngqangweni *et al.*, 2016; Ratshitanga, 2017). To overcome the issues of market access farmers often opt for informal markets or selling at the farm gate. The UFOTI project is another example of how urban farmers can create their own markets while also addressing food security at a household level, as the production quantities may not be sufficient enough for sale at the formal markets.
Ratshitanga (2017), further found that the farmers in Johannesburg were able to supply the supermarkets in the areas, they however, failed to supply continuously to the supermarkets due

to the limited quantity produced. According to the FAO (2007), one of the major advantages of practising urban agriculture is said to be the proximity to the market for the sale of their produce directly to the retailers; the consumers, and the ability to achieve a higher degree of local processing (including street food). Haysom *et al*., (2012), further outlines the role played by the PHA as urban agriculture in the livelihoods of commercial and smallholder farmers in the Western Cape Province. The area is a Peri-urban area that has about 3000 ha of which 1200 ha are suitable for food production, and farmers can produce about 50 horticultural crops within PHA (Haysom, 2012). An essential variety of vegetables are grown, including cabbage, lettuces, cauliflower, broccoli, spinach, carrots, potatoes, and onions. These play a role in the food systems in the Cape Town community as they are the most affordable staples rich in nutrients and allow for diverse diets at household levels (Haysom, 2012), ensuring food and nutrition security at a household level for the farmers. Nonetheless, the farmers were still unable to compete at the formal markets due to price fluctuations and their failure to plan efficiently for the market, so as to get the highest price in the market.

2.1.4 Institutional Risk Relating to Urban Agriculture

According to Kahan (2013), the institutional risk is the unpredictability of how farming services from institutions are offered. These institutions can be both formal and informal, including banks, cooperatives, marketing organisations, input dealers, and government extension services. According to Smit *et al.,* (2001), in less developed countries several constraints hinder the progress of UA, such include the planning, cultural attitudes, and colonial heritage which have conspired to produce policy, administrative and legal hurdles. It is therefore not included in the planning process, and in some countries, UA is often less supported, policies deter it, and laws and regulations limit or prohibit it (Smit *et al*., 2001).
Nonetheless, Nugent (2002), found that the idea of urban and peri-urban agriculture could be potent and an essential part of economic activity under certain conditions, hence, why policymakers should take it seriously this is believed not to be the case in some countries. For instance, in South Africa, as witnessed in the study done by Kekana (2007), where he found that there were new policies initiated from the year 1994 which offer opportunities for promoting the policy tool as a strengthening tool of the asset base of the poor. Smit *et al*., (2001) however, found that even in places where UA is allowed, there are seldom any policies that encourage the development and the greater extraction of its benefits.

Furthermore, Kahan (2013), illustrates that the institutional risk stems from the uncertainty of the government policy affecting farming support such as price support and subsidies. This is further illustrated by the response of farmers in a study done by Antwi-agyei *et al.,* (2016) in Ghana Accra, where the respondents in the Focus Group Discussion voiced their pleas to the Government by saying that*: the "government should take charge and subsidise the cost of fertilisers and vegetable seeds since these are sold at a far higher price on the private market. It even becomes difficult to get supply at certain times*". This makes them susceptible to institutional risk due to the price-fixing in the market, which inadvertently affects the consumers in the market. UA is said to have introduced the use of vacant spaces to enforce food production in green spaces in cities where farming was a foreign concept (Lupia & Pulighe, 2015). However, governance of such spaces in the urban areas makes the farmers susceptible to social ills such as theft and vandalism by the neighbouring communities, as there are no permanent fixtures that prohibit entrants.

Even though the FAO (2007), found that UA enhances the development of the micro-enterprises in the production of the necessary agricultural inputs, processing, packaging, and

marketing of products, as well as the rendering of services such as animal health services and transportation thereby contributing to local economic development. There is still lack of governmental support for such services, due to the risk associated with UA. Therefore, the government support for this type of farming is very limited, the farmers involved in this type of food production lack resources such as capital to purchase or lease land and so they practice farming on vacant land making them vulnerable to evacuation and also the destruction of their produce due to the lack of permits to cultivate the land (Orton, 2010; Haysom *et al.*, 2012). This presents doubt for the farmers, resulting in a reluctance to participate in urban agriculture as there are no institutions that govern its existence and; they are unable to minimise or manage the risk of eviction from municipal lands.

2.1.5 Human/Personal Risk (Health & Safety, Labour)

The health concerns relating to the use of wastewater for irrigation are brought about by the reality that the water used for agricultural production is untreated (Antwi-agyei *et al.*, 2016). Due to wastewater treatment being costly, and even when there is a source of funding for the cities, they rarely treat all the water sources (van Veenhuizen, 2014). This leads to a large volume of the wastewater remaining untreated and left to flow into the natural water bodies. According to Hallett *et al.*, (2016) the suitability of the land, soil, and water used in farming can significantly affect food production, worker safety, and consumer safety, making urban environments sometimes not suitable for agricultural production. Furthermore, Amoah (2008) found that concerns relating to wastewater stem from the evidence of disease outbreaks (that is, cholera, typhoid, and shigellosis), due to untreated wastewater irrigation on vegetables. Moreover, that the vegetables and fruits (that is, lettuce and raspberries) which were imported from countries like Europe and the United States led to *cholera* and *cyclosporiasis* outbreaks (Amoah, 2008). Further enhancing UA's vulnerability to financial risk for farmers as an outbreak result in confiscation or discarding of contaminated products and a period of quarantine. Furthermore, farmer's low levels of literacy and knowledge of microbial contamination, mostly among the elderly pose a health risk to the farmers and the consumers (Toze 2006; Mdluli *et al.*, 2014; Beharielal, 2017).

Table 2.1 depicts how the exposure either external or internal, could lead to physical health hazards which could be unfavourable to the businesses in the area; and would result in authorities and local municipalities calling for a shutdown bringing about financial ruin. **Table 2.1**: further shows how the effects can be psychological as the internal and external exposures could be mentally draining with constant fears and the uncertainty for the urban farmer leading to mediocre performance, thus resulting in negative business performance. The biological hazard makes urban agriculture highly risky, considering the zoonotic nature of the disease and is therefore not fully recognised or recommended by city authorities and policy-makers, regardless of the economic and social role UA plays in urban communities.

TABLE 2.1: POTENTIAL HEALTH HAZARDS LINKED WITH URBAN AND PERI-URBAN AGRICULTURE (UA)

Type of hazard	*Related exposure groupings*		*UA Examples of health risk (s)*
Physical	Internal	-	Repeated bending forward to weed plots
	External	-	Noise from small millets grinding mill
Chemical	Internal	-	Upstream waste discharges into irrigation water,
	External	-	Lead and Polyaromatic Hydrocarbons (PHA's) from the vehicular exhaust in the roadside vegetables
Biological	Directly transmitted	-	Swine fever from pigs
	Via carrier	-	Salmonella from species multiplying in eggs
	Vector borne	-	Malaria breeding in pools of water
Psychological	Internal	-	Long hours of work with multiple demands
	External	-	Unclear land tenure, fear of theft or assault

Source: Boischio *et al.,* (2006).

The use of wastewater has numerous implications for those that reside in the neighbouring town of the irrigated fields and the families of the people who have direct contact with crops such as the crop handlers, and the consumers of the products (van Veenhuizen, 2014). According to Dreschel *et al.,* (2008), the concerns with the use of wastewater for irrigation stem from the fact that leafy vegetables are eaten raw, and some people may not necessarily wash their fruits and vegetables thoroughly before consumption. Moreover, Toze (2006) found that several risk factors depend on the time of exposure (short and long-term) and the severity (that is, level of contact with TWW). For instance, a prolonged exposure to TWW in agriculture may cause saline effects on soil, while severity depends on the level of contact with microbial pathogens (Abdelradi *et al.,* 2017). Hence, the World Health Organisation (WHO) recommendations on wastewater use for irrigation purposes, state that there should be water treatments, crop restrictions, and waste application techniques that minimise contamination. Examples, include the use of drip irrigation, as well as having withholding periods to allow for the pathogens to die off after the last wastewater application, and hygienic practices at the markets and during food preparations (WHO, 2006).

Using the WHO guidelines in place, there should be better care when using wastewater. However; this was not the case in a study by Antwi-agyei *et al.,* (2016) in Ghana Accra. Where the authors found that the farmers were aware of the source of water they were using for irrigation and the market's vendors were mindful based on the irrigation water of the produce they are buying. The consumers stated that "we are aware of the source of water farmers used to irrigate vegetables in Accra- you can even smell it when you buy the produce" (Antwi-agyei *et al.,* 2016). However; they were unaware of the health implications of using wastewater for irrigation on the products and how to reduce it to ensure the continued health of the vendors, by applying the guidelines presented by the WHO to ensure reduced health implications. In a study by Abdelradi *et al.,* (2017) they found that public attitude toward WW reuse declines as the level of contact increases; Crook (2003) also concluded the same as the public supported non-portable reuse, however, found that potable water reuse was problematic. The following section further illustrates the role of water policies, its use, access and quality in urban agriculture.

2.2 The role of water in urban agriculture on livelihoods and the water policies governing its use, access, & quality.

Water plays an essential role in our daily lives; useful in cleaning, cooking and drinking and other (roles). Water is also a source of balance as the human body makes up ~75% of water (Roland, 2019), and it also plays a vital role in the agriculture sector as it uses about 50-63% of the available water, (Bonthuy, 2018). The quality of the water used is also crucial as it can significantly impact the health and the food and nutritional status of the consumer. Moreover, Vilakazi *et al.*, (2019) further note the importance of water in ensuring sustainable aquatic ecosystems for improved food security mainly in urban areas where there are human activities that may pollute the ecosystems through affluent discharges caused by industrial, domestic and mining activities. With South Africa being a water-scarce country; this brought about many issues for the agricultural sector, which is highly dependent on water for irrigation to grow products (Hassan & Thurlow, 2011). The same applies to UA which is at a more significant disadvantage as water allocation in cities is more directed toward the industry sector (Haysom *et al.*, 2012). According to du Plessis (2006), South Africa is categorised as No.2 of the countries in the world to be facing a water scarcity calamity. The consequence of uncertainty in the farming industry then results in farmers being unable to produce enough food to meet the growing demand for the ever-rising population (du Plessis, 2006). **Figure 2.1** further illustrates the water usage by sector in South Africa, and agriculture is the largest consumer of water resources in the country followed by the municipality and then the industry sector.

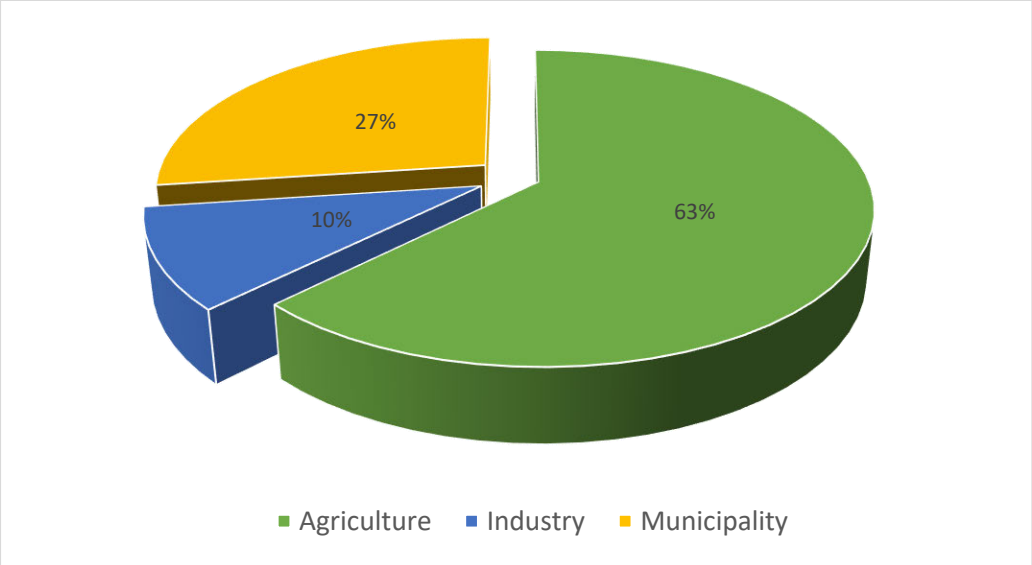

FIGURE 2.1: TOTAL WATER WITHDRAWAL IN SOUTH AFRICA BY SECTOR.
Source: FAO, Aquastat data (2018)

Water is a scarce resource in cities; as a result, urban farmers have therefore opted for other alternative water sources to ensure continued livelihoods, these alternatives, however, present many challenges that can be detrimental to human health. According to Malan (2015), there are many pollutants in the Philippi groundwater table as it is very shallow, and contaminants may easily seep into it, thus compromising the quality of the water used later for irrigation. Even though, the Cape Flats Aquifer have been used by the farmers in the PHA for more than a century, however, the competition for land and urbanisation has put a further strain on the aquifer (Malan, 2015; Haysom *et al.*, 2012). Moreover, the area provides about 70% of the vegetables in Cape Town, and the demand for the vegetables has; however, increased thus

resulting in added pressure on the aquifer as it is the primary source of irrigation water (Malan, 2015). Thomas (2012), notes the importance of water for the urban dwellers as they are without proper and hygienic sanitation which has resulted in a large number of cholera and diarrhoea incidences.

Thomas (2012) further illustrates that about 24% of urban resident's water in the Sub-Saharan region, primarily come from groundwater which comes from boreholes and wells, and a growing proportion of households turn to surface water for drinking water. Regardless of South Africa being the champion of water supply development, even with it being categorised so; it still has enormous challenges when it comes to the water supply sector (Folifac, 2007). The patrons were once in an era of water supply responsibility fragmentation, and with no governmental department for its management, resulting in altered levels and quality of service amongst the white and black areas (Folifac, 2007). According to William (2018), the water allocation reform strategy is one of the pillars of water allocation; the targets were set and are expected to be fulfilled by the year 2024. Previously, the Department of Water Affairs (DWAF) policy of 1997 and its functions was mainly concerned with irrigation and forestry, living millions of individuals without access to water and basic sanitation (William, 2018). After 1994, the new non-racial reforms on water allocation were implemented to address the social ills of the past such policies which include:

1. **Water service policy, (White Paper) 1994**: addresses the countries backlogs in water service and institutions and mechanism needed to remedy the backlogs.
2. **Republic of South Africa constitution (Act 108 of 1996)**: establishes the human right of access to adequate and sustainable water supply and service and enshrines the bill of rights.
3. **Water service Act (WSA) of 1997 (Act 108 of 1997)**: ensures the right to access to essential water supply and sanitation, and also provides a regulatory framework and establishment of water service institutions such as water boards, and water services.
4. **National water policy of 1997 (DWAF 1997)** redefined the ownership and allocation of water. Declaring that all water irrespective of where it occurs in the hydrological cycle is public water and that the national Government will act as a trustee
5. **National Water Act of 1998 (Act 36 of 1998)**: Founded on two pillars, that is , sustainability and equity, it amongst other resources required the establishment of a national water resource strategy to set out a national framework for managing water resources.
6. **National water resource strategy (DWAF, 2004a)**: provides the national implementation framework for and divides the country into 19 water management areas (WMA).
7. **The National Water and Sanitation Program**: An international partnership aimed at enhancing accessible, safe and affordable water supply and sanitation for the poor.

These policies address the water access and allocation for all households in South Africa, where there was a previous disadvantage for the black communities, due to the social ills of apartheid (William, 2018). Furthermore, the water resources management regulations had the key objectives to ensure social development, economic growth, ecological integrity, and water access equality (Perret, 2002). The rural community and smallholding farming levels, individuals are authorised to take water for "reasonable domestic use, gardens and stock watering", (not for commercial purposes) without registration, licensing, or payment as stipulated in Schedule 1 of the Act (Perret, 2002). The Act further states that for irrigation schemes, farmers and rural communities should form Water User Associations (WUA), which

requires license registration, determining the collective rights to water resources and the obligations (Perret, 2002).

Water rights for small-scale irrigation farms remain uncategorised (Perret, 2002), ultimately leading to the unclear allocation of irrigation water through schemes. South Africa currently has about 302 irrigation schemes majority of which are rural-based and benefit smallholder farmers (van Averbeke *et al*., 2011), none of which are inclusive of urban farmers. In a study done by Salidias *et al.,* (2016), they found that farmers were using treated WW due to a limited supply of water from the local municipality. The farmers indicated that they were willing to pay for treated WW for an increase in quantity and not much care was put on the quality of the water used as the assumption is that the water is already treated and the irrigation technique used is less risky when compared to others (Salidias *et al.,* 2016). Furthermore, Adewumi *et al.,* (2010) found that farmers in the City of Cape Town were more concerned with conserving drinking water and mitigating the water shortage effects, they thus opt for WW reuse as the next choice for irrigation water. Further illustrating the water scarcity in the country and the need to conserve the water. A survey study done in the Umgungundlovu District found that water access in the area has increased significantly as the overall access stands at 86.5% for the residents, access ranges from water from communal stands, water inside the yard and the dwelling (StatSA, 2017). **Figure 2.2,** further demonstrates the percentage increase in access to water, as per Act 108 of 1997 of the water service acts, which aimed at improving the access to essential water supply and sanitation. Studies have shown that the domestic water is used for irrigating crops in the areas; however, the water was limited due to the municipality being unreliable and the cost of water being high, which limits the amount of water directed to irrigation (Mudhara *et al.,* 2014).

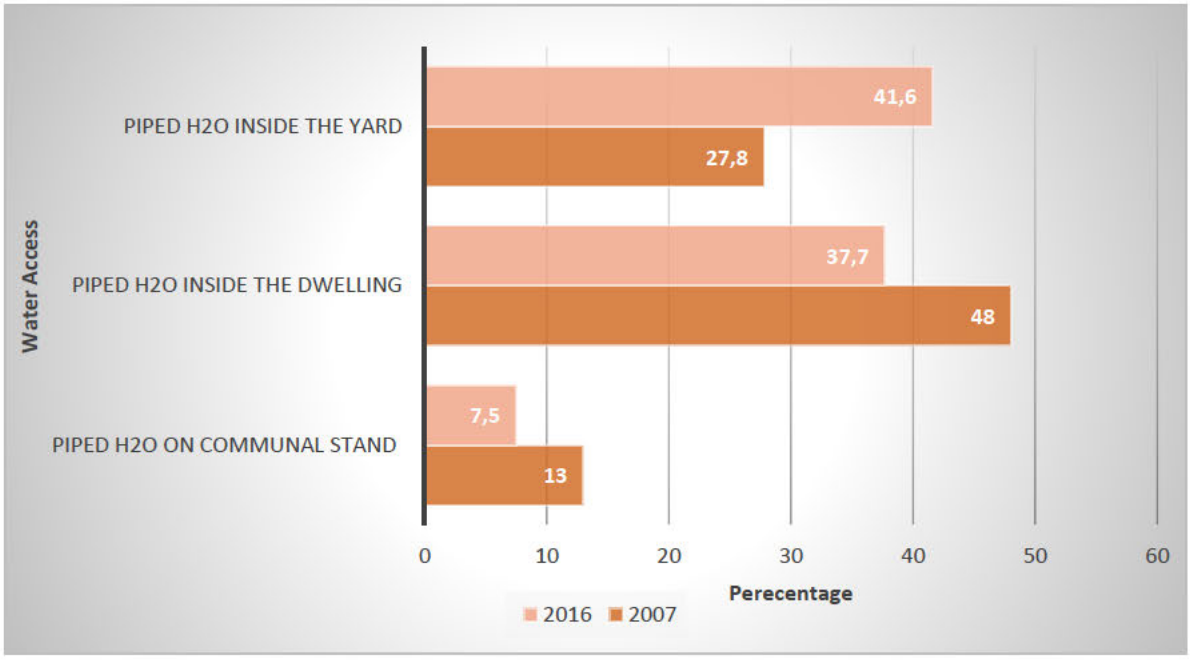

FIGURE 2.2: WATER ACCESS IN UMGUNGUNDLOVU DISTRICT.
Source: STATSA, 2017

Even though, farming in cities could help reduce the contamination risks by the use of eco-friendly cultivation techniques (that is, drip irrigation) which could grow more fruits and

vegetables while cutting the cost of production, as well as increasing greener economies (Thomas, 2012). There is still some disparity, although wastewater in cities can be safe when treated for irrigation purposes and can supply some of the nutrients required for horticultural production (Thomas, 2012). The latter occurred in the Cape aquifers, where there is a direct relationship between PHA and Cape Flats Aquifers which are the primary source of water for irrigation all year round (Haysom *et al.,* 2012). According to van Veenhuizen (2014), there are numerous wastewater sources in urban areas, and they are continuously rising due to the rise in population. The sources include sewage drains, shallow wells, house drainage, and channels, and wastewater treatment plants, are the drivers of WW use in cities (Hassan & Thurlow, 2011). Drip irrigation and rainwater harvesting are some of the techniques that urban farmers could adopt to reduce the demand for water in the urban supplies, consequently contributing to climate change mitigation techniques (Colvin *et al.,* 2016). However, studies have shown that drip irrigation is costly for smallholder farmers who are almost always facing capital constraints, as result they resort to the use of other irrigation techniques such as furrow irrigation (Saldias *et al.,* (2016); Scheierling *et al.,* 2011).

2.3 The role of urban agriculture in the economic growth of cities.

According to Eisazadeh *et al.,* (2015), urban agriculture plays an essential part in the local food systems in cities; while also reducing food shortages in vulnerable groups. As most people in the towns of developing countries spend a significant portion of their incomes (50-70%) on buying food, local food production will reduce the cost (Ghaleh, 2019). According to Ackerman *et al.,* (2014), participation in UA is for community development, food security, and economic growth; and it can strengthen social ties. It also provides sustenance for households that may be lacking, create jobs and contributes to the household's income while offsetting the food expenditure (Ackerman *et al.,* 2014). A study done on Toronto buildings found that 6% of agricultural activities indirectly and directly created 1350 jobs and the commercial value of urban products in UA will be about 5.5 million US dollars. Indicating an economic role played by UA, however minor (Ghaleh (2019). Moreover, Eisazadeh *et al.,* (2015) also illustrate the role played by community gardens in economic growth and agro-tourism, while also striking motivation for commercial development and even its attraction in micro and macro investments within the field. Thereby making UA an essential part of growing local economies more so in socially deprived areas, where there is less investment by governmental or private entities.

Ackerman *et al.,* (2014), further, found that UA plays a momentous role in households that are vulnerable to chronic food insecurity such as children and adolescents, and families engaged in UA have benefited in terms of quality and quantity of food available with low incomes. The role of UA that is, urban gardens promote economic improvement and tourism, and studies have also shown that urban gardens are said to improve ideality for urban residents and commercial areas thus increasing the value, (Ghaleh, 2019). Likewise, Ackermann *et al.,* (2014) found that the extent to which urban agriculture can complement household income can be diverse and is dependent on crop type as well as the scale of production. For instance, staples such as rice provide income security for households, but vegetables fetch a more excellent price at the market (Ackermann *et al.,* 2014). The authors further illustrate how animal husbandry is a source of higher profits, through the sale of dairy products, manure as fertiliser, and animal hides and skin. Moreover, Battersby *et al.,* (2015) note the contribution of UA to the South African economy was significantly small, but the social benefits outweighed the economic benefits. Seed, Uno (2014), further notes the role of UFOTI in the Durban community as it provides 497 families with income from product sales; creates a local market, while also

generating revenue and a stable market for Umgibe and the Co-operatives through the contracts with hospitals.

2.4. The role of urban agriculture in societies

UA plays a different role for different communities. According to Eisazadeh *et al.,* (2015) UA is said to be an agent of reduction or elimination of poverty, as many vulnerable groups such as the orphans, disabled persons, women, and refugees form part of the government or non-governmental organisation in urban management systems. Women's participation in urban agriculture is said to have provided health and economic liberation for numerous households (Seed-UNO, 2014). UA also provided mental and physical health for the vulnerable in society through social ties and the provision of sustenance for the urban residents (Ghaleh, 2019). In a study done in low-income Bogota, the capital of Columbia, the women who grew vegetables on their rooftops, were found to have three times more income as compared to their semi-skilled husbands, (Eisazadeh *et al.,* 2015); further illustrating the vital role of UA at HH level in ensuring food and nutrition security (FNS) and continued income generation. UA participation is driven by numerous factors, for example in developing countries the unreliable transportation of food from rural areas, makes local food production an everyday activity (Kaufman & Bailkey, 2000). In developed countries, UA serves a different purpose. For example, in a New York City (Cornell University) project "new farmers/new markets" played a significant role in addressing the social aims of UA; which serve as a vehicle; for community food security (producing for soup kitchens) (Kaufmann & Bailkey, 2000).

In developing countries like South Africa, UA plays a significant role in social and individual benefits which may, in turn, supersede food security and economic benefits (Battesrby *et al.,* 2015). The benefits include the building of communities and cultivating social capital, reclaiming a sense of belonging, enhancing psychological well-being, and growing importance of purpose and self-worth (Battersby *et al.,* 2015). According to Tujil *et al.,* (2018), UA has at least three benefits, that is, food security wherein in developed countries the aim: is to fight chronic hunger and feed the citizens, the 2nd would be community development where there is an increase in social cohesion between different groups in society, to provide work and training for the unemployed, and as a tool of crime prevention. The 3rd benefit is for educational purposes, that is, through workshops, short courses, and an awareness campaign by urban farmers about the origin and production of the food products (Tujil *et al.,* 2018). In projects like the UFOTI, the PHA, and Abalimi Bezekhaya UA played a very crucial role in society as many of the participants were females. The women who participated in UA wanted to ensure sustainable livelihoods in times of short-run shock and to overcome long-term vulnerability (Jacobs & Xaba, 2008).

To avoid long-term vulnerability, farmers would trade on social capital to access resources such as land and markets. For example, projects like Abalimi Bezekhaya have proved to be beneficial in trading on social capital, which alleviates the production costs and institutional constraints that smallholder farmer's face, while also addressing the food security and income mechanisms, benefiting the UPA participants (Jacobs & Xaba, 2008). Furthermore, Bisaga *et al.,* (2019), also found that there were NGO initiatives in Durban like the Aqualima (http://aqualima.co.za/projects.htm) project which has implemented for rainwater harvesting systems and gravity feed low-tech irrigation systems, as well as the Newlands Mashu agricultural hub located in Newlands, part of the Agricultural Management Unit (AMU), in partnership with Water and Sanitation Unit (EWS) of the Ethekwini Municipality and the

Pollution Research Group (PRG) at UKZN. The project was established to integrate research on sanitation, decentralised wastewater treatment, nutrient recovery and recycling, the project has been serving bio-intensive vegetable production sites, in the effort of promoting household food security, and developing a solution for closed-loop systems for the use of sanitised waste streams, such as wastewater, faeces and urine for agricultural use (Bisaga *et al.,* 2019).

2.5. Urban Agriculture and Food security

According to (FAO, 2002; and Coates *et al.,* 2007), "food security is a state in which all people at all times have both physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life". South Africa is described as food secure at a national level but food insecure at a household level (Altman *et al.,* 2009). Households are said to be food insecure when they have limited access to food and when their dietary requirements are not being met and which may result in poor physical and mental health (Carter *et al.,* 2010). Thus, making it a vital task to identify and evaluate policy options and monitor household food security in urban areas of South Africa. Food and Nutrition security use the four-pillar system of utilisation, stability, access and affordability, conversely, Clapp *et al.,* (2021) have suggested the addition of two more pillars that is, the agency and sustainability pillar. They (Clapp *et al.,* 2021) found that the previously used pillars were somewhat lacking the measurement capacity as the policymakers looked at the indicators of FNS whilst the degree of measurement remains unknown. To combat the lack of measurement, the agency and sustainability pillars are believed to bring about multiple means of measurement of food security. The additional pillars can assist in measuring the knowledge of individuals in terms of food literacy and minimise instances of food wastage in urban areas (Clapp *et al.,* 2021).

According to Feola *et al*., (2020), urban households rely heavily on agriculture to generate household income, therefore, increasing agricultural productivity results in improved food and nutrition security status and improved livelihoods. However, Lal (2020), argued that agricultural productivity in less developed countries was low because of factors such as a lack of inputs, technology, credit, infrastructure, and access to markets. Nonetheless, Feola *et al.,* (2020), note the role of UA in urban areas where the engagement promotes community-building, civic engagement, youth empowerment and minorities, physical and psychological relaxation and environmental education and the provision of care for psychological disorders, all qualities essential in communities in tough times like famine and disease outbreaks. The recent disease outbreak of 2019/2020 Novel Coronavirus brought about food insecurity in developing countries as they were somewhat not prepared for such outbreaks, thus resulting in many individuals being food insecure at some point in their lifetime during the COVID-19 pandemic. The outbreak led to some countries closing off their international borders, which broke the value chain movement of some products, resulting in harvest delays, limited farm workers available as well as dilated times in packaging (Pulighe & Lupia, 2020; Lal, 2020). The closure of borders meant a shortage in certain commodities (e.g., wheat, oil, rice among others) which are mainly exported by other countries.

The pandemic also resulted in a lack of movement between cities to reduce people interaction as the virus was unknown and the mode of infection was not understood very well. As a response to the pandemic, some countries started taking measures to ensure national food security by blocking or restricting several staple commodities, for instance, countries like Russia set limits on the shipment of grain as the country is regarded as the world's largest wheat

exporter (Pulighe & Lupia, 2020). The conventional system of bringing food into large cities, over an average distance of 800 to 1500 km, is prone to several disruptions, such as those brought about by COVID-19 (Lal, 2020; Pulighe & Lupia, 2020). Lal (2020), further illustrated how UA is already producing about 15-20% of the world's food supply, and this plays a critical role in achieving food security during a global crisis created by the COVID-19 virus. The pandemic brought about many challenges for the urban residents and the issues are as follows: 1). large populations living in mega and giga-cities with a large food demand; 2). High food wastage at all steps of the supply chain and long food mileage, 3). undernourishment and malnourishment because of poor nutritional quality of the food, 4). disruption in the food supply chain and 5) low-income generation as a result of lockdown. To mitigate such issues; Lal (2020), found that a system based on a holistic approach to home gardens and urban agriculture (HGUA) can produce food within urban settings including in and on buildings. **Figure 2.3** illustrates what HGUA can provide for its residents, furthering the importance of urban food systems that are easily accessible to the ever-growing population, even in times of disease outbreaks and natural disasters. The **figure 2.3** further illustrates how UA and home gardens ensure continued food and nutrition security at a household level for the urban residents, it also illustrates how UA is good for the environment and the ecological systems in the cities by providing enhanced biodiversity, improving water quality, for health and culture as well as moderating micro-climate. HGUA also play an integral role in providing economic benefits through the provisions of job opportunities, financial savings and increased disposable incomes.

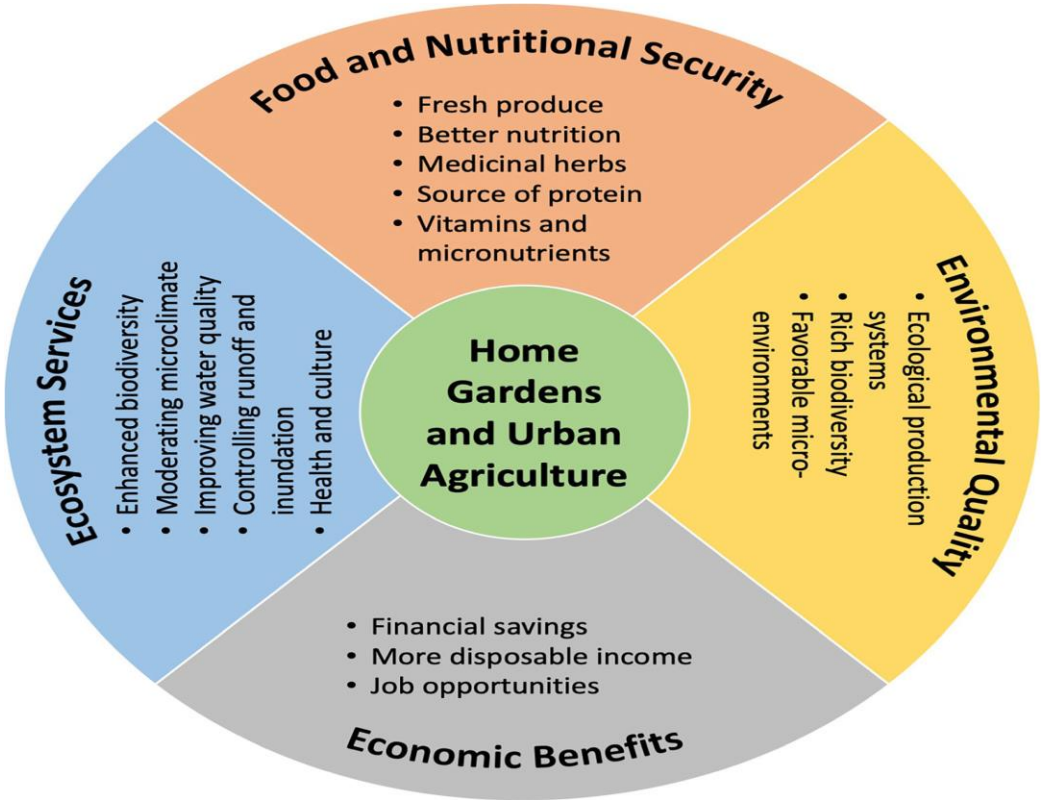

FIGURE 2.3: FOOD, ENVIRONMENTAL, ECONOMIC AND ECOSYSTEM SERVICE BENEFITS OF HOME GARDENS AND URBAN AGRICULTURE.

Source: Lal, 2020.

*Examples of the positive role played by urban agriculture at a provincial level***:**

There are several urban farms in cities like Durban, Pretoria, and Cape Town that produce commodities that are at the local market. In the eThekwini Municipality, there is UFOTI which trains farmers and sells at the market as they enhance farmers' access to markets, thereby boosting local income generation (Seed-UNO, 2014). There were also initiatives by the local authorities where the agricultural zones with agri-hubs trained farmers in areas like Marrianhill, Newlands, Umbumbulu, and Northdene, all of which have a high number of low-income residents and high incidences of food insecurity (Bisaga *et al.,* 2019). Thus, playing a considerable role in innovation and entrepreneurship of small-scale farmers in urban areas, more so the youth and the elderly (woman). As the study found that more women are interested in UA and some were already actively involved in farming around their homes and in community gardens (Haysom *et al.,* 2012; Bisaga *et al.,* 2019). Furthermore, (Haysom *et al.,* 2012) outlined the role played by the PHA in the livelihoods of commercial and smallholder farmers in the Western Cape Province. An important variety of vegetables are grown including; cabbage, lettuces, cauliflower, broccoli, spinach, carrots, potatoes, as well as onions.

