Analysis of informal traders' knowledge and compliance level of Sanitary and Phytosanitary Measures (SPS) in fruits and vegetables in the City of Tshwane, South Africa.

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DEDICATION

This thesis is dedicated to my late father Mokiri Lucky Mathews Moloto and the entire Moloto Family (Bahlaloga).

ACKNOWLEDGEMENT

DECLARATIONS

I, <u>Pheladi Macdonald Moloto</u> certify that this research is my original research and to my knowledge it contains no material which has been accepted for the award of any other qualification in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I acknowledge that copyright the of published works contained within this thesis resides with the copyright holder(s) of those works. I also give permit the digital version of my thesis to be made available on the web, via the University's digital research repository, the library search, also through web search engines, unless permission has been granted by the University to restrict access for some time

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ABBREVIATIONS

AIC - Akaike Information Criterion, AIC

CoT - City of Tshwane

DALRRD - Department of Agriculture land reform and rural development

DOHMH - Department of Health and Mental Hygiene

DPH - Directorate Plant Health

GATT - General Agreement on Tariffs and Trade

GDP - Gross Domestic Product

GPFS - Generic Pest Forecast System

FAO - Food Agricultural Organisation

IDP - Integrated Developmental plan

IPM – Integrated Pest Management

MAT - Mass Annihilation Technique

MCC - Maseru City Council

MD – Mating Disruption

MLE - Maximum likelihood estimation

MRL - Multiple Linear Regression

NDP - National Development Plan

NYC - New York City

SIC - Schwartz Information Criterion

SIT - Sterile Insect Technique

SME - Small or Medium Enterprise

SPS - Sanitary and Phytosanitary

SPSS – Statistical Package for the Social Sciences

SDG - Sustainable Developmental Goals

TBT - Technical Barriers to Trade

USA - United States of America

ABSTRACT

Sanitary and phytosanitary measures are intended to allow countries to protect the health of animals, humans and plants. Sanitary and phytosanitary measures (SPS) may require pest-free products to be inspected, treated, tested and processed. Countries can issue a general authorisation for the import of agricultural products or require an import permit with specific requirements to enforce SPS measures. Invasive agricultural pests have the potential to be carried by fresh fruits and vegetables. Quarantine pests can be introduced into a new area via consignment movements or transportation. Currently, the focus in South Africa is primarily on pest movement control at international ports of entry, rather than movement control from one province to the next. If fruit and vegetable informal traders are unfamiliar with SPS measures, quarantined pests that have never occurred before can easily be introduced in a pest-free area. The main objective of the study was to analyse informal traders' knowledge and compliance level of sanitary and phytosanitary measures for fruits and vegetables in the City of Tshwane, South Africa. The study was carried out in the City of Tshwane (CoT), which is in the Gauteng province. The four suburbs targeted were Arcadia, Sunnyside, Pretoria Central and Marabastad. A sample of 210 informal traders were drawn from the population of 458 registered fruit and vegetable informal traders in the City of Tshwane. The informal fruits and vegetable traders in Tshwane were sampled using a stratified random sampling method. A semi-structured questionnaire validated and piloted was used to collect primary data. Descriptive and inferential analyses were performed on the data. Findings of the descriptive statistics show the following: more females (53.3%) are trading in the streets than males (46.2%); the 30–39 age group dominated the informal trading (34.3%), followed by the 21–29 age group (30%); South Africans dominate in the informal trading in the city (56.7%); married participants account for 48,6%, single participants covered 43.3%; 5.7% of the traders have primary education, while 53.3% have secondary education, national certificate holders were 36.2%, and tertiary qualification holders were 4.8%; 55% of informal traders trade with both fruits and vegetables, while 29% trade only with fruits and 15.7% trade only with vegetables; only 23.3% of the informal traders have valid trading license; 26% of informal traders are members of a union, while 74% are not members of any union; 90% of informal traders prefer to buy stock from the market, while 10% prefer to buy

directly from the growers; 81.9% of traders were making profit; 63.3% are familiar with quarantine pests; 30.5% of traders did not have access to quarantine pest information, 18.1% relied on television for information, 4,3% relied on the radio for information, while 46,2% relied on word of mouth; 91% destroy pests, while 9% repel pests; 44.3% of the traders cover their products with a cloth, 48.1% cover their produce with a box, and 7.1% store the produce in cool temperatures (shade), while only 0.5% spray chemicals; 98.6% of traders were never trained in pest identification; 93.8% of traders had never heard of pest surveillance in Tshwane; 37% of participants understood the concept of phytosanitary measures as more about plant health regulation, 50% of informal traders understood it as a food safety issue, and 13% of traders did not understand phytosanitary measures; 95,2% inspect their products, 4,3% treat them, and 0.5% test their products; 79% said their products were inspected by quality inspectors, plant health inspectors (10%) and other private entities, like Prokon (11%); 24.7% of traders did not have any marking requirements on products, 52,4% had a production unit code (PUC), while 21.4% had the pack house code (PHC) and 1% of traders' packaging bore the food business organisation logo (FBO); 54,4% of informal traders use open trucks, 8,6% use trucks with an open canopy, 0.5% use refrigerated trucks, and 37,6% use other methods such as trollies, because the distance is very short and they found it to be cheaper; 28% of informal traders were aware of a removal permit, 99% of informal traders did not have a removal permit; 74% of informal traders are unaware of the purpose of the removal permit; 38% think lack of a removal permit would not affect their business; 54% of traders said no one requested it, 45% said no one told them about it, and only 1% said they didn't have the money for it; 64% of informal traders in Tshwane never received government support services, while just over a quarter (29%) received them only occasionally, and only 7% received them always. The ordered logistic model was used to analyse the determinants of the level of knowledge of fruit and vegetable pests among the informal traders. Significant variables from the analysis were trading area, stall ownership, pest surveillance and pest disposal. The binary logistic regression model was used to analyse factors influencing the use of removal permit among the informal traders in the City of Tshwane. The significant variables from the analysis were gender, age, country of origin and pest sampling. The Tobit regression model was used to analyse factors influencing SPS compliance among the informal fruit and vegetable traders in the city. The significant variables from the analysis were pest identification training,

phytosanitary practice, product challenges and removal permit. The study recommends that interventions aimed at improving knowledge level, awareness and compliance among the informal traders in the city should be informed by the afore-mentioned significant variables of the study. The government departments, such as the Tshwane municipality and the Department of Agriculture, Land Reform and Rural Development (DALRRD), should collaborate to train informal traders on the use of removal permits, make them aware of phytosanitary measures and train them to recognise pest symptoms.

A model was developed to promote informal fruits and vegetable traders' SPS knowledge and awareness, which will be key when designing relevant municipality intervention programmes in SPS measures.

Keywords: Sanitary and phytosanitary measure (SPS), quarantine pests, removal permit, knowledge level

KGUTSUFATSO

Mehato ya bohlweki le bophelo bo botle ba dimela di reretswe ho dumella dinaha ho sireletsa bophelo bo botle ba diphoofolo, batho le dimela. Mehato ya bohlweki le bophelo bo botle ba dimela (SPS) e ka hloka hore dihlahiswa tse se nang dikokwanyana di hlahlojwe, di phekolwe, di lekwe le ho sebetswa. Dinaha di ka fana ka tumello e akaretsang ya ho reka dihlahiswa tsa temo ho tswa kantle ho naha kapa tsa hloka tumello ya ho reka kantle ho naha e nang le ditlhoko tse ikgethileng ho qobella mehato ya SPS. Dikokonyana tse senyang tsa temo di na le monyetla wa ho jarwa ke ditholwana le meroho e foreshe. Dikokonyana tse behelletsweng ka thoko di ka kenngwa sebakeng se setjha ka metsamao ya thepa kapa dipalangwang. Hajwale, Afrika Borwa ho tsepamisitswe maikutlo haholoholo taolong ya motsamao wa dikokoanyana boemakepeng ba matjhaba, ho fapana le taolo ya motsamao ho tloha profinseng e nngwe ho ya ho e nngwe. Haeba bahwebi ba seng molaong ba ditholwana le meroho ba sa tlwaelana le mehato ya SPS, dikokwanyana tse behelletsweng ka thoko tse e so ka di etsahala pele di ka hlahiswa sebakeng se se nang dikokoanyana. Sepheo se seholo sa thuto e ne e le ho sekaseka tsebo ya bahwebi ba seng molaong le boemo ba ho latela melao ya bohlweki le bophelo bo botle ba dimela bakeng sa ditholwana le meroho Toropong ya Tshwane, Afrika Borwa.Thuto ena e entswe Toropong ya Tshwane (CoT), e profinseng ya Gauteng. Dibaka tse nne tse neng di shebilwe ke Arcadia, Sunnyside, Pretoria Central le Marabastad. Sampole ya bahwebi ba sa seng molaong ba 210 e ile ya nkwa ho tswa ho baahi ba 458 ba ngodisitseng e le bahwebi ba seng molaong ba ditholwana le meroho Toropong ya Tshwane. Bahwebi ba seng molaong ba ditholwana le meroho ba Tshwane ba ile ba etswa disampole ka mokgwa wa karohano ya batho ka dihlopha tse nyane. Lethathamo la dipotso tse hlophisitsweng hantle tse netefaditsweng le ho lekwa le ile la sebediswa ho bokella dintlha tsa mantlha. Ditlhahlobo tse hlalosang le ho bolela e sa le pele di entswe ho data. Diphumano tsa dipalopalo tse hlalosang di bontsha tse latelang: basadi ba bangata (53.3%) ba rekisa diterateng ho feta banna (46.2%); sehlopha sa dilemo tse 30–39 se ne se phahametse kgwebo e seng molaong (34.3%), se latelwe ke sehlopha sa dilemo tse 21–29 (30%); MaAfrika Borwa a phahame kgwebong e seng molaong toropong (56.7%); bankakarolo ba lenyalong ba nka karolo ya 48,6%, bankakarolo ba masoha ba kwahela 43.3%; 5.7% ya bahwebi ba na le thuto ya mathomo, ha 53.3% e na le thuto e phahameng, ba nang le mangolo

a naha a thuto ba ne ba le 36.2%, ha ba nang le mangolo a thuto e phahameng ba le 4.8%. 55% ya bahwebi ba seng molaong ba hweba ka ditholwana le meroho, ha 29% e hweba ka ditholwana feela le 15.7% e hweba ka meroho feela; ke 23.3% feela ya bahwebi ba seng molaong ba nang le laesense e nepahetseng ya kgwebo; 26% ya bahwebi ba seng molaong ke ditho tsa mokgatlo, ha 74% e se ditho tsa mokgatlo ofe kapa ofe; 90% ya bahwebi ba seng molaong ba kgetha ho reka setoko mmarakeng, ha 10% e kgetha ho reka ka kotloloho ho tswa ho balemi; 81.9% ya bahwebi ba ne ba etsa phaello; 63.3% e tlwaetse ho behellwa ka thoko ha dikokwanyana ka thoko ha dikokwanyana; 30.5% ya bahwebi ba ne ba se na tlhahisoleseding ya behellwa ka thoko ha dikokwanyana, 18.1% e itshetlehile ka thelevishene bakeng sa tlhahisoleseding, 4,3% e itshetlehile ka seyalemoya bakeng sa tlhahisoleseding, ha 46,2% e itshetlehile ka lentswe la molomo; 91% e senya dikokwanyana, ha 9% e leleka dikokwanyana; 44.3% ya barekisi ba kwahela dihlahiswa tsa bona ka lesela, 48.1% ba kwahela dihlahiswa tsa bona ka lebokose;