These play a role in the food systems in Cape Flats and Durban community as they are the most affordable staples rich in nutrients and allow for diverse diets at household levels (Haysom, 2007; Sonday, 2014). Moreover, Bettersby *et al.,* (2015) notes that the commodities sold at the Gauteng provincial food gardening program which includes beetroot, spinach tomatoes, beans, carrots etcetera, which also provide diverse diets for residents. Battersby *et al.,* (2015) highlighted that most of the produce sold in the Gauteng Provincial Food Gardening Program was accruing a significant economic value from urban agriculture; however, there appears to be a relatively minor financial benefit. Whereas, Ratshitanga (2017) found that the farmers were unable to keep up with constant supply to the cities merchant's demands due to the quantity produced, as well as the seasonality of production. Complementing the findings by other authors (Bisaga *et al.,* 2019) who found that UA in Durban was beneficial in creating employment opportunities, in skills development as the participants were given training on 'bio-intensive' food production where the soil is the main crop production beds are built through a method of double digging and adding organic composts, as well as composting and organic pest control.

2.5.1 The Benefits & Challenges of UA in the Cities Food Production Systems.

The food systems in urban areas tend to be faced with numerous challenges when products fail to reach the retail at the time they are required, and some factors could result in such occurrences, that is natural (outbreak/disaster) shocks, economic shocks, and political shocks. The benefits and challenges are further outlined below and how they can affect the food production systems in cities.

Benefits of UA in cities' food production systems:

There are numerous benefits of UA in cities and they are noted in various parts of the country, that is, in Cape Town, Johannesburg and Durban all of which are classified as major cities. In the Western Cape, temperatures were expected to rise under the conditions of climate change meaning reduced yields, however, the PHA is said to have become a valuable source for the food systems of Cape Town and the province (Haysom *et al.,* 2012). This later ensured that consumers are less vulnerable to market risk associated with extreme events that result in changes in commodity prices. Thus, leading to food and nutrition security, and since the products are affordable compared to formal markets; and can better accommodate the poor households in the cities (Haysom *et al.,* 2012). The role of peri-urban agriculture in the cities'

food systems is realised as the previous studies focussing on the larger parts of Cape Town are evidence of a resilient local food system's ability to respond to the changes in circumstances by various households and communities (Haysom, 2012).

With South Africa having 19 Fresh Produce Markets (FPM), and some are said to be the largest in the Southern Hemisphere; these markets distribute large volumes of tomatoes, potatoes, and onions, to several buyers,' that is, informal traders, retail chain stores, and restaurants (Battersby *et al.,* 2015). The fresh produce markets are the primary markets for urban farmers; however, the decline in the proportion of fruits and vegetables in the markets due to the increase in direct sales to the supermarkets and the export market; meant urban farmers might not have adequate access to markets (Ratshitanga, 2017; Battersby *et al.,* 2015). Market access is vital for the urban farmers, however, Ratshitanga (2017) also found factors such as price fixing by the marketing agents and the competition at the markets through a coalition with commercial farmers to eliminate Smallholder farmers (SHF) by "slashing prices to undercut markets entrant, before raising prices when smaller companies run out of stock". Regardless of these factors, urban farmers are still an essential component of the community as they account for 40% of the vegetable production in the FPM in South Africa (Battersby *et al.,* 2015). Furthermore, (Steenkamp *et al*., 2021) found that the use of hydroponic system in Johannesburg rooftop gardens, reduced production time, transportation and water usage as well as less space needed for production.

Challenges of UA in the cities' food production systems:

Urban farmers face numerous challenges: such including access to agricultural land due to the marginalisation of poor communities to areas with poor soils; competition for land use for housing development, poor access to markets due to quantities and inconsistent quality, poor extension services, lack of access to agricultural inputs such as seeds, fertilisers, compost, mulch, and water, as well as the restrictive by-laws and attitudes of municipal managers, Battersby *et al.,* 2015). The stringent market requirements also brought about challenges for the farmers as they have capital constraints which influence market access, and as result farmers opt for informal markets. The factors ultimately limit the uptake of urban agriculture. Furthermore, Kennard & Bamford (2020), highlight the difficulties of UA operations to improve healthy food access in cities as commercial entities, as there is a struggle to balance the "unattainable trifecta of urban agriculture". There are contradicting goals of providing quality food to people at affordable prices, providing jobs and work experience at living wages to those that are typically excluded from employment and leadership opportunities, while also remaining profitable from sales to remain sustainable long-term (Kennard & Bamford, 2020). The goals can be attainable if the urban farmers are motivated to become entrepreneurs in UA.

According to Ratshitanga (2017), an increase in economic activities through UA participation and a decrease in social handouts like grants will increase people's chance of coming out of poverty. It was also found that South Africa has a "persistently low level of entrepreneurial activity compared to other countries" (Herrington & Kew, 2016). However, a GEM report on total entrepreneurial activity (TEA) among black people found that government policies, lack of educational programmes on entrepreneurship and training at the school level as well as cultural and social norms were some of the constraints on entrepreneurial success (Herrington & Kew, 2016). While institutions are said to be in support of small medium micro enterprises (SMMEs) in SA it would seem that there is a lack of institutional support for the urban farmers who also fall under the same spectrum of enterprises and can provide food and employment opportunities provided they can operate at full capacity. Furthermore, Bisaga *et al.,* (2019)

found that challenges a rise in terms of resource sharing and arising incomes, and there is also a failure in consistency by the individuals who engage in farming, putting a risk to continuity and sustainability of the UA initiatives. Complementing the findings of Steenkamp *et al*., (2021), where they found that even though the urban farmers were able to tap into the niche markets (herbs and aromatic plants), they were unable to keep up with the market demand, thus making them vulnerable to price volatility.

Empirical Literature of UA entrepreneurial risk and water quality in UA

Many studies have been done on UA, food security and entrepreneurship in South Africa. While others were on UA and water quality. This section will give a review of related literature on entrepreneurial risks and water quality in urban agriculture. A study by Mudhara *et al*., (2014) found that farmers used three sources of water, as 9.6% of the farmers relied of rainwater harvesting, while 15.1% relied on river water and 75.3% of the respondents use tap water. The results show that a large number of the participants use tap water, while some used other sources such as the aforementioned sources, this can be largely attributed to the health risk posed by the use of river water (Mudhara *et al*., 2014). Moreover, Saldias *et al*., (2016), found that while most of the farmers were using rainfall runoff to irrigate their farms, 37% of the farmers were using treated affluent as a source of irrigation water. Even though studies have shown that river water is questionable in terms of quality some farmers were still open to its use in irrigation as well as washing water. The empirical findings from Govender (2016) found this to be the case in the case study where 20 of the participants in the study were found to be using the water for more than 5 years and had experienced some health-related risk (skin rashes, diarrhoea) due to it' s use (for washing, swimming and irrigation). The river was found to have 15% *E. coli* which is above the allowed compliance of < 5% of *E. coli* in river water; presenting a greater risk to the end users (Sikhakhane, 2002; Amoah, 2008). Further illustrating the negative link of agriculture to water quality. Furthermore, Masindi and Dunker (2016), found that even though 75% of the waste treatment plants were not up to standard, the water in the metropolitan areas was of relatively good quality when compared to the water in rural areas. Furthermore, the water is still of good as the blue water certification remains relatively good when compared to other municipalities in the province, as the results in the area show that the province received a green drop certification (90%) performance (DWAS, 2022). This study will therefore, further empirically investigate whether UA leads to water, access, use and quality deterioration in the study areas and if there are any policies that govern water access, use and quality in UA.

The studies on risk show that risk management is an essential skill to possess as an entrepreneur. Farmers like other business persons are faced with numerous risks, however, Wale & Chipfupa, (2021), found that taking a risk by smallholder farmers is equivalent to gambling with their livelihoods with regards to taking a risk or trying out new technology. Moreover, Senapati (2020), found that 64.75% of the respondents in the study areas were risk averse, while only 20.25%, had a risk preference, further revealing the less likelihood of farmer taking on risk. It was also found that factors such as age and land size meant that the farmer is less likely a farmer is to take on risk, as large land size and higher age equates to more risk (Senepati ;2020). Furthermore, Komarek *et al*., (2020), illustrated how studies on risk have focused on one or two types of risk; as 2160 focused solely on production risk (26%), while 13% focused only on market risk and 2.4%, 1.8% and 2.0% focussed on institutional, personal and financial risk only, respectively. Moreover, Korir (2011) found that farmers regard production risk (59 %) as the most serious; while the seasonal and regional fluctuations were expected, market risk (34%) was regarded as the second most serious, and only (3%) saw

institutional risk as a factor and needed to be managed. These results illustrate how risk management is not really practiced by farmers and even though some are aware of its implications in their businesses. Even though they wish to strive for growth and development they still lack the necessary skills to be risk manager and run successful business. This study will therefore, further investigate the role of entrepreneurial risk in UA, and how it affects the low-income households.

Studies on UA entrepreneurial risk and food security show that farmers are willing to engage in UA to ensure food and nutrition security at household level. The study by Mudhara *et al*., 2014 they found that farmers in the Sobantu and Greater Endedale Area (GEA) were planting to be food and nutrition secure, as 16.0% (11%) were found to be mildly food insecure' while 64.0% (57%) were found to be moderately food insecure as well as 20% (32%) who were found to be severely food insecure respectively. The non-farmers in the areas were found to be experiencing moments of food insecurity more so the participants from the GEA as 44% were severely food insecure, while the other non-farmers in Sobantu had only 20% considered as severely food insecure. Also, a study by Ratshitanga (2017) found that farmers in the Soweto in the Gauteng area were moderately food insecure (25%), while (57%) were found to be severely food insecure. While 66.3% of the farmers in the Cape Town area were found to be severely food insecure, and (35%) were moderately food insecure (Battersby, 2011; Battersby *et al*., 2013). These studies are indicative of the role played by UA in urban areas in attaining FNS at a HH level; however, there is still some knowledge gap, in terms of the role of entrepreneurial risk on the food and nutrition security for low-income households. This study will thus, attempt to link food and nutrition security and entrepreneurial risk in UA.

THEORETICAL FRAMEWORK.

This section will elaborate on the theoretical framework that will be applied to this study.

2.6 Theory of Planned Behaviour

The study was based on the integration of two concepts, that is, the Theory of Planned Behaviour (TPB) (Corner & Norman, 2005; Ajzen, 1988, 1991); and Psychological Capital (PysCap) (Luthans *et al.,* 2017; Luthans *et al.,* 2007; Luthans, 2004). The Theory of Reasoned Action (TRA) stems from the social psychology discipline and was developed by Ajzen and Fishbein to find the best connection between religion, attitudes, norms and intentions and behaviours of people (Jieknyal, 2016). The author (Jieknyal, 2016) further highlights how the central conjecture between TRA and TPB is that people are rational when examining their decision-making processes and the consequences of their actions. Moreover, Luthans *et al.,* (2012), illustrate how closely inter-related the family of theories adopt a cognitive approach in explaining the behaviour of individuals' attitudes and beliefs.

According to Ajzen (1991), the theory of planned behaviour is an extension of the TRA made necessary by the original model's limitations in dealing with actions over which people have complete control. The author (Ajzen, 1991) further illustrates how the central factor of the theory of planned behaviour is the individual's *intention* to perform a given behaviour. According to (Jikenyal, 2016; Ajzen, 1991); intentions are the motivational components that influence behaviour. Furthermore, an intention can capture how hard a person is willing to try, and how much of an effort they are ready to exert to perform an activity (Ajzen, 1991). The intention in itself is the outcome of the combination of attitudes towards behaviour (Morris *et al*., 2012). Moreover, McDermmot *et al.,* (2015), clarify how intention indicates the amount of

effort an individual is likely to devote to performing the behaviour. They are in turn determined by attitudes, overall evaluation of behaviour, Subjective Norms (SN), and an evaluation of whether an individual feels significant to how others think he/she should engage in the behaviour and Perceived Behavioural Control (PBC) (McDermmot *et al.,* 2015).

According to Stranieri *et al.,* (2016), TPB has been successfully applied in many fields of study, and the behaviour associated with food choice is quite complicated and is often contradictory. Giving rise to the need for additional predictors which increase the understanding of consumer behaviour in the market when buying certain products, e.g., organic environmentally friendly products (Stranieri *et al*., 2016). The predictors are used to further extend the TPB in terms of green consumer behaviour: Consumer environmental behaviour (Turaga *et al*., 2011; Tobbler *et al*., 2010; Steg & Vlek, 2009), environmental concerns (De Groot & Steg, 2009; Ignatow, 2006), food shopping habits (Van't Riel *et al*., 2011; Honkanen *et al*., 2005) and individual consumer characteristics (Chekima *et al.,* 2016). All of which play an integral role in consumer behaviour as they determine the food choices made at a HH level. The behavioural determinants of food consumption patterns include food literacy, socio-demographic factors as well market volatility and environmental concerns (McDermott, 2015; Van der Warf *et al*., 2019).

2.7 Positive Psychological Capital of the farmers

According to Luthans & Youssef-Morgan, (2017), Psychological Capital (PsyCap) is defined as the state of mind, consisting of positive strengths; and could therefore be considered a positive mind-set. A positive attitude is essential in entrepreneurship as it enables the individual to learn from experiences and adjust to the business dynamics to achieve success (Baluka *et al.,* 2018). Furthermore, PsyCap at its core is about the positivity that the individual can add to his /her work performance, resulting in a competitive advantage on a psychological level (AI Rasyid & Bangun, 2015). The ability to realise the unmet potential in an area and take that opportunity, to integrate some of the livelihood strategies: is one of the characteristics of an entrepreneur, (Shane & Venkataraman, 2000). The individual's mind-set can enhance or hinder the willingness and ability to take advantage of opportunities (for example being part of an irrigation scheme), regardless of the prevailing constraints (Chipfupa, 2017).

PsyCap is multi-dimensional with unique characteristics, that is, hope, efficacy (confidence), resilience and optimism (H.E.R.O positive psychology) (Luthans & Youssef-Morgan, 2017; Luthans *et al*., 2007; Luthans, 2004). *Confidence* (efficacy) is the belief in one's ability to accomplish one's goals. Having a positive mindset is a good motivator for one to invest more time and persevere, even amid challenges (Luthans, 2004). How an individual who is confident in their ability will choose gaols that are challenging to motivate them to achieve them (Luthans &Youssef-Morgan, 2017; Youssef-Morgan, 2017; AI Rasyid & Bangun, 2015). *Optimism* is the hopefulness and confidence about a positive, meaningful desirable future. At the same time, optimistic individual will view their chances of success to be high (Luthans &Youssef-Morgan, 2017). Where *Hope* is about the willpower to accomplish something and the ability to generate unconventional methods to achieve one's goals, while also allowing for the recovery from setbacks along the way (Luthans & Youssef-Morgan, 2017). AI Rasyid & Bangun (2015), further explained hope as one's capability to find the path and the means with a strong will and motivation. *Resilience* is the ability to adjust and adapt to hardships or risks and make a quick recovery (Masten & Reed, 2002). Luthans & Youssef-Morgan (2017), state how hope, optimism and efficacy tend to be proactive, while resilience and the explanatory style of

conceptualisation of optimism are reactive and occur after a positive or negative situation is encountered.

These are vital characteristics of smallholder farmers as they determine their ability to survive in the ever-changing environment and techniques of doing things; it brings about the "entrepreneurial spirit" along with the can-do attitude, which also ensures continued food security due to a rise in incomes and job creation. The current discourse in food and nutrition security refers to six pillars of FNS and makes cases for the formal extension of the traditional pillars (Clapp *et al*., 2021). The additional pillars are agency and sustainability. Agency is defined "as the capacity of individuals and groups to exercise a degree of control over their own circumstances and provide meaningful input into governance process" an important aspect of empowerment. The agency pillar further alludes to aspects of positive psychological capital and has a direct relationship with FNS.

2.7.1 The Role of Psychological Capital in Entrepreneurial Success

As PsyCap is the state of mind, it is vital to note how a positive mind-set is essential for an 'entrepreneurial spirit' that enables individuals to learn and adjust to the dynamics of the business environment (Baluku *et al.*, 2018). According to (Luthans & Youssef-Morgan, 2017; Luthans, 2007b), PysCap goes beyond what the entrepreneur has (Financial capital); or knows (Human capital); or whom the entrepreneur knows (Social capital), the resources look at the individual's strengths more than their weakness (Baluku *et al*., 2018; Luthans *et al*., 2004). In addition to understanding one's self and others relevant to business leadership, there is customer handling, networking, teamwork, negotiations, and conflicting handling (Humphrey, 2013; Borg & Johnston, 2013).

The application of self-efficacy (Confidence) in entrepreneurship drives the individual to undertake the risks of starting and managing the business venture (Boyd & Vozikis, 1994). High self-efficacy relates to setting challenging goals and the persistence to pursue those goals, making it a useful resource for entrepreneurial growth and performance (Baluku *et al*., 2018; Hmieleski & Corbet, 2008). Optimism is another form of physical, which has an impact on the ability to do business. People make risky investments with their money or other resources, even with all the uncertainty because they expect to earn positive returns, with the likelihood of positive outcomes (Baluku *et al*., 2018; Rigotti *et al*., 2011). Hope is a perception that one can achieve his/her goals, which facilitates the development of pathways and persistence toward realising the set goals (Luthans & Youssef-Morgan, 2017; Baluku *et al*., 2018). The hope component is the cognitive or psychological drive individuals need to achieve goals and tasks (that is, willpower and motivation) (Ai Raysid & Bungan, 2015). Resiliency in its origin, Positive Organisational Behaviour (POB) is from the clinical psychology works of Ann (Ai Raysid & Bungan, 2015). In the workplace resilience are the positive psychological capacity to bounce back from adversity, uncertainty, conflict, failure, or even positive change, progress and increased responsibility" as defined by Luthans and colleagues.

The role of psychological capital is noted in agricultural research studies as it is said to influence the farmer's decision-making. Where a farmer with a high positive PysCap endowment is expected to be highly motivated/will exert more effort and vice versa (Zaca, 2018). A farmer with a high PsyCap and retains more livelihood assets will have high positive comportment and exert more effort to attain set goals. However, more farmers value the immediate reward more than the future payoffs (Samson, 2015). Ratshitanga (2015) further corroborated these findings when they found that farmers were more driven by the instant pay-outs and there was a lack of motivation from the farmers. This mind-set affects the farmer's

predisposition to reach the full potential of their entrepreneurial capabilities. The entrepreneurial capabilities have also been known to be hindered by a lack of valuable assets (land, water).

Literature shows that farmers with assets that is, secure land and water rights are more productive than those without (Quisumbing & Pandolfelli, 2010); furthermore, securing the right to agricultural assets often eliminates women (Chitja *et al*., 2016). Consequently, leading to a lack of positive psychology, regardless of the role they play in food security and being the major players in smallholder farming. The gender bias in asset allocation often leads to reduced production, as there is no willpower and motivation to work tirelessly to attain the set goals by the farmers. Corroborating the findings of authors (Kent & MacRae, 2010; Chitja *et al*., 2016) where they found that women tend to be eliminated from gaining livelihood assets, they only use land or water resources of a male relative, which then causes a lack of motivation as there is no incentive for the increase in production quantity, rather they remain subsistent farmers. Furthermore, Clapp *et al.,* (2021) believe that this disempowerment of women in agriculture can be addressed by the agency pillar which notes the disparity within the food systems, and the imbalances of power within the systems. Which more often than not excludes women who tend to be the ones responsible for food provision and preparation, further enhancing food insecurity at an individual and household level.

2.8 Farmers risk preference: Arrow-Pratt measure of risk aversion

Risk in agriculture has been in existence for many years and many farmers have learned and adopted various methods of managing risk, or hedge against it as they can never fully eliminate. Moreover, the recognition of the available options and selecting the appropriate method to elicit risk aversion is a crucial step for researchers to investigate the decision-making processes uncertainly (Sulewski *et al*., 2020). Risk aversion can be defined as an attitude of reluctance to take on a risky decision, which cannot be avoided in any economic activity, including agriculture (Sulewski *et al*., 2020). Risk in agriculture is defined in the category of distribution of outcomes (variance and standard deviation) (Bodie *et al*., 2012). According to Karni (2008); the probabilities applied in risk analysis can be prompted from an objective or subjective perspective; however, the use of probability distribution and the expected value of the outcome as a risk measure does not fully reflect the approach of decision-maker's attitude towards risk (Sulewski *et al*., 2020). Risk aversion might be considered in absolute and relative terms.

According to Orduno Torres *et al*., (2019), risk is the decision variable when there is uncertainty, as each individual or decision-maker has their attitude toward risk; hence, the need to quantify the degree of risk aversion to identify differences and similarities. Several methods can be employed to successfully measure the stated attitudes concerning risk based on surveys of the individuals involved in economic activities (Orduno Toreese *et al*., 2019). These methods can be categorised as: i) methods based on the attitudinal scale with multiple affirmations or statements, ii) methods based on the theory of expected utility, and iii) methods that involve a combination of both. The economic theory of expected utility estimates an indicator of risk aversion as a function of probabilities of the non-parametric framework, considering it's not the function of the utility that governs the behaviour of individuals (Orduno Torres *et al*., 2019). The risk measure in agricultural entrepreneurship indicates that there is awareness of the production risk present, which needs mitigation, through insurance. Furthermore, Miskic *et al*., (2018) note how insurance is very important but studies have shown conflicting results on the factors that impact agricultural production positively for producers with insurance contracts. As Velandi *et al.,* (2009) found that crop insurance contracts had a

positive effect on the business risk, whereas land ownership, off-farm income and education had negative effects. Conversely, the findings of Sherrick *et al*., (2004) established that contract insurance was undertaken through the perception of the yield risk increasing, and also increase production on farms that are larger, older and not leased. Further illustrating the need for risk quantification through the measure of attitudes of the farmers, considering the conflicting findings by other authors.

According to Holt & Laury (2002) literature on auctions commonly assumes the constant relative risk aversion due to its computational convenience and its implication for bid function linearity with uniformly distributed values. In constant relative risk aversion for money *x*, the utility function is $u(x) = x1 - r$ for $x > 0$. This specification implies risk preference for $r < 0$, risk neutrality for $r = 0$, and risk aversion for $r > 0$. However, Pratt (1964) and Arrow (1965), found this to not be the case as cited by Sulewski *et al*., (2020), where they state that the most straightforward measure of absolute risk aversion is expressed as the function regarded as the Arrow-Pratt risk aversion coefficient and described using the following formula:

$$R_a = - \frac{U(X)''}{U(X)'} \quad (2.1)$$

Where $U(X)'$ represents the first and $U(X)''$ represents the second derivative of the utility function U(X). It is worth noting that absolute risk aversion is not a simple indicator but rather a function which reflects the impact of changes in wealth on risk aversion (Sulewski *et al*., 2020).

2.9 Strategic Management for Market (Price) Risks

Market price volatility has brought about the risk for the farmers, as they tend to produce highly volatile crops which are also dependent on seasonality, resulting in price risk. This type of risk can be mitigated by the application of different management strategies, such as the use of options in the markets as well as futures and forwards contracts as risk mitigation techniques in the market. Moreover, Kahan, (2013) & Korir (2011) note that risk management strategies as an important skill farm manager should possess as risk is inevitable, and hedging against risk reduces the costs of input and output costs to the farmer. According to Bodie *et al*., (2012), the option in the market has two parts namely the call and put options; where the call option gives the holder the right to purchase the item at a specified time, the price they pay for the commodity is referred to as the exercise or spot price before the expiration date. The put option, however, gives the holder the right to sell the asset for a specified exercise or strike price on or before the expiration date (Bodie *et al*., 2012). The existence of such options in the market can have a cost or benefit for the writer (the person who enters into a contract), as the contract states the underlying writer receives a premium (specific price) where they have to deliver an asset at a specified date in future in return for the asset at an exercise price lesser than the market value, depending on the whether the option is exercised or not (Bodie *et al.,* 2012).

2.10 P.E.S.T.E.L Analysis and Porter's Five Forces Analysis in Agriculture.

This section will address the third question of the research. The objective of this analysis tool is to evaluate the internal and external environment of the business. One of the modes used to analyse the competitive environment in industry to formulate strategies is the porters five forces model, which is on a competition basis (Abinsay, 2020). Another model used is the PESTEL analysis which explored the external environment of the business, relating to agriculture. The different analyses are further explained below:

2.11.1 Porter's Five Forces and P.E.S.T.E.L Analysis in agriculture

To gain a competitive advantage, the competitors offer consumers greater value by lowering the prices or providing greater benefits and services that justify the high prices (Maciejczak, 2007). The root of the competition is in the principles of economic and competitive forces beyond the competitors, as trying to gain more market share, the competition is only revealed in the action of competitors (Abinsay, 2020). There is a fundamental idea that the company operates on a network of buyers, suppliers, substitutes, new entrants, and competition that is still valid (Dalken, 2014). Although the small-scale farmers in UA are mostly not well organised to have a well-developed network of buyers, suppliers among others there are lessons to be learned such as appropriate input markets, reduced transaction costs at the market as well as an increased influence on the market. To achieve this Porter's five distinct forces, have to be thought of when determining the attractiveness of a specific industry (Larry *et al*., 2014). Where attractiveness refers to the profitability, the industry offers its entrants, the concept of profitability should be thought of upon entry into the industry as reasonable or should be avoided (Abinsay, 2020).

The competitive strategy is fundamental in searching for a favourable position in the industry where competition occurs (Maciejczak, 2007). One can employ several tools to analyse the competitive environment, such as the Porter's Five Forces model, Game plan, Value Chain model, PESTEL model, and Strategic group analysis. Among the many models used, porter's five forces model has been categorised as the best (Dalken, 2014).

P.E.S.T.E.L analysis on factors influencing business environment.

The external environment of the business can be evaluated using the PESTEL analysis, which is a standard tool used in general. PESTEL analysis was initially published in 1960 by Jeremy McCarthy and focused on the political, economic, sociocultural, technological, environmental and legal aspect (Walstoom, 2004). According to Stefan & Zehle (2009), the factors are uncontrollable for the firm as they are external and reveal how many external environment factors influence a business's performance. The table below gives an illustrative overview of the different aspects of each element:

TABLE 2.2: THE GENERAL EXTERNAL ENVIRONMENT IN BUSINESS, EXAMPLES OF PESTEL-ASPECTS.

Political	Economical	Socio-cultural
*Trading policies * Funding, grants and initiative * International pressure group * Political trends * Internal political issues	* Economy situation and trends * Seasonality and weather Issues * Market and trading cycles * Specific industry factors * Customer/end-user drivers * Unemployment * Employment	* Consumer attitudes/opinions * Consumer buying patterns * Buying trends * Population shifts * Trends * Earning capacity
Technological	**Environmental**	**Legal**
* Competing for technology development * Replacement technology/solution * Consumer buying mechanism * Innovations	* Ecological and environmental issues * Customer values * Market values * Global factors * EU based factors	* European/international legislation * Environmental regulations * Consumer protection * Industry-specific regulations * Competitive regulations

Source: Friend & Zehle, 2009.

2.11 A Framework for analysing vulnerability to future food insecurity

The sustainable livelihood framework (SLF) is a tool to improve or understand livelihoods, more so of the poor or vulnerable (Lovendal & Knowles, 2007). The framework further presents the main factors that affect people's livelihood. The SLF is widespread and is a continuing strategy employed by the poor and more vulnerable in communities (Olivier, 2019). The SLF assumes that individuals pursue a different agricultural and economic activities based on their endowment (human, financial, social, natural and physical capitals, their vulnerability context (Shocks, Seasonality and trends) and the institutional environment (Twigg, 2001; Lovendal & Knowles, 2007; Olivier, 2019). The livelihood strategies employed by the farmers are prone to uncertainty better referred to as the vulnerability context on the framework. The vulnerable context frames the external environment which the farmer has no control over, the trends, shocks and seasonality factors affect people's livelihoods and the availability of assets as well as the food and nutrition security (Lovendal & Knowles, 2007). The shocks have a direct impact on assets (in the case of floods, storms, and conflicts) they can also present a risk of food and nutrition insecurity for the most vulnerable in society (Lovendal &Knowles, 2007).

The shock effects were witnessed in times of war (for example Russia-Ukraine conflict) which is causing food and nutrition insecurity to the groups prone to poverty (Helleger, 2022). Studies have shown times of shocks like conflict and health scares (e.g., Ebola, Covid-19); countries close borders, and limit trade of certain agricultural commodities to ensure food security protection of national production (Pulighe & Lupia, 2020; Hellegers, 2022; Hassen &El Bilali, 2022). The conflicts also lead to people being displaced of their assets (land) as coping strategy; Recent events in the have illustrated the impacts of war on global food and nutrition, as the

countries at war are one of the biggest wheat, sunflower oil and barley, which lead to the rise in prices of such commodities (Hellegers, 2022).

TABLE 2.3 THE SLF VULNERABLE CONTEXT THAT AFFECT FOOD AND NUTRITION SECURITY

Trends	Shocks	Seasonality
*Population trends *Resource trends (incl. conflict) *National/International economic trends *Trends in governance *Technological trends	*Human health shocks *Natural shocks *Economic Shocks *Conflicts *Crop/livestock health shocks	*of prices *of production *of health *of employment opportunities

Source: DFID, 1997; Lovendal & Knowles, 2007

2.12 CONCEPTUAL FRAMEWORK

Figure 3.2 below demonstrates the entrepreneurial risks in urban agriculture and the role of water and the effects on the food security status of the urban residents. The water policies were found to have an effect on food security as access, use and quality, affect the utilization pillar, since clean water, nutrition and sanitation have an impact on the quality-of-life for urban residents. Water scarcity in cities; has resulted in the use of other alternative water resources for the urban dwellers (farmers) to ensure continued livelihoods. The alternatives, however, presented many challenges that are detrimental to human health presenting a risk. Furthermore, risk in agriculture has been studied over the years. However, the impact of it is still not fully understood as studies evaluate the capital effects of farming, without also evaluating the attitudes and behaviours of the farmers; as they too can influence the farmer's willingness to take on risk as well as the risk management strategies undertaken to reduce the uncertainty (Knudson *et al*., 2004; Seuneke *et al*., 2013). Furthermore, Korir (2011) found that risk factors such as biophysical, characteristics of transacting partners, international prices, commodity stock level and institutional environment are out of the farmer's control. The factors introduce many risks to the farming activity that is production, financial, price human and institutional risks (Kahan, 2013). The risks interrelate with the farm and the household characteristics in determining the type of risk management strategies employed. As a mode of risk management, some farmers opt for off-farm investments, while others opt for contracting or insurance, which hedges against risk for the farmer. The type of strategy employed affects the outcome that is stability of income and subsequently the household's utility the entrepreneurial success.

Developing the entrepreneurial spirit goes beyond just simply developing the entrepreneurial skills of farmers. In addition to improving their abilities, smallholders have to renew their entrepreneurial characters, break the limitations in agriculture and adapt to shifting surroundings (Knudson *et al*., 2004; Morgan *et al*., 2010; Seuneke *et al*., 2013). In economic concepts of entrepreneurship three characteristics are essential (McElwee & Bosworth, 2010). The first one is risk-taking; the assumption is that an entrepreneur takes calculated economic risks and maximizes profits. The second measurement is growth positioning that is increasing profits by expansion of business undertakings. The last characteristic is innovativeness that is searching, developing and trying new products, markets and methods. Therefore, aspirations or willingness and ability to expand farming operations can be an indication of having an entrepreneurial spirit. The positive psychological capital is attributed to the motivation the farmers have to become a successful entrepreneur, which can be negatively influenced by the lack of livelihood assets (land, water and farming inputs) (Zaca, *et al*., 2021). Moreover, Clapp *et al*., 2021) illustrates how the motivation of the farmers can be further addressed by the

inclusion of the agency and sustainability pillars to food security. Thereby, indicating a link between the additional pillars of FNS and positive PysCap of the farmers.

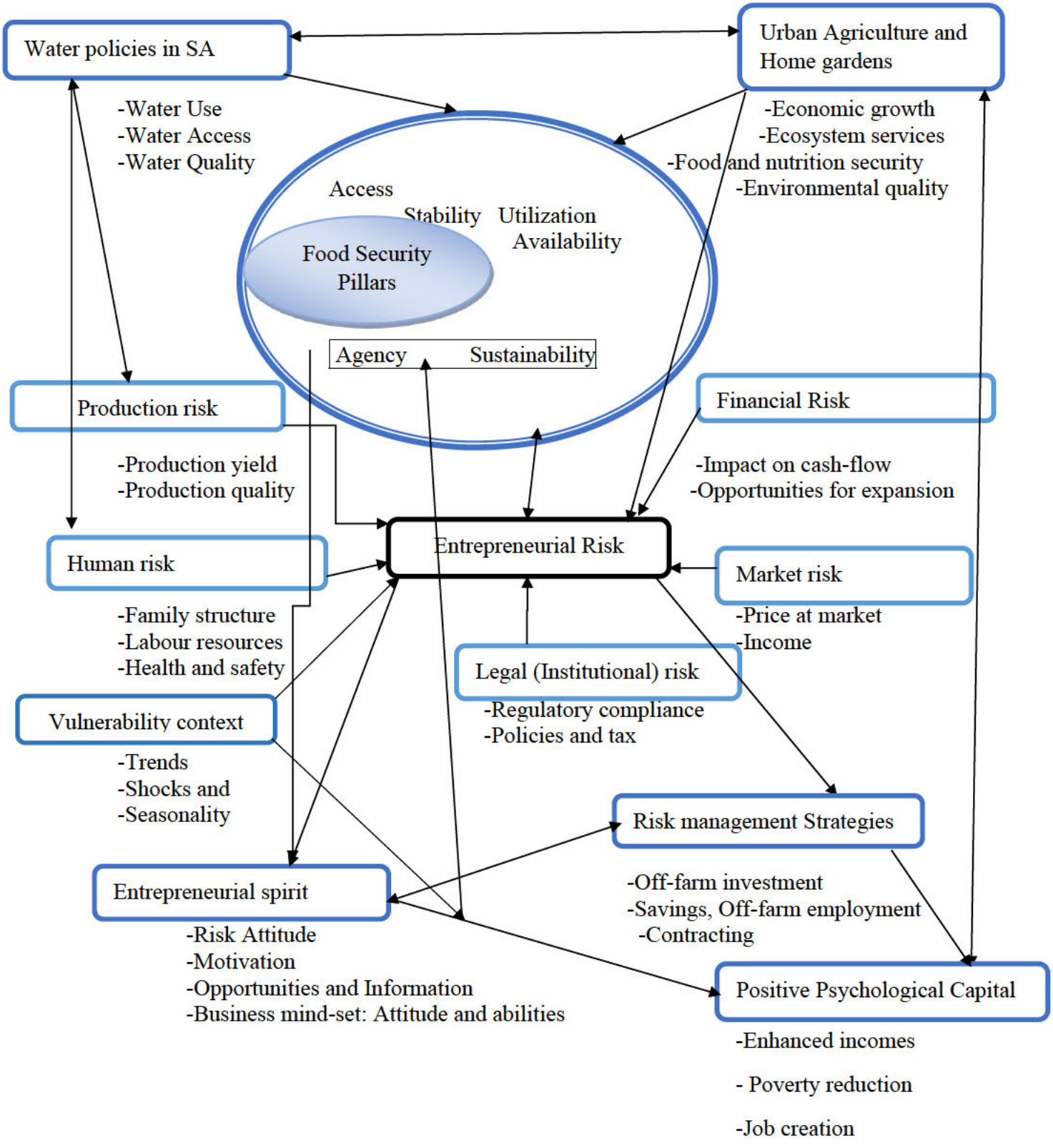

FIGURE 2.4: THE LINK BETWEEN WATER POLICIES, URBAN AGRICULTURE, ENTREPRENEURIAL RISK, POSITIVE PSYCHOLOGICAL CAPITAL IN FOOD SECURITY.