mme 7.1% e boloka dihlahiswa motjhesong o phodileng (moriting), ha 0.5% feela e fafatsa dikhemikhale; 98.6% ya bahwebi ha ho mohla ba kileng ba kwetlisetswa ho tseba dikokwanyana; 93.8% ya bahwebi ba ne ba e so utlwe ka leihlo le shebileng dikokonyana Tshwane; 37% ya bankakarolo ba ile ba utlwisisa mohopolo wa mehato ya bophelo bo botle ba dimela jwaloka taolo ya bophelo bo botle ba dimela, 50% ya bahwebi ba seng molaong ba ile ba e utlwisisa e le taba ya polokeho ya dijo, mme 13% ya bahwebi ba ne ba sa utlwisise mehato ya bophelo bo botle ba dimela; 95,2% e hlahloba dihlahiswa tsa bona, 4,3% e a di hlokomela, mme 0.5% e hlahloba dihlahiswa tsa bona; 79% e boletse hore dihlahiswa tsa bona di ile tsa hlahlojwa ke bahlahlobi ba boleng, bahlahlobi ba bophelo bo botle ba dimela (10%) le mekgatlo e meng e ikemetseng, jwaloka Prokon (11%); 24.7% ya bahwebi ba ne ba se na ditlhoko tsa ho tshwaya dihlahiswa, 52,4% ba ne ba e na le khoutu ya tlhahiso ya dihlahiswa (PUC), ha 21.4% e ne e e-na le khoutu ya ntlo (PHC) mme 1% ya diphuthelwana tsa barekisi e ne e e na le letshwao la mokgatlo wa kgwebo ya dijo. (FBO); 54,4% ya bahwebi ba seng molaong ba sebedisa diteraka tse bulehileng, 8,6% ba sebedisa diteraka tse nang le khenopi e bulehileng, 0.5% ba sebedisa diteraka tse nang le sehatsetsi, mme 37,6% ba sebedisa mekgwa e meng e kang ditroli, hobane sebaka se sekgutshwanyane haholo mme ba mme ba fumane. e le theko e tlase; 28% ya bahwebi ba seng molaong ba ne ba tseba ka tumello ya ho tlosa, 99% ya bahwebi ba seng molaong ba ne ba se na tumello ya ho tloswa; 74% ya bahwebi ba seng molaong

ha ba tsebe morero wa tumello ya ho tloswa; 38% e nahana hore ho hloka tumello ya ho tloswa ho ke ke ha ama kgwebo ya bona; 54% ya bahwebi ba re ha ho motho ya e kopileng, 45% e re ha ho motho ya ba boleletseng ka yona, mme ke 1% feela e ileng ya re ha ba na tjhelete ya yona; 64% ya bahwebi ba seng molaong ba Tshwane ha ba e so ka ba fumana ditshebeletso tsa tshehetso tsa mmuso, athe kotara feela (29%) ba ne ba di fumana ka dinako tse ding, mme ke 7% feela e neng e di fumana kamehla. Mokgwa o laetsweng wa thepa o ile wa sebediswa ho sekaseka dintlha tsa boemo ba tsebo ya dikokanyana tse senyang ditholwana le meroho hara bahwebi ba seng molaong. Diphetoho tse kgolo ho tswa tlhahlobong e ne e le sebaka sa kgwebo, beng ba ditala, leihlo la dikokwanyana le ho lahlwa ha dikokwanyana.

Mokgwa wa ho hlahloba ho noha ntho tse pedi o ile wa sebediswa ho hlahloba dintlha tse susumetsang tshebediso ya tumello ya ho tloswa hara bahwebi ba seng molaong ba Toropong ya Tshwane. Diphetoho tsa bohlokwa ho tswa tlhahlobong e ne e le bong, dilemo, naha ya tswalo le sampole ya dikokwanyana. Mmotlolo wa Tobit wa dipalopalo wa ho hokahanya dikamano pakeng tsa phapano o ile wa sebediswa ho sekaseka dintlha tse susumetsang boikamahanyo ba SPS hara bahwebi ba seng molaong ba ditholwana le meroho toropong. Diphetoho tsa bohlokwa ho tswa tlhahlobong e ne e le kwetliso ya ho tseba dikokonyana, boikoetliso ba bophelo bo botle ba dimela, mathata a dihlahiswa le tumello ya ho tloswa.Thuto ena e kgothalletsa hore ditseko tse reretsweng ho ntlafatsa boemo ba tsebo, tlhokomediso le boikamahanyo hara bahwebi ba seng molaong ka hara toropo di lokela ho tsebiswa ke dintlha tse fapaneng tse boletsweng ka hodimo tsa thuto. Mafapha a mmuso, a kang masepala wa Tshwane le Lefapha la Temothuo, Phetoho ya Mobu le Ntshetsopele ya Dibaka tsa Mahae (DALRRD), a lokela ho sebedisana ho kwetlisa bahwebi ba seng molaong ka tshebediso ya mangolo a tumello ya ho tloswa, ho ba hlokomedisa ka mehato ya bophelo bo botle ba dimela le ho ba kwetlisa ho lemoha matshwao a disenyi. Ho ile ha etswa mmotlolo wa ho kgothaletsa tsebo le tlhokomediso ya barekisi ba ditholwana le meroho ba SPS, e leng ntho e tla ba bohlokwa ha ho etswa mananeo a bohlokwa a bonamodi ba masepala mehatong ya SPS.

Mareo a bohlokwa: Tekanyo ya bohleki le bophelo bo botle ba dimela, dikokonyana tse behelletsweng ka thoko, tumello ya ho tloswa, boemo ba tsebo

CHAPTER 1

1.1 INTRODUCTION

This chapter will present the background of the study with informal traders as the main participants. The problem statement and the research questions, objectives as well as the contribution of the study are highlighted. The limitations, delimitation and ethical clearance are presented. The conceptual framework and summary of the variables to be measured have been outlined.

1.2 Background of the study

In early 1995, the World Trade Organization (WTO) was established to replace the General Agreement on Tariffs and Trade, which gave birth to the formation of sanitary and phytosanitary agreements (Wong & Yu, 2015). Sanitary and phytosanitary measures are intended to allow countries to protect the health of animals, humans, and plants (Gröschl, 2012). Phytosanitary measures may require pest-free products to be inspected, treated, tested, and processed. Countries can issue general authorization for the import of agricultural products or require an import permit with specific requirements to enforce phytosanitary measures (Eschen et al., 2015). Fresh fruits and vegetables, according to Hallman (2017), have the potential to carry invasive agricultural pests.

Phytosanitary measures are used to allow the trade of quarantined commodities by reducing the risk of carrying quarantine pests (Hallman, 2017). Inspections, sampling, surveys, treatment, and testing are all examples of phytosanitary measures. The Sanitary and Phytosanitary (SPS) measure is a market entry barrier due to the increased costs of testing, inspection, and approval procedures (Crivelli & Groeschl, 2016). Failure to comply with phytosanitary measures required by the importing country will result in delays that will have a negative impact on the profitability of a specific market. Other SPS measures that directly relate to product characteristics, such as quarantine requirements, pesticide residue levels, labelling, or packaging, also pose a barrier to market entry; however, once products meet higher standards, exporters gain market access (Crivelli & Groeschl, 2016).

Trade-in live plants are widely recognized as an important entry point for quarantine pests, and such pests can have serious economic and environmental consequences

(Liebhold et al., 2012). However, when phytosanitary measures are not followed, transporting fruits and vegetables within a country from one province or region to another can be hazardous. This movement could be from a pest-free area to a quarantine area.

In the local informal trade sectors, compliance with SPS measures is still crucial and expected. However, informal traders could view stringent SPS compliance as a barrier to market entry or as a barrier to economic participation in the informal trade sector. In most developing countries, there are no laws in place governing the informal trade sector. Studies like that of Gamberoni and Sear (2013) indicated that informal economy Laws and various specific non-tariff barriers have an impact on the trade activities of women-owned enterprises. These barriers often push women traders into the informal economy further as policymakers are overlooking women's contributions (Brenton et al., 2013). The informal economy could help to address the challenges of creating employment and encouraging economic growth in downgraded areas (Charman et al., 2017).

In South Africa, SPS compliance is enforced at international ports of entry; however, the same compliance locally, thus, from province to province is not visible. The same phytosanitary potential risks that could be transferred at the international ports of entry could be transferred locally. Each of South Africa's nine provinces has informal fruit and vegetable traders in their cities who can source their products outside of those cities. Because Tshwane has a low pest prevalence, this study concentrated solely on informal fruit and vegetable traders. Within the country, there are areas, which are quarantined, and those, which are pest-free.

It is of interest in this study to look at the role that informal traders play in the transference of pests from quarantine areas to pest-free areas in the City of Tshwane. At the municipality level, the informal traders are supposed to comply with by-laws. However, it is simple for municipalities to regulate or enforce these by-laws if the traders are registered. Arnold (2014) found out that the lack of street trading licenses exposes traders to harassment, punitive measures, and confiscation of goods. In the process they lose their commodities, resulting in closing their businesses, However, having a license does guarantee safety and recognition by urban authorities.

The informal trading sector is crucial in South Africa and cannot be overemphasized, especially in the current economic environment where the unemployment rate is much prevalent among youth. Helen Suzzman foundation (2015) in South Africa indicated that informal traders differ in what they trade with, and they are mostly found on the streets and, public markets of the inner-city centre. They trade their goods which are accessible and affordable in stationary, temporary, or moving locations further providing much-needed jobs in the economy (Skinner & Haysom, 2016).

This study seeks to investigate the knowledge of informal traders on the SPS measures of fruits and vegetables. This will be done by investigating the operational activities of traders with the focus on (i) quarantine pests' knowledge level (ii) phytosanitary measures compliance (iii) agricultural acts and standards knowledge level and (iv) ownership of removal permits by the informal traders.

1.3 Problem statement

Informal fruit and vegetable traders lack knowledge of quarantine pest observation, are unaware of SPS measures, and are non-compliant with phytosanitary measures. The quarantine pests are easily spread. Because government officials from DALRRD and the municipality are unable to visit the stalls to sample and inspect the products, traders will be less informed about the importance of inspecting their products and protecting them from infestation. This can pose significant economic risks in the informal trading sector, jeopardizing job creation in the City of Tshwane.

1.4 Justification of the study

Given that this study was conducted in Tshwane, which is considered a pest-free zone for *Bactrocera species*. After the study is completed, a copy of the thesis will be made available at the municipality offices, where it can be shared with the informal traders if necessary, allowing them to reflect on their knowledge of quarantine pests, removal permits and phytosanitary measures. Depending on the findings of the study, the municipality and the Department of Agriculture Land Reform and Rural Development may organize tailor-made roadshows, awareness and workshops through the informal trader's union to protect the city from pest infestations. The study will be useful to policymakers because it will provide a model for promoting informal fruit and vegetable traders' SPS knowledge and awareness, as well as detailed information about the

level of knowledge in SPS measures among informal traders. This will be critical when developing relevant municipal intervention programs in SPS measures.

1.5 Gaps/Originality of the study

1.5.1 General contribution of the study

Many studies were conducted in the City of Tshwane, with many focusing on informal traders facing challenges from government by-laws, a lack of trading space, product seizure due to trading licenses and many more. The researcher in this study felt that the informal traders' knowledge of SPS measures and quarantine pests was not thoroughly investigated. This is the chasm that this research aims to bridge.

The study will add to our understanding of the role of informal fruit and vegetable traders in the introduction and spread of quarantine pests from the quarantine area to a pest-free area in the City of Tshwane.

The study will also provide a model for promoting SPS knowledge and awareness among informal fruit and vegetable traders, which will be critical when designing relevant municipality intervention programs in SPS measures.

1.5.2 Integrated Developmental plan (IDP)

According to the resolution of the City of Tshwane Council on the 2016/2017 IDP budget process plan, intergovernmental engagement between the National and Provincial sectors should engage horizontally and vertically in plans and programs between the city and other spheres of government. This study will contribute to the IDP because it intends to investigate the interaction between municipal, provincial, and national government officials in pest control. This research will be extremely useful in identifying existing gaps in pest control operations at the municipal, national and provincial levels.

1.5.3 The National Development Plan (NDP) 2030 goals

According to the National Planning Commission (NPC) (2011), the National Developmental Plan (NDP) is a plan for a better future for South Africa; Chapter 3 aspires to a future in which no one lives in poverty, no one goes hungry and there is

work for all, a nation united in the Constitution's vision. The majority of South Africans live in cities, which generate 85 percent of economic activity. The majority of people living in cities are young people of working age who are unemployed or involved in small businesses. Because cities do not generate enough jobs, this youth relies on street trading for a living. If informal traders are found to be ignorant of SPS measures, training and education aimed at closing this knowledge gap can help to eliminate poverty and reduce inequality in the long run. The infestation will be eradicated, and trade and employment will be safeguarded. Informal fruit and vegetable traders will then be able to rely on the product sold on the street as a source of income.

1.5.4 Sustainable developmental goals (SDGs)

Sustainable development goals (SDGs) are about development and transformation as much as they are about restoring people's dignity. This will necessitate the collaboration of all social partners in order to grow South Africa and ensure that our country is capable of eliminating poverty, creating jobs and employment opportunities for its people, and creating a more equitable society (SDG U, 2019). This study, conducted in light of the SDGs, will assist the government in identifying gaps that may jeopardize the livelihoods of informal traders. According to the study's findings, if policymakers are aware of the sector's existing gaps, the informal trader sector will be able to receive the tailored intervention. This progress will then help to achieve the Sustainable Development Goals (SDGs), which aim to create a world with no poverty, (ii) zero hunger, (iii) quality education, (iv) decent work and economic growth and (v) reduced inequalities (UNDP, 2015).

1.6 Research objectives

1.6.1 Main objective

The main objective of the study is to analyse informal traders' knowledge and compliance level of Sanitary and Phytosanitary measures in fruits and vegetables in the City of Tshwane, South Africa.

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1.6.2 Specific objectives

The specific objectives of the study are:

1. To assess the compliance of phytosanitary measures among the informal traders and the presence of information synergy from the government to traders.
2. To assess the determinants of the knowledge level of phytosanitary measures of fruits and vegetables informal traders.
3. To analyse factors influencing SPS compliance among the informal fruit and vegetable traders in the city.
4. To analyse factors influencing the use of the removal permit amongst the informal traders in the city of Tshwane.
5. To develop a framework for promoting informal fruits and vegetable traders' SPS knowledge, awareness, and compliance in the study area.

1.6.3 Research questions

- Are informal traders compliant with phytosanitary measures and is there synergy of information from the government to traders in the study area?
- What are the determinants of the level of knowledge of SPS among informal fruit and vegetable traders?
- What are the factors influencing SPS compliance among the informal fruit and vegetable traders in the city?
- What are the factors influencing the use of removal permits among informal fruit and vegetable traders?
- What framework can best promote informal fruits and vegetable traders' SPS knowledge, awareness and compliance?

1.7 Limitations and delimitations

1.7.1 Limitations

The limitations of this study might be caused by factors such as language considering that the city is a multi-lingual setting.

1.7.2 Delimitations

During the study, no collection of the specimen to test samples of fruit and vegetables for pests. The study focuses on informal traders in the City of Tshwane.

1.8 Definitions

Informal traders- can be defined as street traders, street vendors, or hawkers who are visible on the streets and public markets.

Spread-the range in which a pest can be distributed over the area.

Inspection- official visual examination of plants, plant products or other regulated articles to determine if pests are present.

Quarantine pests- a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled.

Pest-free area- an area in which specific pests are absent as demonstrated by scientific evidence.

Quarantine area- an area where a quarantine pest is present and is being officially controlled.

Pests- any species, strain or biotype of plant, animal or pathogenic agent injurious to plant or plant product.

Phytosanitary measures- any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests.

Test- official examination, other than visual to determine if pests are present or to identify pests.

Quality- means the attribute, property or basic nature of an object, the degree of excellence or superiority.

Regulate- to bring under the control of law or organized authority.

Survey- an official procedure conducted over a defined period of time to determine the characteristics of a pest population or to determine which species are present in an area.

Treatment- official procedure for the killing, inactivation or removal of pests, or for rendering pests infertile.

Consignment- quantity of plants, plant products being moved from one place to the other covered with a phytosanitary certificate when required.

1.9 Conceptual framework
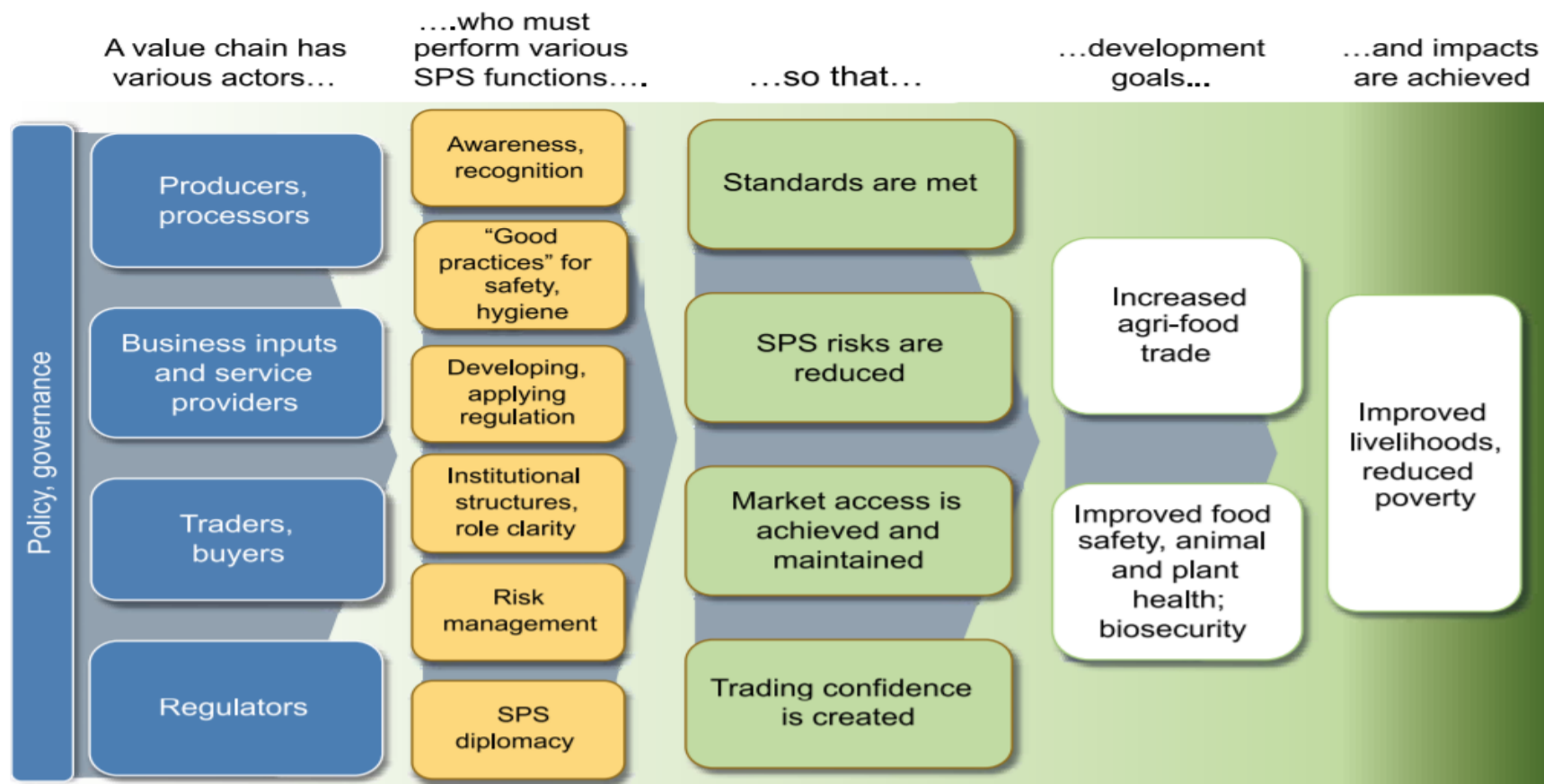
Figure 1. The role and context of SPS compliance in the development.

(Source: Day et al., 2012)

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┌─────────────────────────────────────────────────┐
│     Quarantine pest infomation flow between      │
│            municipality & province               │
└─────────────────────────────────────────────────┘
            ┌─────────────┴─────────────┐
    ┌───────────────┐           ┌───────────────┐
    │  Municipality │           │   Province    │
    └───────────────┘           └───────────────┘
            │                           │
    ┌───────────────┐           ┌───────────────┐
    │  Fruit & veg  │           │  Fruit & veg  │
    │    Farmer     │           │    Farmer     │
    └───────────────┘           └───────────────┘
            │                           │
    ┌───────────────┐           ┌───────────────┐
    │   Municipal   │           │  Provincial   │
    │ Inspector test│           │ inspector test│
    │   for pests   │           │   for pests   │
    └───────────────┘           └───────────────┘
              ╲                     ╱
    ┌─────────────────────────────────────────────────┐
    │ Inspectors from municipality & provincial feed one main │
    │    quarantine pests database accessible by the   │
    │ market,other government officials , trader's, trader's │
    │                     unions                       │
    └─────────────────────────────────────────────────┘
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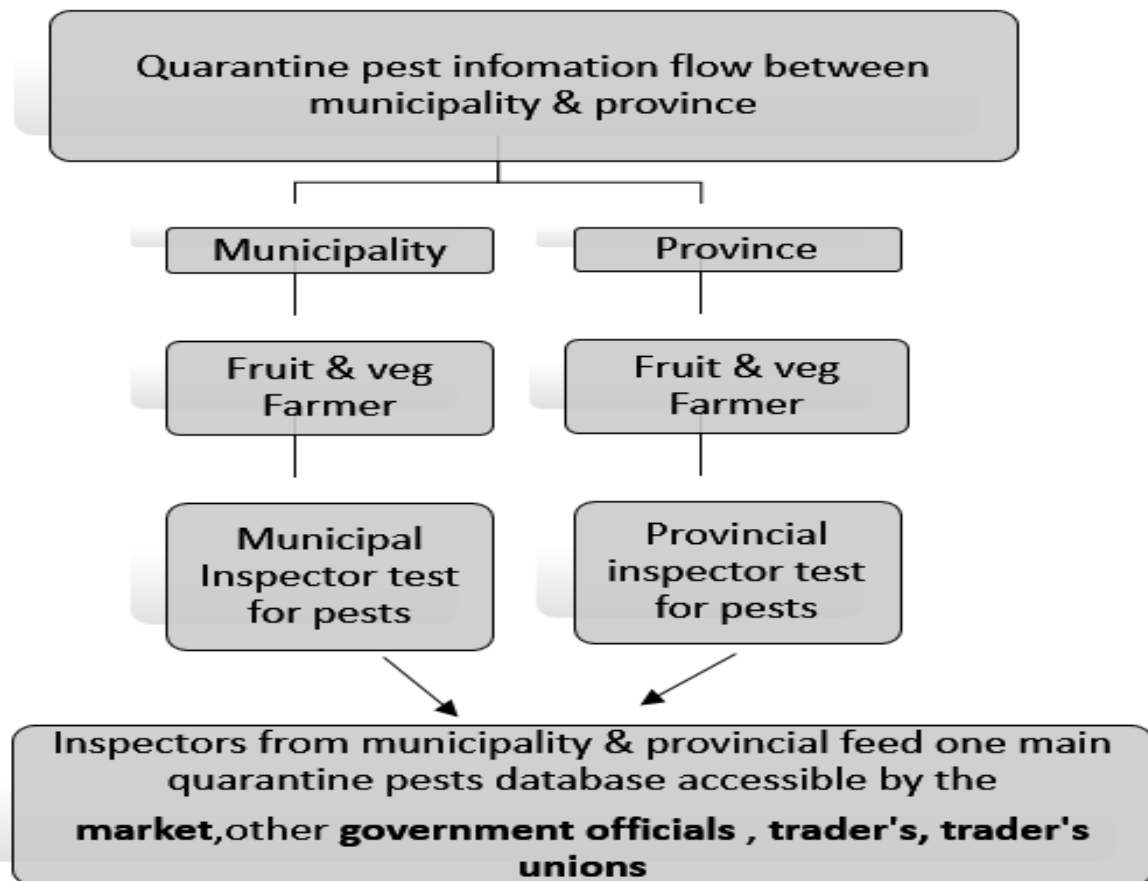
Figure 2. The synergy of information from the National government to traders.