Source (s): Adopted from Korir, 2011; Cele, 2017; Lal, 2020; Clapp *et al*., 2021.

2.13 Institutional framework on Urban Agriculture

The institutional risk is defined as the institutional framework influenced by some factors and such including community self-organisation before the adoption of official UPA (Urban, Peri-urban Agriculture) policies, the location of the UPA process, and mechanisms within the government bureaucracy such department of environment, social department and economic department (Cabannes, 2012). The issue of institutionalisation and anchoring is complex as it directly impacts the longevity and stability of the UPA, however, equally because it raises the question of the "equilibrium point" (Cabannes, 2012). It is noted that UPA is a dynamic policy area, there is so much work to be done in securing legal status at the national, regional and municipal levels that protect the UPA while enabling broad participation and citizen inclusion in decision-making about UPA (Cabannes, 2012).

The presence of extension officers helps mitigate the risk for farmers by giving them less risky alternatives in terms of farming. Since risk management is also a risky endeavour, as there are too many unknown variables from the beginning to the end (Korir, 2011). The unknowns range from, prices, weather, labour, diseases and pests; and the strategies in place are at best the only estimates of how the farmers can cope with the range of risks, (Kahan, 2013). Making experience an important factor in estimating risk, as more experience means better management of risk and making of reasonable risks, however, an understanding of the presence of a risk factor should always be a priority as the farmers can never be fully protected from risk (Kahan, 2013). According to (Mudhara *et al*., 2014; van Veenhuisen & Danso, 2007), UA has multiple functions which produce things of value to the households or the general urban public, hence, the emphasis on its role in the city's sustainable development by the households and stakeholder. The social policy dimensions refer mainly to but not exclusively to subsistence-oriented types of UA that form part of the livelihoods strategies, of the urban poor, and mainly focus on producing food and medicinal products for the household (van Veenhuisen & Danso, 2007). They (van Veenhuisen & Danso, 2007;), also illustrated the importance of UPA in society as it includes social inclusion, poverty alleviation, community development, HIV-AIDS mitigation food security, even though it's not profitable. Furthermore, Mudhara *et al*., (2014); Ratshitanga; (2017) note that there are no institutions that support the urban farmers in SA, even though the country has extension services available, as they found that agricultural extension services were poor and farmers were not previewed to necessary production information and encouraged to engage in UA.

2.14 SUMMARY

The section reviewed the literature on water access, use and quality in urban agriculture, and how water quality influences the behaviour of the farmers and consumers. Further review indicated that even though WW re-use was acceptable to some farmers in other regions in the world others found the risks far greater, and were not willing to compromise on the quality of water used even though WW re-use ensured increased quantity. A further review of literature based on entrepreneurial risk factors that affect UA found that there were several risk factors affecting agriculture. However, smallholder farmers are still failing to manage the risk due to capital constraints, and lack of information and knowledge. The section also presented the theoretical and conceptual framework of the study as well as the empirical literature to illustrate the knowledge gap. The following chapter will present the study description and the different descriptive statistical measures used in the study as well as the motivation for the site selection.

CHAPTER 3: RESEARCH METHODOLOGY & STUDY AREA

3. INTRODUCTION

This section presents the description of the study areas. The subsequent sections described the study areas, the sampling procedure and sample size, the data collection and survey instruments as well as the data analytical techniques. The study's mode of data collection included a primary source of data from focus group discussions and questionnaires on the risk perception and behavioural changes of the farmers, as well as that of key informant's interviews.

3.1 STUDY AREA

This section gives the historical and brief overview of the study areas that is, Sobantu, Sweetwater and Mpophomeni Township(s). The study areas are further described individually below.

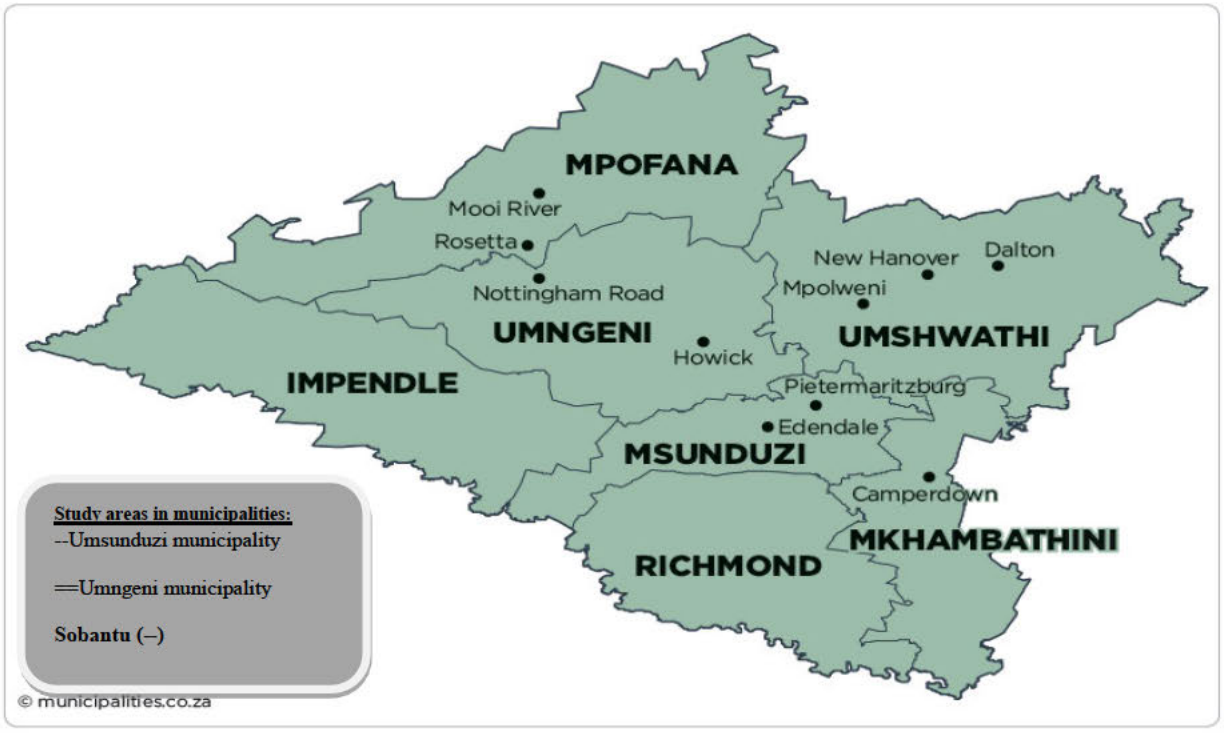

FIGURE 3.1: MAP HIGHLIGHTING THE AREAS THE DIFFERENT MUNICIPALITIES IN UMGUNGUNDLOVU DISTRICT.
Source: Integrated Development Plan 2020/2021.

The study was conducted in the KwaZu Natal province, in the Pietermaritzburg (PMB) in different regions. The province is one of the best watered provinces, and has a large area of agricultural land, as such is the national leader for several agricultural commodities. The areas of study were located in the urban and non-urban regions in PMB which is under the uMgungundlovu district. The district is located in the midlands between Pietermaritzburg and the Drakensberg, where there are great agricultural activities, despite the size of the region. The population size in UMgungundlovu District in KwaZulu-Natal is 1 095 865 according to 2016 HH survey, a 10.8% growth from the 2007 population size in the district (StatSA, 2017). The district has several municipalities under it; however, the study only took place under two municipalities that is Umngeni and Msunduzi municipality. The municipal population sizes are

109 867 and 679 039 respectively of the total population in the district (StatSA, 2017). The selected participants in the study areas are from Sobantu, Mpophomeni and Sweetwater. The areas that were selected for the study were chosen for close proximity to the urban areas and those that are outside the urban centres to allow for comparison between the two groups.

3.1.1 Sobantu Township

Sobantu is located on the outskirts of Pietermaritzburg in the province of KwaZulu-Natal. The area is under the Umsunduzi local municipality, in uMgungundlovu District. The township covers an area of 1.16 km2 with a population size of 30 000 (Integrated Development Plan, 2020/2021). The main employment for people in this township is at nearby factories. The area has two rivers that run through the town and there are numerous flood plains associated with the rivers. Sobantu has a comparatively flat topography, is well drained and surrounded by two rivers; Umsunduzi River and Baynespruit River. The farmers use both rivers as a source of irrigation for small-scale agriculture and also used for other various human activities such as fishing.

According to Partridge & Maud (2000), they indicated that Sobantu Township is located on a flood plain and with limited further housing development. Agriculturally, however, the area has high potential based on the good soils located at the 50-year flood line. The noted agricultural activities in the study area include several community gardens and individual small production units or home gardens (Cebekhulu, 2016). The Sobantu community comprises formal and informal residential areas and is located toward the lower reaches of the Baynespruit River. Historically and currently, the community used the flood plains for agriculture and the interest in initiatives to develop further agriculture on the flood plains for agricultural purposes has increased (Govender, 2016). The area can be classified as a close-knit community, with close facilities such as schools, clinics, community halls and shopping centres and factories. Sobantu was purposively selected because as the areas had farmers who were experienced in urban agriculture, and were part of the Umngeni projects. The area has land in the homes of the farmers or near their homes in previous dumpsites; the areas are fenced to keep out the livestock and other wild animals from coming into the fields. The farmers in the area grow vegetables such as spinach, cabbages, pumpkins, maize, imifino, onions, amadumbe, beetroot, tomatoes, potatoes, carrots, and kale and spring onions.

3.1.2 Mpophomeni Township

Mpophomeni was another study area; it is a Peri-urban township in KwaZulu-Natal Province. Mpophomeni which means “home of the falls” is located outside Howick, 28.3 KM from Pietermaritzburg central town. It was established in 1972 to provide housing for people who were moved from the areas of Howick West, Cedara, Merrivale, Zenzele Location, Tweedie, Lion’s River and Lidgetton (Baiyegunhi & Makwangudze, 2013). The population was estimated at 35 000 people, with a more than 18 % unemployment rate in 2018 (IDP, 2020), with those in formal employment working in and around the Howick area, Hilton, and Mpophomeni shopping Centre and Pietermaritzburg. Mpophomeni, was marketed as part of the ‘Zulu tourism experience’, is surrounded by waterfalls and is close to the Midmar Dam (Mathambo & Richter, 2007). The area is mostly populated with households that are subsistence farmers and a very small proportion who are smallholder farmers (Baiyegunhi & Makwangudze, 2013**)**. The challenges that the community face is high unemployment rates, and pollution in the area which cause degradation of the soil and water quality used for irrigation for those that use water from rivers in the area, dams and springs (van Deventer, 2012).

The area can be classified as a close-knit community, with close facilities such as schools, clinics, community halls and shopping centres. The area has land in the homes of the farmers or near their homes in previous dumpsites; the areas were also fenced to keep out the livestock and other wild animals from coming into the fields. The farmers in the area grow vegetables such as spinach, cabbages, pumpkins, maize, imifino, onions, amadumbe, beetroot, tomatoes, potatoes, among others Mpophomeni Township was purposively selected for the study, as there is a high incidence of poverty, a high unemployment rate and the high dominance of urban agriculture home gardens, and pollution which is attributed to the deterioration of the water quality in the catchment areas. Mpophomeni has a wastewater treatment plant located adjacent to the Mthinzima River which historically treated domestic wastewater (van Deventer, 2012). The observed and potential impacts within Mpophomeni range from solid waste in and around waters sources, to the damaged and inadequate sewage infrastructure, etcetera. As seen in **Figure 3.2** where there are numerous pollutants which can affect the health of the river and the soils in the area.

FIGURE 3.2: OBSERVED POTENTIAL EFFECTS ON WATER QUALITY IN MPOPHOMENI TOWNSHIP IN THE UPPER UMNGENI CATCHMENT FEEDING MIDMAR DAM.
Source: Survey 2021

3.1.3 Sweetwater's

Sweetwater's is a semi-urban area located on the outskirts of Pietermaritzburg. It is 18km wide and is under the authority of a Chief and Izinduna, who govern the area. Sweetwater's is located in the Umsunduzi Local Municipality, under the Umgungundlovu District. It covers an area of approximately 12.94 km2; with a population size of approximately 14 417 (Integrated Development Plan, 2011/2012). Approximately half of the households are involved in subsistence and smallholder farming in Sweetwater's. The major problem facing Sweetwater's is high rates of unemployment and poverty and people lack the capacity to produce enough food (Integrated Development Plan, 2020/2021). The area is found to be under dual leadership, as there is an area under the chief authority and an area where there is no chief or Izinduna. The non-urban farmers in the study mostly came from Sweetwater. They were found to have bigger plots of land and were able to plant different commodities, which varied from those produced by the urban farmers. The areas were purposely selected as it is somewhat urban but still has some characteristics of rural areas. Sweetwater's was found to have farmers who were engaged in traditional farming (growing maize, pumpkins, amadumbe), while the other farmers were involved in the growing of leafy products such as spinach, mealies, cabbage, tomatoes, chillies, beetroot and kale.

3.2 Sampling Procedure and Sample Size

The study used a mixed-methods approach, which involved both the quantitative and qualitative techniques for data collection, to increase the reliability of the research. The use of either the qualitative or quantitative technique alone does not give the full picture, as there will be some level of deficiency by the researcher. The qualitative research approach is an investigation in which data is collected in a one-on-one situation by interacting with the selected individuals (Creswell, 2003). Furthermore, Hsieh & Shannon (2005) found that the qualitative approach of answering the questions about the nature of the problem, assist to understand the point of view of the participants. The targeted participants in the study were the urban and urban farmers. The urban farmers were characterised by reduced land size or rented land, the close proximity to markets, the dependency on other sectors for employment as well as the multiple sources of income in the HH. The non-urban farmers had access to larger plots of land, the dependency on farming as a source of HH food production as well as pensions, social grants and remittances as an additional source of income. To get the targeted participants in the study, relevant authorities were made aware of the research and proper procedure was followed.

The sample size was limited by factors such as population size in the respective areas, as well as the number of individuals engaged in UA and those who were non-urban. Data collection was phased out into multistage, where in the first stage was the focus group discussions (FGD) which were conducted with the urban farmers (48) and non-urban farmers (30) and (6) key informants (that is, extension officers, Hello-Choice, UMEDA, DUCT) who were part of the study. Subsequently, a survey was conducted using structured questionnaires with the respondents who were asked questions and gave applicable responses. The structured questionnaire was designed to capture the demographics, farming type, livelihood strategies, farming techniques, water quality, and entrepreneurial risk measures in farming as well as market access. The structured questionnaire was pre-tested on 10 households in Sobantu that were not part of the actual survey, the questionnaire was then modified, finalised and administered in the study. Questionnaire pre-testing was used in improving the translation of some of the critical questions in the questionnaire to the local language. Pre-testing was also used to improve the reliability and validity of the questionnaire that is, ensuring that there was consistency in measurement and ensuring that the instrument measured what it was intended to measure. The questions that were ambiguous and culturally insensitive during questionnaire pre-testing were amended.

3.2.1 Sampling Procedure

Sampling is very critical to the study as this is when the researcher chooses the participants for their study (Williams, 2007). The target population for the study were household members from the different communities and key informants within the two municipalities who are engaged in urban and non-urban agriculture. The study used a multistage sampling technique. The first stage involved the purposive selection of the list of the locations (Pietermaritzburg and Howick) based on the Umngeni resilience projects. According to Creswell & Poth, (2017); Maxwell (2012) a purposive sampling is defined as the type of sampling, in which particular settings, persons or events are selected deliberately to fit certain criteria for the research. The second stage involved a simple random selection of respondents (both urban and non-urban farmer). Sampling is designed according to the specific characteristics considered to be important for the study objectives (Teddlie & Yu, 2007). The farmers that formed part of the

study were selected to fit a certain criterion of being urban or non-urban farmers, to allow for different comparisons between the groups. The urban farmers were smallholder farmers; this was done to capture the developmental paths and challenges or constraints of progressing to the next level for each farmer. While the non-urban farmers were more established farmers, and had extensive farming experience. The study aimed at having 100 participants for the study, however, due to the budget, time and limited participant due to lockdown restrictions due to COVID-19 outbreak; the study ended up with only 78 participants from the three study areas. The study used a survey questionnaire to obtain data on the smallholder urban and non-urban farmer's demographic characteristics, their thoughts, beliefs and perceptions and how they conduct their farming activities, focussing on the entrepreneurial risks and water quality in their farm operations.

3.2.2 Justification for sample selection

The purposive selection of the three schemes was done using the Water Research Commission's (WRC) project requirements. The study was part of the entrepreneurial risk linked to water quality, water security for urban-based farming and agro-processing project. The WRC project seeks to find ways of linking water quality to urban farming and evaluate the entrepreneurial risks relating to urban-based farming, in urban farms and home gardens to address food security at the household level. The selection of the urban farmers was based on the following criteria:

-The farmers are located in areas that are close to rivers or water sources.

-The farmers are near the markets

-The farmers have other non-farm or off-farm economic activities

-The farmers have fewer social conflicts and is already exposed to the urban farming methods

-The farmers have water source available to them regardless of type.

-The farmers were either urban farmers or non-urban farmers to allow for comparison

The main factors considered when selecting the farmers were diversity amongst farmers, and their potential to expand. The farmers are surrounded by factories, schools, and industries, which form a market for the farmers in the study areas. The rest of the products are sold to the community and surrounding supermarkets and Spaza shops. The farmers are also closer in proximity to the nearest town that is Pietermaritzburg and Howick. Before the commencement of the study, three focus group sessions and a workshop took place, to ascertain the source of water source for the farmers and the type of crops grown in the areas. It was found that the farmers in Sobantu were using water from the Umsunduzi River and Baynespruit River; further discussions revealed that river water was not their only source of water as there was also the use of tap water, borehole water as well as communal tap water. The farmers in Mpophomeni were found to be using mostly water from the taps, springs and rainwater harvesting as well as river water. The farmers in Sweetwater's were also found to be using water from the taps and nearby streams and the Umsunduzi river water. The farmers from all the study areas revealed that they were paying for the municipal water they were using, however, those using the river

water did not have full water rights for the water they were utilising. The discussions revealed that the farmers were unaware of the quality of the water they were using as they have never had it tested, even though Duzi-Umngeni Conservation Trust (DUCT) does water quality checks and ensures the river health is maintained. However, the farmers have never had it tested independently, to have assurance of the quality of water used for irrigation purposes.

The data collected was meant to generate knowledge for a better understanding of the entrepreneurial risks faced by the urban farmers in the study areas and the water quality effects on urban agriculture. It was therefore important to evaluate the psychological capital of the urban farmers. Urban farmers are relatively small when compared to the smallholder farmers in rural areas as well as commercial farmers, heterogeneity is thus vital. The three study sites were selected to account for the diversity in the Kwa-Zulu Natal agricultural environment.

3.3 Data Collection and Survey Instruments

The study used several modes of data collection, using different instruments. The data was collected through various interactions with the participants in the focus group discussions, farm observations, as well as through conducting surveys.

3.3.1 Data Collection Methods

The study used questionnaires, observation and focus group discussions for data collection, from both groups in the study. The data was collected over a period of ten days that is, five days in Mpophomeni and Sweetwater's in November 2021, and over five days telephonically with the farmers from Sobantu in October 2021. The data of the urban farmers was collected from participants in Sobantu and Mpophomeni; while the data from the non-urban farmers was from farmers in Sweetwater. Prior to data collection, other participatory activities such as meeting with the community gatekeepers for the required permission were conducted. There were also meetings with the farmers which aimed at the exposition of the research project and the benefits of the research for the farmers through experimental learning and these were amalgamated. The questions were pre-tested on 10 smallholder farmers who were randomly selected but were not part of the study. Due to the language barrier for some of the farmers, the questionnaires were thereafter administered to the farmers in IsiZulu to ensure that the research captures what is intended. The questions that were not clear during questionnaire pre-testing were modified to make them straightforward. Possible responses that were not captured in the closed-ended questions were also added to reduce the number of responses getting too 'other' as response.

3.3.2 Survey Instruments

Primary and secondary data were collected in a bid to achieve the objectives and also answer the research questions of the study. Primary data was collected directly from the participants in the urban and non-urban regions in the form of interviews (telephonically or face to face) using a structured questionnaire. Secondary data was collected through a series of a literature reviews from various authors on the policies that govern water access, use and quality in urban settings, and determining the risks of entrepreneurship in urban areas for smallholder farmers.

Survey

The study used a survey questionnaire to obtain data on the respondents who are urban farmers through demographic characteristics, their thoughts, beliefs and perceptions (Denzin & Lincoln 2000), and how they conduct their farming activities, focussing on the entrepreneurial risks and water quality in their farm operations. The questionnaire was structured in a manner that allowed for open and close-ended questions to be asked, giving the respondents room to express themselves without being restricted in their knowledge of observations, feelings, experiences and perceptions on the use of wastewater in agriculture as well as their perception of entrepreneurial risk in agriculture. The close-ended questions were included to allow respondents to rank their responses in the questions provided. The questionnaire was divided into four parts including demographic information, water use, quality and access, as well as the perception of entrepreneurial risks faced by urban farmers and how they mitigate against the risks, as well as the psychological state of the farmers.

Focus Groups

Focus group discussions were conducted to obtain in-depth qualitative information on the impact of entrepreneurial risk, and the effects of water access, and use on urban farms. According to Kruger (2000), a focus group is a carefully planned discussion designed to obtain opinions on a well-defined area of interest in a tolerant, free and comfortable setting. Neumann (2002) describes a focus group discussion as a type of qualitative research in which a group of people are asked about their attitude towards a product, their perception, beliefs and perspective to create a meaningful understanding of their situation. In focus group discussions there are multiple points of view, perspectives and answers, in a short time frame, then could be provided in an individual setting (de Vos *et al*., 2002). Upon further review, de Vos *et al*., (2002) found that focus group discussion enhances deep thinking and argument from respondents, thus providing a wide range of information for analysis. The data obtained from focus group discussions together with the information from questionnaires provide a more detailed answer to the research question and overcome the weaknesses and limitations of a single approach (Creswell, 2013). The study the focus group discussions included the farmers, the key informants, that is the extension officers, other stakeholders such as UMEDA, Hello-Choice, and AgriSeta. The study hosted three workshops in total, which formed part of the FGD and participatory learning in the field, with one of the key informants (that is UMEDA).

Key informants

Key informant interviews are aimed at obtaining a general idea regarding the extent to which the indigenous knowledge practices are applied in each study village and identifying farmers who could be used as case studies conducted (Creswell, 2013; 2003). The study had six key informants from different organisations. The key informants were extension officers, Hello-choice (an online market outlets), UMEDA, AgriSeta, DUCT, as well as the ward councillors from the area (s).

3.4 Data analytical techniques

Different econometric models were used to achieve the specific empirical objectives of this study. **Table 3.1** gives the specific objectives and the corresponding analytical methods that

were used. Descriptive statistics were used to supplement these results and show the endowment of different smallholder farmers in Pietermaritzburg, KwaZulu-Natal. According to Birner & Resnick (2010), a promising research strategy combines qualitative case studies with quantitative modelling in such a way that each informs the other. The case studies can help to discover how policy change occurs and to identify the factors that influence processes of change (Cele, 2017). The emphasis in the fieldwork was mainly on the smallholder urban farmer's perspective, by studying how they explain their preferences, decisions, challenges and opportunities. This was achieved through the use of surveys, and focus group discussions. Equally important was the analysis of what factors are involved in influencing those processes according to their explanations. An important note to make in analysing the data was that certain aspects of the variables like water quality, psychological capital and entrepreneurial spirit are perception and behaviour based. Therefore, to capture the richness of the smallholders' experiences one needed to account for such factors. The approach was justified by the fact that the farmers are the key factor in the process of smallholder development and so the farmer's viewpoint was crucial to this study (Morgan *et al*., 2010). The following programmes SPSS 27, Microsoft Excel and STATA V17 were used to analyse the data.

TABLE 3.1 SUMMARY OF THE STUDY METHODOLOGIES FOR THE SPECIFIC OBJECTIVES

Objectives	**Data to be collected**	**Data Collection Tools**	**Data analysis**
-To assess and analyse the relevant policies impacting water access, use, and quality for urban agriculture.	- Policies on access to water by urban farmers - Factors influencing the use and quality of the water available.	-Focus groups -Questionnaires (Survey)	-Thematic Analysis -Descriptive Analysis -Content Analysis -Principal Component Analysis
- To determine the entrepreneurial (financial, production, human, market and institutional) risk factors associated with engagement in urban agriculture and their effects on water quality and use.	- Perception on water use and quality - Factors influencing the prices at the market - The effects of urban agriculture in entrepreneurship. - Entrepreneurial risk factors	-Focus Groups -Questionnaires (Survey)	-Descriptive Analysis -Frequency Tables -Logistic Regression analysis - Principal Component Analysis
- To investigate the implications of urban agriculture and entrepreneurial risk on food and nutrition security in low-income households.	-PESTEL effects on the urban farmer's income generation -The effects of entrepreneurial risk factors on HH income - Income generation effects on food and nutrition security	-Questionnaires (Survey) -Focus groups	-Thematic Analysis - Descriptive statistics -PESTEL Analysis

3.4.1 Thematic Analysis

Data analysis is essential in summarising the collected data; it assists in the interpretation of data gathered using analytical and logical reasoning (Braun & Clarke 2012). Thematic analysis will be used to analyse the data collected for this research. Thematic analysis is one of the most common forms of analysis and it helps in identifying, interpreting and analysing patterns of meanings in the data (Braun & Clarke, 2012). This method of analysis was suitable for this research as it guides the researcher's choice of theoretical framework, appropriate research questions and data collection methods. Thematic analysis can be used to explore questions around participants' lived experiences, perspectives, behaviour and practices (Guest *et al*., 2011). This analysis allowed for the research to capture the responses of the participants using different themes relevant to the study.

3.4.2 Content Analysis

According to (Berelson, 1952; Krippendorff, 1980; Weber, 1990 and Stemler (2000)) Content Analysis (CA) is defined as the systematic, replicable technique for compressing many words into fewer content categories based on explicit rules of coding. Holsti (1969), further defined CA as the technique that is used to make an inference by objectively and systematically identifying specified characteristics of messages. CA allows the researcher to shift through large volumes of data with relative ease in a systematic manner (Stemler, 2000). It allows for inferences to be made which can then be corroborated by using other methods of data collection (Viasmorado *et al*., 2013). Content analysis can be used in determining the trends and patterns in documents (Stemler, 2001). This study evaluated relevant water policies in place that impact urban and non-urban agriculture in terms of access, use, and quality, and the ultimately effect on food security at an individual and household level.

3.4.3 Descriptive Statistics

The descriptive analysis was performed using averages and mean difference tests, Chi-square ($\chi 2$) test, and percentages to compare socio-economic characteristics of smallholder urban farmers' typologies. The descriptive analysis involved looking at means, frequencies and standard deviations of the variables. Some of these variables were then later used as explanatory variables in the logistic regression model.

3.4.4 Principal Component Analysis

Large datasets are increasingly available worldwide in several disciplines, to interpret such datasets methods are required to drastically reduce the dimensionality in an interpretable way to allow for the data to be preserved (Jolliffe & Cadima, 2016). The Principal Component Analysis (PCA) method makes this possible as it reduces the data set without eliminating much information. James *et al*., (2013), explain the PCA as a popular approach to deriving a low-dimension of features of a large set of variables. Many techniques have been developed for this sole purpose, but PCA is one of the oldest and most widely used. The idea is to simply reduce the dimensionality of the dataset while preserving as much "variability" (that is statistical information) as possible (Jolliffe & Cadima, 2016). James *et al*., (2013), also attest to this as they state that the PCA method allows for the summary of the set with a smaller number of representative variables that collectively explain most of the variability in the original set. To use the principal components regression, they just simply use principal components as

predictors in a regression model in place of the original larger set of variables (James *et al*., 2013). This was also the case in the study by Magingxa *et al*., (2009), where they used the PCA to reduce the large data sets and then predictors were used in the logit regression model using the component loadings found from the analysis.

Principal component analysis as an explanatory tool for data analysis

The standard context for PCA as an explanatory data analysis tool involves a dataset with observations on *p* numerical variables, for each of the *n* entities or individuals (Jolliffe and Cadima, 2016). The data values define the *p n*-dimensional vectors $x_1,\ldots,x_p$, or equivalently, an *n* x *p* data matrix X, whose *jth* is the vector x_j of observations on the *j*th variable (Jollife and Cadima, 2016) , seeking a linear combination of columns on the matrix X with maximum variance. James *et al*., (2013), also notes the importance of low dimensionality provided by the PCA method which ensures that there is much variation kept in the data set. Where the idea is that each of the *n* observations lives in *p*-dimensional space, but not all this information is equally interesting. The first principal component of a set features X1, $X_2,\ldots,X_p$ is the normalised linear combination of the features that has the largest variance.

$$Z1 = Ø_{11}X_1 + Ø_{12}X_2 + \ldots\ldots + Ø_pX_p \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.1)$$

Where normalised means that $\sum_{j=1}^{p} ø_{j1}^2 = 1$.

Referring to the elements $Ø_{11},\ldots..,Ø_p$, as the loading of the first principal component; together, the loadings make up the principal component loading vector, $Ø_1 = (Ø_{11}, Ø_{12}\ldots.Ø_{p1})^T$ (Jollife, 2002). Jollife & Cadima (2016) also found that a linear combination is given by $\sum_{j=1}^{p} ajxj = Xa$, where **a** is a vector of constants $a_1, a_2,\ldots,a_p$. The variance of such linear combinations is given by Var (Xa) = a'Sa, where S is the sample covariance matrix associated with datasets and *'* denotes transpose (Jollife & Cadima, 2016). Furthermore, PCA has been used by various researchers (E.g. Filmer &Pritchett, 2001; Jollife, 2002; Magingxa *et al*., 2009; James *et al*., 2013; Muchara *et al*., 2014). The studies on entrepreneurship are usually measured using an index (Lichtenstein & Lyons, 2001; Acs & Szerb, 2009; Marcotte, 2013) both at the national and individual level.

Bartlett's test of sphericity was applied to check if the observed correlation matrix diverges significantly from the identified matrix. Furthermore, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was also applied, a value above 0.5 implying PCA could be performed. To better interpret the meaning of estimated components, the varimax rotation method was used. This method does not change the outcome, but it aims to make fewer variables have relatively larger factor loadings that can be easier to interpret. In this study, only factor loadings greater than 0.30 were included in the interpretation of the results.

3.4.5 Logistic Regression

The binary logistic model was used in this study for analysing the factors that influence entrepreneurship in low-income households of smallholder farmers. The binary logistic model has advantages that make it easier to compute and interpret than others. Also, it does not assume a linear relationship between the dependent variable and the independent variables. Due to the linear requirement of linear models' independent variables concerning the dependent variable, heteroskedasticity is eliminated. The study assumes two possible outcomes "urban agriculture

participation" or "non-participation in urban agriculture". A binary equation is set up which defines Y=1 for a situation where a farmer is participating in UA entrepreneurship or Y=0 in a situation when a farmer is not participating in UA entrepreneurship.

The linear equation: $E(Yi) = \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots\ldots + \beta nXn$ ……. (3.2)

The above linear equation is not appropriate because the dependent variable (Yi) in this case is not binary (Cele, 2021). For the outcome of the dependent variable (Yi) to take on the binary value, a special function $f(E(Yi))$, known as the logistic function must be found. The special function is as follows: $f(E(Yi)), = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta nXn$ .....….. (3.3)

Where the outcome, Yi takes the value of 1 with probability pi and the value of 0 with a probability 1-p, thereby resulting in logistic regression model being as follows:

$$\text{Logit (Pi)} = \ln (Pi/\ 1\text{-}Pi) = ß_0 + ß_1 X_1 + \cdots + ßnXn + Ɛt \quad . \cdots\cdots\cdots . . \quad (3.4)$$

Where:
ln (Pi / 1 - Pi) = logit for urban agriculture participation
Pi = participation in urban agriculture
1-Pi = non-participation in urban agriculture
$ß_0$ = Intercept
$ß_1$, ßn, = binary regression coefficients
X = explanatory variables
Ɛt = error term

The **table 3.2** below further illustrates the variables employed in the analysis of the factors that influence UA in the study areas.

Dependent: Urban agriculture participation: The binary variable takes a value of 1 for urban agriculture those who are actively involved in urban agriculture that is "Agriculture, Forestry and fisheries" and 0 otherwise.

Age: Refers to the age of an individual respondent

Land size: Refers to the land size used for farming

HH income: The response categories were, 1= Pension, 2=farming, 3=Remittances, 4=Casual income, 5=Social grants, 6=Pension and farming and 7= Wages. In the logistic regression the farmers were able to select more 2 sources of income, but the main source of livelihood was used as a reference category.

Education: The respondents were asked to state the highest education level attained. Their responses were categorised into six category groups. Where 1=No formal education, 2=Primary education; 3=Secondary education; 4=Vocational Training; 5= Completed primary & Secondary school, and 6=other. In the logistics regression analysis, the first group was used as reference category.

Gender: The binary variable takes either 0 for male or 1 for females.

Farmer type: The binary variable takes on the value 1 for the participants that are urban farmers or 0 otherwise.

Farming experience: The binary variable takes 1= for having less than 5 years farming, 2= from 6-10 years farming; 3= from 11-15 years farming; 4= between 16-20 years farming; 5= from 21-30 years farming and 6= for more than 31 years farming.

Psychological capital: The respondents were asked questions on their psychological capital and the HERO index was used, 1=Hope, 2=Efficacy, 3=Resilience and 4=Optimism. In the logistic regression analysis, the first group was used as reference category.