(Source: Author, 2018)

Ideally, it is anticipated that there is a synergy or collaboration between municipal and provincial officials in terms of sharing information about pests identified in farmers' produce. If farmers' produce from various municipalities is inspected and detected for pests then such information is shared in a central database wherein other stakeholders such as traders, markets, agents and government officials from all the provinces can have access.

The importance of such a central database is simply because traders can either source produce from the municipality in a different province or the same province. The produce can also be sold to customers in the same or different municipality or province. The fact is that farmers move their products from municipality to municipality or province to province. If there is no central database for sharing the pests status of farmers' produce, therefore, it will be impossible for traders and municipal or provincial inspectors to know about such products. Failure to have this kind of central information sharing will mean that a farmer from a certain municipality (e.g. North West) can

transport produce with certain pests to another province (e.g. Gauteng) without detection. For instance, if North West province is a quarantine area and Gauteng is a pest-free area, it then means that the pest status of Gauteng will change. It is the interest of this study to assess the current synergy of information from the government officials in the City of Tshwane to the informal traders.

1.10 Chapter arrangement in the thesis

The current chapter provided the formulated research problem statement, objectives, research questions, limitations & delimitation, and conceptual frameworks. Chapter 2 provides a literature review based on the study objectives. Chapter 3 covers the methodology and research design of the study, chapter 4 Socio-demographics, compliance with phytosanitary measures and information synergy, and Chapter 5 to 7 is the analysis models: Ordered regression model, Tobit regression model and Binary logistic regression. Chapter 8 details the framework for promoting informal fruit and vegetable SPS compliance. Chapter 9 is the conclusion and recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The Chapter highlights the theoretical framework, the literature, and the analytical review of the study. The focus will also be on the common *Bactrocera* species such as the oriental fruit fly, which is very much prevalent amongst fruits and vegetables in South Africa. The review is mainly informed by the study objectives.

2.2 Concept of international trade
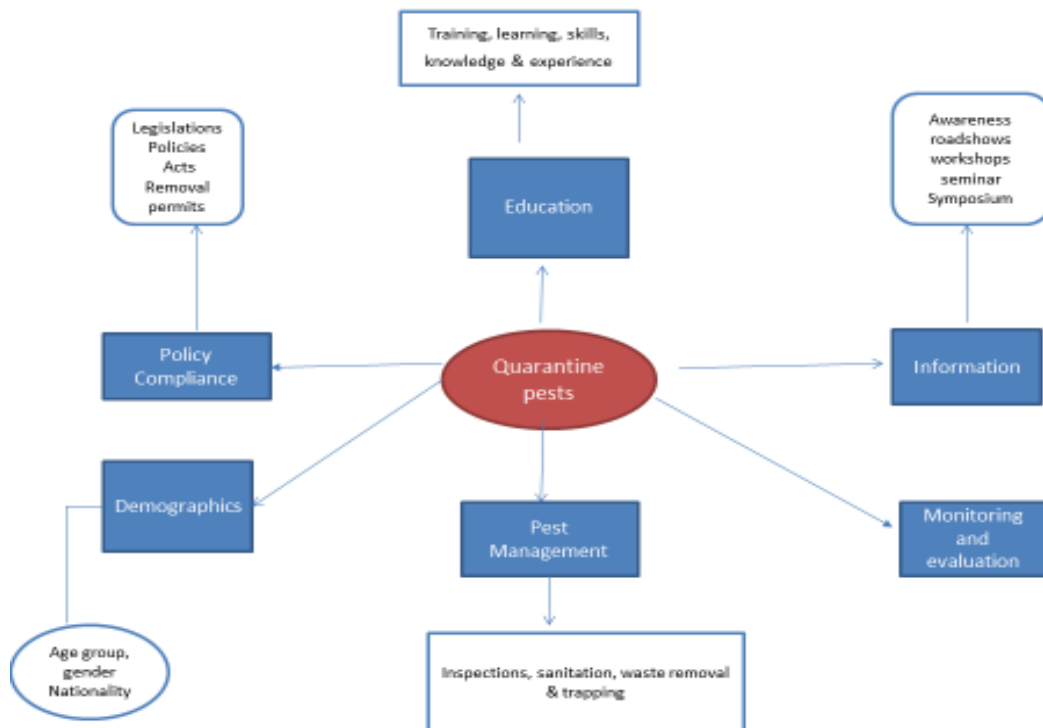
Figure 3. A framework of Quarantine pests.

(Source: Author, 2022)

2.2.1 Formation of World trade organization

Since 1948, the General Agreement on Tariffs and Trade (GATT) has developed and implemented global trade rules. GATT was overhauled in the 1980s, leading to the

formation of the World Trade Organization (WTO) in 1995. The WTO's agenda was to promote trade, reduce trade barriers through trade talks, and provide a forum for trade disputes to be resolved (Kang, 2018). The WTO developed the Technical Barriers to Trade (TBT) Agreement, which encourages members to base their technical regulations, standards, and conformity assessment procedures on international standards to facilitate trade (Partnership, 2016). International trade allows countries to obtain foodstuffs that they may or may not be able to produce or manufacture within their own borders, and it also has the potential to transport pests to pest-free areas. Pest-free countries are implementing control measures in commodity imports to reduce the risk of this infestation (Dominiak, 2012).

International trade agreements are a critical component of the global economic system, serving as a driving force in the expansion of global trade and investment. The WTO can be defined in two trade terms. (i) Individual governments will tend to abuse tariffs and other trade restrictions, even if it means shifting the cost of protecting a domestic industry onto foreign producers by changing the terms of trade. (ii) The WTO forces countries to internalize the terms-of-trade effects of their policies, causing them to make more efficient policy choices (Ludema & Mayda, 2013). The Agreement on the Application of Sanitary and Phytosanitary Measures is one of the annexes to the (WTO) (SPS). Its primary goal is to protect human, animal and plant life and health (sanitary measures) as well as plant life and health (phytosanitary measures) during international trade. It encourages WTO members to base their policies on internationally recognized standards, guidelines, and recommendations (Torres, 1995).

The SPS agreement defines SPS measures as any measure used to (i) protect animal or plant life or health from risks arising from the entry, establishment, or spread of pests, diseases, disease-carrying organisms, or disease-causing organisms; or (ii) to protect animal or plant life or health from risks arising from the entry, establishment, or spread of disease-carrying organisms or disease-causing organisms (iii) to protect human or animal life or health from hazards posed by additives, contaminants, toxins, or disease-causing organisms found in foods, beverages, or feedstuffs, (iv) to protect human life or health from risks posed by diseases transmitted by animals, plants, or their products, or from pest entry, establishment, or spread; and (v) to prevent or limit other damage caused by pest entry, establishment, or spread (Torres, 2013).

Furthermore, Torres (2013) stated that SPS measures may require that plants and their products come from disease-free areas, that products be inspected for microbiological contaminants, that specific fumigation for product treatment be enforced, and that maximum permissible levels of pesticide residues in food are established.

2.2.3 Informal economic sectors

The formal and informal sectors are the two pillars of the urban economy. The formal sector is modern and industrialized, consisting of public and private enterprises that are legally and financially supported by government agencies, private sectors and banks whereas the informal sector is uncontrolled by the state but is linked to the formal economy through production and distribution. In poor countries, the informal sector provides an invaluable service to large segments of society and frequently determines the overall economic direction (Ezeah et al., 2013). The study of Popov et al. (2018) indicated that to function efficiently, a formal economy requires a high-quality institutional environment. On the one hand, the institutional setting should encourage the growth of social entrepreneurship. The informal economy is distinguished by the fact that it is not properly registered, recorded, or identified, with businesses operating illegally and failing to pay taxes or comply with labour and employment laws (Darbi & Knott, 2021). Informal economic activity is defined as the production and exchange of legal goods and services outside of the state's legal and regulatory structures (Young, 2020).

Table 2. 1 Characteristics of formal and informal trading sectors

Features	Formal sector	Informal
Firm size	Large	Small
Ownership / management	Corporate	Family/self
Technology	Capital investment	Labour intensive
Bargaining status	Collective	Individual
Legal status	Registered	Extra-legal
Official policy	Promoted	Unpromoted
Barrier to entry	Economies of scale	Modest investment

Source (Vorley, 2013).

2.3 Literature Review

2.3.1 The history of quarantine of pests (*Bactrocera species*)

Bactrocera species Diptera: Tephrtitidae is the most common quarantine pest in fruit and vegetables in South Africa. It is the Oriental fruit fly, a devastating Asian pest that is a major quarantine concern. These fruit flies are one of the most important pests of fruits and vegetables worldwide, and they are highly invasive due to poor quarantine infrastructure in developing countries (Khamis et al., 2012). Adults have a strong proclivity to spread, and immature stages are easily transported to new areas via fruit movement. *Bactrocera invadens,* a member of the genus *Bactrocera*, was first discovered in Africa in 2003 in Kenya (Khamis et al., 2012).

The pest is thought to have originated in Sri Lanka and has rapidly expanded its geographic range, with reports now coming from 28 African countries, including South Africa. It attacks over 43 different fruit varieties from 23 different families, with mango being one of the most popular cultivated hosts (Lux et al., 2003). The success of the informal trader's business is dependent on maintaining high productivity while meeting the ever-increasing quality and quarantine standards demanded by the local and export markets. Both producers and government officials are aware that once new exotic pests are introduced and established in the country, they have the potential to devastate the industry. According to Li et al. (2021) Quarantine pests are difficult or expensive to control, so the most cost-effective strategy is to prevent establishment by enforcing strict quarantine measures in areas where the species is not yet present. However, quarantine is still unnecessary in areas that are unsuitable for pest establishment or where the pest is already present or likely to spread naturally.

Inadequate national and regional protective mechanisms, such as quarantine services, pest surveillance systems and commodity movement regulation, exacerbate the risk, particularly in the case of small-scale transboundary trade. Furthermore, regional response systems for immediate and effective containment or eradication of newly detected pests are inefficient or non-existent. Under such conditions, introduced pests may remain undetected in an area for an extended period of time, allowing them to spread and establish themselves easily. According to Jeanmonod and Rebecca,

(2018) Fruit flies are classified into two families: *Tephritidae* and *Lonchaeidae* (*Tephritoidea).* They are economically significant; they are regarded as the primary pests affecting the production and marketing of fruits and vegetables worldwide. Both families cause both direct and indirect damage (their eggs hatch and the larvae eat the underlying flesh of the fruits) (opening holes through which it penetrates the fruit as decomposers, causing the early fall of fruits)

Fruit flies are classified as "quarantine insects" of the Tephriditae family because they lay eggs in fruits and vegetables, rendering them inedible and destroying crops. They prey on horticultural crops; they are the most dangerous and cause significant damage (Sarwar, 2015). *Tephritidae* species have a similar life cycle; the female lay her eggs in the ripening fruit of the host plant as well as in young fruits that have fallen on the ground, and the larvae develop in the flesh of the untreated fruit. The larvae's growth accelerates the maturation of the fruit, which falls to the ground. The larvae leave the fruit, then the pupae develop, and finally the adult. Fruit fly hosts include melons, pumpkins, and bitter gourd, while fruits include mango, guava, fig, tomato, stone fruits, apples, pears and loquat.

It is a nuisance for gardeners, but it can also have a significant impact on agriculture and plant protection. The majority of citrus species are suitable for quarantine plants of the *Tephritidae* genera *Anastrepha, Bactrocera,* and *Ceratitis.* "Severe quarantine procedures, risk mitigation, and safeguards are required to prevent the spread of the fruit flies by regulating international and domestic movement," writes Sarwar (2015).