TABLE 3.2: DESCRIPTION OF EXPLANATORY VARIABLES USED IN THE LOGIT MODEL

Variables	**Description**	**+/ -**
Urban Agriculture participation	(1=Yes, 0=Otherwise)	-
Age	Age of respondent (Years)	+
Gender	Gender of respondent (1=Male; 0=Otherwise) Dummy	+
Hh_income	Household Income (1=Pension; 2=farming, 3=Remittances, 4=Casual income, 5=Social grants, 6=Pension and farming and 7= Wages)	+
Education level	Farmer education level (1=No formal education, 2=Primary education; 3=Secondary education; 4=Vocational Training; 5=Completed primary & Secondary school, and 6=other)	+
Land_size	Land size household has access to (Ha)	+
ENTRP1_environmental hygiene	Farm and market hygiene conditions	-
Farm_experience	Farmers farming experience (in Years)	+
ENTRP2_market price	Price risk management (1=Yes; 0=Otherwise) Dummy	-
Farm_training	Agricultural training (1=Yes; 0=Otherwise) Dummy	+
Water_quality (WW used)	Wastewater contains pathogens (1=Yes; 0=Otherwise) Dummy	-
Entrp3_inmrkt1,2	Easy market entrance (1=Yes; 0=Otherwise) Dummy	-
Psychological_capital	Psychological capital index= Hope. Efficacy. Resilience. Optimism (HERO)	+

3.5 SUMMARY

The study was conducted in three study areas, namely, Sobantu, Mpophomeni and Sweetwater's which were in and around Pietermaritzburg, KwaZulu-Natal. The chapter provided the background information on the study areas, and giving the reasons for the selection. A total of 78 participants were selected using multistage sampling technique that is purposive and simple random sampling methods. The study employed structured questionnaires, focus group discussions and key informant interviews to gather the data. The questions used to collect the data were guided by the conceptual framework that was designed for the study to ensure that all the information needed was gathered. To analyse the data, the

study used descriptive statistics, content analysis, thematic analysis and principal component analysis, as well as logistic regression analysis, to answer the research questions of the study. The following chapters 4 & 5 present the empirical results and discussion for the study using the studies objectives where the 1st objective will be addressed in Ch4 and the 2nd and 3rd objectives are addressed in Ch5 and Ch6, respectively. Chapter 7 will give the conclusions and recommendations based on the study's results, in terms of policy implementation.

CHAPTER 4: **The effects of water policies on water access, use and quality: implications on urban agriculture (UA).**

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ABSTRACT

The competition for water in the urban areas has been present for many years, and the practice of agricultural production puts a further strain on the available water resources. With agriculture consuming a large quantity of the available water, as well as population growth; water quantity deterioration is the expected consequence of urbanisation. To manage water quality deterioration certain measures, have to be employed such as control of water resources, the use of drip irrigation techniques and water re-use. Studies have also shown that drip irrigation and rainwater harvesting techniques help mitigate the effects of climate change around the globe, while also cutting the cost of production. The study employed a review of the literature on the policies in place that govern water access, use and quality in South Africa. The case study employed a mixed-methods approach and the case study is Sobantu, Mpophomeni and Sweetwater's Township with a purposefully sampled case of up to 78 respondents. The study also employed Principal Component Analysis (PCA) and risk perception on the use of WW in UA, from the study areas. Furthermore, the study analysis incorporated a content analysis and thematic analysis of the data on the policies in place on water use, access and quality. The socio-demographic results from the 78 case participants of the survey conducted show that the respondents were mostly female (66.7%) of the participants; with a mean age of 58, and only 12.8% of the respondents were youth (18-40), which is concerning, with the current youth unemployment rates in South Africa. The results on access to water indicated that the farmers largely had a source of water (tap water) albeit not sufficient at all times. The respondents also used other sources of water such as rainwater, dam and river water as well as wastewater. The results on farmer perception revealed that the majority of the farmers were not open to using WW even though they were aware of its use in agriculture. The results revealed that there are no policies in place that are specific to urban agriculture, just those relating to water access, use and quality in agriculture. The study concluded that farmers need knowledge on the safe use of WW following the guidelines presented by the WHO, and the DWAF with the ever-rising water scarcity. Also, there is a need for more youth involvement in the agriculture sector in urban areas, to ensure continued livelihood, job creation and ensuring food security. It is recommended that policy-makers incorporate policies on water quality, use and access for the farmers and also have programmes in place to address the water issue faced by the agriculture sector. The protection of the water reserves and the perception of WW use without perception bias warrants further research in SA.

Key words: Urban Agriculture (UA), Wastewater uses (WW), Water policies, Water Quality, and Perception on WW use.

4.1 INTRODUCTION

The state of water at the global level indicates that there is a shortage of freshwater resources, due to the increase in population, which leads to over-consumption and pollution of the water sources due to human activities (Mateo-Sagasta *et al*., 2017). The global attention has focused on water access, use and quantity, neglecting the quality, as availability means nothing without the health and safety of the water. Factors such as urbanisation, climate change effects, and pollution are expected to exacerbate the water deficit problem, which is expected to increase by 27.6% in the year 2050 (Hassan & Thurlow, 2011; Scheierling *et al*., 2011). Globally 80% of the municipal wastewater is discharged into the water bodies untreated, while the industrial sector is responsible for the dumping of millions of tonnes of heavy metals, solvents and toxic sludge and another contributor of waste is the agricultural sector (Water U.N, 2017). Moreover, water scarcity globally is expected to increase by 44% in the year 2050, (Molden 2007); the increasing urban population and more urban agricultural activities are said to be contributors to the scarcity (Scheierling *et al*., 2011). To combat the effects of water shortages there is use of wastewater for irrigation in developing areas, such includes the direct use of untreated wastewater or the indirect use of rivers and streams that have been polluted by wastewater discharge (Amoah, 2008; Scheierling *et al*., 2011). However, a study done by Saldias *et al*., (2016) found that the use of wastewater was acceptable to the farmers in Cape Town, provided there was a guarantee that the water was of good quality, and safe to use and there was less restriction on its use.

The restrictions in the newly revised government gazette by the DWAF are on the use of WW for irrigation, restricted on three levels' that is high, moderate and low restrictions (DWAF, 2004; RSA, 2013; Saldias *et al*., 2016). The 'high' restriction refers to the strict measures on the use of WW on crops eaten raw, control over irrigation by periodic inspections and strict monitoring of the water use by enforcing the use of Personal Protective Equipment (PPE) clothing and allowing for resting periods before harvesting (DWAF, 2004; RSA, 2013). While the "moderate" restrictions imply that irrigation is allowed on crops not consumed raw, including fruit trees, and vineyards and there is moderate periodic inspection and regular monitoring on the use of water; and "low" refers to no restriction on crops, no restriction of irrigation methods, regular monitoring of water use (protective measures) (RSA, 2013; Saldias *et al*., 2016). Nonetheless, other studies have found that WW in cities can be safe when treated for irrigation purposes and can supply some of the nutrients required for horticultural production (Thomas, 2012). The author (Thomas, 2012) further found that farming in cities could help reduce the contamination risks by the use of eco-friendly cultivation techniques (that is drip irrigation, furrow irrigation) which grow more fruits and vegetables while cutting the cost of production, as well as increasing greener economies. However, another study found that the use of drip irrigation can also result in contamination of the crop depending on what part of the crop is harvested, and if it was touching the ground or not (Jimenez, 2007). Moreover, it was found that even though drip irrigation is the most expensive technique to implement it is mostly adopted by the farmers as it provides a benefit that other techniques such as sprayer or sprinkler irrigation do not offer to the farmers and the communities nearby (Amoah, 2008).

The water access and distribution in South Africa had been skewed and largely directed to the commercial farmers in the apartheid Era; thus, eliminating smallholder farmers and urban farmers, ultimately leading to reduced productivity as rain-fed crops are seasonal dependent (Mazibuko, 2018). The problem is the water allocation policies available which are limited to smallholder farmers and commercial farmers but are not inclusive of the urban farmers. The lack of recognition results in the use of HH-allocated water resources or the readily available

WW in cities. The water scarcity presents a challenge for the farmers, they thus opt for the use of other water sources (that is WW), which is accompanied by personal and production risks. The government restrictions, therefore, imposed certain restrictions on the WW use also bringing about other forms of risk for the farmers, production and market risk as a consequence, due to the reduced water supply available to the farmer. The objective of this study is to assess the policies on water access, use and quality in urban agriculture and how they affect farming activities. Identifying these policies will help in recommending the necessary interventions and improving the quality of water in South Africa for urban farmers. The results of the study can be essential in policy development on the use, and quality of wastewater in urban agriculture, for the government and non-government organisations. The findings of the study will contribute to the existing literature in identifying which policies, influence water use, access and quality, and of what significance they are concerning urban agriculture.

4.2 RESEARCH METHODOLOGY & STUDY AREA

The following section presents the study methodology employed in the case study.

4.2.1 Study Area and Sampled Farmers Description

The following section gives a brief overview of the study areas that is Sobantu, Sweetwater's and Mpophomeni Township(s). The study consisted of 48 urban farmers and 30 non-urban farmers totalling 78 participants from the following areas in and around Pietermaritzburg, Sobantu, Sweetwater's and Mpophomeni townships. The study sites are located under uMgungundlovu District but fall under different municipalities that is Umsunduzi and Umngeni. The farmers were purposely chosen based on the type of farming they are engaging in, their water source and their area of operation that is peri-urban or urban agriculture. The farmers were also selected using simple random selection to ensure there was probability, in the farmers selected for the study. The water sources at the farmer's disposal for the farmers were tap water, dam water, river water, rainwater, as well as wastewater. The sources are also subject to availability as seasons like winter have little to no rain for the dams and rivers. Irrigation techniques used were also a contributing factor to the water shortage that is (the use of watering cans and hosepipes emits more water than necessary). The water sources were endangered by human activities (oil spillages, dumping, and sewage spillages among others) as illustrated in **Figure 3.2**; as well as animal faecal matter in the water bodies.

4.2.2 Analytical Framework

The study employed different methodologies for the analysis of results based on the research objectives. A questionnaire was administered to 78 participants in three communities surrounding the city Pietermaritzburg, in the KZN province, South Africa. The communities are Sobantu, and Sweetwater and on the outskirts of Pietermaritzburg was Mpophomeni Township. The areas included in the study can be classified as urban (Sobantu and Mpophomeni) and non-urban/per (Sweetwater's) communities. The communities were chosen based on their location which are urban or peri-urban areas, which are associated with high levels of poverty, high unemployment rate, socio-economic vulnerability, and less adaptability (Gbetibouo, *et al*., 2010; Golder Associates Africa, 2013; Wilk, *et al*., 2013 and Hlahla & Hill, 2018); as well as their proximity to water sources such the Umsunduzi river, Baynespruit river as well as the Umngeni Catchment feeding Midmar dam. The study used thematic and content analysis to analyse the focus group discussions as well as policies in place that influence water

access, use and quality. The data on health risk was analysed using Principal component analysis to generate components which were later used in the study. Descriptive statistics were employed in the study to analyse the socio-demographic data of the respondents in the study, and principal component analysis was employed to analyse the water quality perception in the study areas.

TABLE 4.1: ANALYTICAL FRAMEWORK PER OBJECTIVE AND RESPECTIVE ANALYTICAL TOOLS

Objective	**Data to be collected**	**Data Analysis**
To assess and analyse the relevant policies impacting water access, use, and quality for urban agriculture.	- Policies on access to water by urban farmers - Farmers perception on the use and quality of the WW in UA -Farmer's access, use and quality of water in the study area	-Content Analysis -Thematic Analysis -Descriptive Analysis -PCA

4.3. RESEARCH DESIGN

The study employed a mixed-methods methodology where both qualitative and quantitative approaches to collect data were used to reveal information under the research question. The study employed a case methodology of three geographical areas, each case had various participants. Although often associated with mainly qualitative research, case study research can also be quantitative and carry elements of scientific review (Mills *et al*., 2010), as is in this study. The overall number of participants in all three cases was 78 that is (48) urban farmers and (30) non-urban farmers. Other methods employed were focus group discussions, and surveys. This type of methodology is essential for providing a strong foundation for community-based participatory research as it involves smallholder farmers, different stakeholders, markets actors, researchers and government extension officers (Ivankova, 2017). Both the purposive and simple random sampling technique was used to sample 78 participants, and the data was collected using a survey questionnaire and FGD to gather information on the access, use and quality of water, the entrepreneurial risks and their impacts on urban household incomes within the study areas.

4.3.3 Data analysis

The data was collected using a questionnaire survey during one-on-one session with the farmers, this was done telephonically with the farmers in Sobantu who had been a part of the focus group discussions before the formal collection of data. The rest of the respondents in the study were interviewed one on one, either at their farms or homes. The data collected was then coded and transcribed from Microsoft excel to Statistical Software Package (SPSS V27) for Social Sciences. For the analysis, a descriptive statistical analysis was used to summarise the demographic data as well as the sampled respondents. The qualitative data was analysed using thematic analysis.

4.4 RESULTS AND DISCUSSIONS

The results below illustrate the qualitative and quantitative data analysed in the study, where qualitative data stems from the focus group discussions with the farmers and the open-ended

questions; where the farmer would elaborate in the form of a follow-up question to the question. The data analysis focused on the farmer's profile, access to water, the quality of water as well as the risk perception of the farmers on the water they use in irrigation.

4.4.1 Farmers Profile

This section illustrated the analysis of the socio-demographic data of the urban farmers that were part of the study and the analyses are presented below. Further analysis of the water access, quality and use in the urban areas, is presented below.

TABLE 4.2**:** GENDER OF THE RESPONDENTS THAT ENGAGE IN URBAN AND NON-URBAN AGRICULTURE

Gender	**urban farmers**		**Non-Urban farmers**		**Pool**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Female	32	66,7	20	66,7	52	66,7
Male	16	33.3	10	33.3	26	33.3
Total	**48**	**100**	**30**	**100**	**78**	**100**

Source: Survey Oct/Nov 2021

The results on gender show that most of the urban farmers were female 32 (66.7%), and 16 (33.33%) were male. While the same was found for the non-urban farmers as most of the participants were female 20 (66.7%) and 10 (33.33%) were male. The results further, indicate that the most of the participants in the study were females 52 (66.7%) from both urban and non-urban areas, compared to their counterparts, with a mean of 0.33 and a standard deviation of 0.4747. Thus, indicating that most of the participants involved in UA were mostly female. This was found to be same in other African countries, where women participated to ensure continued livelihoods and economic liberation (van Veenhuizen, 2014). Another reason for more female participation was to enhance food available to the household in times of short-term shock and eliminate long-term vulnerability. The FGD found that women who are generally disempowered and with low incomes, benefit greatly from agriculture as it allows them to take on numerous roles in the household, that is take care of the household, engage in food production fields as well as engage in off-farm employment. The women in other studies have been found to engage in UA, to provide sustenance, and allow the women to work closer to home (Mougeot, 2000).

TABLE 4.3: AGE RANGE OF THE RESPONDENTS FROM THE STUDY AREAS

Age range	**Non-Urban agriculture**		**Urban agriculture**		**Pool**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
<25	0	0	1	1.9	1	1.3
26-30	0	0	0	0	0	0
31-40	2	6.7	3	6.3	5	6.4
41-50	4	13.3	9	18.8	13	16.7
51-60	9	30	8	16.7	17	21.8
>61	15	50	27	56.3	42	53.8
Total	**30**	**100**	**48**	**100**	**78**	**100**

Source: Survey Oct/Nov 2021

The results indicate that majority 27 (56.3%) of the urban farmers in the study were above the age of 61, while the same was found with the non-urban famers 15 (50%). Most (53.8%) of the farmers in the study area were above 61 years of age. While only about 8.2 % are urban farmers, and only 6.7% are non-urban farmers were within the age range of 18 and 40 years. The mean age of the both the urban and non-urban participants was 58.32 with a standard deviation of 10.986 from the mean. These results were alarming considering the unemployment rate for the past quarter (Q4 of 2021) show that 34.9% of people are unemployed in South Africa, and of those 64.4% can be classified as a youth (StatSA, 2021). These statistics should be a motivator for the youth to engage in the agriculture sector, as the household heads are almost always involved, even if it is not the main source of income within the HH. Farmers who were older in terms of age appeared to be the ones largely involved in the sector in comparison to the youth, indicating disinterest in agricultural activities. The farmers also stated that the lack of interest the youth has in urban agriculture has hindered the ageing and retiring urban and non-urban farmers from passing on their knowledge and skills of which is threatening the growth and sustainability of urban farming. This in turn will diminish the number of youth participants in UA or any other related field in agriculture.

TABLE 4.4. EDUCATION LEVEL OF THE RESPODENTS IN THE STUDY AREAS

Education level	**Urban agriculture**		**Non-urban agriculture**		**Pool**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
No formal education	4	8.3	2	6.7	6	7.7
Primary school	19	39.6	9	30	28	35.9
Secondary school	24	50	13	43.3	37	47.4
Completed primary & secondary school	1	2.1	5	16.7	6	7.7
Vocational training	0	0	1	3.3	1	1.3
Total	**48**	**100**	**30**	**100**	**78**	**100**

The level of education of the farmers' shows that majority of the farmers had some form of education apart from (7.7%) of the participants who indicated that they had no form of formal education. The results indicate that of the urban farmers participants only 4 (8.3%) had no formal education while the majority 24 (50%) received up to secondary school education. Even though some of the participants did not finish it, and those that completed both primary and secondary schooling who were urban farmers only constituted 2.1% of the participants. The results further indicate that non-urban farmers who had no formal education represented 6.7% of the participants, while majority (43.3%) reached the secondary schooling level. However, of those that reached secondary education only 5 (16.7%), completed Grade 12. The results further show that the non-urban farmer participants 1 (3.3%) attained vocational training, while none of the participants in UA had any vocational training. The mean level of education of both urban and non-urban participants in the study was 2.83, with a standard deviation of 0.797 from the mean. Indicating that most of the participants who were actively involved in UA, obtained education at either a primary, secondary level or completed secondary level of schooling. Studies have shown that the level of education of the HH head can greatly influence the food

and nutrition status of farmers, where the education level refers to the years spent in school and the level achieved. Furthermore, studies have shown that people from all educational backgrounds are involved in UA; however, the sector is largely dominated by people with no formal education or very low educational level (Amoah, 2008), contradictory to the study findings.

TABLE 4.5: INSTITUTIONAL SUPPORT FOR THE RESPONDENTS IN THE STUDY AREAS

Institutional Support in agriculture	**Urban Agriculture**		**Non-UA**		**Pool**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
-know of organisational support	24	50	10	33.3	34	43.6
-Part of an organisation	8	16.7	4	13.3	12	15.6
-Access to extension services	21	43.8	11	36.7	32	41

Responses=Y/N (values in the table reveal the Y responses)

According to Murungani (2015), extension officers facilitate the improvement of farmers' fresh produce quality and navigate the formal markets. The majority of the urban farmers indicated to were not aware of any organisation that supports urban farmers that is (50 %), while 50 % knew of an organisation that supports them as farmers. The organisations were non-governmental organisations such as Umgibe Farming and Training Institute. Only (16.7 %) of the farmers that were part of the study indicated being part of an organisation that recognises urban agriculture in the region. While (83.3%) of the respondents were not aware of any organisation that recognised them as farmers in the urban areas. The results further revealed that large number of the respondents had access to extension services in the urban areas, while only a few (36.7%) in the non-urban areas had access to extension services.

During the workshops and focus group discussions the farmers were introduced to organisations such as UMEDA (UMgungundlovu, Economic Development Agency), and DUCT (Duzi Umngeni Conservation Trust). The organisations were willing to relate with the farmersand provide them with all the relevant information on how to farm using methods that require lesser quantities of chemicals and water, while producing nutritional dense food products. The farmers were also introduced to entities that connect farmers to markets/buyers through online marketing of products that is Hello-choice. The organisations were either governmental or non-governmental. The support from the organisations could be the turning point the farmers needed to change the trajectory they were on in terms of farming. Meanwhile, during the focus group discussions, farmers revealed that they were not aware of any organisation that was responsible for the monitoring. However, it was found that DUCT, a non-profit benefit organisation was responsible for checking the water quality of Umngeni and Umsunduzi rivers in the areas which have been badly degraded due to human activities, and over-exploitation, which were used for irrigation purposes by some of the farmers. The water quality testing service was not offered by the Department of Agriculture and Rural Development at the district or local level.

TABLE 4.6: MAIN LIVELIHOOD STRATEGIES OF THE REPSONDENTS IN THE STUDY

Livelihood strategy	Urban Agriculture		Non-Urban Agric.		Pool	
	Frequency	%	Frequency	%	Frequency	%
Farming	24	50	13	43.3	37	47.4
Fulltime employment /job	4	8.3	6	20	10	12.8
Casual/Salaried Labour	5	10.4	4	13.3	9	11.5
Other (Social grant; remittances among others)	15	31.3	7	22.3	22	28.2
Total	**48**	**100**	**30**	**100**	**78**	**100**

The main livelihood strategies in the study areas are presented in table 4.5. The table shows that a majority of the participants were farming for income generation as they represented 37 (47.7%) of the total population in the study. While only 10 (12.8%) had full-time employment/jobs, as the main source of livelihood. The results further indicated that 9 (11.5%) of the participants were dependent on casual labour. About 22 (28.2%) of the respondents were dependent on sources such as social grants, remittances and gifts from friends and family as a main livelihood strategy. The mean of the main livelihood strategy was 2.21 with the standard deviation of 1.303. Farming was found to be the main livelihood, and off-farm income was found to supplement the income generated from the sale of produce from the farm. The households who mainly depend on agriculture as their main source of income have realised that one source of income is not sufficient, and thus diversification is important for smallholders, for them to reduce the risk, while also fighting poverty in a household level by ensuring food security (Maziya *et al*., 2017).

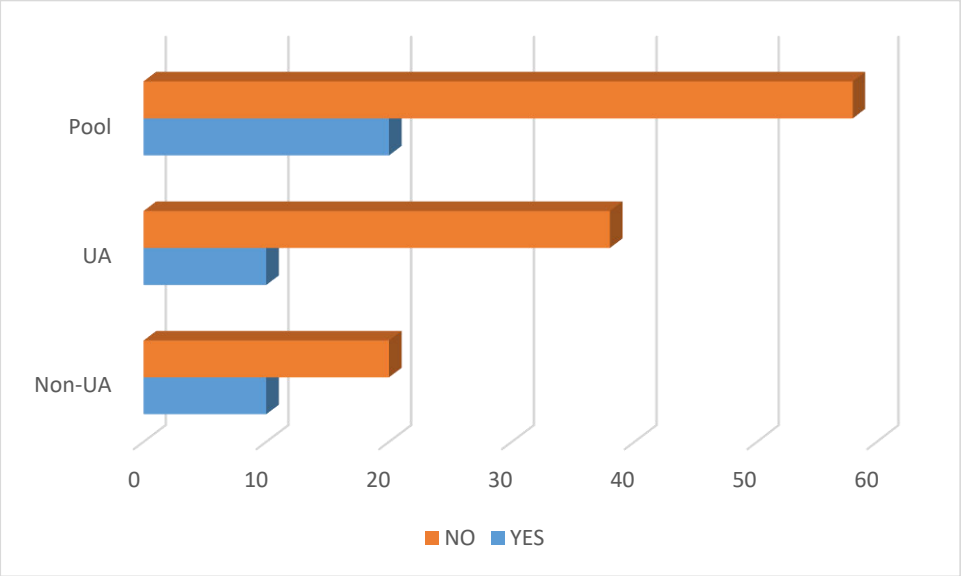

FIGURE 4.1: REPONDENTS WITH FORMAL FARM TRAINING IN THE THREE CASES.

A small number of farmers indicated having received some form of farm training 20 (25.6%) participants of the 78 said they have been trained as farmers' or have some form of agricultural training; while 58 (74.4%) indicated not having any formal training in terms of farming. The results show that of the respondents that were urban farmers in the study only 10 (20.8%) received some formal training, while the rest 38 (79.2%), and have never had any type of training in agriculture. Furthermore, the results show that of the non-urban farmers in the study

10 (33.3%) received some formal training in agriculture, while 20 (66.6%) never received any training. Even though majority of the respondents in the study were urban farmers, the majority of the respondents who had been exposed to agricultural training emanated from the non-urban farmers. The results can be attributed to the farmers not having any information as to where the training centres are at or if any centres offer such services as there are mostly farmers who were above the age of 61. The farmer training programmes are also mostly offered to the youth in a form of learner-ships, apprenticeships or formal training in agricultural institutes, thus putting other elderly farmers at a disadvantage when it comes to acquiring knowledge on the new techniques of farming. The socio-demographic data reveals that there is less youth involvement in UA, which is concerning as the youth has opportunities to gain knowledge from the elderly and the extension officers on the farming techniques that could be implemented effectively.

TABLE 4.7: FARMING EXPERIENCE (IN YEARS) OF THE RESPONDENTS IN THE STUDY AREAS

Farming exp. (years)	Non-Urban Agric.		Urban Agriculture		Pool	
	Frequency	%	Frequency	%	Frequency	%
<3	3	10	6	12.5	9	11.5
3-6	9	30	11	22.9	20	25.6
7-9	5	16.7	8	16.7	13	16.7
10-12	3	10	10	20.8	13	16.7
>13	10	33.3	13	27.1	23	29.5
Total	**30**	**100**	**48**	**100**	**78**	**100**

The farmers indicated having some years of farming experience, those that have less than 3 years of farming experience of the urban farmers accounted for 6 (12.5%), while the non-urban farmers accounted for 6 (10%). Majority of the respondents in the study had more than 13 years of farming experience whether they were non-urban 10 (33.3%) or urban 13 (27.1%) farmers in the study areas. The overall results also show that majority of the respondents had more than 13 years of farming experience, while only 9 (11.5%), had less 3 years in farming. The mean number of farming experience was 5.36 with a standard deviation of 3.732 from the mean. The number of years of experience for some of the farmers indicates that most of the farmers are very much experienced, in terms of farming; however, the techniques they may be using in their farms may needs adjustments, as the times of climate change require re-adjustments., and bone meal and emphasises techniques such as crop rotation and companion farming.

During the workshop at Sobantu Hall, farmers were introduced to the technique in theory as well as practical. The farmers noted that some of the techniques they were using were killing their soils (use of chemicals such as insecticide and herbicides) or were the reason behind the reduced harvest, as soil quality deteriorated due to soil preparation techniques used such as excessive digging of the plots an also not practising rotation planting. The farmers were then given the chance to ask questions after the session of information relayed by one of the key informants from UMEDA, which is a government entity in the district that deals with economic development at the district level. The farmers also revealed that they were using the techniques used as they allowed for reduced planting seasons, they were, however, unaware of the costs and benefits of the techniques either to them or the end users of their products.

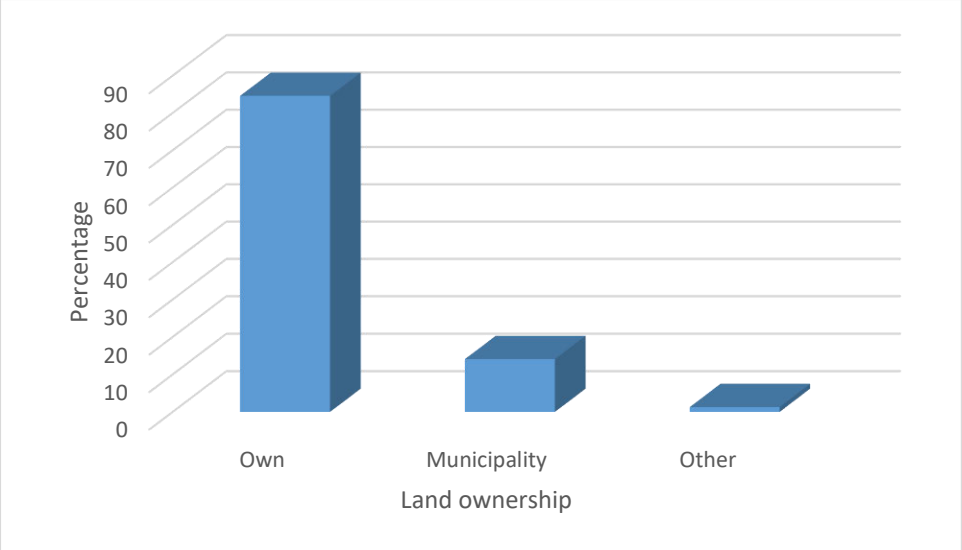

FIGURE 4.2: ILLUSTRATION OF THE AGRICULTURAL LAND OWNERSHIP IN PERCENTAGE IN THE CASES.

Figure 4.2 shows that the majority of the farmers were using their land sites for production. This is shown in figure 4.7 where (85%) of the farmers were using their own land, while (14%) and (1%), used municipal land and the rest were either using rented land for production purposes respectively. The land size as shown below in Table 4.8 shows how most of the farmers had less than 1 ha of land used for production purposes. The urban farmers were found to be mostly having land ranging from 0.03 to 0.06 ha of land making (50%); the same was observed of the non-urban farmers in the study. Regardless of the land size, it was still observed that the land was not fully utilized by the farmers, due to constraints such as labour costs, hiring machinery costs, seeds etcetera. The capital constraints also resulted in reduced quantity and reduced incomes for the farmers.

TABLE 4.8: LAND SIZE OF THE RESPONDENTS IN HECTARES (HA) IN THE CASES

	Non-Urban Agric.		Urban Agriculture		Pool	
Land size (Ha)	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
<0.03	8	26.7	10	20.8	18	23.1
0.03-0.06	11	36.7	24	50.0	35	44.9
0.07-0.10	2	6.7	2	4.2	4	5.1
0.11-0.25	4	13.3	2	4.2	6	7.7
0.26-0.5	3	10.0	7	14.6	10	12.8
>0.6	2	6.7	3	6.3	5	6.4
Total	**30**	**100**	**48**	**100**	**78**	**100**

Most of the farmers had a land size that was between 0.03-0.06 ha, 35 (44.9%) of the total respondents. The mean for the land size was 0.170 with a standard deviation of 0.316 from the mean. As a result, the land sizes did not proportionate to the products required in the market, which also meant the farmers are not producing enough to sell. This indicates that some of the farmers were rather subsistence, and would only sell what was left once the household has had its share.

4.4.2 Farmer's perception on the use of wastewater treated or untreated

The table below gives the perceptions of famers in the three cases, and how they relate to the socio-demographic results by using the chi-square test for association.

Table 4.9: Socio-demographic data descriptive statistics on WW use perception in UA, Chi-square test.

Perception on the use of wastewater	**Mean (std. dev)**	**Min**	**Max**	**χ-2**	**P-val.**
Gender	0.333(0.474)	0	1	0.507	0.477
Age	58.32(10.98)	18	78	0.608	0.508
Education level	2.58(0.797)	1	5	5.5	0.233
Farm training	1.784 (0.439)	1	2	2.938	0.087*
Farming Experience	5.628(3.731)	0	10	0.485	0.490
Have enough water for maximum capacity	1.474 (0.502)	1	2	1	0
Wastewater should be used in urban agriculture	1.013 (0.113)	1	2	2.938	0.087*
WW use poses a human risk on the farmers	1.57 (0.497)	1	2	0.586	0.443
WW use poses a human risk to the consumers of products	1.99 (0.113)	1	2	2.938	0.087*
WW should be treated before use in UA	1.38 (0.489)	1	2	0.485	0.486
WW contains pathogens when used to irrigate crops	1.461 (0.501)	1	2	1.346	0.246
Does crop type matter when irrigating with WW:					
-Would consumer leafy vegetables	1.461(0.501)	1	2	0.409	0.522
-Would consume roots and tubers	1.320 (0.409)	1	2	0.614	0.433
Follow the WHO guidelines on the use of WW	1.987 (0.113)	1	2	0.349	0.555

***, **, * represents 1%, 5% & 10% significance levels respectively.

Table 4.9 illustrates the means, standard deviation and the chi-square test of the participants in the study. The data was used in other test statistics in the study, in this study there were tests for association of the socio-demographic with farmers' perception of the use of WW in agriculture. The study tested for association between socio-demographic results such as gender, education level, farm training and farming experience as factors that influence farmers' perception of WW use and quality. The results indicate that gender was statistically insignificant in the farmer's perception of the wastewater chi-square test results ($\chi 2$=0.507; df= 2, *P*=0.477). The test of association of the producer's level of education and perception WW use revealed that there was no statistical significance ($\chi 2$= 5.5 df =4 *P*= 0.233) between perception and the responses given, verifying the findings from Amoah (2011) where the study found there was no relationship between education and perception.

The chi-square test on training and perception revealed a statistical significance ($\chi 2$= 2.938; df= 2; *P*=0.087) at 10%. These results revealed that there was a positive relationship between farm training and the perception of the farmer, regardless of their educational background. This meant that a percentage increase in farmers' training increases their positive perception of WW use by 2.938 per cent, all things being equal. Validating the findings of Saldias *et al*., (2016) where they found that farmers who had some type of training on the use of WW, be it in the form of workshops or practical's or having read the guides, were more open to using WW, unlike those who were not previously exposed to this information. This was also in agreement with a study by Adewumi *et al*., (2010), where they found that farmers were not opposed to the

use of treated WW in their production sites as they do not associate WW use with human risk or production risk in the Cape Town farms. Their study further found that the farmers who were using WW on their farms may not have been entirely forthcoming about the negative impact of the use of WW on the environment and human health (Adewumi *et al*., 2010; Amoah, 2011; Saldias *et al*., 2016).

4.5 WATER ACCESS, USE AND QUALITY IN URBAN AGRICULTURE

This section discusses water access, use and quality in urban agriculture. It also presents the results of perception of the urban farmers to WW use and the effect on water quality on the health of the farmers. The urban farmers sample indicated that farmers had access to water used for irrigation. The sources of water identified include river water, dam water, rainwater, tap water and wastewater.

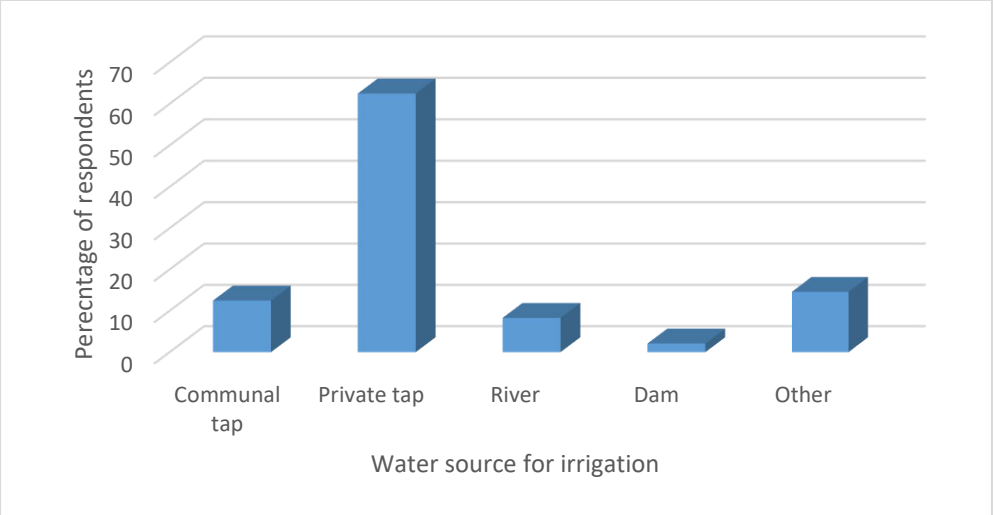

FIGURE 4.3: WATER SOURCES FOR IRRIGATION BY THE RESPONDENTS IN THE URBAN COMMUNITIES.