Quarantine mitigations include fumigation, hot water immersion, high-temperature forced-air, vapor heat, cold, and irradiation treatments. According to Nicanor and Robert (2015), Fruit flies (Diptera: Tephritidae) are one of the world's most economically important pest species. They feed on a wide variety of fruits and fleshy vegetables in tropical and subtropical areas. Major control and eradication programs are being developed to combat these species. Insecticide sprays on foliage and soil, bait sprays, male annihilation techniques, releases of sterilized flies and parasitoids, and cultural controls will be used as control methods (Vargas, Piero & Leblanc, 2015).

2.3.2 Pest management

The destruction of fallen and infested fruits, cold treatment, heat treatment, bait sprays containing protein hydrolysate, biological control methods, and sterile insect techniques are all pest management practices for B. species (Bhagat, Samanta & Bhattacharya, 2013). Furthermore, according to Vargas et al. (2015), the suppression or eradication of fruit flies has frequently been the goal of control programs. Integrated Pest Management (IPM) is a technique that can be used to achieve sustainable agricultural production while causing less environmental damage. It manages pests and keeps them at economically insignificant levels. Control components such as synthetic pesticides and biological control are beneficial in completely managing pests through nonchemical means.

2.4 Socio-economic factors of Informal economy traders

Charmes (2012) defined the informal economy as a means for appeasing the two concepts, national estimates of size (employment) and contribution (share of the domestic product [GDP]) of the informal sector. Employment in the informal economy is high at 58–70 % of non-agricultural employment at the national level and the contribution of the informal sector to non-agricultural GDP is between 25% and 50%. The informal economy consists of economic activities (goods and services) that occur outside of formally recognized boundaries such activities also remain within informally recognized boundaries for large segments of society (Webb et al., 2013). The informal traders often lack the marketing knowledge and skills to compete with formal firms and domestic markets for export and imported goods. Currently, there is interest in the informal economy due to its growth and emergence in unexpected places worldwide (Chen, 2012).

The informal sector consists of those businesses that are not registered. They are generally small in nature and are seldom run from business premises. Instead, they are run from homes, street pavements or other informal arrangements. Street trading and hawking are terms which apply to vendors (Horn & Sakebesigheidsareas, 2008). According to Masuku & Nzewi (2021) The informal sector accounts for a sizable portion of the global economy. The informal economy employs over 85% of people in Africa and employs approximately two billion people worldwide. Report framework

(2004) defined Informal traders as retailers such as spazas, tuck shops, hawker's/street vendors, kiosks, take-away and fast foods that are not registered for VAT in South Africa. Products traded include food and nonfood products. They are located in public spaces where there are high volumes of people and places such as pedestrian malls, learning institutions, streets in CBDs, taxi ranks and train stations.

In most African cities, there is an increase in self-employment due to Neoliberal policies and the decline in formal employment opportunities. According to Arnove (2019), Neoliberal education policies prioritize investing in the first four years of schooling over secondary and higher education. The policies advocate for the imposition of user fees at the secondary and, particularly, tertiary levels of education. The sharp increase in self-employment and employment rates frequently results in intense competition in the informal economy (Lindell, 2010). Informal traders include both married and unmarried men and women. They work as street vendors, hawkers, or peddlers. Their products are relatively cheap and readily available and can be delivered to customers at their doorstep (Khairuzzaman et al., 2014). A street vendor is defined as a person who offers food for sale to the public without a permanent structure, however using a temporary static structure or mobile stall-head load/wheel-barrow/truck (Nurudeen, Lawal & Ajayi, 2014).

Most informal traders left the rural areas for the urban area looking for better living conditions and employment. Their unstable socio-economic backgrounds in their families force them to migrate. With an irregular and low-paid income, which required hard manual labor some left their employment and settled for street trading (Khairuzzaman et al., 2014). The informal traders are self-employed and do not depend on any institutional support for their incomes. Their enterprises' progress depends on their own individual strengths and support from immediate families and other close associates to provide for themselves and their dependents. The activities of street trading not only provide income but also reduce the dependency on the state (Chen, 2012).

In developing countries, the tolerant policies, allow informal trading but do not promote and incentivize it. Traders have restrictions on trading hours, locations and trader appearance. The intolerant policy focuses on the relocation and removal of informal traders. The officials such as police and municipal officers often use their power to

remove informal traders and their goods from the streets (Mackie, Bromley & Brown, 2014). Table 1.2 below indicates various characteristics of the Formal and informal trading sectors.

2.4.1 Food safety and quality assurances

Soon after harvest, a lot of fresh fruits and vegetables are lost worldwide due to physiological pathological and physical damages. In South Africa, a study by Mashau et al. (2012) found that Limpopo province produces about 31% of the country's sub-tropical fruit. It produces 25% citrus, 75% mangoes, 65% of papayas (pawpaw), 60% avocados, 25% of bananas, and 20% of litchis. All those products are the host of pests (*Bactrocera spp*). All fresh fruits and vegetables are subject to damage when exposed to extreme temperatures. So, during transportation, the product should be at a controlled temperature. Fruits vary considerably in their temperature tolerance. Low temperatures are of great importance in maintaining fruit quality which will always attract buyers. Informal markets where large numbers of small traders participate are common across the agro-food value chain (Silva-couto et al., 2010.).

Charman et al. (2017) also contributed to the fact that Informal sector activities, such as street vending, provide food for many citizens and contribute substantially to the economy. The fruit trade can be adversely affected by weather changes. Temperature is the most important environmental factor that influences the deterioration of harvested fruits. It has been shown by Charman et al. (2017) that temperature has an intense effect on the rates of biological reactions, and gives rise to respiration and further indicated that holding the fruit in the temperature range of 20 to 23°C provides the best appearance, improves palatability and control decay in ripening mangoes.

2.4.2 The informal traders' marketing strategies.

It is commonly suggested that commercially oriented informal traders are likely to struggle because they cannot compete with established, large-scale formal traders. In Silva-couto et al. (2010) a study of the smallholder's informal traders examined illustrated the three main marketing strategies: (i) local direct marketing in one's own community, (ii) formal established marketing chains and (iii) high-value position

markets. Each marketing strategy offers real opportunities for informal traders and has its place. Direct local marketing can serve as a useful strategy for informal traders attempting for the first time to street trade as a main source of income. However local markets have their own challenges such as transport costs and/or seeking the most advantageous market opportunity.

2.4.3 Food Transportation

Food products can be transported using different methods such as reefers containers, land, sea and air modes. They all have different structures for keeping food fresh throughout the transport chain. Good packaging methods are important to control ripening and reduce the deterioration of food products. For food products such as fruits and vegetables, the time has a direct impact on their shelf life (Aung & Chang, 2014). The transportation starts immediately after harvest, using covered bins to protect against direct sunlight, rain dust, and pest infestation. For precooling, products are stored in a refrigerated room to remove any remaining field heat and preserve quality. After pre-cooling, products will be sorted and packaged, then stored in a cold store under refrigerated conditions. From the cold storage, products will be ready to be sold locally or exported internationally to the consumer in good quality. If the transport duration is more than two hours, refrigerated (reefer) containers or refrigerated trucks are used (Freiboth et al., 2013).

2.5 Informal trading around the World

Figure 2: Selected constraints of small businesses around the world

Source: adapted from Okpara (2011)

In the United States of America (USA), a study found that informal traders in New York City (NYC) were given Green Carts (Li et al*.,* 2014). The NYC Department of Health and Mental Hygiene (DOHMH) issued 1,000 permits for Green Carts to be privately owned and operated by mobile fruit and vegetable informal traders in order to increase the availability of fresh produce in all neighbourhoods. Although Green Carts may locate anywhere within these designated areas, however, for economic reasons, Cart vendors may choose to occupy any busy commercial areas that already have fruits and vegetables rather than in food deserts (Li et al., 2014).

In sub-Saharan Africa, the informal economy is the main source of urban jobs for the growing urban poor. The dramatic growth in the informal economy has been driven by fast urbanization, political restructuring, war, food shortage and disease. Urban population growth has been accompanied by limited job creation for the poor. Informal traders are one of the largest groups in the informal economy after home-based and

domestic workers, who operate in a visible but contested field (Brown, Lyons & Dankoco, 2010).

In Sub-Saharan Africa, for example, India, informal traders are also known as street entrepreneurs because they sell goods to the public on the streets. They are without any permanently built structure from which to sell and are stationary. Some traders occupy space on the pavement or some other public/private space, or they are seen being mobile carrying their goods on push carts or in baskets on their heads (Roever, 2016b). Amongst the challenges, they do not have business permits, violate zoning codes, fail to report tax liability, lack compliance with labour regulations governing work conditions, and/or lack legal guarantees in relation to suppliers and clients.

In countries such as Kenya, Uganda, Zimbabwe, Ghana, and Cote d'Ivoire street vending is unaccounted for and unrecognized in national economic statistics (Mashau, Moyane & Jideani, 2012). The Informal markets where large numbers of small traders participate are common across the agro-food value chain. Informal sector activities, such as street vending, provide sustainability for most citizens and contribute substantially to the economy (Silva-couto, Prado-medeiros, Oliveira & Alca, 2010).

South Africa's informal economy is regarded as an important sector of the economy with the potential to assist the country in addressing the country's high levels of poverty, which stand at a staggering 55 % and 29 % unemployment rate (Khambule, 2020). Unemployment is one of South Africa's most pressing socio-economic challenges, affecting a quarter of the workforce (Davies & Thurlow, 2010). Besides the provision of income to the less educated and unskilled people, it has other major roles, it generates employment, helps in alleviating poverty, makes a significant contribution to exports and trade and provides raw materials to local consumers. Informal traders are flexible and can adapt quickly to changing market demand and supply situations.

The informal sector's contribution towards GDP is evident due to the fact that they grow at a very rapid rate and give the unskilled and illiterate a chance to earn an income. Generally, this has made this sector to be one of the leading sectors in many national economies. For example, small or medium enterprises (SMEs) in Ghana provide about 85% of manufacturing employment. They are also believed to contribute

about 70% to Ghana's GDP and account for about 92% of businesses in Ghana. In the Republic of South Africa, it was estimated that 91% of the formal business entities are SMEs and also contribute between 52 to 57% to GDP and provide about 61% to employment (Abor & Quartey, 2010).

2.6 Challenges faced by informal traders in South Africa

The informal trader's sector is a diverse and mixed sector operating in a number of fields that provides goods and services at low cost and within the reach of the consumers. However, it experiences problems that come from its small size which restricts them from benefiting in a number of ways such as economies of scale and even a lack of security for them to borrow loans (Li et al., 2014). The lack of capital as the internal barrier makes it difficult to obtain credit from the financial sector such as banks due to the lack of collateral. This leaves informal traders with no option but to source loans from money lenders who charge them high-interest rates that they cannot easily repay. The external barriers are factors that include technical trade restrictions, bureaucratic procedures and marketing and distribution problems that businesses have no control over (Tshuma & Jari, 2013).

The informal traders are seeking to grow and join the formal sector; however, this transition is complicated and expensive. In most countries like Europe, Asia, and Africa, with South Africa included the legal processes of registration and obtaining a license are very long and costly. Licenses take too long to be processed since informal traders lack the influence or bargaining power enjoyed by the formal sectors. This pushes some informal traders to resort to bribes as they try to make the government officials speed up the processing of their applications (Tshuma & Jari, 2013).

2.7 Factors that influence the informal trader's compliance with phytosanitary measures

One of the difficulties that informal traders face is frequent encounters with law enforcement, particularly abuse by municipal police. In the study of (Kabonga et al., 2021) the respondents stated that they were subjected to a threatening relationship with the municipal police on a daily basis, which included arrests and their property being impounded and auctioned.