Figure 4.3 demonstrates the water sources for the farmers which are not limited to the ones illustrated on the bar chart. The farmers indicated not having enough water to reach their full capacity. Several reasons were stated by the farmers, however, the major one was municipal water cut-offs to reduce water usage, as a result farmers had to find alternate water sources such as rain harvested, wastewater reuse, spring water among others. The figure above further clarifies that the majority (62.5%) of the farmer's used private tap water to irrigate their fields, while 12.5 % of the respondents used communal tap water, both of which required a licence to utilise. The farmers indicated that they have the water licences for the utilisation of the water they were using, even though the license is for HH water provision. This is not surprising as studies in the past have found the same to be true, for instance, the study of Mudhara *et al*., (2014) in Sobantu Township found that the respondents were mostly using tap water. The graph also depicts that (8.3%) of the respondents were using river water to irrigate their crops, while (2.1%) used dam water and 14.6 % used other sources of water not mentioned in the figure above. The other sources of water used by the farmers included rainwater harvested by Jojo tanks or any other container, spring water, TWW and water from the boreholes which were used as alternatives during water cuts and dry months and when there was a limited water supply.

A small number 7 (14.6%) of the farmers were using wastewater to irrigate their crops; they, however, felt uneasy with its use, indicating the lack of information on the safe use of wastewater. There are however guidelines by the WHO and those specific to treated WW use in South Africa done by the Department of Water Affairs. The guides are such that the WW reuse is done in a manner that does not cause health risks to the users, the community or the consumers of the products irrigated. Steel & Odumera, (2004) explained that growers particularly Smallholder farmer (SHF) experience great difficulty in controlling water quality, as the water used often originates from sources that were polluted. As a result, the international and national board of food safety gave recommendation guidelines, which suggested the level of selected hygiene indicator organisms like coliforms and *E.Coli*, to ensure acceptable water quality for irrigation (Steele & Odumeru, 2004; Scheieiriling *et al*., 2011; Saldias *et al*., 2016). The water used in irrigation can greatly influence the final product, for instance, fresh produce which undergoes minimal processing (DWAF, 2004).

The policies in place indicate that water policies are formed by the Department of Water and Sanitation; they are aimed at positively impacting the country and its people (Masindi & Dunker, 2016). While the governance, safety and provision are municipal activity, excluding the water governed by the water boards, recent studies indicate that there is weak governance, a disconnect between national budgets and requirements for water and sanitation financing, lack of finance to meet the requirements as a result of fragile municipalities, weak monitoring and evaluation, lack of accountability and responsiveness to communities (Masindi & Dunker, 2016). The drawbacks bring about vulnerability to the farmers and communities and a lack of interest in investing in urban agriculture, due to the uncertainty associated with water and sanitation service provision at the local level. The current statistics of water provision at a national level indicate that people in rural and urban areas should have access to some type of water, that is groundwater (9%), surface water (77%), recycled water (14%), however, the distribution of water is not even, as some areas would not have enough water, due to lack of infrastructure in rural areas (Masindi & Dunker, 2016). The farmers also explicitly stated that there were times when they would have water cut-off due, which put a strain on the crops and yields as less water meant reduced quantity and quality for the farmers at harvest.

The farmer's perception of the use of wastewater indicates that the farmers were aware of the use of wastewater in agriculture, and even though some were aware of the use they still felt it was a health risk to them and their consumers. This was found in the answers (Table 4.10) of some of the farmers when asked if they thought the use of WW poses a health risk, to which 42.3% of the respondents said yes, while 52.7% did not think so. Follow-up questions show that the farmers who were risk averse to using wastewater, however, were not aware of the risks that WW used for irrigation posed to their health. The assumption would be that the farmer's lack of information on the safe use of treated WW and how much water can be used efficiently without causing any harm to the end-users is a shortcoming. However, policymakers have presented guidelines by the World Health Organisation (WHO) which were adjusted by the DWAF in RSA in 2013 for the farmers on the use of WW farmers for irrigation purposes. The guidelines stipulated that there should be the treatment of water, crop restriction, and a specific wastewater application technique which minimises contamination (WHO, 2006). However, the high cost of water treatment in less developed countries has been noted as one factor that hindered the availability of treated WW for use, even with infrastructures available in some areas there is still improper management of funds and lack of good governance (Saldias *et al*., 2016; Masindi & Dunker, 2016).

For example, the use of drip irrigation as well as having withholding periods to allow for the pathogens to die off after the last wastewater application, and hygienic practices in the markets and during food preparations (WHO, 2006; Scheieiriling *et al*., 2011). The lack of wastewater treatment infrastructure also brings about major problems, as the water washes from the ground to the clean water bodies, in areas where the infrastructure has not been upgraded for the growing population sizes (Masindi & Dunker, 2016). **Figure 3.2** shows the sewerage sipping to the water bodies in Mpophomeni Township, where there is a lack of sewerage systems maintenance, such incidences, are some of the reasons why the farmer's attitudes and perceptions of WW reuse are linked to human risk and production risk. This indicates a lack of governance in ensuring the elimination of poverty and inequality, as the National Water Resource Strategy Second Edition (2013) notes the role played by water in eliminating poverty and inequality in the form of job creation, the core focus of the strategy is to ensure equitable and sustainable access, and use water while also sustaining the water sources for a better life and environment for all. However, wastewater plants in South Africa are not maintained properly to ensure the safety of water bodies (Masindi & Dunker, 2016).

TABLE 4.10: PRODUCER PERCEPTION ON THE USE OF WW AND QUALITY OF WATER IN UA.

Perception on WW use	Frequency	% of Respondents
Aware of use of wastewater in agriculture	78	100
Believe WW causes health risk	33	42.3
Think WW should be treated	48	61.5
Crop type matters:	36	46.2
-would eat leafy vegetables	36	46.2
-would eat roots and tubers	53	67.9

Table 4.10 demonstrates the opinions of the farmers on the use of WW for irrigation on crops they produce and what it means for their consumers or them as the end users of the products. Even though all of the respondents were aware of the use of WW in farming for irrigation, (42.3%) of the farmers believed that its use causes health risks to them and their consumers, and (57.7%) did not associate any health risk with the usage of wastewater. Even though (42.3%) of the respondents alleged that WW causes a health risk, none of them could give an example/instance where WW was used and a person got sick, which could lead one to conclude that the perception is largely based on the beliefs of the farmers, or the lack of desire to use such water as it is considered unclean. Furthermore, the farmers revealed that they believe that WW should at least be treated (heat/chemical) before use to irrigate, that is (61.5%) of the respondents, alluded that they would be open to using WW if it was treated, while the rest (that is, 38.5%) did not mind. When asked if crop type matters to the farmers in terms of leafy and roots and tubers, (46.2%) of the respondents indicated that crop type does matter, while (53.8%) said it didn't matter. Of the respondents that indicated crop type being a major factor, 46.2% said they would consume leafy vegetables such as spinach, cabbage, lettuce among others that were irrigated with WW, while (53.8%), said they wouldn't consume the produce. When further asked, whether they would consume roots and tubers irrigated with WW (67.9 %) said they would eat roots and tubers, while (32.1%) said they were not open to it.

The results show that although (42.3%) of the farmers related to WW as being a health risk to them and their end-users, they were still open to consuming products irrigated with WW, whether, they were leafy vegetables or roots and tubers. Those that weren't open to consuming leafy vegetables stated that the raw state of consumption of the product was a hindrance, as they believe that heat can kill microbes. This association is in line with the current guidelines

by the WHO and RSA new government gazette on the use of WW, where high restrictions were on the crops that were eaten raw, while moderate restriction was applied on crops that can be cooked (WHO, 2006; RSA, 2013; Saldias *et al*., 2017). Hence, a great number of respondents were open to eating roots and tubers, as the majority of these crops are cooked before consumption. The results also reveal that the perception of WW being associated with the risk to their health is solely based on personal opinions, with no prior experience of the health implications of the use. Even though, there were instances where crops irrigated with WW and the consumers of the products had serious health implications. Amoah *et al*., (2007) found that concerns with the use of wastewater for irrigation stem from the fact that leafy vegetables are eaten raw, and some people may not necessarily wash their fruits and vegetables thoroughly before consumption. Amoah (2008) highlights those concerns relating to wastewater use stem from the evidence of disease outbreaks (that is cholera, typhoid, and shigellosis), due to untreated wastewater irrigation on vegetables. A study done by Amoah (2008), revealed that the vegetables and fruits (that is lettuce and raspberries) which were imported from countries like Europe and United States led to *Cholera* and *Cyclosporiasis* outbreaks. However, the heating or processing of food has been found to help with reducing the micro-organisms content in the produce.

FGD on the water sources and water governance in the study areas

Table 4.11 presents a thematic analysis of the state of water in one of the study areas that is Sobantu Township, which has most of the farmers who were using water from the nearby rivers that is Umsunduzi River and Baynespruit River. While Mpophomeni township farmers were using rivers near the Midmar dam catchment in the area. The questions that were asked during the focus group discussion with the key informants and the farmer's responses were analysed below according to themes (Political, Technical, Economical, Environmental and Legal) at Sobantu hall. The responses from the key informants were indicative of the role of government in water quality testing, ensuring access to clean and safe water for human consumption which is following the SDG-6 which advocates for the availability of safe and clean water and sanitation. However, there is still much to be done in terms of river water testing as farmers who used water from the rivers, dams, boreholes and springs were also using WW. A study by Scheierling *et al*., 2011; Saldias *et al*., 2016, found that there were two modes of WW use that is, through the use of WW from the urban waste systems and the use of untested water from the rivers, dams and boreholes.

The responses from FGD (Table 4.10) found that the Umsunduzi municipality does quality testing of the river in the areas, to ensure that the health of the rivers is always up to standard. The water sources are nearby factories and residential areas which are the major sources of pollution; which can pose a great health risk to the users of the water, as there are strict health and safety standards to adhere to when river water is used for agricultural production or human consumption. To ensure adherence to the safety standards the municipality imposed strict rules that prohibit dumping or settlements near the rivers. DUCT does water quality checks to ensure river health is continuous; the check is also an incentive as the reduction of pollution and effectiveness of other stakeholders in the municipality through the removal of barriers such as lack of threat of enforcement. The farmers also revealed that they do not have enough water sources as the tap water is costly to direct toward irrigation only due to the rates paid; ultimately leading to the use of other water sources that is, springs, dams, rivers and boreholes, which can also pose a great health risk is not accounted for accordingly through water testing.

TABLE 4.11: THEMATIC ANALYSIS ON THE EFFECTS WATER ACCESS, USE AND QUALITY ON URBAN AGRICULTURE, AND RELEVANT POLICIES APPLICABLE.

Themes	Concepts	Responses
Political	- Are there any efforts from authorities to ensure water quality?	-The Umsunduzi municipality checks the water quality from the rivers. Water samples are taken to identify any possible spillage from the nearby factories and also if the water is safe to use for agricultural purposes or human consumption.
	-Does the local municipality ensure equal access to water for the urban farmers?	-The municipality provides tap water for households; the water is also found to be used for irrigation purposes.
	-Are there any local policies or programmes that govern water use and access?	-There are strict rules that restrict dumping waste into the rivers and residents are also not allowed to build too close to river beds.
Technical	-What is the water quality of the water used for irrigation?	-The department of Agriculture does not check water quality for the farmers. Farmers can do this if in partnership with a research project, or in their own capacity.
	-Do you have access to water?	-Farmers' have access to river water or municipality water, those that use river water have to purchase water pipes to pump the water from the river to their tanks, for use, others used rainwater harvesting techniques to have enough water.
	-Do you know of any policies or programmes that govern Urban Agriculture?	-The department of agriculture has an extension officer who is responsible for facilitation knowledge, information among others to advance farming in Sobantu. This facilitated a participatory workshop where the project team was present to identify organizational/institutional, social, technical and financial issues and the process and activities necessary to investigate urban agriculture. This is being used to guide further engagement.
	-Are there any capacity building interventions that exist?	-Training and assistance in implement use are done by the extension officer as well as the project co-ordinators.
Legal	How are the farmers organised?	-There is a number of farmers that are part of a co-operative, and they apply for farming permits through the municipality near areas with a reliable water source. There is no WUA rights known by the farmers apart from the permit from the municipality

Environmental	-How is the water quality affecting the environment? - Are there any policies and programs on water quality?	-DUCT checks the water quality and they ensure that rivers are healthy.
	-How does water access affect the urban farmers?	-They also help in the removal of some of the 'artificial' barriers, such as the lack of an enforcement threat or satisfaction with the status quo, holding other stakeholders back (particularly those in industry, but also in regulatory agencies and parastatals) and preventing what would otherwise be powerful incentives to reduce pollution from being effective.
	-Does water quality and access affect urban farming entrepreneurship?	-The farmers are unable to produce enough products if their access to water is restricted, it is also time consuming to fetch water using the bucket, thus taking away time which could be dedicated to other farm activities.
		- There are negative effects if the quality of the water is compromised as it can cause farmers to be eliminated from the SA-Gap certification as markets have a minimum number of allowable residues. Access can also affect farm profitability and productivity in the long resulting in business failure.
Economical	-Do the farmers pay for the water they use for irrigation?	-A number of the farmers who used tap water for irrigation purposes are assumed to be paying for the water as there are municipal levies (rates) on the water supplied for each household.
	-What is the cost/per litre of the water used?	-The cost of water per litre used for irrigation is unknown. The rates on a monthly basis amount to approximately R350 depending on usage.

4.6 PCA-DIMENSIONS OF GENERATED INDICES ON WATER QUALITY IN UA.

TABLE 4.12: DIMENSIONS ON WATER ACCESS, QUALITY AND USE IN URBAN AGRICULTURE.

Variables	**Principal Components**			
	PC_1 –WW_Perc.	**PC_2-Hlth_risk**	**PC_3-Hlth_risk effects**	**PC_4-Water qua.**
Aware of the use of WW		0.485	-0.387	
WW poses a health risk				0.848
Any health risk known to you			-0.482	
Wastewater should be treated (WQ)	-0.370			
Wastewater contains pathogens	0.432			
WW should be cooked before use/consumption		0.422		
Crop Type matters	-0.447			
Would eat leafy vegetables	0 .434			
Would eat roots and tubers	-0.391			
Know of WHO guides on WW use		-0.528		
Pre-wash the vegetables before use			0.528	-0.315
Health risk examples (cholera, worms.)			0.505	
Eigen Value	**4.21**	**1.54**	**1.34**	**1.10**
Variance explained (%)	**35**	**13**	**11**	**9**
Cumulative % of variance	**35**	**48**	**59**	**68**

Note: Component loadings greater than |0.3| are included in the interpretation. KMO= 0.76 and Bartlett test of sphericity Chi-Square= 425.46; *P*-value= 0.000.

The PCA derived from the water quality indices is reported in the table 4.12. Bartlett's test of sphericity and the KMO measure of sampling adequacy indicated that the data was appropriate for PCA. In **Table 4.12**, the significance of Bartlett's test (1%) suggests that variables were inter-correlated. Moreover, the KMO measured 0.8 which was greater than 0.5, indicating that the PCA could be applied to the dataset. The components of water quality that were used to extract water quality indices were 12 and only 4 principal components (PCs) were extracted with Eigen values greater than 1 as per Kaiser Criterion. The four extracted PCs contribute 68% of the total variation of the variables 1234-s used. The first component (PCW1) explained 35% of the variation and was found to be closely related to the water quality and farmers' perception. According to Namara *et al*., (2010), access to agricultural water decreases temporary poverty at the farm level. Van Deventer (2012) further illustrated that water quality is also an important factor to address food security at a farm level, however, sewage discharge from commercial and domestic sewage, agricultural runoff and industrial effluent poses a great threat to the surface water, thus resulting in health risk. The second component (PCwq2) explained 13% of the variation and was found to be closely related to the health risk of UA to farmers. Boischio *et al*., (2008), risk management on the use of WW can significantly reduce health risks at the farm and household levels.

The third component (PCwq3) explained 11% variation and was found to be closely linked with health risk effects. Dreschel *et al*., (2008) found that there are cases where the use of WW causes cholera in the respondents; they also note that some agricultural products are consumed raw. The

fourth component explained the 9% variation and was found to be closely related to water quality. In a study by Murugani & Thamaga-Chitja (2018), they found that reduced water quality results in reduced product quality and quantity of the marketed products and affected plant growth. Dreschel *et al*., (2008); Furthermore, Boischio *et al*., (2008) also found that water treatment techniques could improve the quality, that is careful collection of irrigation water without disturbing the sediment reduced the helminth egg count by 70%, while most of the removal of helminth eggs took place on the first day of sedimentation, faecal coli forms in the same three-day period were about 2 log10 units due to natural die off.

4.7 SUMMARY

This study aimed to analyse the policies on water access, use and quality and how they affect UA, the study achieved this in the form of questionnaires and focus group discussions and a review of the literature. The data was analysed with the aids of content, thematic and principal component analysis.

The demographic results in the study showed that there were more female participants in UA and non-UA, than their male counterparts. The study also found that urban farmers come from different age groups and educational levels; however, the study found that majority of the farmers were the elderly and the youth was not participating as much in the sector. The educational level of the participants indicated that the majority of the participants had some form of educational background, even though a substantial number of the respondents only went as far as primary school and only a small percentage went beyond Grade 12. The results on income show that majority of the participants depend on farming and pension and some had other sources of income such as social grants and remittances among others. Furthermore, the results also showed that there is less youth participation in the study even though, current unemployment rate should be the motivation for an increase in youth participation in UA, as well as other agricultural opportunities available for the youth to study. The motivation could also be in venturing into business and not farm for subsistence only as the study findings illustrated. The absence of the youth in the sector could result in the loss of valuable knowledge on the different techniques not being passed down to the next generation. Even though there are ample opportunities available for the youth in the sector, the youth are not participating in the sector not because they are not interested, but because of the stereotype attached to the sector “perhaps this is because agriculture is for the white men or that only old people farm”. Breaking stereotypes can evoke interest in the sector by the youth. Although education was found to not be significant in the perception of WW use, however, training on the use of WW was found to have a positive significance. A public and private partnership on the safe use of WW results in the continued availability of water, of better quality for the farmers, and the cost can be minimised by this partnership.

The content analysis in the study revealed that several policies were anti-poverty which ensure that those who are most vulnerable in society, that is, those who are old people, children, the unemployed, women and those living with disabilities, are always taken care of. To ensure this happens women's empowerment is always at the forefront for the policymakers, hence, the Act on

water allocation addressed access and allocation for all households in South Africa, where there was a previous disadvantage for the black communities, due to the social ills of apartheid. The policies have achieved this as the objective on access and allocation indicates that the HHs have access to water. However, the use of water indicates that the urban farmers are using water allocated to the HH for irrigation purposes. Resulting in a strain on the available water resources. Some policies ensure water access and quality to the most vulnerable in society that is women and children, as the policy states that every household should have tap water or any other source, which is in line with SDG6 of 2030. However, none of the policies or acts available is specific to UA, which uses water from various sources in urban areas. Water User Rights are specific to the SHF in rural areas, none relate to UA, due to the absence of policies, but just guides on the use of WW in farming.

The results on access to water, its use and the quality of water revealed that the farmers had access to water sources even though some indicated not having enough, and would have supplemented the available tap water with water harvested from the rain, or they would have to use large containers to store water to be used in times of water shortages. The state of unemployment in the country left some individuals without jobs and food, to mitigate against the effects of unemployment, they thus engaged in farming activities, bringing about unintended consequences on water quality degradation and availability. The water quality is good as there are tests done due to their use that is for human consumption, as the farmers were using mostly tap water. The results on awareness of WW use indicate that there isn't much education on its use. Regardless of the guidelines by the WHO and DWAF; which allow for the use of such water but have guides in place to be followed by the users. The guidelines limit the health risk perception and occurrence of disease outbreaks due to WW use while taking a strain off the water resources. It is therefore recommended that the farmers be taught about the use of WW and the importance of withholding periods in irrigation. The guidelines available should be adjusted to accommodate farmers from different sub-sectors, and also illustrate how to restrict accordingly using the scale of low, moderate and high restrictions levels. This is found to be effective in the sectors that mostly use water resources.

Although UA is recognised for its role in ensuring food security, local economic growth and social inclusion, there are still disquiets regarding the sector's use of the available freshwater resources and the perceptions of the reuse of WW in cities. Thus, the lack of support for the activities as they are deemed unsafe to the residents due to various factors such as pollution, soil degradation, water consumption and degradation. The factors can be better managed if some rules and regulations govern the practice in urban areas, as the benefits far outweigh the drawbacks. Following proper hygienic practices, through the use of TWW for a certain period, and allowing the required waiting period after applications as well as restrictions on certain crop types can address the concerns of the farmers. Ultimately changing their perception of the use of TWW in agriculture, further reducing freshwater use in irrigation, and addressing the looming water scarcity issue. The available water can be put to better use by other sectors and less be directed toward agricultural production.

CHAPTER 5: **The entrepreneurial risk factors that affect decision-making and income generation in urban agriculture for households: A case of farmers in Pietermaritzburg, KwaZulu-Natal.**

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ABSTRACT

Urban Agriculture (UA) is said to play an essential role in urban societies who are faced with numerous challenges. These can be classified as risk/uncertainty. The risk factors include production, price (market), human, financial and institutional risks, all of which can have an impact on their 'entrepreneurial spirit' and the willingness to undertake risk. Research studies over the years have addressed risk factors that affect commercial and smallholder farmers in rural areas; however, there is limited research which considered the entrepreneurial risk factors in UA, the impact decision-making and income generation. The aim of the study is therefore to evaluate the impact of entrepreneurial risk on decisions of urban farmers and the effects on income generation. Data was collected from randomly sampled 48 urban and 30 non-urban farmers, totalling 78 participants through a structured questionnaire. A principal component analysis (PCA) was employed to evaluate the risk factors and a logit regression analysis model was used to estimate the effects of entrepreneurial risk in UA. The results found that farmers had several constraints which affect their attitudes in UA. The results further found that factors like age, education, water quality, entrepreneurial risk factors like (production risk, market price risk) and psychological capital, were statistically significant in influencing participation of HH in UA. Thus, having the potential to influence the risk perception and subsequently increase urban agriculture participation ultimately leading to increased incomes. The study concluded that farmers were lacking motive which influenced their income generating capacity. Government budgets toward UA can also entice youth involvement in the sector, which may ultimately lead to a reduction of youth unemployment and improve food security at an individual and household level. While also reducing the risk perception in urban agriculture.

Key Words: Entrepreneurial risk, Urban Agriculture, Decision-making, Principal Component Analysis, Logit regression**.**

5.1 INTRODUCTION

In developing countries like South Africa, UA plays a significant role in social and individual benefits which may, in turn, improve food security and economic benefits (Battesrby *et al*., 2015; Bennedetti *et al*., 2023). However, this may be changing due to the weaknesses shown in the food systems during the COVID-19 pandemic and riots that disrupted the movement of products along the marketing value chain (Sihlobo, 2021). UA has also presented a way for urban dwellers to put small, vacant, unconventional and unutilised spaces to use, as a means of food provision, income cash generation and offers entrepreneurial opportunities (Hovorka, 2004; Ben-Othmen *et al*., 2023). Further illustrating how UA can reduce poverty, and become a source of income in low-income households, (Bisaga *et al*., 2019) opined that participation in UA adds to asset generation of farmers (i.e., women & children). Furthermore, in developing countries'; UA may be seen as a way to create sustainable economies and address food security (Ibrahim et al., 2023). The benefits include the building of communities and cultivating social capital, reclaiming a sense of belonging, enhancing psychological well-being, and growing importance of purpose and self-worth (Battersby *et al*., 2015). The conventional system of bringing food into large cities, over an average distance of 800 to 1500 km, is prone to some disruptions, such as those brought about by COVID-19 (Pulighe & Lupia, 2020). Urban farmers have what it takes to be successful entrepreneurs, it is dependent on several factors which can influence the farmer's decision, depending on the level of risk they are willing to take, i.e., entrepreneurial risk, as well as create resilient value chain systems (Sihlobo, 2021).

Empirical studies on risk have been concentrated on one or the other risk factors faced by commercial and smallholder farmers in rural areas (Clapano *et al*., 2022). However, studies have shown that one type of risk can cascade to the formation of the other risk factors culminating from neglecting that risk (Just 2003; Chambers & Quiggin, 2004). Other studies have evaluated UA entrepreneurship as a means of eradicating poverty and ensuring food security, while other studies (Ratshitanga, 2017; Wheeler *et al*., 2022) have looked at the role of UA in addressing food security as a response to natural/production risk; as well as studies on risk factors impacting agriculture in smallholder farmers (Komarek *et al*., 2020; Dlamini *et al.,* 2022). However, there is limited information on the entrepreneurial risk effects of UA and the effects on UA low-income households. While recent studies have focused on human and financial risk, production risk and less concentration have been put on the "easy" risk factors such as price and institutional risk. All of which according to Komarek *et al*., (2020), have long-term effects on livelihood improvements. Furthermore (Louw & Jordaan, 2016), found that a smallholder farmer is less likely to take on risk along the formal value chain but rather opt for the low-value formal markets. Hence, the need to address the risk factor of agriculture holistically mainly focusing on urban farmers as they too are faced with risk, regardless of the type of enterprise of interest while generating income as smallholder farmers. As it affects food security pillars more specifically on the agency and sustainability pillars, as the farmers invest less in agriculture with the increased risk due to price trends, seasonality and shocks in the sector. The study, therefore, aims to determine the entrepreneurial risk factors that affect urban agriculture, concerning water access and use; as well as determine the role of UA in low-income households in urban agriculture participation.

5.2 RESEARCH METHODOLOGY & STUDY AREA

5.2.1 Study area and sampled farmer's description

The study consisted of 48 urban farmers and 30 non-urban farmers totalling 78 participants from the following areas (Sobantu, Sweetwater and Mpophomeni townships) in and around Pietermaritzburg. Two (Sobantu and Sweetwater) of the areas in the study were under the Umsunduzi local municipality, while Mpophomeni was under the Umngeni local municipality in the uMgungundlovu district. Sobantu and Mpophomeni were considered as close-knit communities where houses are close together, near community service centres such as clinics, community halls, police stations, as well as nearby factories. Whereas, Sweetwater is a peri-urban area as it had landscape adjacent to or surrounded by urban settlements. The farmers are close to an urban centre that is Pietermaritzburg town, and Howick. The farmers in the study areas were mostly involved in cultivating vegetables such as spinach, beetroot, mealies, butternut, onions, potatoes, lettuce, carrots, cabbage, and kale and there were also farmers involved in poultry farming. The crops grown were found to be suitable for growth in the area as they are better suited for growth in terms of climate as well as the soil type in the areas.

5.2.2 Analytical Framework

The study employed different methodologies for the analysis of results based on the research objectives. A questionnaire was administered to 78 participants (30 non-urban farmers and 48 urban farmers) in the three cases surrounding the city Pietermaritzburg, in the KZN province, South Africa. The cases are Sobantu, Sweetwater's and on the outskirts of Pietermaritzburg was Mpophomeni Township. The cases were selected based on their location which was urban or peri-urban areas, which were associated with high levels of poverty, high unemployment rate, and socio-economic vulnerability, less adaptability (Gbetibouo *et al*., 2010; Golder Associates Africa, 2013; Wilk, *et al*., 2013 and Hlahla & Hill, 2018). The study used principal component analysis (PCA), which is a multivariate data analysis technique used to reduce the dimensionality of many interrelated variables while retaining as much as possible of the data set, and therefore simplify the analysis and interpretation of the data (Jolliffe, 2002; Armeanu & Lache, 2008; Gujarati & Porter, 2009). The study employed PCA to reduce the data and variables with an Eigenvalue above 1 were included in the analysis, components with loadings of 0.3 were considered for the analysis. Bartlett's test of sphericity was applied to check the observed correlation matrix divergence significantly from the identified matrix. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was further applied and a value above 0.5 implies that PCA could be applied. The PCA results were further used in the logistic regression model to ascertain the effects of the risk factors in income generation in low-income HH's of the participants.

TABLE 5.1**:** ANALYTICAL FRAMEWORK PER OBJECTIVE AND RESPECTIVE ANALYTICAL TOOLS

Objective (s)	**Variables**	**Analysis Tool**
To determine the entrepreneurial (financial, production, human, market and institutional) risk factors associated with engagement in urban agriculture and their effects on water quality and use.	- Perception on water use and quality - Factors influencing the prices at the market - The effects of urban agriculture in entrepreneurship. - Entrepreneurial risk factors	-Descriptive Analysis -Frequency Tables -Principal Component Analysis

5.3 RESEARCH DESIGN

The study employed a mixed-methods methodology where both qualitative and quantitative approaches to collect data were used to reveal information under the research question. The study employed a case methodology of three geographical areas, each case had various participants. Although often associated with mainly qualitative research, case study research can also be quantitative and carry elements of scientific review (Mills *et al*., 2010), as is in this study. The overall number of participants in all three cases was 78 that is (48) urban farmers and (30) non-urban farmers. Other methods employed were focus group discussions, surveys and observations. This type of methodology is essential for providing a strong foundation for community-based participatory research as it involves smallholder farmers, different stakeholders, markets actors, researchers and government extension officers (Ivankova, 2017). Both the purposive and simple random sampling technique was used to sample 78 participants, and the data was collected using a survey questionnaire and FGD to gather information on the entrepreneurial risk factors associated with engagement in UA and their effects on water quality and use.

5.3.1 Data Analysis

The data collected was then coded and transcribed from Microsoft excel to Statistical Software Package (SPSS V27) for Social Sciences and the STATA SE17 software. For the analysis of quantitative data, a descriptive statistical analysis was used to summarize the risk perception of the farmers and present the frequencies of the marketed products, access to markets and the farming constraints of the sampled respondents. The qualitative data was analysed using thematic analysis, which mostly applies to this type of dataset. For further analysis of quantitative data Principal Component Analysis (PCA), was used; this is an analysis that is applied in large data sets. The results from the PCA were later used to perform a Logistic regression analysis to answer the second question of the study.

5.4 RESULTS AND DISCUSSION

This section outlined the results of the entrepreneurial risk factors, psychological capital, the principal component analysis and the logistic regression analysis on the effects of urban agriculture at the HH level. It will further highlight the role played by urban agriculture at a household level in the form of income generation. Entrepreneurial risk factors are analysed using the PC analysis and a logit regression analysis is conducted using the PCA results. Furthermore, inferences are made based on literature and observations, to make rigorous conclusions and recommendations based on the study's aims and objectives.

5.4.1 Produce and Environmental hygiene condition on farm /at market.

This section will give an overview of the impact of hygiene conditions and how they increase the entrepreneurial risk (that is production risk).

TABLE 5.2: RISK PERCEPTION OF RESPONDENTS ON AND OFF FARM RELATING TO THE ENVIRONMENT AND THE PRODUCTION SITES.

Factors influencing farmers risk perception of the environment		**Percentage %**	**Frequency**
Practice safe animal husbandry		92.3	77
Lavatory facilities at farm/market	Public toilets	91.0	70
	Open Fields	1.3	2
	Neighbours' toilet	7.7	6
Source of drinking water at farm or market	Store bought	28.21	22
	Tap water	71.8	58
	River/Dam	-	-
Mode of discarding organic waste	Throw away	10.26	8
	Burn	2.56	2
	Make compost	80.7	63
	Throw in Dumpsite	6.4	5
Mode of discarding animal waste (Manure)	Use in vegetable farming	76.92	60
	Sell to neighbours	16.7	14
	Throw in dumpsite	5.13	4
Use of chemicals in fields		37.18	29
Believe that environment has enough land for everyone		83.3	65
UA can mitigate climate change effects		53.8	42
Humans abusing the environment		84.6	66
Use of vacant land and abandoned building to mitigate climate change and address food insecurity		73.1	57
Have crop insurance in case of hazard (drought, fire, hailstorm or floods)		-	-
See hazard insurance as vital		85.9	67

Would acquire crop/hazard insurance	67.9	53

*Likert scale measure was used where 1 is in strong agreement and 5 is in strong disagreement

The results from the study revealed that (1.3%) of the respondents were somewhat aware of the World Health Organization (WHO) recommendations on the use of wastewater. They achieved this through training course they had undertaken on safe irrigation techniques. The farmer's awareness did not imply, however, that they were using only WW in their production. This was also displayed in the water sources they used for irrigation, even though farmers received training on the safe use of WW; they rarely implement its use. The majority of the farmers (98.7%) of the farmers said they pre-wash their vegetables before selling to their consumers, which shows their awareness of consumer perception when it comes to product attractiveness, besides the price. The farmers who practised mixed farming (92.3%) said they practised safe animal husbandry by creating a boundary in a form of fencing for their livestock and their crop production sites. However, the focus group discussions on the environmental effects showed that even though the farmers had the fence put in their spaces, human and social capital was not practised as well as some members of the community would that cause destruction or even go as far as stealing their produce, once ready for harvest, resulting in human risk as social cohesion is lacking in the communities.

The farmers indicated that they have a community informal market, where they sell their produce, besides selling at their farms. These markets are informal, as a result, the farmers may not have access to lavatory facilities, and some farmers did not have such facilities in their fields which could be far from home. The results show that most of the farmers (91%) were using public toilets, while (7.7%) would use their neighbour's toilets, and only (1.3%) were using open fields. This shows that there is a basic understanding of the health implication of not using the correct facilities as it can also have an impact on the number of customers you get. As consumer perception also influences their buying decision. The majority of farmers stated that their source of water at the markets and on-farm is tap water (71.8%), while (28.2%) of the respondents said they would buy water when at the market. The results further show that the majority of the farmers (79.5%), were converting their organic waste into compost for their fields, which can be seen as a less costly alternative when land prepping, as it's cost-effective and good for the soil. While some farmers (10.3%) threw away the organic waste, as means of discarding it, this also indicates the level of information the farmers have on the benefits of the use of organic waste in their fields. Most of the farmers (78.1%), mentioned that they were not discarding the animal waste but were using it as manure in their production sites, and other farmers (16.7%), would sell it to their neighbours.

However, there was still a cause for concern as some (37.2%) of the farmers are not open to implementing environmentally friendly techniques such as using fewer pesticides in their crop production. As roughly (78.2 %) of the farmers did mention that they are using animal manure on their production site, which can be regarded as an environmentally friendly technique. The use of animal manure is motivated by many factors and such include "the price of compost at the market and the suitability of the manure for the soil, as well as its benefits to their crops". This was found to be the case with the farmers in this study, where during focus group discussions the farmers also mentioned that they use animal manure as well as organic waste from the harvest in their land prepping, not necessarily because of its environmental benefits but for its cost-effectiveness. Hardly any individuals were said to be aware of the environmental benefits, however, they would still use herbicides/pesticides on their farms, to get rid of pests and weeds, and such use of chemicals can be perceived as defeating the organic farming process.

To answer the question of environmental risk assessment (production risk), the respondents (83.3%) believe that the environment has enough land to plant sufficient food for everyone, and when asked if they believe that engaging in UA can mitigate the impacts of climate change only (53.8%) agreed, while some were not aware of the impacts of climate change (negative or positive). This comes as a concern as (84.6%) of the respondents agreed that humans are abusing the environment, but only a few were aware of the negative impacts of climate change as well as the main causes of climate change that is human activities. When asked if they would use abandoned buildings, and vacant land in cities to plant crops and ultimately aid in the reversal of the climate change effects, 73.1% agreed with this statement. The responses indicate the lack of knowledge by the farmers on the environmental risks, as some would agree to questions or statements, with lots of contradiction, as well as climate change knowledge on what the causes are, as well as the ways to mitigate its effects. According to Gainnin *et al*., (2017), climate change effects have an impact on the agricultural yield (in commodities such as maize, rice, sorghum and millet), as the worst ever drought and famine experienced in the early 1970s, which culminated into the 1972/73 production decrease. The effects are expected to be more severe in leafy vegetables as they have a high-water requirement, thus making vegetable growers vulnerable to climate change effects (Gainnin *et al*., 2017; Hlahla & Hill, 2018).