SPS measures are clearly intended to ensure safety and national regulatory mechanisms governing their implementation and enforcement are required to ensure that only healthy agricultural products and foodstuffs are delivered to the general population. Commodity producers, traders and regulatory authorities are all responsible for ensuring SPS compliance (Ic & Cetinkaya, 2021).

A variety of factors influence informal traders' phytosanitary compliance. One of the factors identified is infrastructure issues. The informal traders are found in slums where living conditions are exceptionally poor. Women working as street vendors, for example, face the spatial challenges of working in a changing public space with poor hygiene and safety conditions (Horwood et al., 2019). Transportation infrastructure is frequently mentioned as an important factor in promoting growth and development. Transport links have the potential to significantly improve economic growth and development. The safe and secure movement of goods from their origin or source to their final destination is a critical factor in promoting commercial activity, economic growth, and development (Banerjee et al., 2020). Most municipalities have long ignored planning for the spatial distribution and servicing of informal traders. Surveys of street and market traders in South Africa and elsewhere have repeatedly revealed infrastructure deficiencies – water, toilets, paved surfaces, shelter, storage and electricity (Skinner & Watson, 2020).

According to the findings of Etim and Daramola (2020), the informal sector in South Africa faces challenges such as a lack of credit/low capitalisation, poor technology adoption, poor support infrastructure, poor government policy and a lack of social protection. However, the South African informal sector has had to deal with the consequences of unfavourable zoning laws, which specify where informal activities are permitted and prohibited.

People still have difficulties entering informal street trading spaces. Many are practising informal trading because they cannot find employment in the formal sector, or they earn insufficient income elsewhere. Finding start-up money through savings or loans is not easy. Ownership rights are required as collateral for bank loans and If they cannot provide collateral, they cannot obtain access to formal credit from banks.

Alternative financing occurs through savings or loans from informal sources, including family or moneylenders with high interest which they battle to repay (Willemse, 2011).

Municipality also faces challenges when they deal with informal traders. There are instability and vulnerability of informal traders 'representation and associations. Multiple structures within municipalities that do not plan and operate jointly are mandated to facilitate, manage, implement and monitor informal trading. There is no common denominator between hawkers and their constitutional rights to trade. The municipal by-laws prohibit them from trading on specific sites. Increasing the number of street traders which results in overcrowding. Low literacy levels are also a challenge to the local government because informal traders are unable to exercise their constitutional rights and duties and this continuously frustrates municipal officials (Arnold, 2014). For the informal trader's business to grow and be sustainable certain skills such as marketing skills, product inspection, writing and negotiation skills and interpretation skills are needed. Poor marketing skills of informal traders are suggested to be due to a lack of education. Buying products from the supplier can seem to be a difficult exercise as the product should be inspected for quality and quarantine pests. This inspection is activated by the conditions in the import permit that should accompany the consignment from the farm.

2.8 The role of informal traders in the distribution of Quarantine pests to pest-free areas

Traders or travellers can easily spread pests by carrying infested fruit into or between horticultural regions. In a process, the local and regional market is also deeply affected. It can be helpful to protect the horticulture sector by heeding all local advice about travelling with fruit and by disposing of fruit in quarantine bins as necessary (Sarwar, 2015). According to Venter and Sekgala (2014), the quarantine pest spread from infested areas through people moving with fruit to the non-infested areas as well as through natural movement. Fruit flies are classified as "quarantine insects, exporting countries are applying strict measures on imported consignments in order to intercept consignments. If consignments are found with traces of such pests they are confiscated and destroyed in incinerators at harbours and airports of importing states due to major economic losses which can be introduced to the country (Shah et al., 2014).

2.9. The role of State in Phytosanitary measures of fruits and vegetables around the World

In India, in a bid to reduce informal fruits and vegetables in the streets, the police are using the India Penal Code of 1860, the India Police Act of 1861, and the Bombay Municipal Corporation Act of 1888 as justification for seizing vendors' goods (Mahadevia et al., 2013). The municipal authority is granted permission by the by-laws to seize the informal trader's goods as a sanction against unauthorized use of public space (Roever, 2016b). in many cases, those provisions are not accompanied by restrictions on what municipal authorities can do with seized merchandise afterwards and, where such restrictions exist, vendors have little hope of recovering their goods. Arbitrary eviction by state authorities is common in most countries.

In China, a local government has typically provided space and necessary infrastructure support at a reduced cost, with special subsidies, tax breaks for informal traders, and by-passed formal rules, regulations on labour use, and environmental protection. All of these informal practices, as well as the massive informal economy that supports them, have been the primary dynamic cause of both China's remarkable GDP growth and its mounting social and environmental crises (Huang, 2011). These opened opportunities for local citizens to occupy streets in major cities. While it has been noted that there have been Africans in China, including students and diplomats, for a long time, there has never been, until now, a massive presence of Africans from all walks of life actually migrating to China to start up businesses serving both Africans and Chinese (Bodomo, 2010).

In South Africa, the movement of host fruit and vegetables from quarantine areas or infested districts and municipalities is supposed to be subject to a removal permit issued by the Department of Agriculture Land Reform and Rural Development (DALRRD). For instance, the movement of any host fruit and vegetables from quarantine areas such as Limpopo Province, Mpumalanga Province and other parts of North West Province must be accompanied by a removal permit and comply with the conditions of the permit. Control pest-free areas can be established and maintained by monitoring traps, doing chemical eradication, sanitation and following other possible methods that can suppress the pest. A farmer must apply for a removal permit from the DALRRD which will inspect the farm for compliance with the permit

conditions. Once the removal permit is granted, the farmer should place the copy on records and always give a copy to traders who buy fruit and vegetables from his/her farm without any charge (Venter & Sekgala, 2014).

2.9.1 The participation of women in the informal sector

Women have a low participation rate in the formal sector in Nigeria. They start their own businesses in the informal sector. They mostly operate in a hostile environment and are largely ignored in terms of public policy. They are viewed as illegal traders who must be harassed by law enforcement. They typically have limited access to start-up and working capital, as well as other resources such as credit and technology (Fapohunda, 2012). They settle on simple technology that requires little capital investment.

In the Philippines, women, in particular, migrate from rural to urban areas, making city streets their new business venues for selling goods such as fresh produce, manufactured goods, and cooked food. Local authorities and national governments place limitations on informal traders in efforts to develop and modernize their cities. The authorities do not recognize street trading's efforts to make a living; however, they are considered to be illegal, and exposed to fines, prosecution and having their goods confiscated (Milgram, 2011).

Historically, Lesotho had a high rate of migration by men to seek work in South Africa, leaving women as the main breadwinners, which led to women entering street trading. The country is facing developmental challenges, such as poverty, economic dependence on other countries and political uncertainty (Brown, Lyons & Dankoco, 2010). Informal traders face challenges that badly affect their operations. These challenges include stiff competition within informal sectors and low incomes, harassment by the Maseru City Council (MCC) police, the perishability of goods, the failure of debtors to repay, and transport cost (Chingono, 2016). The controlling legislation and procedures for licensing are so complex making it impossible for traders to comply. Ministries have the power to do inspections or eviction. Eviction of traders is also common and a place outside designated markets; the spaces that traders use are described as crime-ridden which has been used to justify some evictions (Brown, Lyons & Dankoco, 2010). This is the exercise of unequal power in evicting informal traders from particular streets or blocks. This has been observed

during evictions implemented by multiple city departments, such as the infamous Operation Murambatsvina in Zimbabwe and Operation Clean Sweep in Johannesburg, South Africa which is violent in nature (Benit-Gbaffou, 2015).

2.10 Legislations affecting the informal traders in South Africa.

2.10.1 Informal trading by-laws

The City of Tshwane municipality public amenity regulation (BY-LAW NO. 8/2007: PUBLIC AMENITIES) stated that the public amenity includes any public road, road reserve, street, lake, dam, river, stream which is owned and rented or managed by the municipality and which the citizen was allowed to use in their personal capacity. This by-law prevents any person from selling any product at all without being permitted by the municipality to do so. Any person who deliberately contravenes this law will be fined more than R10 000 or be imprisoned for a period of 1 year (Nkrumah-Abebrese, 2018). This clearly indicates that any informal trader found trading unlawfully will be fined or even be jailed.

2.10.2 Bill of rights

The constitution of the Republic of South Africa under section 12 stated clearly that every citizen alive has the right to freedom and security. This includes the right not to be deprived of freedom arbitrarily or without just cause; not to be detained without trial, to be free from all forms of violence from either public or private sources; not to be tortured in any way; and not to be treated or punished in a cruel, inhuman or degrading way (Republic of South Africa, 2008). These rights protect the informal traders from any form of abuse from the municipal authorities during the operation such as 'Operation Fiela' or 'Clean Sweep'.

2.10.3 Business License Application Regulation

In May 2013 in order to promote competent government and support, the department of trade and industry in South Africa drafted a business Licensing bill with the intention to provide an uncomplicated, facilitative framework for the licensing application procedures by providing a set of norms and standards (Helen Suzman Foundation, 2013). The main aim is to have a formal and informal business licensed and registered

with the local municipality. According to Helen Suzman Foundation (2013), the new business licenses will be valid for five years. This license should be issued within 30 days of the application; however, authorities can extend it to 14 days under certain circumstances. A trader must produce a license on demand to an inspector or face a fine and confiscation of goods.

2.11 Review of analysis methods

Data analysis methods are primarily affected by the aims and objectives of the intended research. Nkrumah-Abebrese (2016) study explains that data analysis is a procedure that is used to examine, organize, convert and represent data with the aim of finding constructive information, ideas and conclusion based on information collected. For this study, the nature of the analysis will be a quantitative method. However, the nature of data collected in the study was both qualitative and quantitative which will strengthen the data depth in the study (Lowry, 2013). The research design for this study will be quantitative in nature.

2.11.1 Qualitative and Qualitative research

Nkrumah (2016) describes qualitative data analysis as the organization and explanation of field notes, interview records tapes, audio footage or articles. Furthermore, Nkrumah-Abebrese (2018) cautioned that the qualitative research method must interpret the data collected from the participants for the research findings to be practical**.** Qualitative research is inductive, and generally, the researcher will explore meanings and insights in a given situation. It refers to a range of data collection and analysis techniques that use purposive sampling and semi-structured, open-ended interviews (Mohajan, 2018).

It is social science research that collects and works with non-numerical data and seeks to interpret meaning from these data which will help the researcher to understand social life through the study of targeted populations or places (Punch, 2013). Qualitative research consists of the following methods: logic, ethnography, discourse analysis, case study, open-ended interview, participant observation, counselling, therapy, grounded theory, biography, comparative method, introspection, casuistry, focus group, literary criticism, meditation practice, historical research, etc. (Cibangu, 2012). Qualitative research is interpretative research; the researcher will be involved

in a sustained and intensive experience with participants. This introduces a range of strategic, ethical, and personal issues into the qualitative research process (Creswell, 2013).

For this study, the nature of data was qualitative and included participants' preferences, values and personal backgrounds, such as gender and socioeconomic status that will shape the participants' interpretations during the study. The data was collected using a semi-structured questionnaire. It was analyzed with indicators such as frequencies, percentages, averages, and means. The benefit of descriptive research is that data can be easily described (Cleary et al., 2012). The goal of descriptive research is to describe a phenomenon and its characteristics. It is more concerned about what not how or why something has happened (Nassaji, 2015).

This study was a case study for the City of Tshwane. There are three main types of descriptive research methods namely: observation method, case study and survey method (Jackson, 2009). However, this study followed the case study method, according to Baxter and Jack (2008), a case study design should be considered when the focus is to answer questions "how" and "why" when the researcher cannot manipulate the behaviour of those involved in the study.

Other variables in this study were quantitative, a quantitative variable can be either continuous or discrete. A continuous variable is one that in the model could take any value in an interval. A discrete quantitative variable is one that can only take specific numeric values (rather than any value in an interval), but those numeric values have a clear quantitative interpretation.