The farmers were also asked if they had insurance in case of hazards, and none of the farmers had the insurance, while a majority (85.8%) saw the insurance as vital, only (67.9%) alluded that they would acquire the insurance if they had the means to it (that is finance, institutions that have such facilities). The responses indicate that even though the majority of the farmers are aware of the risk (s) of climate change to their enterprises, they are not curious about the means to mitigate the effects or even reduce the cost of damage in times of natural disasters. According to Hlahla & Hill (2018), there is a high degree of vulnerability of the urban poor to climate variability due to the non-climatic factors. Socio-economic factors such as low income, poor housing and infrastructure, food insecurity, high population growth rate, land degradation, water quality degradation and poor service delivery are more prevalent in the low-income population (RSA, 2015, Hickmann & Stehle, 2017; Hlahla & Hill, 2018). Unlike in high-income populations where the farmers can mitigate against climate change risk through the utilization of savings, insurance or the sale of assets to cope with the effects of climate change (Hlahla & Hill, 2018).

5.4.2 Access to Input & Output Markets in UA

TABLE 5.3: FACTORS DETERMINING CHOICE OF CROP CULTIVATED BY RESPONDENTS

Reasons for farming crop type	Frequency	Percentage (%)
Availability of a market	50	64.10
Availability of seeds from government	26	33.3
Crop suitable for the soil type	33	42.3
Crop Seasonality	42	53.8

*Likert scale measure was used where 1 was in strong agreement and 5 was in strong disagreement

Most of the urban farmers (64.6%) chose their crops based on the availability of markets and the crop seasonality (53.8%). During the FGD the farmers indicated that they do sometimes get seeds from the extension officer from the local municipality, they also got government assistance in the form of vouchers to buy inputs. While the initiative may have been good farmers indicated to have been met with constraints such as reduced bargaining power as they were only allowed to use the

vouchers in one vender, which could also lead to price fixing by the merchant. Even though, 33.3% of the participants said they chose their crop type because of government assistance, it still shows how much the government assistance with seeds play a vital role in motivating farming, regardless of the challenges. Other farmers (42.3%) chose their crops based on the suitability of the soil in the land used for production. Indicating that the farmers' awareness of the environmental impacts of not planting the crops on the correct soil type. These results suggest that most smallholder farmers are not thinking about the markets as the main priority for choosing their crops. As a result, their produce is mostly bought by the van traders who have been very little researched (Cousins, 2016). There are also instances where the farmers would sell their produce at a reduced price because it is either it makes a sale or a loss. The majority (53.8%) of the farmers mentioned that they use the seasonality of the crops as a motivator for the crops they plant. While it is a good technique to use, in terms of profitability it is not a good strategy as there do several factors that impact profitability that is the surplus or deficit in the markets results in crops prices having to decrease/increase until equilibrium is reached (Obeth *et al.*, 2010). Smallholder farmers need to be encouraged to shift from the mind-set of selling the surplus and be more market-driven, and for this to happen, they must have an adequate marketable surplus, market information and smallholder farming has to be their main source of income.

Figure 5.1 gives an illustration of the vegetables grown in the study areas, taken from different study areas, and they show that the farmers are growing the same products in different areas, except for those who also had livestock (cows, goats, and sheep) as assets and mixed-enterprises with poultry and vegetables. The farmers were found to be implementing organic farming techniques such as using cut grass to minimise the weeds in their farms, as well as inter-cropping techniques to reduce the pests in their plots and chemical usage.

FIGURE 5.1: LEAFY VEGETABLES GROWN IN THE STUDY AREAS.
Source: 2021 Study survey

5.4.3 Farming constraints and Attitude on Urban Agriculture

Table 5.4 indicated that the farmers were faced with numerous constraints in farming, due to lack of inputs, which were necessary for increased crop yields. They were also not knowledgeable in farming techniques that apply to the current weather conditions as well as methods of farming that allow for the continued availability of products even when they were out of season. **Table 5.4** indicated that a majority of the smallholder farmers (91.9%) face a challenge of accessing inputs such as seeds, fertilizer and chemicals, which limit their productivity, as fertiliser prices and seeds have an influence on the number of products the farmer produces. While it is difficult to reach input markets for smallholder farmers, most of them (89.7%) were faced with the challenge of increase in input prices or price fixing by the input suppliers. According to Jayne (2014), the tendency to produce a little surplus on very small farms leads to problems in buying required inputs. The issue of lacking financial resources was raised by most smallholder urban farmers (89.7%), as a result most of them had to finance their farming activities with additional sources of income that is pension, social grants, wages or salary. Moreover, most (74.4%) of the urban farmers in the study still found it difficult to gain access to information on farming and improve their skills. While there were also smallholder urban farmers (74.4%) that still find it difficult to access farming knowledge and skills. Thus, limiting their farming knowledge and the improved farming techniques that were good for the environment, while also achieving maximum productivity. The farmers also mentioned that the lack of financial resources results in their inability to hire additional labour as (85.9%) related to labour costs. The lack of thereof results in failure to produce at optimum capacity since they use time-consuming techniques of land prepping, as well as planting, that is, labour intensive techniques. The lack of resources results in challenges such as inconsistent supply, poor quality produce, breach of contracts by farmers, going against the stipulations of the contract as well as too high transportation costs (Louw & Jordaan, 2016).

TABLE 5.4: ACCESSIBILITY TO INPUTS FOR SMALLHOLDER FARMERS IN THE STUDY AREAS

Major Farming Constraints	Frequency	% of respondents
Lack of Access to Inputs	72	91.9
Large increase in input prices	70	89.7
Lack of farming Knowledge & skills	58	74.4
Lack of financial resources	70	89.7
Lack of labour costs	67	85.9

Likert scale measure was used where 1 is in strong agreement and 5 is in strong disagreement

Table 5.5 illustrates the farmer's attitude toward urban farming and their farm as a business. Farmers were asked questions aimed at capturing the dimensions of positive psychological capital the farmers (Luthans & Youssef, 2004), that is confidence, hope (having the willpower and paths to attain one's goals); optimism and resilience (having the capacity to bounce back from failure). The farmers said they were confident in themselves as farmers and were optimistic about their future in urban agriculture. While some farmers were able to cope with the shocks of natural disasters and other farmers were not able to cope with natural shocks that is hail storms and droughts, which are very common in the study area. The farmers were also able to plant in the following season despite not having made any profit or having experienced no reserves which could be used in the time of shock.

Farmers were asked questions aimed at capturing the dimensions of the positive psychological capital (Luthans & Youssef, 2004), namely, confidence, hope (having the willpower and pathways to attain one's goals), optimism and resiliency (having the capacity to bounce back from failure). Most of the smallholder farmers (64.1%) are optimistic about the future of agriculture. Even though the majority of smallholder farmers (65.4%) do not give up easily, very few of them can cope with natural disasters like droughts and hail storms and price changes in the market (42.3 %) which are common in the study areas. Out of all the smallholder farmers (64.1%) indicated that they would not be farming if there were other good alternative sources of income and (35.9%) are willing to take a job or start a business not related to farming. The minority of the smallholder farmers (21.8%) consider themselves risk takers, while the majority of the farmers are not willing to take any risk. The results further show that most of the farmers (60.3%) trust others in the same industry as them, however, there was no evidence of collective action between the farmers to reach the market demand for a particular product (Muchara *et al*., 2014).

The farmer's attitude toward UA indicated that the farmers were not motivated enough to take on other challenges for them to grow their businesses, even though some are seen to have the entrepreneurial characteristics required to make is as businessmen/women in the sector. They are also not knowledgeable on ways to diversify risk through enterprise diversification, contracting land, or engaging or investing in off-farm activities. The strategies mentioned have been found to help with continued income generation, while the farm is faced with risk factors such as production risk, market risk and financial risk, Kori (2011) found that portfolio diversification can help with risk management, and educational level, as well as the age and net worth of the farmers, were factors that influenced off-farm investment by the farmer.

TABLE 5.5: RESONDENTS ATTITUDE TOWARD UA IN THE STUDY AREAS

Farmers Attitude	***Frequency***	***Response (%)***
I am optimistic about the future of UA	50	64.1
I am able to cope with shocks such as natural disasters and prices in markets	33	42.3
I do not give up easily	51	65.4
I would not be in farming if I had other means of livelihood	50	64.1
I trust other farmers in my community	47	60.3

Likert scale measure was used where 1 is in strong agreement and 5 is in strong disagreement

Table 5.6 illustrates the market access of the urban farmers, and their profitability in terms of farming. Of all the farmers that were part of the study only 10.3% of the participants are said to be selling to the local supermarkets, even though they were selling to the supermarkets, they were still unable to reach the desired capacity by the markets. The farmers also indicated to have sold to the fresh produce market in the area that is the Pietermaritzburg Fresh Produce Market (21.8%) of the participants alleged to have sold to the market. Upon further enquiry, the farmers stated that they have since stopped selling to the market due to numerous reasons, some of which are transport costs, and the price that their produce fetched at the market; for example, they would have to sell a head of cabbage for R5/R8 depending on several factors, such as DD and SS as well as transaction costs (agent fees, packaging among others). Such factors were a disincentive for continued market participation by the farmers, the farmers preferred other modes of selling, such as van trading, online markets (not yet explored) and informal markets.

TABLE 5.6: MARKET ACCESS FOR THE RESPONDENTS IN THE STUDY AREAS

Farmers access to markets	*Frequency*	*% of respondents*
Sold to supermarkets in the area	8	10.3
Sold at the PMB Fresh Produce Market	17	21.8
Consider their business profitable	46	59.0
Give customers credit	22	28.2
Keep farming records	14	17.9
Have knowledge of Profit and Loss	12	15.4

The price at the market did not give much of an incentive for the farmers to continue selling their produce at the market as the costs outweighed the benefits of selling there. In a study by Murangai &Thamaga-Chitja (2018), they found this to be true for the SHF in Limpopo as the farmers were not motivated to sell at the markets due to high transaction costs (transportation, agent fees, packaging among others). The farmers did not have accurate information about the prices in the market and they only priced their products based on the prices they see in the supermarkets in the area. However, the pricing mechanism is not reflective of the market prices based on the seasonality or the DD and SS at the fresh produce markets. According to DAFF (2014), there is a market information system (MIS) in a place where the farmers can access the price information, for them to implement the correct prices of the produce. The farmers were not keeping records of the farming activities and the financial records of how much is spent and the profit generated as only (17.9%) of the participants alluded to having some type of record. Even with those that kept some kind of record (s), the records were not reflective of the farming activities on the farm from land preparation to harvesting and sale of the products.

Record keeping is essential as it allows the farmer to be aware of how much money is spent on farm inputs and how much profit is generated from the sale at the market, also allowing for the indicative farming activities at the farm. However, (59%) the participants indicated that their businesses are profitable, which revealed that farmers may not be explicitly aware of what the concept of profitability means as only (15.4%) of the respondents were familiar with the concept of profit and loss. It was also found that the farmers may not have the basic financial literacy when it comes to farming as profit and loss had to be accounted for when operating a business to know what measures are to be implemented, this is based on the amount of profit they generated on the sale of their products. As during the FGD session farmers said the maximum amount they make from the sale of their products is R800, whereas they would spend about +/-R1500 per planting season on inputs such as seedlings, manure and insecticides. The farmers, therefore, need more financial literacy programmes as it is evident that even if the farmers were generating profit, they would not be able to account for it, thus indicating the importance of record keeping where the farmer records every activity conducted on the farm from land preparation to the marketing activities.

5.4.4 Principal Component Analysis for entrepreneurial risk factors

This section outlined the principal component analysis in UA using entrepreneurial risk factors and the psychological capital of the farmers in the study. An analysis was done while also making inferences based on the literature on each risk factor in urban agriculture.

TABLE 5.7: PCA DIMENSION FOR HUMAN OR PERSONAL RISK ON & OFF FARM EFFECTS ON ENTREPRENEURSHIP IN UA

Variables	**Principal Components**	
	PC-Hygiene.	**PC-Waste Man.**
Place of ease at farm or at the market	0.502	
Mode of discarding animal waste (Manure)	0.425	
Source of H2O at market/farm		
Vegetables sold at the market (e.g., Leafy, roots &tubers)	0.361	-0.770
Mode of discarding organic waste (Spoiled crops)	0.563	0.600
Use of chemicals in fields (Pesticides)	0.363	0.427
Eigen Value	**2.928**	**1.612**
Variance explained (%)	**42**	**23**
Cumulative % of variance	**42**	**65**

Note: Components with loadings greater than |0.3| are included in the interpretation. KMO = 0.633 and Bartlett's Chi-Square = 270, p-value = 0.000
Source: Survey (Oct/Nov 2021)

The PCA derived from the entrepreneurial risk that is environmental condition indices were reported in the table 5.7. Bartlett's test of sphericity and the KMO measure of sampling adequacy indicated that the data was appropriate for PCA. The table 5.7 indicated the significance of Bartlett's test (1%) and suggests that the variables are inter-correlated. Moreover, the KMO measure is 0.6 which is above 0.5, indicating that PCA could be applied to the dataset. The components of the environmental condition hygiene were used to extract the entrepreneurial risk indices in the environmental hygiene conditions category where 6 indices were extracted and only 2 categories had Eigenvalues above 1 as per the Kaiser criterion. The two extracted principal components contribute 63% of the total variation of the variable12-s used. The first component (PC-EHC1) explained 42% of the variation and was found to be closely related to human/personal risk. According to (Korir, 2011) human/personal risk is close to injury, death or ill-health of the principal in the firm (farm). The second component (PC-ECH2) explained 23% of the variation and was found to be closely related to the human risk of improper disposal of organic waste. Van Deventer (2012) found that proper waste disposal increased food and nutrition security at the market or the farm, as it can greatly impact the health of the workers and the dwellers in the area.

TABLE 5.8: PCA DIMENSION FOR MARKET (PRICE) RISK EFFECTS ON ENTREPRENEURSHIP IN UA

Variable	Principal Components			
	PC_1 -Market entry	**PC_2 –Substi**	**PC_3 -Switch buyers**	**PC_4-Prod in mrkt**
Switch from one buyer with ease	0.489			
Able to sell to supermarkets	0.456			
Readily available substitutes at market			0.666	
Keep Records of produce	0.471			
High degree of competition			0.651	
Sold at the PMB-FPM	0.481			
Enough Producers in the Market for price setting		0.368		0.750
Consider their business successful (P/L)		0.392		-0.633
Ease of Market entry		0.591		
Give customers Credit		0.589		
Eigen Value	**3.509**	**2.258**	**1.489**	**1.019**
Variance explained (%)	**35**	**22**	**15**	**10**
Cumulative % of variance	**35**	**57**	**72**	**83**

Note: Components with loadings greater than |0.3| are included in the interpretation. The variables in the first column are captured using a 5 point Likert scale in terms of farmer's agreement/disagreement. Correlation = 0.000; KMO = 0.687 and Bartlett's Chi-Square = 421.32, p-value = 0.000

Source: Survey data (Oct/Nov 2021)

The PCA derived from the entrepreneurial risk that is market access indices were reported in the table 5.8. Bartlett's test of sphericity and the KMO measure of sampling adequacy indicated that the data was appropriate for PCA. The table 5.8 indicated the significance of Bartlett's test (1%) and suggests that the variables are inter-correlated. Moreover, the KMO measure (0.7) was greater than 0.5 which indicated that PCA can be applied to the dataset. The components of entrepreneurial risk used to extract market risk indices were 10 and only 4 principal components (PCs) were extracted with Eigen values greater than 1 as per the Kaiser Criterion. The four extracted PCs contribute 68% of the total variation of the variable 1234-s used. The first component (PC-Mrkt1) explained 35% of the variation and was found to be close to market access. According to Murangai & Thamaga-Chitja (2018), market access was found to reduce poverty at a household level for smallholder farmers, however, concerns over the price at the market, the trustworthiness of the agents at the market and among farmers, and the excessive pricing of agent fees affects the income generating capacity of the farmers.

The second component (PC-Mrkt2) explained 22% of the variation and was found to be closely linked to the threats of substitutes in the market. According to (Abinsay, 2020) the availability of substitutes in the market reduces the risk for the consumers as it allows them to switch from alternatives in response to the price increase. The third component (PC-Mrkt3) explained 15% of

the variation and is found to be closely linked to the bargaining power of buyers that is the ability of buyers to control the producer or the supplier's ability to be profitable. According to Bechdol *et al*., (2010), the quantity of product produced has an influence on the price at the market, and farmers tend to be price takers when there are a limited number of buyers. The fourth component (PC-Mrkt4) explained 10 % of the variation and is found to be closely linked to the number of producers in the market to determine the price. According to Abinsay (2020), the number of suppliers in the industry is typically directly proportional to the players in the industry. They (Bechdol *et al*., 2010; Abinsay 2020) found that a large number of farmers get exploited by the input suppliers (for fertilizers, seeds and pesticides among others) due to the adverse bargaining power of the suppliers.

TABLE 5.9: PCA DIMENSION OF PRODUCTION RISK EFFECTS ON ENTREPRENEURSHIP IN UA

Variable	**Principal Components**			
	PC_1 (Risk aware)	**PC_2 (Clmt-eff.)**	**PC_3 (Environ-Aware)**	**PC_4 (UA-Mit.)**
-Know organisation supporting UA		0.445		
-Have access to extension services		0.423		
-Importance of Crop insurance	0.499		0.641	
-Would take contracting to diversify risk	-0.415			
-Part of UA organisation	0.513	0.576	0.610	
-UA mitigates climate change	0.411			
-Use of vacant spaces to feed poor				
-Humans abuse environment		-0.481		0.638
-Insurance on crops		-0.413		
-Environment has enough land			-0.580	
-Would acquire crop insurance	0.401			0.471
-Aware of contracting				0.520
Eigen Value	**3.579**	**2.113**	**1.682**	**1.197**
% of Variance	**32**	**18**	**14**	**10**
Cumulative % of variance	**32**	**47**	**62**	**71.4**

Note: Components with loadings greater than |0.4| are included in the interpretation. The variables in the first column are captured using the 5-point Likert scale in terms of farmer's agreement/disagreement. KMO = 0.672 and Bartlett's Chi-Square = 384.42, p-value = 0.000
Source: Survey (Oct/Nov 2021).

The PCA derived from the entrepreneurial risk that is production, financial and institutional risk indices were reported in the table 5.9. Bartlett's test of sphericity and the KMO measure of sampling adequacy indicated that the data was appropriate for PCA. The table 5.9 indicated the significance of Bartlett's test (1%) and suggests that the variables are inter-correlated. Moreover, the KMO measure (0.7) was greater than 0.5 which indicated that PCA can be applied to the dataset. The components of financial and institutional risk used to extract indices were 12 and only 4 principal components had Eigenvalues above 1 as per the Kaiser Criterion. The 4 extracted PCs

contributed 71% of the total variation of the variables 12334-s used. The first component (PC-Risk awareness) explained 32% of the variation and was found to be closely related to awareness of contracting as a risk management strategy. According to (Kahan 2013; Korir, 2011) risk management strategies in agriculture are vital as there is high variability in the agriculture sector, thus, it the importance of implementing strategies such as crop insurance and price stabilization and information and credit subsidies can be employed to minimise uncertainty. The second component (PC-Clmt-eff.) explained 18% of the variation and was found to be closely linked to climate change. According to Hlahla & Hill (2018), the effects of climate change can be seen in the urban poor (that is women, children and the elderly) thus doubling the vulnerability due to climate-related risk and poverty. The third component (PC-Environmental awareness) explained 14% of the variation and was found to be closely linked to awareness of environmental awareness. According to Giannini *et al*., (2016), there is a link between climate change and food security, which can be positive provided the farmers understand the climate variability and how it can be better managed in its complexity. The fourth component (PC- UA Mit.) explained 10% of the variation and was found to be closely linked to urban agriculture mitigating the impacts of climate change. Studies done by (Khalil & Najar, 2012; Hallet *et al*., 2016; Steele, 2017) found that urban farming can reduce the carbon footprint, depending on the type planted as some fruit for example strawberries were found to be contributing further to GHG emissions.

TABLE 5.10.: PSYCHOLOGICAL CAPITAL DIMENSION ON ENTREPRENEURSHIP IN UA

Variables	**Principal Components**		
	PC_1- Hope & Res.	**PC_2- Optimistic**	**PC_3- Risk taking**
-Poor yields, capital constraints and struggle to make ends meet don't deter me in UA	0.744		
-Trust other farmers	0.625	0.463	
-Enjoy new challenges	0.557		-0.546
-Willing to take on risk in comparison to other farmers	-0.510		
-Do not give up easily (low yields and constraints are temporary)		0.825	
-Optimistic about the future of UA, even when faced with constraints		-0.551	
-Cope with shocks such as droughts and natural disasters			0.831
Eigen Value	**1.587**	**1.244**	**1.123**
Variance explained (%)	**22.67**	**17.78**	**16.04**
Cumulative % of variance	**22.67**	**40.446**	**56.50**

Note: Components with loadings greater than |0.3| are included in the interpretation. The variables in the first column are captured using the 5 point Likert scale in terms of farmer's agreement/disagreement. KMO = 0.651 and Bartlett's Test of Spherecity Chi- Square = 60.05, p-value = 0.000
Source: Survey (Oct/Nov 2021)

The PCA derived from the entrepreneurial risk that is psychological capital indices were reported in the table 5.10. Bartlett's test of sphericity and the KMO measure of sampling adequacy indicated that the data was appropriate for PCA. The table 5.10 indicated the significance of Bartlett's test (1%) and suggests that the variables were inter-correlated. Moreover, the KMO measure (0.6) was

greater than 0.5 which indicated that PCA can be applied to the dataset. The components of psychological capital used to extract indices were 7 and only 3 principal components had Eigenvalue above 1 as per the Kaiser Criterion. The 3 extracted PCs contributed 57% of the total variation of the variables 123-s used. The first component of (PC- Opt_Agr) explained 23% of the variation and was found to be close to farmers being optimistic about the future of urban agriculture, as they believe that the constraints are minor and can be addressed easily. The second component explained 18% variation and was found to be closely linked to the hope and resilience of the farmers. It was found that the farmers were still willing to continue farming even though they were faced with several constraints such as financial (Zaca *et al*., 2021) The third component explained 16% of the variation and was found to be closely linked to the willingness of the farmers to take on risk that is, the take on other business opportunities. The farmers were open to exploring farming business opportunities however, capital farming constraints and lack of resources made it difficult for them, making them risk takers (Cele, 2017; Zaca 2018; Zaca *et al*., 2021). Studies have shown that increased monthly incomes and a relaxation of capital constraints, influences farmers' willingness to take on risk as well as be more competitive.

5.4.5 Logit Regression Output of the Effects of Entrepreneurial Risks and Water Quality on UA.

Once the principal components were estimated, a regression analysis was performed to study how the estimated components influence urban agriculture (UA) entrepreneurship. **Table 5.9** demonstrated the results of the regression analysis performed on the PCA output variables using the dominant (more loadings), and other socio-demographic variables were used in the analysis. The dependent variable was UA entrepreneurship, the study found that 6 of the 12 variables were statistically significant for UA participation in the study. The variables were age, education, and water quality, entrepreneurial risk factors (market price risk and production risk) as well as psychological capital. Other variables such as gender, land size, HH income, entrepreneurial risk (market-forces) and farming experience were found to be insignificant. The research aimed to assess the entrepreneurial risk factors on UA and its effect on water quality and use of the respondents in the study. The logit regression model was used to answer the 2nd research question of the study which was evaluates the role of UA entrepreneurial participation in low-income households. The explanatory variables used in the logit regression were tested for multicollinearity using the variance of inflation factor (VIF). As illustrated in table 5.9, the VIF=1.29, indicated that there was correlation between the variables, as the value was below the threshold. This according to Everitt & Skrondal (2010) indicated an absence of multicollinearity in the model, if a VIF value was greater than 10. The probability>Chi2 (0.016) indicated that the model was viable for the study as the significance is found to be at 5%.

TABLE 5.11: LOGISTIC REGRESSION ON THE EFFECTS OF ENTREPRENEURIAL RISKS AND WATER QUALITY ON URBAN AGRICULTURE

UA participation	**Coeff.**	**Std. Error**	**P-value**	**dy/dx**	**Std. Error**	**P-value**
Water quality (PC2)	0.567	0.276	0.040**	0.097	0.043	0.023**
Entr1_Enviro-Hygiene (PC1)	-1.000	0.482	0.038**	-0.172	0.075	0.022**
Entr2_Market price risk	0.391	0.184	0.034**	0.067	0.028	0.017**
Entr3_Record keeping	-0.263	0.173	0.129	-0.045	0.028	0.110
Psyc_Cap	-1.327	0.493	0.007***	-0.228	0.070	0.001***
Gender	-0.073	0.616	0.905	-0.013	0.106	0.905
Age	-0.069	0.033	0.040**	-0.012	0.005	0.023**
Educ.	-1.374	0.475	0.004***	-0.236	0.065	0.000***
HH_Inc	0.077	0.157	0.625	0.013	0.027	0.622
Farm_Trnng	1.141	0.708	0.107	0.196	0.115	0.088*
Farm_Exp	0.057	0.083	0.490	0.010	0.014	0.484
Land_SZ	-1.076	0.972	0.268	-0.185	0.163	0.255
Constant	9.995	3.879	0.010**			
Mean depend var.	0.603					
Pseudo r-squared	0.236					
Chi-square	24.727					
Akaike crit. (AIC)	106.099					
Bayesian crit. (BIC)	136.736					
Prob > chi2	0.016**					
Mean Variance inflation factor (VIF)	1.29					

****p<0.01, **p<0.05,* p<0.1 significance level,* ***N=78***

Age variable was found to be negatively significant to influence the participation of the household head in UA. As the household head ages, the propensity to participate in UA reduces. This can be attributed to the majority of the participants were above the age of 61 (42%), thus the lack of entrepreneurship in UA engagement, as elderly people were less likely to be innovative and visionary. The marginal analysis indicates that an increase a unit increase in age results in a decrease in UA participation by the farmers by 6.9 per cent. This finding indicated that elderly people were less likely to participate in UA, which was in agreement with studies that indicate there needs to be more youth involvement in UA (Cele, 2017); also due to the current high unemployment rate of 34.5% nationally and 22.5% being the youth as of Q1 of 2022 (StatSA, 2021). According to the GEM report of 2017-2018, "South Africans aged between the age of 25-34 years were the most entrepreneurially active, amounting to 50-60% of the early-stage entrepreneurs". While there was a drop (6.3%) in the figures in 2016, the percentage of entrepreneurs increased to 14.5% in the subsequent year; for those that were entrepreneurs only 1.8% of the entrepreneurs were engaged in agriculture, more specifically subsistence agriculture (Bowmaker-Falconer & Herrington, 2020). This indicated that the youth was mostly involved in other sectors besides agriculture, due to other effects.

The education variable was found to be negatively significant to influence the participation of the household head in UA. An increase in education, results in the propensity to participate in UA reduction. This can be attributed to the number of participants in the study that had gone beyond secondary school. Furthermore, a study by Mudhara *et al*., (2014), found that the educated farmers attached more importance to UA, indicating a better knowledge of the benefits of urban agriculture comes with better education. Moreover, Ratshitanga (2017) recognised that educational backing was necessary for young farmers' participation in agriculture, as knowledge of sustainable and profitable agriculture is very limited. This study, however, found that there was a negative correlation between UA and education which is contradictory to what other authors have found in past studies, factors such as participant's age, educational level and the number of participants could have influenced the outcome.

The water quality variable was found to be positively significant to influencing UA participation of the household head. An improvement in water quality, increase the propensity for participation in UA. This is not surprising as most of the farmers were using tap water, which is not associated with health risk perception of the farmers. The expectation of the study was also that water quality will be positively correlated. In a study done by Mudhara *et al*., (2014) they found that farmers in urban areas (that is, Sobantu) were using tap water as their main source of irrigation water, even though there was the use of other types of water sources used that is. rainwater, river and dam water. The study further found that the river water could be a potential health risk, unless if water is tested and proven to be compliant with the water quality standards. Furthermore, a study done by Saldias *et al*., (2017), found that water reuse was acceptable to the farmers, provided there was assurance of good-quality water. This illustrates that a unit increase in the water quality used in

UA increases urban farmer participation by 0.569 per cent all things being equal. The results also illustrate that farmers are aware of the water scarcity, but they are also concerned about the health implications of water reuse as they wanted quality assurance, above the quantity available.

The entrepreneurial risk factor that affects UA participation, that is, farm and market environmental conditions (production risk) was found to be negatively significant to influence participation. As the production risk increases, the lesser the likelihood of participation in UA by the household head. The results indicate that factors such as soil deterioration and environmental conditions can harm the produce grown on the land in terms of quantity and quality. As revealed in the study of Hlahla & Hill (2018) where the environment also affected the farmer's ability to produce at maximum capacity, due to challenges such as water shortages, floods, droughts and pest diseases and insect damage, as well as soil deterioration can result in food insecurity for the farm participants. Mudhara *et al*., (2014), confirmed this as these challenges were the same in the study areas. The challenges were pests and disease, water shortages, lack of inputs and market access challenges through the support of extension services. A study done by Stranieri *et al*., (2016) found that knowledge of environmental issues of the consumer plays a role in predicting the purchasing power of analysed products. An essential part of risk management techniques in terms of environmental preservation for future generations.

The entrepreneurial risk factor that is, market price risk was found to be positively significant for the household head UA participation. An improvement in the market price risk, the inclination of participation of the household in UA increases. Contrary to the findings in a study by Korir (2011) which found that yield and prices in the market are negatively correlated in a small area and the local price are determined by local production and demand which is volatile. Farmers face yield and price risks that are correlated depending on the level of regional market integration (de Jenvry & Sadoulet, 2002), while price risks depend on the consumer's ability to substitute products and on the extent of market integration. Furthermore (Korir, 2011; Korir *et al*., 2015) notes how market integration is dependent on infrastructure and the type of markets available; developing countries are said to have poor infrastructure and thin markets that is, low productivity and low marketed surplus. Price volatility often leads to reduced incomes for the farmers, while inter-annual price volatility generally leads to inefficient planning and resource allocation through price uncertainty (Gabre-Mahdin *et al*., 2002).

Psychological capital was found to be negatively significant in influencing UA participation of the household head. The results indicate a unit decrease in psychological factors such, as efficacy, hope, resilience and optimism can have a negative influence on entrepreneurship in UA participation of the farmers. This was found to be in contradiction to the expectation of the study on the role of positive psychological capital in urban agriculture, as a study by (Cele, 2017; Zaca, 2018) found that factors such as self-confidence, risk-taking and optimism have positively influenced the farmers. However, this study found self-confidence, risk-taking and

competitiveness to be negatively influencing the urban farmers. The study found self-confidence to be negatively influencing entrepreneurial behaviour in UA participation, contradictory to the study expectation on self-confidence influencing positive entrepreneurial behaviour in UA participation. Cele (2017) found that the farmer's self-confidence was influenced by the farmer's level of education, access to inputs and increased incomes. For the farmer to take on risk, there must be an incentive such as secure water and land rights, access to market information, and access to input resources, these factors can have a significant influence on the farmer's willingness to take on risk. The results in the study income showed that there was no significance as the HH income variable was found to not influence UA. Suggesting that farmers were mainly involved in UA to lessen the burden on funds directed toward vegetable purchases.

5.5 SUMMARY

This chapter aimed to investigate entrepreneurial risk factors that affect UA and water quality and use in low-income households. To recap, the study found that some of the farmers in the study had some training on the use of WW in their fields, they, however, still felt uneasy using this type of water as they were not aware of the health implications associated with its use. The perception of the water as being unclean also played a role in their decision not to use the water in their irrigation practices. The study further found that the farmers in the study were aware of the role of the environment in UA, as unhygienic farming practices influenced the buying decision of the consumers. The farmers were found to be practising basic farming hygiene in terms of keeping their working spaces clean (on and off-farm) and also pre-washing their produce before selling at the market, to make their products more appealing to the buyers. The farmers who practised mixed-farming in their enterprises said they were practising safe animal husbandry by separating animals from the crops grown to avoid any health implications as well as the destruction of produce in the fields. The farmers, however, had issues of theft in the community of their produce and destruction of the crops from stray animals in farms that were not fenced or adequately fenced.

The farmers were found to have access to informal markets in the community for the sale of their produce. The study also found that farmers were aware of the environmental benefits of using organic fertilizer, such as using organic waste into compost and also the use of animal manure. A technique they said was cost-effective and they also found to be good for their soils. The farmers were, however, still using chemicals in their field as they revealed that pests and diseases are a major factor in their capability for optimum productivity. The farmers also believe that the earth has enough land to produce enough food for everyone, but the farmers were not aware of the impacts of agriculture on climate change as only more than half of the respondents had an idea of the impacts, while some were oblivious. The study found that even though farmers were sometimes affected by environmental hazards such as floods, droughts and hailstorms, indicating an experience of production risk. However, the farmers were not protected from this type of risk as they did not have crop insurance and would suffer a loss in case of hazards.

The study also found that the motivational factors for the crops grown were the availability of markets, inputs (Seeds) from the government, suitability of the soil as well as the seasonality of the crops. These factors were in the best interest of the farmer at the time; however, this meant that

the farmers were planting the same products at the same time, causing competition at the market with commercial and other stallholder farmers other areas, who were also selling to the formal markets. The farmers also found it difficult to sell at the market as they would have to reduce the price of their products to avoid spoilage and further loss at the market. The crops mostly grown revealed that there was predictability in the farmer's products, even though other factors such as land size and seasonality may have influenced the farmer's decision on the crop type. The study also found that there was no collaboration between the farmers in the areas who were planting individually and those who were planting as a cooperative, in terms of crop planning and scheduling based on prices at the market and the supply and demand for the products. The farmer revealed that they had offers from institutions (hospitals, schools and organisations) to produce a certain number of products that would be later collected by the contractor, however, it was found that the farmers were sometimes unable to meet the desired capacity due to land size and the amount harvested. The drawbacks influenced farmers' attitudes toward UA as negative outcomes failed to motivate the farmer to acquire more land and increase their farming capacity.

The study found that the attitudes of the farmers toward UA indicate a lack of motivation to be competitive farmers and the unwillingness to take on risks in farming. The lack of motivation can be attributed to the lack of government support, the lack of knowledge on how to diversify risk, as well as the education level and age of the respondents in the study. The study also found that the farmers were not keeping records of their production activities that is farming records, financial statements, balance sheets and profit and loss statements. These are the type of records that could farmers get a clear picture of how they are doing and if there are changes that they need to make in their farming activities. The principal component analysis was employed in the study to extrapolate the variables that were later used in the regression analysis of the study to answer the question of the study. The PCA results used in the regression model were those found to have more loadings of the entrepreneurial risk factors in UA, as well as psychological capital factors that influence the entrepreneurship of the farmers. The regression analysis found 6 variables that were significant at various levels, that is, 1%, 5% and 10%, the coefficients, presented a positive and a negative relationship between the variables in the study. The study's positive significance was found with the following variables, water quality, and market price risk. While the environmental hygiene conditions psychological capital, age and education variables had a negative significance level; to the participants in the study. Factors such as improved water quality, reduced market risk are found to increase HH incomes and ultimately led to food and nutrition security. It can also be therefore concluded that factors such as age, educational level, production risk and psychological capital can greatly influence income generation capacity and increase the vulnerability to food and nutrition insecurity of the participants. The following chapter will give the study results based on the final research question.

CHAPTER 6: The impact of urban agriculture and entrepreneurship in food and nutrition security in low income HH

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ABSTRACT

Many of the urban poor depend on urban agriculture to ensure food and nutrition security at an individual and household level. While UA has been found to ensure FNS through the sale of products sold from the harvest and reduce the cost of production. The rural to urban migration for better job opportunities, has resulted in people in urban areas failing to make ends meet. To overcome the effects of food and nutrition security people engage in urban agriculture in South Africa and other African countries. This paper presents the findings of the study on the implications of urban agriculture on the entrepreneurial risks and food and nutrition in low-income households. A survey with purposively and randomly selected participants from the uMgungundlovu district was conducted. The sample included urban farmers (48) and non-urban farmers (30) who were purposely selected for the study. The data was analysed using descriptive statistics, and relevant statistical test were conducted to compare the means and the goodness of fit of among variables. The results show that there is still lack of governmental support, and recognition by the policymakers, mostly due to the land size, the product sizes as well as the inability of farmers to keep up with the constant supply to the consumers due to a number of constraints. The results also show that the prevalence of poverty in the district as the participants were farming to ensure food and nutrition security at a household level, there was less motivation to farm for income generation and growth toward become more commercial than subsistence farmers. The results also show that the farmers are still subsistent in their production even though there have been several studies on agricultural entrepreneurship. The conclusion was that the farmers are not motivated to farm to sell they are however concerned about ensuring food security. Even though their production may not be sufficient at time, they are able to supplement the food supply in the household in times of deficit.

Key words: urban agriculture, food security, income, poverty, entrepreneurial risk,

6.1 INTRODUCTION

Urban agriculture plays an essential part in the local food systems in cities; while also reducing the food shortages in vulnerable groups (Eisazadeh *et al*., (2015). Furthermore, it was noted how most of the people in towns or cities of developing countries spend a significant amount of their incomes (50-70%) in buying food, therefore local food production will reduce the cost of food (FAO, 2007). Moreover, participation in urban agriculture is found to be for community development, food security, and economic growth; and it can strengthen social ties (Ackerman *et al*., 2014). UA also provides sustenance for households that may be lacking, create jobs and contributes to the household's income while offsetting the food expenditure (Ackerman *et al*., 2014). As postulated in other studies where they found that about 6% of agricultural activities indirectly and directly created 1350 jobs, the commercial value of urban products in UA will be about 5.5 million US dollars (Ghaleh, 2019). Further illustrating the role of UA in community gardens in economic growth and agro-tourism; while also striking motivation for commercial development and even its attraction in micro and macro investments within the field (Eisazadeh *et al*., (2015). The outbreak of diseases and social unrest (riots) can hinder movement of products from points of production and also cause a loss for farmers, it was therefore found that local food production is essential in times of uncertainty (Lal, 2020; Sihlobo, 2021). Thereby, making UA an essential part of growing local economies more so in socially deprived areas, where there is less investment by governmental or private entities.

The high food prices in cities make the most vulnerable in society engage in urban farming, such include; the very poor and food insecure (including the child and female-headed households, HIV/AIDS-affected households, young unemployed people and the elderly without a pension grant) to address food insecurity (van Veenhuizen, 2014). Furthermore, UA has been found to strengthen many ecosystems such as improving human health, food access to local communities, income and jobs along with economic prospects, aesthetic value and beauty, education about farming and community resilience (Obeholtzer *et al*., 2014; Thomas 2014; Santo *et al*., 2016; Lal 2020). The Covid-19 pandemic and the Russia-Ukraine war has amplified the calls for resilient local food systems, as the lockdowns and conflicts have an impact on the value chain movement of food (Puighe & Lupia, 2020; Chibanada, 2021; Ojokoh *et al*., 2022). Furthermore, it was noted that the pandemic impacted the buying power of the consumers due to the unemployment or the loss of jobs, even though South Africa had enjoyed a season of abundant harvest (Sihlobo, 2021). Moreover, South Africa has long-standing challenges with income and poverty where the poor people are unable to afford nutritious food (Sihlobo, 2021). The food prices have been found to rise drastically due to conflict as the Ukraine being an exporter of agricultural products, thus pushing millions of people into deeper hunger and poverty (Hassen & El Bilali, 2022).

Further exacerbating the effects on food and nutrition insecurity to the most vulnerable in society. Even though, governments in some countries had introduced some stimulus packages to help with the impacts of the pandemic and the conflicts on food and nutrition security. However, there is still an urgent need for more convenient modes of food production systems and supply chains (Sihlobo, 2021; Hassen & El Bilali, 2022). Studies over the years have therefore argued for the endorsement of UA in cities to ensure the continuation of food production and combat the food and nutrition insecurity of the urban poor households. The research on UA and entrepreneurship has been mainly concentrated on UA addressing food and nutrition security for the urban residents. Others have championed for the youth involvement in UA so as to invoke the innovativeness in the participants

(Chibanda, 2021). This study therefore aims to do so by investigating the implications of urban agriculture and entrepreneurial risk on the food and nutrition security in low-income households. This will be achieved by using proxies such as income, land size, and risks in agriculture to conclude the explicitly if the households were food and nutrition secure. Literature over the years has displayed how the food and nutrition status of individuals can be affected by numerous factors one of which can be controlled and some of which are out of the control of the individual such factors are the vulnerability context (shocks, trends and seasonality) of livelihoods.

6.2 RESEARCH METHODOLOGY & STUDY AREA

The following section is an illustration of the analytical framework as illustrated in table 5.1 showing the analysis employed in the study, for each of the variables used in the study for data analysis

6.2.1 Study area and sampled farmer's description

The study consisted of a sample of 78 participants from the following areas in and around Pietermaritzburg that is Sobantu, Sweetwater's and Mpophomeni townships. Two (Sobantu and Sweetwater's) of the areas are under the Umsunduzi local Municipality, while Mpophomeni is under the Umngeni municipality in the uMgungundlovu district. The study areas are in a close-knit community where houses are close together, near community service centres such as clinics, community halls, police stations, as well as nearby factories. The farmers are close to an urban centre that is Pietermaritzburg town, and Howick; the plots of land are close to the houses. The farmers in the study areas are mostly involved in the growing of vegetables such as spinach, beetroot, mealies, butternut, onions, potatoes, lettuce, carrots, cabbage, and kale and there are also farmers involved in poultry farming. The crops grown here are found to be suitable for growth in the area as they are better suited for growth in terms of climate as well as the soil type in the areas. The products have also been found to be closely related to food and nutritional security considering the nutritional contents. They are also the predominantly produced commodities in the study areas even though they are highly perishable they are fast cash crops and area able to provide the farmers with income, faster in comparisons to other agricultural commodities.

6.2.2 Analytical Framework

The study employed different methodologies for the analysis of results based on the research objective. A questionnaire was administered to 78 participants (30 non-urban 48 urban farmers) in three areas surrounding the city Pietermaritzburg, in the KZN province, South Africa. The cases area Sobantu, Sweetwater's and on the outskirts of Pietermaritzburg was Mpophomeni Township. The study employed PESTEL analysis, which is a standard tool for analysis of the external business environment. PESTEL analysis in the study evaluated the political, economic, socio-cultural, technological, environmental and legal aspects of urban agriculture. The results are presented in a table form to answer each question during the focus group discussion.

TABLE 6.1 **:**ANALYTICAL FRAMEWORK OF THE RESEARCH OBJECTIVE AND THE ANALYTICAL TOOLS USED

Objective	**Variables**	**Analytical tool**
To investigate the implications of urban agriculture and entrepreneurial risk on food and nutrition security in low-income households	-PESTEL effects on the urban farmer's income generation -The effects of entrepreneurial risk factors on HH income - Income generation effects on food and nutrition security	-Thematic Analysis -PESTEL Analysis

6.3 RESEARCH DESIGN

The study employed a mixed-methods methodology where both qualitative and quantitative approaches to collect data were used to reveal information under the research question. The study employed a case methodology of three geographical areas, each case had various participants. Although often associated with mainly qualitative research, case study research can also be quantitative and carry elements of scientific review (Mills *et al*., 2010), as is in this study. The overall number of participants in all three cases was 78 that is (48) urban farmers and (30) non-urban farmers. Other methods employed were focus group discussions, and surveys. This type of methodology is essential for providing a strong foundation for community-based participatory research as it involves smallholder farmers, different stakeholders, markets actors, researchers and government extension officers (Ivankova, 2017). Both the purposive and simple random sampling technique was used to sample 78 participants, and the data was collected using a survey questionnaire and FGD to gather information on the impact of urban agriculture and entrepreneurial risk on food and nutrition security in low-income households.

6.3.1 Data Analysis

The data collected was then coded and transcribed from Microsoft excel to Statistical Software Package (SPSS V27) for Social Sciences and the STATA SE17 software. For the analysis of quantitative data, a descriptive statistical analysis was used to summarize commodities produced in the study areas, the reasons for farming and the P.E.S.T.E.L, focus group responses pertaining to the farming activities of the respondents. The qualitative data was analysed using thematic analysis, which mostly applies to this type of dataset and statistical tests. The study also used proxies to measure the food and nutrition security in the study areas using the total income, sales, yield and frequency of production.

6.4 RESULTS AND DISCUSSION

The results showed the crops grown in the study areas and the income generated from the crops sold as well as the perceptions of UA of the participants. The results also illustrated the sector employment as well as the poverty indicators in the study areas. These results were captured to make conclusions on the food and nutrition status of the participants in the study areas.

6.4.1 Crops grown in the study areas and the income generated from the sold products

Table 6.2 showed the types of crops that are produced by the farmers on their land. A limited number of smallholder farmers were found to plant crops with consumers and competitors in mind. The result of such was their inability to sell all their produce at the market, due to limited market information on the supply (SS) and demand (DD) of products at the market, as well as the lack crop scheduling according to the market's demands. For farmers to meet the DD needs at the market, they had to familiarise themselves with online platforms which have the necessary information on the number of products available at the market and their trading price at the market. This study found that there were three major crops grown that is cabbage, spinach and maize, as well as beetroot and onions in smaller quantities. These crops were found to be grown in seasons where high quantities were supplied to the market. During the focus group discussions, the majority of the farmers mentioned that they had no formal markets for the crops they were producing, but the sale was done in informal settings. According to Louw & Jordaan (2016), farmers opt for this type of market as it presents lesser risk, due to the standards; it also offers security and swift payment rather than the fresh produce markets which would only make payments once their product was sold or never if the product is not sold. The marketed products are further discussed below.

Marketed commodities in the study areas

The commodities in table 6.2 below denoted with the (*) represent the farmers that engaged in mixed farming as they were involved in poultry and vegetable farming. The results revealed that 0.66% of the urban farmers were growing chickens, while 3.36% of the non-urban farmers were engaged in poultry farming. The farmers were found to be planting for household consumption and would only sell the excess. The vegetables that were mostly consumed by the households were beetroot, onions, traditional pumpkins, sweet potatoes and imifino. Other commodities were mostly grown for selling, but the farmers would consume what was not sold to avoid spoilage or loss on the farm or at the market. The commodities that were frequently grown for selling are spinach (19.14%), cabbage (16.17%), maize (9.28%), potatoes (7.26%) and traditional pumpkins (7.59%). These crops were generally sold by commercial farmers as well as other smallholder farmers, which brought about competition in the market, thus resulting in price reduction at the market depending on product seasonality. The farmers were also found to not be scheduling their products on seasons when there was a deficit in the market, to maximize production yields and profit.

TABLE 6.2: CROPS GROWN BY THE RESPONDENTS, THE PRICE RANGE AS WITH THEIR PERCENTAGE (%) ALONG WITH THE NON-VEGETABLE COMMODITIES.

		Urban Agriculture		Non-Urban Agric.		Pool	
Commodities	**Price and use**	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
Sweet potatoes	For HH consumption	2	1.32	4	2.68	6	1.98
Amadumbe	R30/dish	1	0.66	5	3.36	6	1.98
****Cabbage**	**R10-15/Head**	**27**	**17.76**	**22**	**14.77**	**49**	**16.17**
****Beetroot**	**For HH consumption**	**15**	**9.87**	**6**	**4.03**	**21**	**6.93**
Carrot	R10/Bunch	5	3.29	8	5.37	13	4.29
Lettuce	--	10	6.58	3	2.01	13	4.29
****Spinach**	**R10/Bunch**	**30**	**19.74**	**28**	**18.79**	**58**	**19.14**
*Chickens	R80-100/Chicken	1	0.66	5	3.36	6	1.98
****Potatoes**	**R10/Dish**	**10**	**6.58**	**12**	**8.05**	**22**	**7.26**
****Maize**	**R10-15/Cobb**	**10**	**6.58**	**18**	**12.08**	**28**	**9.24**
Butternut	--	2	1.32	4	2.68	6	1.98
**Onions	For HH consumption	6	3.95	10	6.71	16	5.28
Green Pepper	--	5	3.29	3	2.01	8	2.64
****Pumpkins**	**For HH consumption**	**8**	**5.26**	**15**	**10.07**	**23**	**7.59**
Tomatoes	--	3	1.97	1	0.67	4	1.32
Brinjol (Egg-plant)	--	2	1.32	0	0.00	2	0.66
Green beans	--	3	1.97	1	0.67	4	1.32
Chillies	R5/Dish	4	2.63	2	1.34	6	1.98
Kale	R10/Bunch	8	5.26	2	1.34	10	3.30
Imifino	For HH consumption	0	0	0	0.00	2	0.66
Total		**152**	**100**	**149**	**100**	**303**	**100**

*NON-VEGETABLE COMMODITIES

** Frequently grown crops by the farmers

--Farmers did not want to disclose/did not recall the price for commodities.

Multiple commodities were produced by the respondents in the study areas.

During the focus group discussions, it was found that the farmers that plant their crops based on crop seasonality, were also not coordinating amongst themselves allowing for production rotation between the farmers to ensure continued production throughout the year. They, therefore, would lose out on profit maximization as the sale of products in times of market deficits yields the highest price attainable at the market. It was also noted that the supply of products by the farmers is also not sufficient for local supermarkets to enter into a contractual agreement to be their full-time suppliers. However, during the focus group discussion, some farmers mentioned they were asked by some institutions like nearby hospitals (Northdale), and Umgibe farming institute to supply them with products like carrots, spinach, butternut, beetroot and onions. These farmers were found to be unable to fulfil the contractual agreement or they had to ask neighbouring farmers for the additional produce, to ensure delivery of the desired quantity. The land size for the production of an individual farmer was found to not be sufficient to produce the required quantity by the markets, institutions (e.g., hospitals, schools) as well as supermarkets. There was also competition in the markets by the commercial farmers who were better suited to produce the required quantity, at

reduced costs. As a result, the majority of the farmers opted to sell their produce in informal markets (tables or vans) or at their farm-gate, to minimise transaction costs (transport cost, agent fees, packaging fees etcetera.) of selling their produce at the formal markets, which far-outweighed the benefits.

A study by Murugani & Thamaga-Chitja (2017) found that price fluctuations due to market forces often leave farmers uncertain about what price their batch of produce would fetch at the fresh produce markets, and living farmers vulnerable to relatively huge losses if the prices fall in response to national and global market dynamics. Such instances are what is referred to as a market (price) risk to which urban farmers are not insured against or they cannot offset the risks as their production quantity is not enough. The price they would get at the market would not yield any profit or even cover the production costs, but result in a loss. Competition, lack of transport, poor product quality and lack of packaging material are some of the post-harvest and marketing risks farmers face (Louw & Jordaan, 2016). In the FGD, farmers revealed that they have had bad experiences with fresh produce markets because they would send about 10 crates of spinach and would be told that only about 4 or 5 cases were sold. They would then have to pay for storage space at the market or fetch their produce. The over-supply and production competition in the market often resulted in low prices at the market (Louw & Jordaan, 2016). This was another reason why they preferred the van traders or would opt for informal markets because with them, that would never happen and they also feel in control of the price negotiation of their produce. However, this is contrary to the findings by Murugani & Thamaga-Chitja (2017) who found that despite the uncertainty in fresh produce market prices, the farmers in their study thought it was better to keep sending their produce to the fresh produce market rather than relying on farm-gate sales. This once again highlights the risk of the "one size fits all" approach. Table 6.3 below further illustrates the crops grown the income generated from the sale of products.

TABLE 6.3 ESTIMATED TOTAL INCOME GENERATED FROM THE SALE OF COMMODITIES IN THE STUDY AREAS

Commodities sold	Output (Q)	Price (R)	Income (R*Q)
Amadumbe	60	30	1800
*Cabbage	490	12.5`	6125
Carrots	110	10	1100
*Spinach	580	10	5800
Potatoes	220	10	2200
*Maize	280	12.5	3500
Chillies	60	5	300
Kale	100	10	1000
*Broiler Chickens	60	90	5400
Total income (R)			**27225**

*Products generating income >3500

Table 6.3 Illustrates the commodities sold by the farmers in the study areas and the price and output each commodity. The table shows that the farmers are mostly producing cabbages and spinach as 490 heads of cabbage and 580 bunches of spinach were sold. Even though the farmers produced

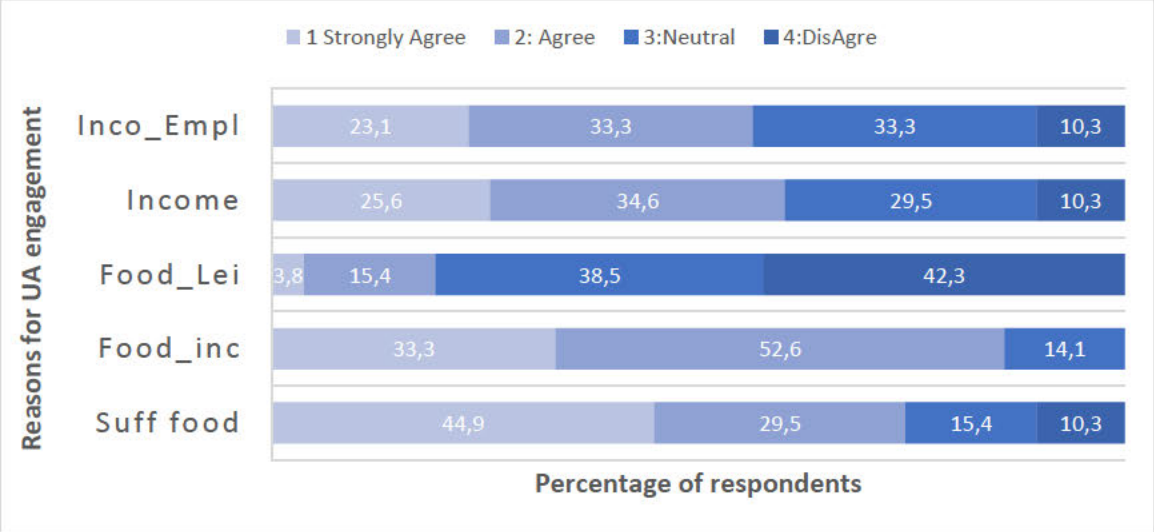
these commodities they were still selling them at relatively low prices, as they depended on seasonality of the products. This meant that there was surplus in the market and the consumers had the bargaining power to set the price, and a loss of sale meant that the farmers would not be able to generate an income to buy inputs for the following planting season. The results also show that the cabbage, spinach, and broilers were the commodities that generated more income for the farmers and other commodities were not enough to fetch a high enough price at the market. The total income value (R 27 225.00) shows that in the study area shows that 48 participants in the study areas who were selling their produce were making -/+R605 from the sales of the products, all things being equal. The values indicate that the farmers are not making enough as the average value of the costs of production ranges between R800-1000, depending on the commodity planted and the pests and diseases, prone to the area.

These output values indicate that the farmers were facing other constraints such as land size and the number of inputs necessary for the increase in production capacity for those who had bigger land size that is more than 1ha. The farmers were also hindered by access to markets as a result they sell their commodities at reduced prices or market entrance. Even though, it is often assumed that supermarkets are the only markets that smallholder farmers should be targeting (Mkhabela, 2005). Yet, experience displays that such assumptions do not always hold as these formal institutions (Fresh Produce Markets, supermarkets, wholesalers) are not always accommodative or the smallholder farmers are not always able to meet the set standards and are often compared to commercial farmers (Baiphethi & Jacobs, 2009; Rao & Qaim, 2011; Chamberlin & Jayne, 2013). Regardless, of their behaviours in crop selection as well as decision making, which influence intention and psychology, the farmer's entrepreneurial spirit can be deterred by lack of resources and also lack of support from government and other NGOs. Researchers like (Jayne *et al*., 2010; Rao & Qaim, 2011) are concerned about smallholder farmers increasing marginalisation and modernisation of the world retail food system occurring at a global, national and local level.

The requirements for the certification to trade in a global market have been found to have succeeded in minimising the risk of disease transmission, due to the high standards (DARD, 2004). The SA-Good Agricultural Practice (GAP), is said to be a vital source of information for the producers and the consumers as it enforces responsible farming methods from site selection, land prepping, harvesting and handling at post-harvest (DAFF, 2016). Nevertheless, smallholder farmers and commercial face different constraints and their production capacities are not similar, thereby, missing the point of the different roles played by the farmers in society. Studies by Chamberlin & Jayne (2013) and Okunlola *et al.* (2016) have since argued that the point is often missed in policy debates about smallholder farmers, which tend to impose very homogenous assumptions about what constitutes a desirable market for the farmers. According to Okunlola *et al.* (2016), subjective evidence from areas such as Nwanedi in Limpopo and Pongola in KwaZulu-Natal suggests that many small-scale farmers who supply agro-processors, such as Tiger Brands, or large retailers, such as Massmart (with formal contracts and in ‘tight value chains’) also tend to supply van traders purchasing vegetables at the farm-gate (that is, in ‘lose value chains’).

6.4.2 Farmers perception on UA entrepreneurship and food and nutrition security

Figure 6.1 gives a brief illustration of the reasons for farming the participants were, and what their main motivation for farming. The farmers who were part of the study expressed that the major reasons for them engaging in farming were mostly for them to have sufficient food (44.9%) and only (10.3%) were in disagreement with their reason, while others were indifferent about their reasons for farming. Other farmers mentioned being involved in farming for sufficient food and income (33.8%), and others were indifferent. Even though some of the farmers would plant for sufficient food and leisure (3.8%), 42.4% disagreed with this statement. While only 25.6% of the farmers were planting to generate an income and 10.3% were not planting for only income purposes but were subsistent as well. Some of the farmers were farming as a source of employment and income as farming was their only source of income (23.1%), while (10.3%) other farmers regarded farming as more of a leisure activity rather than being their main source of income. These findings indicate that farmers were mostly involved in farming to ensure food security, at a household level as there were rare cases of farmers having to go to bed hungry, or would have lesser meals in their lifetime. The farmers are therefore assumed to be subsistent in their farming, as they would sell the excess harvest, instead of selling all their produce at harvest to generate enough income.



Note: Likert scale responses were used where 1=strongly agree; 2=agree, 3=neutral; 4=disagree and 5=strongly disagree
FIGURE 6.1: REASONS FOR ENGAGING IN UA BY THE RESPONDENTS.

Agricultural activities have been associated with food and nutrition security at an individual and household level. **Figure 6.1** is indicative of the role of UA in the HHs in the three cases as the participants were majorly farming to have sufficient food, and the amount of water available at their disposal poses a great risk to their FNS status. As studies have shown that access to water and security are directly related to food security at an individual/household level. Figure 4.5 further illustrates how sufficient food is the main reason for engaging in UA for the participants, and the quantity and quality of water can greatly impact the FNS of the participants. As postulated by Gemma & Schmidt, (2010); Scheierling *et al*., (2011) where they note how the quality and quantity

of the water used are influenced by factors such as climate change effects, availability, and use. A study by Saldias *et al*., (2016), found that prioritising the quantity of water may not be the best measure for availability as the quality also matters to the consumers and the producers; ultimately impacting the FNS of the users of the water resources and those nearby. In the case of farmers in Cape Town, they (Saldia *et al*., 2016) found that farmer's perceptions of the use of treated effluent differed among respondents, while others were against the use of treated WW for reasons such as a cause to public health and the environment, others were for the use of treated WW as they were already using the resource.

The findings of the study also illustrated how the farmer's FNS status of the participants was impacted by the availability of water as well as the land size, as only a few (3.8%) participants were leisurely engaging in UA. The quantity of water led to reduced production capacity, resulting in the stability pillar of food security being affected. Confirming the findings by Hlahla & Hill (2018) where they found that the nutrition status of the farmers is insecure in periods of droughts and floods as this causes a decrease in the crops harvested, the farmers would then have to depend on remittances from family and friends, to ensure continued livelihoods. A study by Mudhara *et al*., (2014) found that water availability was a contributing factor to the reduced UA activity in the area as the water supply was unreliable and other water sources could pose a health risk to the farmers and the consumers. Hence, the aforementioned reluctance in **Table 4.9** of the farmers to use WW in their gardens or farms is due to the perception of the use of WW, which they see as harmful to them and the consumers.

According to Mudhara *et al*., (2013); van Veenhuisen, (2014); Lal, (2020), UA has been found to address food security in numerous HHs and it continues to be the most used technique by urban dwellers. The studies have also associated UA engagement to be gender specific as women; children and the elderly are the most vulnerable in society (Khumalo & Sibanda, 2019). Studies in the past have shown that more females are engaged in agriculture, unlike their male counterparts, for reasons such as having other sources of employment, which thus reduce male participation (Khumalo & Sibanda, 2019). The study revealed the same to be the case in this study as 52 (66.6%) of the female respondents were engaged in UA. To test for the association between gender and food security, the study found that there was no association between gender and sufficient food as the motivating factor for engaging in UA; the results only indicate an association between gender and food security when farmers engaged in UA for food and leisurely purpose, the Chi-square test shows ($\chi 2$=6.361; df=3 and P=0.095), indicating significance at 10%. This meant that a 1% increase in male or female participants in UA increases the food and nutrition status of the HH'S by 6.361 times, all things being equal.

The results also indicate that the farmers are subsistent in their operations and lack the "entrepreneurial spirit", even though some were optimistic about the future of UA in South Africa, they note the constraints as one of the factors affecting their production capacity. Other conditions remain unaffected as there is no relationship between gender and income and employment, income, food & income as well as sufficient food. It can therefore be concluded that there was no gender bias in the study, even though women were the majority of participants. The study also indicated that there was a statistically significant relationship at 10%, between water quality and food security (income and employment) ($\chi 2$=7.476; df =4; P=0.058). indicating a relationship between water quality and FNS (income and employment), as an increase in water quality will result in

food and nutrition security as the farmers will generate more incomes and also create employment which is one of the factors that motivates engagement in UA. The statistical results indicate that a 1% increase in water quality will result in an increase in income and employment by 7.476 per cent all things being equal.

Furthermore, other studies in the area show that there is engagement in several employment activities, and agriculture is one of the activities that residents in the areas engage in for a number of reasons. According to StatSA (2019), the district has 18.2% of agricultural activities in the area. Figure 6.3 shows that some of the households in the district in the study areas were engaging in agriculture as a main source of income (2.3%), while others engaged in agriculture as an extra source of income (5.8%), as well as a leisurely activity (5.8%). While in other households it was found to be the main source of food for the HH (16.2%), and others would plant for an extra source of food for HH (69.9%). These figures are indicative of the role played by agriculture in different HH's in achieving food and nutrition security through income generation and the household consumption of food harvested. Complementing the results found in the study where the study found that the farmers were concerned about having sufficient food and less motivation in generating income through agriculture as seen in figure 6.1.

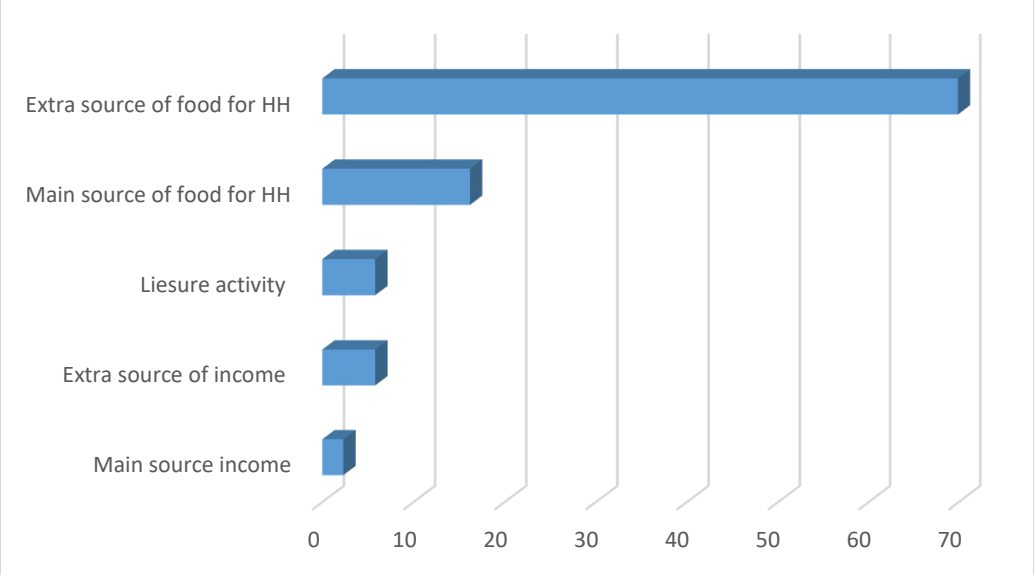


FIGURE 6.2: AGRICULTURAL ACTIVITY ENGAGEMENT IN THE STUDY AREA (2012-2019)
Source: StatSA (2019)

The **figure 6.2** shows the poverty prevalence in the municipalities in the study areas, with further analysis below.

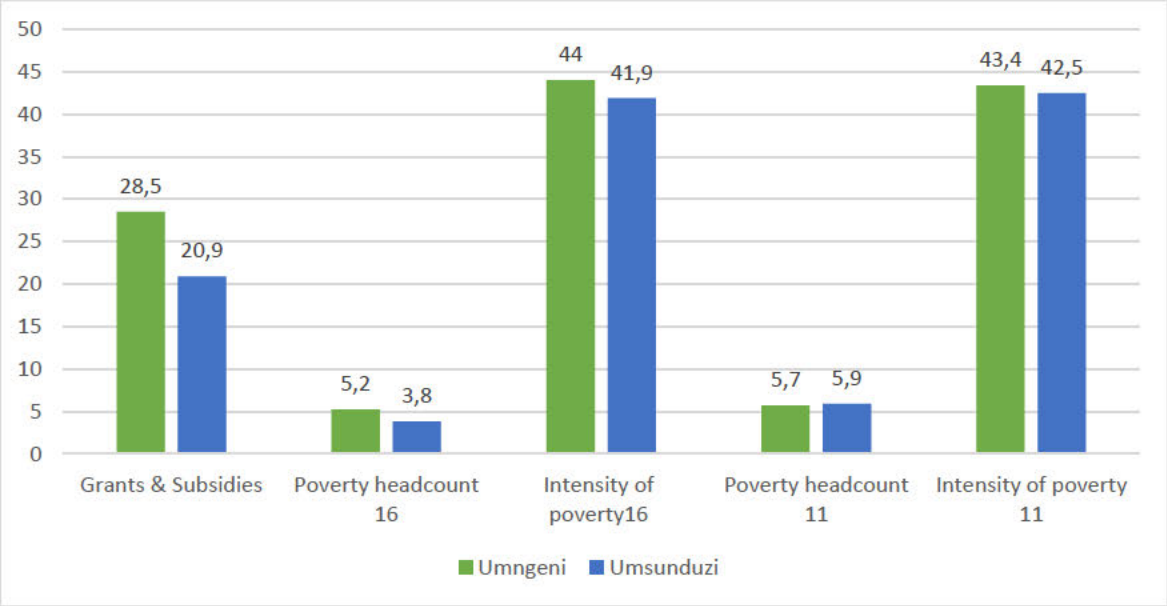


FIGURE 6.3: POVERTY INDICATORS IN THE UMGUNGUNDLOVU MUNICIPALITY FOR THE YEARS (2011-16)
Source: UMgungundlovu District Municipalities (2015/16).

The figure 6.3 illustrates the poverty headcount in the uMgungundlovu districts in the period of 2011/16. The values in the figure show that some of the households in the Umngeni local municipality are dependent on the grants and subsidies (28.5%), while those in Umsunduzi municipality were also found to be depend on grants and subsidies (20.9%), with a difference of 7.6% between the municipalities. The study results also found that some of the respondents were dependent on such government interventions, as (10.3%) depended on pension, while (7.7%) depended on social grants. The poverty headcount values are indicative of how the municipalities are prone to food and nutrition insecurity, as the values have slightly decreased from (5.7%-5.2%) in Umngeni and from (5.9%-3.8%) in Umsunduzi, while the intensity of poverty in the study area was high the values seem to have not shifted much as Umngeni has seen an increase (43.4%-44%), whereas Umsunduzi has seen a slight decrease (42.5%-41.9%). There are numerous factors that would have resulted in the shift in the intensity of poverty values, such can include, closure of businesses and migration from rural areas.

6.4.3 Sector employment distribution in the study areas

Unemployment is a problem for many countries, more so the youth unemployment as per the 2022 quarterly report, which states that the unemployment rate is (33.9% Q2 of 2022). According to Ratshitanga (2017) unemployment can cause a sense of worthlessness and a feeling of being redundant, which can lead to high rates of crime, and can also lead to unmet potential by those who are unemployed at the time, that is through starting of businesses (e.g., agriculture). Unemployment in the country is a huge problem and this can be seen in the figures of unemployment as the district unemployment in the study area is 30.4%, while the youth unemployment is an alarmingly 39.5% (StatSA, 2019). Furthermore, the statistics still show that 63.4% in the study area are living below the poverty line, an of the 63.4% about 45.6% have no source of income, while 17.8% earn less than R400 per month (StatSA, 2017). These value show

that there is still much that needs to be done as the numbers indicate a majority of the households in the study are vulnerable to food and nutrition insecurity both at an individual and household level.

Table 6.4 illustrates the PESTEL responses on the questions asked during the FGD with the farmers, the non-farmers and the key informants from the study areas.