2.12 Chapter Summary

The informal sector contributes a lot to the economy, however, there is stiff competition from the formal sectors. Informal traders are defined as non-tax and VAT payers. They occupy the inner part of the city centre where they trade in food and nonfood products. The informal traders are facing many challenges such as municipality laws, financial constraints, poor working conditions, poor infrastructures etc. However, regardless of the challenges, they have the potential to create employment and alleviate poverty.

The informal traders of fruits and vegetables have the potential of introducing pests from the quarantine area to pest-free areas such as the city of Tshwane. Transportation of fruits and vegetables should be monitored to avoid such so the usage of refrigerated containers as well as refrigerated trucks will be beneficial. The pest of concern is the *Bactrocera species* of the family *Tephriditae* which puncture the fruit and insert the egg and larvae develop to damage the commodity resulting in it being less marketable. This species if not controlled will spread and contaminate the pest-free area and that will impact trade negatively. To control this pest is expensive as it will require bait control, insecticides as well as sterile insect techniques.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Chapter 3 presents the description of the study area, the research design, and the research methods and data analyses of the study. The data presented in this chapter was analysed using frequencies, percentages, graphs and pie charts. Some of the variables discussed in this chapter were later used in the models as dependent and independent variables. A sample of 210 respondents was drawn from the target of 458 population of the informal fruit and vegetable traders in the City of Tshwane Gauteng Province. The respondent targeted was male and female young and old informal traders situated in Arcadia, Sunnyside, Marabastad and Pretoria central. Ethical clearance consideration,

3.2 Study area
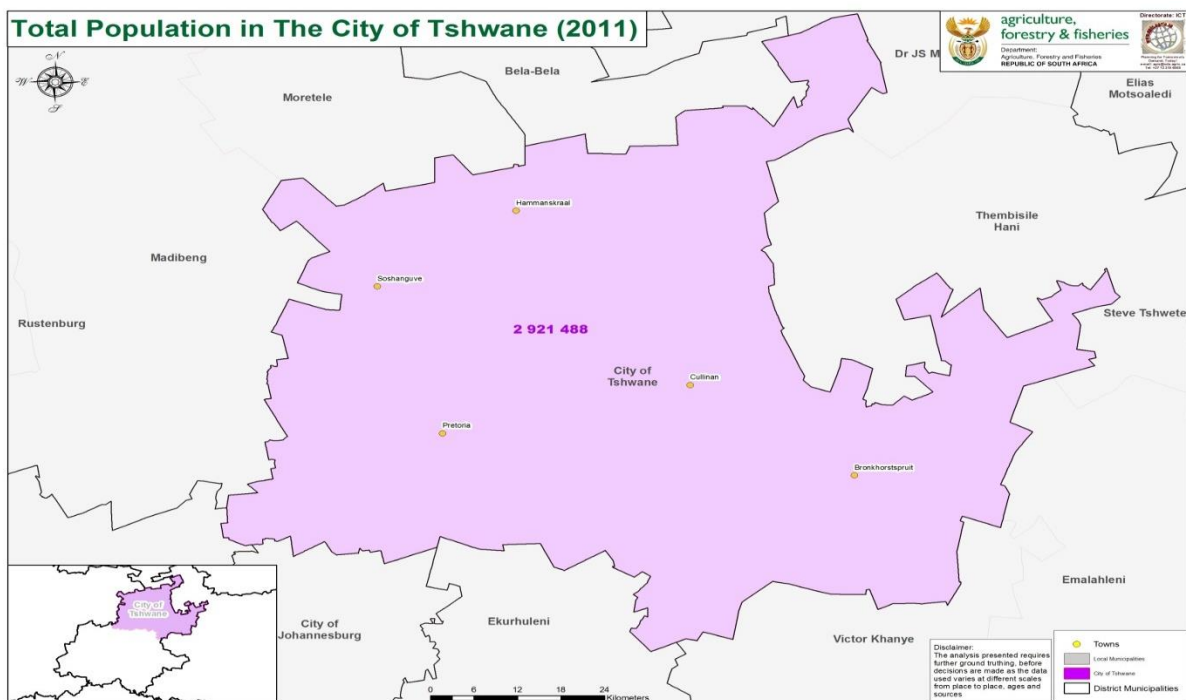
Figure 3: City of Tshwane map.

Source: Geological Information Systems, Department of Agriculture Forestry and Fisheries and City of Tshwane (2011).

The City of Tshwane (CoT) is located in the Gauteng Province and is South Africa's capital city. It is one of the three (the City of Johannesburg, City of Ekurhuleni and City of Tshwane) largest metropolitans in the province. It is covering an area of 6 368 km^2 which makes it the third-largest in the world in terms of land mass with an estimated population of 2, 9 million (Metro, 2014).

It was formerly called Pretoria, during the reconfiguration in Gauteng the then Executive Mayor, Mr Kgosientso Ramokgopa named it the city of Tshwane. It houses almost all the administrative offices of the executive office bearers and government departments (Nawa et al., 2012). In South Africa, the City of Tshwane is the second wealthiest municipality in terms of Gross Domestic Product (GDP) per capita and the largest in land size (Africa Insight & GDP, 2014). About 30% of the economy is in the government social and community services sector (23,7%), finance and business services (15.4 %), wholesale and retail trade, as well as manufacturing activity (11.2%) (Africa et al., 2014). The City of Tshwane consists of some educational institutions like universities and colleges, tourist attractions such as museums, monuments, statues and government buildings like the union building.

The City of Tshwane is chosen for this study because it has the potential of luring people from other major provinces and foreign countries to invade it for better job opportunities, however, failing to do so they opt for informal trading. Trading in different services ranging from washing cars, barbershops, fast food and selling of perishable products. The City of Tshwane has been declared a free-pest area due to surveys of *Bactrocera invadens* which have been conducted by the DALRRD 2012, with continued traps and monitoring, the city has been declared to be a pest-free area. The Study will take place in four areas within the Central Business District (CBD) of the city of Tshwane namely: Arcadia, Marabastad, Sunnyside and Tshwane central.
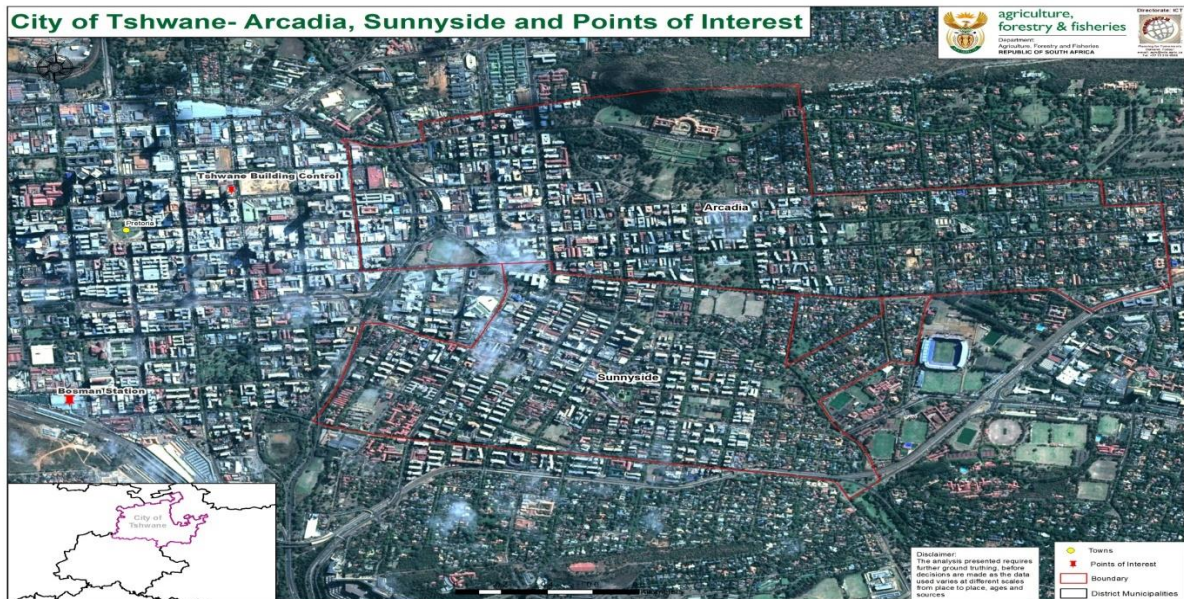
Figure 4: City of Tshwane map indicating areas of the study

3.2.1.1 Sunnyside

Sunnyside is a suburb situated in the south-eastern part of the city of Tshwane's central business district. It is mainly residential and highly populated with a lot of informal businesses. Streets bordering the suburb include Schoeman, Park Street to the north, Nelson Mandela Drive, Walker Street and Esselen Street (Masonganye, 2010).

3.2.1.2 Arcadia

Arcadia is a suburb situated in the east of the city of Tshwane, South Africa, it is known for its historical buildings, embassies, hotels, the Union Buildings, the official residence of South Africa's President and the University of Pretoria. There are small flats used by young workers and students. The main streets bordering Arcadia are Stanza Bopape Street, Pretorius Street, Francis Baard Street and Park Street.

3.2.1.3 Marabastad
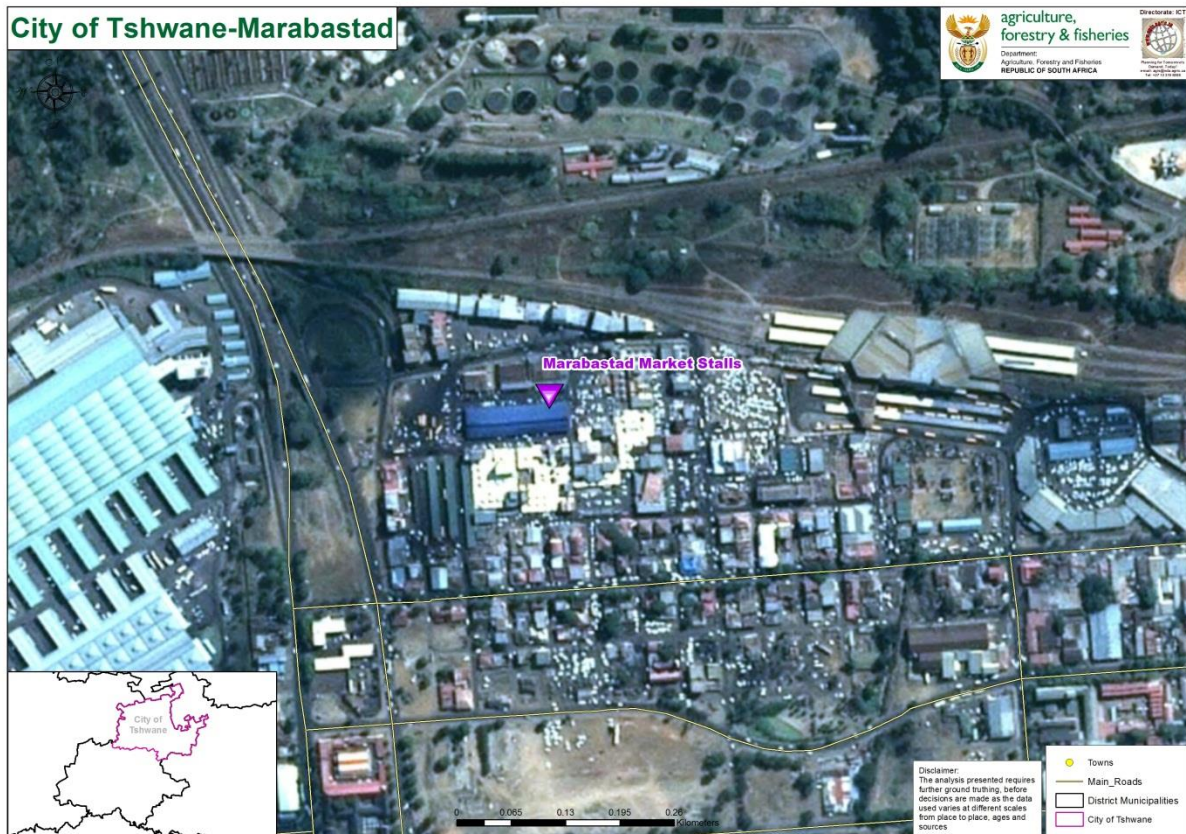
Figure 5: Marabastad Map

Marabastad is situated between Boom and Bloed Street with Belle Ombre station located to the North side of it. It is one of the most undeveloped parts of the city of Tshwane. Marabastad hosts 18% of Pretoria's informal trading. Formal traders of Marabastad consist mainly of the Indian community whereas informal trade is a mixture of black cultures (Karel & Breed, 2010).