TABLE 6.4: THEMATIC ANALYSIS OF THE FOCUS GROUP DISCUSSIONS USING PESTEL THAT IS POLITICAL, ENVIRONMENTAL, SOCIAL, TECHNOLOGICAL, ECONOMIC AND LEGAL IMPACTS

Themes	Concepts	Responses
Political	Are there any political issues that affect the urban farming process?	The farmers were unaware of any political issues that might hinder their farming process
	Are there any political disputes in the area that hinder your productivity?	The farmers made it known that they were unaware of any political disputes that might hinder their farming process.
	Are there any changes made by the new authority?	There are no political changes that farmers were aware of.
	Are there any existing policies that hinder their business growth of the urban farmers?	No policies in place hinder or lead to the growth of their businesses.
Environmental	Are the farmers located in an environment that is affected by climate change?	The farmers made it known that their farming locations were viable for their producing crops.
	What are the environmental changes having the farmers experienced or noticed in the area?	The farmers did mention how the heavy rains (floods) have made it somehow of an issue to plant other crops as the crops would drown from the immense amount of water. There were also cases of hail storms causing a loss of products
	Are the weather conditions suitable for urban farming?	The farmers made it known that their farming locations were viable for their producing crops; there have been no environmental conditions that hinder their productivity. In terms of soil suitability and crop type.
	What impact do these changes have on urban agriculture?	The impacts can lead to elimination from the market, as there were minimum residue level (MRL) tests that have to be done on the produce before sale at the market.
	Is the environment polluted?	The farmers alluded to that the water they use for irrigation is polluted by the sewage system from uphill as the river is on the lower side of the topography. Thus, affecting the utilisation pillar of food security which depends mainly on food safety and quality.
Social	Are the community members motivated to buy from the urban farmers?	The farmers mentioned that their consistency in producing food crops such as spinach and cabbages of which can be considered as staple food crops motivates the community members to continuously purchase from them.

	Are there any crime related issues that affect urban farming in area?	The lack of fencing has resulted in a common issue of crop theft. However, the farmers admitted that the crime levels are only to a certain degree.
	Are there any diseases that are affecting urban farming in the community?	The emergence of diseases such as Covid-19 put a stop in crop production training programmes that were implemented in Sobantu specifically for the youth.
	Is there enough health care-support in the community?	The community has access to clinics and hospitals, which provide the necessary healthcare support.
	Is urban farming affected by any of the following factors: -Child-birth, -Family responsibility, -Unemployment and aging?	The farmers expressed concern over the unemployment in the community, especially within the youth. The farmers also stated that youth disinterest in farming has hindered the aging and the retired urban farmers from passing on their knowledge and skills of which is threatening the growth and sustainability of urban farming. One farmer mentioned that their produce is only for sustenance purposes and is not utilised as a source of income. This is an indication that some of the farmers feel compelled in providing food for the household rather than selling and generating income.
Technological	Are farmers up to date with the latest technology? (Cell-phone, laptops, newspapers, television and radio?	A majority of the farmers do not own Smartphone's and any electronic devices that use internet. These devices can be used to gain information on weather conditions, prices in the markets as well as the crops in deficit.
	Are the farmers actively searching for markets using technology? E.g., Hello-Choice	Despite some farmers having cell phones with internet, they are still unable to access information particularly on markets as the elderly are often not technologically versed. They are also not aware of the source of information e.g., Marketing Information Systems (MIS) for prices.
	Are farmers using technology to find out the prices of the produce in the markets?	Farmers who had access to the internet were not using it for the advancement of their establishment and timing of their produce at the markets so they could take advantage of the prices at the market.

Economy	How do you finance your farming practices?	The farmers use their own funds from social grants to finance their farming inputs such as seedlings, shovels among others Furthermore, the farmers mentioned that they do not make sufficient profit after market commissions are deducted by the market agents, they therefore unable to create permanent jobs as they do not have the capital for it.
	Do you know of any micro-financing institutions that work with urban farmers?	The farmers mentioned that they were not aware of any micro-financing institutions.
	Does the seasonality of products affect their profitability in the market?	The farmers mentioned that they sometimes have to reduce the price of their products due the surplus in quantity at the market
	Do the farmers make any profit from urban agricultural practices?	The farmers stated that the market agents usually deduct a high percentage of market commissions than initially agreed on. This evoked feelings of discouragement from the farmers as they felt that they are being underpaid (no profit) for their own produce. The farmers also stated that they made profit in times of produce deficit in the market, however they profit they made was not nearly enough, that is, R250-300 per season of harvest
Legal	Is there any discriminatory law, consumer law, employment law and health law that affect urban farmers?	The farmers mentioned that they were not aware of any laws that prohibited their farming practices.

ki

6.4.4. P.E.S.T.E.L analysis results from the FGD held in the study area(s) with KI and the participants

Table 6.4 is an illustration of the responses that were given by the farmers when asked questions relating to their farming activities, using a PESTEL analysis tool to get a clear indication of external factors that influence UA entrepreneurship in the study areas.

Political Effects on UA

Studies have shown that policy changes affect the practice of UA. In a study by Cilliers *et al*., (2020), the two case study areas (that is, Cape Town and /Johannesburg) evaluated the level of support UA as an instrument of sustainable urban development capable of providing economic, social and ecological benefits to cities and its inhabitants. They (Cillier *et al*., 2020) found that there are numerous policies in place that address issues such as food security, and the spatial land use management act; however, these policies do not directly refer to UA practices. The farmers in the study were also not affected or were included in any policies that govern the UA practices. The lack of inclusion in policy-making decisions puts the urban farmers and the most vulnerable in society that is, women and the elderly at risk of being food insecure at some point in their lifetime.

Environmental effects on UA

Studies have shown the importance of greener cities and the role they play in reducing the carbon footprint in cities, as well as putting idle land and buildings in cities to use (Hlahla & Hill, 2016). According to Cilliers *et al*., (2020) also found that there are policies in place in South Africa that call for the 'land development that optimises the use of existing resources and land development in locations that are sustainable and result in communities that are viable'. However, they are not specifically referring to the UA practices but rather to the farmers and industries in South Africa. The lack of policies that advocate for the greening of cities to ensure fewer carbon emissions in cities and ensure effective use of the urban resources and waste, while also addressing food insecurity and environmental degradation in urban areas.

Economic effects on UA

Studies have shown that UA plays a vital role in urban economies as a means of addressing food security and the greening of the cities. Authors such as (Ackerman *et al*., 2014; Eisazadeh *et al*., 2015; Battersby *et al*., 2015), found that UA plays different roles in different communities as they found that developed communities engage in urban farming for the environmental and health benefits while developing communities engage for food security and socio-economic benefits. However, there are fewer empirical studies in South Africa that indicate the importance of enabling or inhabiting UPA to improve food security in low-income households. During the FGD farmers indicated that they need other means of selling their produce to the supermarkets that are going to buy from them when their product is ready. According to the farmers, the sale at farm-gate and in the informal market is a better option because they pay instant cash and they are not strict on the quality and quantity of the product compared to the supermarkets or the Fresh produce market. Confirming the findings by Louw & Jordan (2016) where they found that even though the informal market yields low returns, it was still preferred over the formal market due to the low marketing costs such as packaging, grading and labelling required by the formal markets.

The farmers also mentioned that they are unable to sell at the market because of the quantity they are producing, which was barely enough to fill a 4-ton truck which can be provided by

AgriSeta (Agricultural Sector Education and Training Authority) a governmental organisation. The failure of farmers to fill the truck is mostly linked to the land size of the farmers as the farmers mostly have less than a hectare of land (that is, mean = 0.170ha), land security is also an issue as some farmers are renting land or are using municipal land, which is subject to change in its productive use. Although, the stakeholder partners from AgriSeta did stipulate that the conditions for farmers being granted this request for transportation cannot be fulfilled if they are unable to fill the truck with their products, which is most likely to be the case as the farmers are subsistent and do not produce more to sell. The condition forces farmers to go for collective action where they coordinate themselves accordingly and produce enough to fill in the truck and also share the profits which will be generated from the sale at the market. This type of collective action is one mode of ensuring a coordinated way of working together as farmers, which can build trust and reliability between them as a community (Muchara *et al*., 2014). For instance, if any farmer fails to fill the whole truck alone, the vehicle can easily move around to find other farmers that have their products ready for harvest as the communities are close-knit. Jordaan *et al*., (2014) validate the importance of informal institutions as a value chain influence when considering the behaviour of smallholder farmers from South Africa.

6.5 SUMMARY

This chapter aimed at investigating the implications of urban agriculture and entrepreneurial risk and on the food and nutrition security in low-income households. The measures used were proxies such as income sources, land size, and the risks in agriculture. To recap the study found that some farmers were selling the surplus after the household has had its share. The results also showed that majority of the respondents in the study areas were producing the same commodity, and they were producing seasonal products, mostly in autumn to harvest and sell in winter and planting in spring to harvest and sell in summer. The results also showed that the participants who were planting during these seasons were able to substitute some vegetables for the household and save the money that would have been directed to the purchase the products for the HH. The non-participants in the study mentioned to being dependent on social grants and remittances during time of food shortages in the HH. Even though 61% of the respondents were selling their produce, the income generated was not sufficient to cover the cost incurred for production. This occurrence deters farmers from growing and becoming more commercial rather than subsistent farmers. The SS and DD in the market also presents a market risk for the farmers as the price is dependent on SS and DD, as well as other factors in the market. The inability to fulfil contractual agreement and supply consistently by the farmers makes them prone to food and nutrition as the income generated from sales is seasonal.

The results also showed that majority of the farmers were farming to ensure there was sufficient food in the HH. Some farmers were farming to generate income from the sales of the commodities grown in the study areas even though this number was small as not all the products were sold. Ultimately the farmers were able to ensure food and security from the yields generated from the harvests, regardless of the entrepreneurial risk factors such as limited land and water available to the farmers. These risk factors such as production risk (pests and diseases) were causing product losses, while the natural risks rarely affected the farmers, however, some farmers were affected by the hailstorms and floods, if they planted late in the planting season or too early. The participants in the study areas were found to be mostly impacted by factors such as input availability, water quantity, capital available as well as access to formal markets. The results further show that the agricultural sectors employ more individuals in the study areas in comparison to the other industries that is the mining and electricity, thus contributing to incomes and FNS of the residents. However, the unemployment figures also indicate that there are still individuals who are susceptible to food and nutrition insecurity in the study areas. Those who are without assistance from government such as social grants, pensions and the vouchers are prone to food insecurity. However, the results show that in the study areas the participants had some form of income, and had access to food most of the time and those who were non-urban farmers had occurrence of food insecurity, as they were mostly dependent governmental assistance through social grants and pensions.

The study found that the PESTEL factors that affected urban agriculture, were economic, environmental and to some extent political. The economic factors were brought about by the farmers, who were unable to finance their farming activities since they were only selling a portion of their produce to the formal markets, while the majority of them said they had challenges of selling their products at a loss. The transactional costs (that is packaging, grading and labelling) were found to be too high for the farmers, and product attractiveness due to the packaging and labelling eliminated their products from selling at the formal markets. The

farmers were not aware of any political impact on their farming, they however did note that they are rarely ever able to get the assistance they need from the extension officers available in the study areas. The respondents will depend on information rendered by like farmers who have experience in the field of farming and also from their own experiences. The following chapter will give the overview of the study, the conclusions and policy recommendations as well as the areas of future studies.

CHAPTER 7: CONCLUSION AND POLICY RECOMMENDATIONS

7.1 OVERVIEW OF THE STUDY

The presence of UA in both developed and developing regions has been noticeable and, in some regions, UA was aimed at addressing poverty reduction while also noting the role of water in agriculture. UA was found as a means to put idle agricultural land and urban waste (WW and organic matter) to productive use. Even though UA has been around for many years nonetheless, there is still a lack of recognition from policymakers, presenting several uncertainties for the participants due to factors such as financial risk, human risk, price risk, institutional risk and production risk, all of which can greatly impact the farmer's willingness to participate in UA. Water issues in agriculture have been studied for many years owing that the sector uses a high percentage of the available water resources, while also being the major contributor to water degradation due to chemicals and pesticides seepage in the freshwater resources.

The overall objective of the study was to investigate the entrepreneurial risk factors in urban agriculture participation and water quality effects on food security in the Umsunduzi and Umngeni local municipalities. The study first sought to analyse the relevant water policies affecting water access, use and quality in urban agriculture and the food security of the participants. Secondly, it sought to investigate the determinant of entrepreneurial risk factors affecting urban agriculture as well as the water quality and use effects. Lastly, it sought to investigate the implications of urban agriculture and entrepreneurial risk on food and nutrition security in low-income households. The study used a questionnaire survey in to gather data from 78 urban and non-urban farmers, 12 from Sweetwater's, 27 from Sobantu and 39 from Mpophomeni Township. The study employed a mixed-methods methodology where both qualitative and quantitative approaches to collect data were used to reveal information under the research questions. The data analysis involved both descriptive and econometric techniques. The descriptive statistics made use of chi-square tests, frequency tables, and thematic analysis, while the econometric analysis made use of a binary logistic model and the principal component analysis. Based on the empirical results, this chapter discusses the study's main conclusions based on the findings. Several policy proposals are made in the chapter, and finally, the chapter presents the remaining knowledge gaps and future areas of research.

7.2 CONCLUSIONS AND RECOMMENDATIONS

Majority of respondents in the study were the elderly, with only a few youth respondents. Thus, the reduced motivation for the farmers to engage further in urban agriculture, as the elderly people lacked the motivation to be visionary in their agricultural activities. The upsurge in youth involvement in UA can invoke the 'entrepreneurial spirit' essential to becoming a successful entrepreneur, as studies have shown that there is youth involved in other sectors. Water was also not a limiting factor for the farmers as they had other sources of water to utilise in times of need, even though the farmers were not at ease with some of the sources (WW, river and dam water) due to perceived health risks. However, the water quality used to irrigate the crops was good as the majority of the farmers were using tap water, and only a few were using different water sources such as river, dams, boreholes, and wastewater. There are policies in place that govern access, quality and use of water, they however do not apply to UA, as such they were left with limited supply of water, or water with questionable quality. Even though there was NGO.s that ensured water quality checks and ensured river health, there is still much to be done as there was much pollution in areas near the river banks. Farmers perception on the

water used also influenced their decision on the type of water they would use for irrigation and a majority of the participants used tap water due to the perceived cleanliness of the water source. This was regardless of the cost of tap water consumption by the farmers when used to irrigate their fields.

The entrepreneurial risk factors revealed how age, education and psychological capital were limiting factor in UA entrepreneurship. While the water quality and market price were motivators for the farmers, however, these were not enough as several factors impact the farmer's ability to become an effective risk manager. However, factors such as financial constraints, lack of farming inputs, and high transactional costs resulted in reduced farming capacity for the urban farmers, thus the increased lack of motivation to participate in agriculture value chain markets also affected the farmers food and nutrition status. Furthermore, most of the farmers produce the same commodity resulting in reduced prices at the markets for the sold commodities. Furthermore, the farmers would have to supplement their production input costs from their own funds, which resulted in less profitability. The factors such land size, yields, sales and water had a negative effect on the food and nutrition status of the participants. There is still a disparity in household in terms of FNS as some individuals are not involved in agricultural activities to sell the produce but only for household consumption. The farmers were vulnerable to shocks such as price changes in the markets, climatic conditions as well as war or the disruption of the food systems value chain.

Policy Recommendations

The study findings had fundamental implications for the government and other development interventions for improving the food and nutrition status in urban areas in Umsunduzi and Umngeni local municipalities. The policy recommendation should aim for improved access to information and education on the safe use of wastewater can help ease the burden on the water resources. To ensure the continued protection of the water reserves and reduced perception of WW use without bias warrants further research in SA. It is therefore, essential that before and after the formation of cooperative groups that there is some form of education for the farmers on the safe use of wastewater and the importance of UA in tackling the food insecurity issue at a household level. To commercialise the smallholder farmers, there is a need to change their mind-set in terms of running smallholder farming as a business. The government should invest more in young people, especially young women who are involved in the sector. There is still a need to address the observed problem in the empirical analysis where smallholder urban farmers are contributing a small portion toward the household income; it is seen as top-up income to other livelihoods. The lack of important resources calls for government intervention and policies that will address food security these while also implementing new techniques of farming that will ensure increased productivity, and are cost-effective and ensure an increase in income and address food security at a household level. The findings suggest that the household income emanates from mostly unearned income (social grants, pensions and remittances), and farming is done as a part-time job or as a leisurely activity. Thus, presenting a challenge for the urban farmers as they have no incentive to invest more in farming and change their income structure. The policymakers should prioritise policies that support UA as it plays a significant role in societies, in mitigating the effects of climate change, enforcing social capital and also ensure local economic growth and food security. Government budgets toward UA can also entice youth involvement in the sector and ultimately lead to a reduction of unemployment of the youth while ensuring food security for an individual and households.

7.3 AREAS OF FUTURE STUDIES

Due to resource and logistical limitations the research was a one-time season study conducted on urban farmers and non-urban farmers in the three communities within Pietermaritzburg. Similar studies in the future should try to expand the study to be inclusive of other provinces. This will ensure inclusivity and more comprehensive results across different urban communities in South Africa. Resource allowing, similar future studies should seek to compare two-time or three-time periods. The research in future studies should aim for inclusivity of young farmers to test their attitude toward farming and their level of entrepreneurial spirit to ensure that urban agriculture programs by the government are endorsed and become a success. Even though the farmers in the study were relatively closer to the market in comparison to other farmers, the farmers also experienced so-market access barriers. Hence, the need to research further on what factors influence market access in both urban and rural farmers as studies have mainly been focused on factors that affect smallholder farmers in rural areas. Furthermore, investigate if there is a significant difference between urban and rural farmers' wealth or income and productivity through selling to retailers, fresh produce markets or supermarkets (that is, contracting) or informal markets (vans and stalls).

Future research should also be focused on entrepreneurial risk factors for urban farmers and how they differ from those of farmers from rural areas as there is little to no information available on such factors on UA. Moreover, it would be advantageous to investigate the impact of the youth's willingness to participate in urban agriculture to tackle food and nutrition insecurity at household level. Future research should also investigate the land and water insecurity policies in urban areas and how they affect willingness of expansion by the farmers. The study has provided baseline information on the effect of entrepreneurial risk factors on urban agriculture and food security, as well as the effect of water access, use and quality in urban agriculture in the Umsunduzi and Umngeni local municipalities. It has been identified that water policies and entrepreneurship in urban agriculture can help address food insecurity at a household level. This study did not consider the impact of group characteristics (such as group size, number of group meetings attended, and the average age of group members) and the position held by the farmers in the group. Future studies should consider looking at group characteristics among other factors that may affect entrepreneurship.

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APPENDICES

QUESTIONNAIRE

QUESTIONNAIRE

African Centre for Food Security
School of Agricultural, Earth and Environmental Sciences,
College of Agriculture, Engineering, and Science
University of KwaZulu-Natal,
Pietermaritzburg

Date: _____ Questionnaire ID: _____

General instructions:

The purpose of this questionnaire is to collect for a Master's thesis at the University of KwaZulu-Natal (UKZN), African Centre for Food Security. The main aim of the research study is to assess the entrepreneurial risks and the water quality in Urban Agriculture. The study adds to the body of knowledge and policies by identifying urban farming risks and the drawbacks of water quality on the farmer's ability to generate profit in their enterprises (farms).

SECTION A

Socio-Demographic Characteristics of the Respondent (s)

1) Respondent's name: _____

2) Gender of the respondent (tick applicable)

Male	Female

3) Age of respondent _____

4) Respondent's level of education

No formal education	Primary	Secondary	Tertiary Educ.	Other, specify

5) Household's sources of monthly income (Please specify the number of recipients within the household)._____

Pensions	Remittances	Wages	Farming	Casual Income	Pension and Farming	Other, specify

6) How much land do you have for planting? _____ (Ha)
7) Who does the land belong to?

Own	Municipality	Other (Specify)

8) Do you use any other areas in the area for your agricultural production? If yes (Specify)
_____

SECTION B

A) Water sources for farming capacity.

1) Do you have access to sufficient water all year round?

Yes	No

2) Is the water source (Tick the appropriate box):

a. Communal tap	
b. Private tap	
c. River	
d. Dam	
e. Other... (Specify)	

3) If private, do you have a water license that allows you to utilise the water?

Yes	No

4) Do you have enough supply of water for your productive capacity?

Yes	No

4.1 If not, which other sources of water do you use to reach your desired capacity?
_____
_____

B) Perceived Behavioural Control (Wastewater use)

Questions on perceived behavioural control	**Responses**
5) Are you aware of the use of wastewater in agriculture?	
6) Do you think the use of treated or untreated wastewater in agriculture poses a health risk to the consumer?	
7) If so, are you aware of the health risks associated with the consumption of produce that are irrigated with wastewater? Mention a few:	
8) Do you think wastewater should be treated before use in urban farming?	
9) Do you think wastewater contains pathogens (micro-organisms that cause diseases) when used to irrigate crops?	

C) Attitudes and perception towards the use of wastewater in urban farming

Questions on WW attitude and perception	**Responses**
10) Do you think wastewater should be used for irrigation in UA?	

11) Does crop type irrigated with wastewater matter to you?	
12) If yes, would you eat vegetables irrigated with wastewater? (E.g. leafy vegetables)	
13) If yes, would you eat root and tubers irrigated with wastewater? (E.g. potatoes, onions among others)	
14) Do you think produce irrigated with treated wastewater would be more acceptable?	
15) Do you think produce irrigated with wastewater would be more acceptable when cooked vs uncooked?	
16) Would you buy vegetables irrigated with untreated/treated wastewater?	

D) Produce hygiene conditions

Questions on Produce hygiene conditions at farm and market.	**Response**
17) Are you aware of the World Health Organisation (WHO) guidelines on the use of wastewater?	
18) If not, then what actions do you take to ensure safety of the products to the consumers? _____	
19) Do you allow for withdrawal period before selling your products at the market?	
20) Do you pre-wash your produce before selling to the consumers?	
21) Do you think the process of urban agriculture presents a health risk for example; ringworms, cholera, or other (s)?	
22) Do you practice safe animal husbandry by provision of PPE's as a means of limiting transmission of diseases from animals to humans?	
23) If not, how do you ensure that it never occurs considering the zoonotic nature of diseases? _____	

E) Environmental Hygiene Conditions

Questions about environmental hygiene	**Response**
24) When at the market, where do you normally ease yourself? a) Public toilets b) open space or c) Neighbours toilet	
25) How do you discard off your organic waste? a) Throw away b) Burn c) Make compost or d) Throw in a dumpsite	
26) What is your source of drinking water at the market? a) Store bought water b) Water from the tap or c) Water from the river or dam	
27). How do normally discard off your animal waste in the farm? a) Use in vegetable growing b) sell to neighbours c) discard in a dumpsite	
28). Do you use chemicals in your fields?	
29). If so, do you allow for the required waiting period before harvesting?	

F) Health Risk Awareness and Perceptions

30). Are you aware of the water used to irrigate the crops that you are buying?

_____
_____

31) What are the main reasons for the continuous buying of these vegetables and animal products and not others?

_____
_____

32) Do you think the source of water used for irrigating the vegetables would influence your buying decision? If so, how?

_____
_____

33) Where do you normally buy the vegetable you use? (Tick the appropriate box)

Market type	
a) Farm gate	

b)Wholesale	
c) Retail shops or	
d) Other (Specify)	

G) Market price risk awareness and perception (producers)

34) Types of crops you produce (Tick the appropriate box)

Crop type	To sell (How much)	To eat	Or Both
Sweet potatoes			
Amadumbe			
Cabbage			
Beetroot			
Carrot			
Lettuce			
Spinach			
Chickens			
Potatoes			
Maize			
Butternut			
Onions			
Green Pepper			
Traditional Pumpkins			
Tomatoes			
Brinjol			
Green beans			
Chillies			
Kale			
Imifino			

35) Are you aware of the any contracts that is, an option to put (sell at specified price) or call (sell at a lower market value price) of products in the market?

YES	NO

36) Do you plant crops that are only in season or do you plant all year round?

_____

37) Do you think you would ever get into a contractual agreement to diversify risk?

YES	NO

37.1) If not, how do you plan on reducing the risk of loss in the market?

_____
_____

H) Natural Risk Assessment and Measure

To what extent do you agree with the following?

Questions on Production risk	Response
38) The environment has enough land to plant food sufficiently for everyone?	
39) Urban agriculture can help mitigate the effects of climate change on the environment?	
40) Humans are abusing the environment?	
41) Using abandoned building and vacant land helps with feeding the poor while also helping reverse the effects of climate change?	

1= strongly agree; 2=agree; 3=neutral. 4=disagree; 5= strongly disagree

I) Financial risk fair value of insurance assessment

Question on Financial risk	Response
42) Do you have insurance for your products in case of climatic hazard(s), for example, hail storms, floods or fire?	
43) Do you think having insurance is important in agriculture considering the climatic conditions?	
44) If you had the means to acquire insurance, would you take insurance for your farm?	

1= yes; 0=No

J) Institutional framework

Questions on IF	Response
45) Do you know any organisations that support the urban agriculture in South Africa?	
46) Are you part of any organisation that recognises UA?	
47) Do you have excess to extension services?	

1= yes; 0=No

48. In what capacity are your farming?

Capacity	**Tick applicable response**
a. Individual/Household	
b. Farmers group	
c. Cooperative	

SECTION C

K) Porter's Five Forces to evaluate the internal environment of the market.

To what extent do you agree with the following?

Questions on Internal environment of the market	**Responses**
1) It is relatively easy for other players to enter the market.	
2) There are readily available substitutes in the market at attractive prices or quality/quantity.	
3) Other buyers in the market are able to switch from one supplier to another without any worry.	
4) There are enough producers in the market to determine the price of the product (e.g. Spinach/Cabbage among others).	
5) There is a high enough degree of competitive rivalry in the market.	
6) I am able to sell your produce to any supermarkets in the area	
7) I have sold produce at the PMB Fresh Produce Market Specify if not:_____	
8) I consider business as profitable Mention profit amount: _____	
9) I keep records of how much money you make at the market from your produce	
10) I sometimes give your customers food on credit If so, do all of them honour their debt? _____	
11) I keep farming records of the produce.	

1= strongly agree; 2=agree; 3=neutral. 4=disagree; 5= strongly disagree

L) PESTEL analysis of the External Environment of the Business (Farming)

12) are you aware of any political, international, or internal political issues that might affect your business (Urban farming) in a negative manner?

YES	NO

13) Are you aware of any economical, market and trading cycles, seasonality of the products that might negatively impact your profitability?

YES	NO

14) How do consumers buying patterns, attitudes or opinions, population shift and trends affect your earning capacity as a farmer?

_____
_____
_____

15) How has technological advancement, helped you grow your business in terms of consumer buying mechanism, innovation and technological solution/replacement?

_____
_____
_____

16) How has the environmental and ecological conditions, customer values, market values, and global factors affected the business?

_____
_____
_____

17) Are there any legal barriers that hinder your access to markets, such as European/International legislation, environmental regulations, consumer and industry specific?

YES	NO

17.1) If, Yes mention a few

_____

M) **PSYCHOLOGICAL CAPITAL**

1. What are your main reasons for farming?

Reason for farming	**Response**
To have Sufficient food	
To have enough Food and leisure	
To have enough Food and income generation	
For only Income	
For Income and employment	

2. Do you separate your farming practice to that of your family operations?

1. Yes	2. No

3. Choose the applicable response:

1: Strongly agree, 2: Agree, 3: Neutral, 4 Disagree and 5: Strongly disagree

Farmers Attitude	**Response**
a. I am confident in myself as a farmer	
b. I am optimistic about the future of UA	
c. I am able to cope with shocks such as droughts and natural disasters	
d. I enjoy new challenges	
e. I do not give up easily	
f. I would not be in farming if I had other means of livelihood	
g. I would take a job or start a business outside of farming	
h. I am willing to take more risk compared to other farmers in my community	
i. Poor production yields, capital constraints are not motivation enough to quit farming	
j. I am willing to forgo profit in the short-run for long-run potential benefits	
k. I trust other farmers	

4. Do you identify as an urban farmer?

YES	NO

5. To what extent do you agree with the following?

Strongly agree, 2: Agree, 3: Neutral, 4 Disagree and 5: Strongly disagree

Farming Constraints	**Response**
a. Lack of to access inputs (seeds, fertilizer and chemicals among others) is a constraint	
b. Large (unaffordable) increase in input prices is a constraint	
c. Limited or lack of farming knowledge and skills is a constraint	
d. Lack of access to adequate land is a constraint	
e. Insecure land ownership is a constraint	
f. Lack of financial resources is a constraint	
g. Too high labour cost is a constraint	
h. High pump and maintenance cost is a constraint	
i. Unavailability or lack of access to adequate water supply is a constraint	
j. Water quality is a constraint, hindering access to clean irrigation water	
k. Lack of adequate storage facilities for vegetables or fresh produce is a constraint	
l. Poor output price is a frequent challenge	
m. Limited access to market information is a constraint	
n. Lack of access to transport services for marketing agricultural produce is a constraint.	
o. Access to the agricultural extension service is a major constraint	
p. Local or social conflict- resource use related – is a major constraint	
q. Political conflict – local government and traditional leadership-related – is a major issue	
r. Irrigation scheme is far away from my home	
s. Stray animals destroy my crops in the field	
t. Any other (specify):	

KEY INFORMANT INTERVIEWS

PESTEL questions on Water access, use and quality PESTEL discussion with stakeholders.	
Political	- Are there any efforts from authorities to ensure water quality? -Does the local municipality ensure equal access to water for the urban farmers? -Are there any local policies or programmes that govern water use and access?

Environmental	-How is the water quality affecting the environment? - Are there any policies and programs on water quality? -How does water access affect the urban farmers? -Does water quality and access affect urban farming entrepreneurship?
Technical	-What is the water quality of the water used for irrigation? -Do you have access to water? -Do you know of any policies or programmes that govern Urban Agriculture? -Are there any capacity building interventions that exist on water use, access and quality?
Legal	-How are the farmers organised? E.g. Water User Access (WUA) rights
Economic	-Do the farmers pay for the water they use for irrigation? -What is the cost/per litre of the water used?

PESTEL workshop discussion with farmers and key informants. Second Discussion	
Political	Are there any political issues that affect the urban farming process? Are there any political disputes in the area that hinder your productivity? Are there any changes made by the new authority? Are there any existing policies that hinder their business growth of the urban farmers?
Environment	Are the farmers located in an environment that is affected by climate change? What are the environmental changes having the farmers experienced or noticed in the area? Are the weather conditions suitable for urban farming? What impact do these changes have on urban agriculture? Is the environment polluted?
Social	Are there any crime related issues that affect urban farming in area? Are there any diseases that are affecting urban farming in the community? Is there enough health care-support in the community? Is urban farming affected by any of the following factors? -Child-birth, -Family responsibility, -Unemployment and aging? Are the community members motivated to buy from the urban farmers?
Technology	Are farmers up to date with the latest technology? (Cell-phone, laptops, newspapers, television and radio? Are the farmers actively searching for markets using technology? E.g. Hello-Choice, Agrivi among others Are farmers using technology to find out the prices of the produce in the markets?
Economy	How do you finance your farming practices? Do you know of any micro-financing institutions that work with urban farmers? Does the seasonality of products affect their profitability in the market? Do the farmers make any profit from urban agricultural practices?
Legal	Is there any discriminatory law, consumer law, employment law and health law that affects urban farmers?

INFORMED CONSENT

Dear Participant,

Department of Food Security School of Agriculture, Earth and Environmental Sciences. University of Kwa-Zulu Natal, Pietermaritzburg campus

I (**Sinethemba. Z. Ndwalane**) am working on a research project for my Master of Agriculture (by coursework) in Food Security at the University of KwaZulu-Natal, Pietermaritzburg campus. I am interested in assessing the entrepreneurial risk and water quality in the urban farms in the Sobantu, Mpophomeni and Sweetwater's in KwaZulu-Natal.
To obtain information for this study, we are interested in asking you a series of questions. Please note that;

- You will be interviewed in the language you prefer and if you feel that the interview is too long, you can stop at any time.
- Your identity is confidential, and your name will not be released in the study or to any other party.
- Any information given by you is for the purpose of this research only and it cannot be used against you.
- It is your decision whether you want to participate or not in this research, and you can stop participating at any time that you want, should you wish to do so, and there will be no negative consequences towards you.
- The data collected will be stored at a secure storage and destroyed after 2 years.
- Your participation is only for research purposes, and there are no financial benefits or free inputs from government involved.
- If you accept to be a participant to be interviewed for the research, please indicate (by a cross where applicable) whether or not you are willing to allow the interview to be recorded by the following equipment:

Equipment	Willing	Not willing
Audio recording equipment		
Photographic equipment		

Thank you for your participation.

Our supervisor is Prof. Joyce Thamaga-Chitja who is based at the school of Agricultural, Earth and Environmental Sciences, Pietermaritzburg campus at the University of KwaZulu-Natal.

Contact details:

Email:chitjaj@ukzn.ac.za
Tel:033 260 6171

Details of the participant in the research.

Name (optional):_____

Signature: _____ Date: _____

Ethics office contact details: Tel.: 031 260 8350/4557/3587

Email: hssrec@ukzn.ac.za

ETHICAL CLEARANCE

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

08 October 2021

Sinethemba Zakhona Ndwalane (212521156)
School Of Agri Earth & Env Sc
Pietermaritzburg Campus

Dear SZ Ndwalane,

Protocol reference number: HSSREC/00003325/2021
Project title: Assessment of the Entrepreneurial Risk and Water Quality in Urban Agriculture
Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 09 September 2021 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 08 October 2022.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,

[redacted]

Professor Dipane Hlalele (Chair)

/dd

Humanities and Social Sciences Research Ethics Committee
Postal Address: Private Bag X54001, Durban, 4000, South Africa
Telephone: +27 (0)31 260 8350/4557/3587 **Email:** hssrec@ukzn.ac.za **Website:** http://research.ukzn.ac.za/Research-Ethics
Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

GATEKEEPERS PERMISSION LETTER

The Msunduzi Municipality

City Hall Luthuli Road
Pietermaritzburg 3201
Tel: 033 – 3482198
Fax: 033 – 392 2208

Enq: Busisiwe Tel : 033 3482193 E-mail:busisiwe.mbokazi@msunduzi.gov.za

21st DECEMBER 2020

Attention : To Whom It May Concern

Re: GATE KEEPERS LETTER FOR UKZN STUDENTS

I, Councillor S. Dlamini under Ward 35 jurisdiction wish to grant permission and accept your presence in Sobantu and surrounding areas in our ward for the purposes of conducting research titled : **ENTREPRENEURIAL RISK LINKED TO WATERQUALITY, WATER SECURITY FOR URBAN BASED FARMINGAND AGRO-PROCESSING during 2020-2023.**

Sincerely,

SANDILE DLAMINI
COMMISSIONER OF OATH (Ex Officio)
WARD 35 COUNCILLOR
MSUNDUZI MUNICIPALITY
CITY HALL, CHIEF ALBERT LUTHULI
3200

Cllr S. Dlamini – 35
072 8483587