3.2.1.4 Tshwane central

For this study, Tshwane central is the area that is surrounded by the Marabastad, Arcadia and Sunnyside. The researcher will focus on interviewing the informal traders that are sitting on the streets of Tshwane central more on taxi ranks and train stations, which are mostly situated between Paul Kruger Street and Nelson Mandela drive.

3.3 Research design

Holloway and Wheeler (2010) define research design as the general plan of the research process including strategies and procedures. The research design was used to describe the nature of the study, the unit of analysis, the outline of the plan, structure, and strategies to be adopted for the research. University of Southern California Libraries (2016) emphasized that a descriptive research design obtains information concerning the status of the phenomena and describes, "What exists" with respect to variables. There are two types of research methods namely: qualitative and quantitative methods. Qualitative research emphasizes experiences, describing the phenomenon, and developing theory. In this study, the quantitative research design was used. A quantitative method is more effective as it offers a complete perspective as to why certain things happen in a particular way (Etikan, 2016). Probability sampling was used coupled with cross-sectional survey data. Furthermore, descriptive statistics and inferential analysis were employed in the study

3.4 Research methods

3.4.1 Population

The population can be defined as people or items that a researcher wishes to understand (Rahi, 2017). A population may be when all elements are similar in all aspects (homogenous) or elements are not similar to each other in all aspects (heterogeneous). (Cleary et al., 2012). The population of the study was 458 registered fruit and vegetable, informal traders in the City of Tshwane as indicated by the office of the municipality.

3.4.2 Sample size

A sample is a portion of the sampling frame that is used for research purposes (Taruvinga, 2012); however, Neuman (2011) points out that a sample is a "small set of cases a researcher selects from a large pool and generalizes to the population. Sampling is the method of selecting part of the population for research and selecting a sample of units from a data set to measure the characteristics, beliefs, and attitudes of the people using a structured questionnaire (Rahi, 2017). Who and how many participants will depend on 'what the researcher wants to know, the purpose of the

inquiry, what's at stake, what will be useful, and what will have credibility (Cleary, Horsfall & Hayter, 2012). The statistical rule-of-thumb approach recommended by Ramkissoon and Uysal (2011) and Hair, Black, Babin and Anderson (2009) has been used to determine the required sample size for many studies.

A standardized system of sample determination developed by Krejcie and Morgan (1970) was used in this study. According to Krejcie and Morgan (1970) the population size of 458 was represented by a sample size of 210 (See table 3.1 and formula below). This study opted to use a sample of 210 informal fruits and vegetable traders in the City of Tshwane.

Since the research is a quantitative study and the target population is finite as 458 the formula stated below by Krejcie and Morgan (1970) was used to determine the sample size.

$$S = \frac{X^2 NP\,(1-P)}{d^2\,(N-1)+ X^2 P\,(1-P)}$$

Where:

S = Required Sample size

X = Z value (e.g. 1.96 for 96% confidence level)

N = Population size

P = Population proportion (expressed as decimal) (assumed to be 0.5 (50%)

d = Degree of accuracy (5%), expressed as a proportion (0.05) is the margin of error

Table 3. 1 Sample size guideline

Table 3.1									
Table for Determining Sample Size of a Known Population									
N	**S**	**N**	**S**	**N**	**S**	**N**	**S**	**N**	**S**
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384
Note: N is Population Size; S is Sample Size						*Source: Krejcie & Morgan, 1970*			

Source: Krejcie and Morgan (1970)

3.4.3 Sampling technique

For this study, participants were sampled from four areas: Arcadia, Tshwane central, Sunnyside and Marabastad.

In this study, the population of the registered informal fruit and vegetable traders in the Central Business district (CBD) of the municipality was given as 458. The Krejcie and Morgan (1970) formula was used to obtain a sample size of 210. The researcher has made a follow-up to obtain the figures for the traders within the 4 respective areas earmarked for the study. After determining the sample size for each stratum, then stratified random sampling was employed to obtain the respondents for each area in accordance with each stratum.

Table 3. 2 Sampling size of each suburb

Population	Suburb	Frequency	Sample size
458	Arcadia (111/458) X 210	51	**210**
	Sunnyside (115/458) X 210	53	
	Pretoria Central (115/458) X 210	53	
	Marabastad (115/458) X 210	53	

Source Author (2020)

3.4.4 Primary and Secondary data

Data are raw facts that have not been processed, organized, or analyzed, and they have little meaning and provide little benefit to researchers. They are uninterpreted materials upon which a decision is to be made, and they are based on facts that are known to be true or exist. They can be in text or numerical format in terms of content (Mohajan, 2017). The researcher collects primary data in order to answer specific questions in the project, and then analyzes and publishes the results of the data collection (Boslaugh, 2007). Primary data was gathered from informal traders. Secondary data is information gathered by other researchers for primary research purposes that provides fundamental research principles (Nassaji, 2015). In this study, this information was gathered from journal articles, websites, books, and government publications. It is in ready-to-use formats, but it may not meet research needs, may have license restrictions, and data quality may be poor (Ajayi, 2017).

3.4.5 Data collection tool/ instrument

To collect primary data from Tshwane's informal fruits and vegetable traders a questionnaire was used. This type of questionnaire was extremely beneficial because it provided both qualitative and quantitative data to the researcher (Taghizadeh, 2013). Face-to-face interviews were used to administer the questionnaire because this method ensures that questions are clear (Phellas et al., 2011). The questionnaire was divided into sections based on the objectives of the study. Given the busy schedules of the Informal traders, the questionnaire interviews were conducted by appointment and at the convenience of the participants. Each respondent was interviewed using a questionnaire that lasted no more than 45 minutes. This was thoroughly tested during the data collection instrument's pre-testing. Respondents were given the option of splitting the interview into two shorter sections if necessary.

3.4.6 Validity and reliability of data collection instrument

The data collection instrument was validated by consulting with an expert in the agricultural economics field to ensure that the questionnaire could measure all of the study objectives. Pilot studies are commonly associated with a quantitative approach to testing a research instrument, which in this study was a questionnaire. The main reason was to strengthen the interview questions, identify flaws or limitations in the questionnaire, and make necessary changes to the major study (Othman et al., 2018). The questionnaire was piloted on about ten informal traders who were not part of the main survey in this study for reliability. This was done to see if the questionnaire was clear and simple to fill out.

3.5 Data analysis

3.5.1 Descriptive analysis

The goal of the descriptive analysis is to define a phenomenon and its characteristics; it is more concerned with what rather than how or why something has happened (Nassaji, 2015). Descriptive analysis used was frequencies and percentages. presented in the form of tables and charts (see Annexure 2 questionnaire). In this study, Statistical Social Science Packages (SPSS) version 27 was used for descriptive statistics.

Objective one: To assess the compliance of phytosanitary measures among the informal traders; and the presence of information synergy from the government to traders.

For this objective, descriptive analyses were used to describe the nature of the data. The findings were presented in a form of tables and charts. The analyses described the socio-economic demographics of the informal traders and the measures that were currently practised in compliance with phytosanitary measures in the city of Tshwane. The availability of information from government officials to the informal traders was also analysed in the study area. Variables from Table 3.2 to 3.5 below were used.

3.5.2 Inferential analysis.

Sayers's (2015) study highlighted that inferential statistical analysis creates interpretations as to the nature of effects between elements in the data, thereby allowing observations on how one element could influence another and facilitating a complete understanding of the density of a situation. In this study, objective one used descriptive statics and objectives two to four used inferential analysis. Objective five was a development of a framework which was emanated from the research findings. The analysis for each objective is discussed below.

Objective two: To assess the determinants of the knowledge level of phytosanitary measures of fruit and vegetable informal traders.

The dependent variable in this study was measured using a Likert scale, and the ordered logistic regression was used to investigate the determinants of the

participants' (informal fruit and vegetable traders') knowledge level of pests and possibly SPS measures. The ordered logistic model is used because the response variable can have three or more values. If the participant knows nothing about fruit and vegetable pests the value was **0 -poor.** If the participant heard but never seen fruit and vegetable pests the value was **1 -fair.** If the participant has knowledge of fruit and vegetable pests had a value of **2- good**; and knowledge and ability to differentiate fruit and vegetable pests had a value of **3- excellent knowledge.**

The **Ordered logistic model** was used to analyse the determinants of the level of knowledge of fruit and vegetable pests among the informal traders. The model is specified as:

$Yi^* = \beta'Xi + \varepsilon i,$

$where\ i = 1... N,$ (1)

Y^*-knowledge-**dependent variable**
Y would be:

$Y = 0$ if $Y^* \leq 0$

$Y = 1$ if $0 < Y^* < \alpha_1$

$Y = 2$ if $\alpha_1 < Y^* < \alpha_2$

$Y = 3$ if $\alpha_2 < Y^* > \alpha_3$ (2)

In this study, categories of Y are represented as follows;

Category 0 = trader knowledge is poor

Category 1 = trader has a fair knowledge

Category 2= trader's knowledge is good

Category 3= trader knowledge excellent

Where;

(Xi) - Covariates/ **independent variables** (Tables 3.6 below)

(εi)- Certain unobservable factors/ error term

The independent variables to be used in the analyses are indicated in the table below.

Maximum likelihood estimation (MLE), was used to estimate or fit the model. MLE is the method used to calculate the logit coefficients. This contrasts with the use of ordinary least squares (OLS) estimation of coefficients in linear multiple regression. OLS seeks to minimize the sum of squared distances of the data points to the regression line. Maximum Likelihood (ML) methods seek to maximize the Log-likelihood (LL), which reflects how likely it is (the odds) that the observed values of the dependent may be predicted from the observed values of the independents (Vinayak et al., 2019).

Hosmer and Lemeshow chi-square test of goodness of fit. The recommended test for the overall fit of a logistic regression model is the Hosmer and Lemeshow test also called the chi-square test. This test is considered more robust than the traditional chi-square test, particularly if continuous covariates are in the model or the sample size is small. A finding of non-significance corresponds to the researcher concluding the model adequately fits the data. This test is preferred over classification tables when assessing model fit (Surjanovic, & Loughin, 2021).

Omnibus tests of model coefficients According to (Andrei, & McCarthy, 2020) It tests if the model with the predictors is significantly different from the model with only the intercept. A finding of significance corresponds to the research conclusions that there is an adequate fit of the data to the model, meaning that at least one of the predictors is significantly related to the response variable.

Information Theory Measures of Model Fit. The Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC), is a common information theory statistics used when comparing alternative models. Lower is a better model fit (Jenkins & Quintana-Ascencio, 2020).

The Schwartz Information Criterion (SIC) is a modified version of AIC. Compared to AIC, SIC penalizes overparameterization more (rewards model parsimony). Lower is a better model fit. Both AIC and SIC will be employed in this research when assessing alternative logistic models (Pruchnicki, & Opieliński, 2021).

Objective three: To analyse factors influencing SPS compliance among the informal fruit and vegetable traders in the city.

Regression is a statistical technique for investigating the practical relationship between one or more independent variables (Y) (Cox et al., 2021). The relationship between variables is expressed by a model that connects the dependent variable with one or more independent variables. The Tobit Regression model was used to analyze factors influencing SPS compliance among the city's informal fruit and vegetable traders for this objective.

The SPS Compliance Index (Yi)

To be fully compliant with SPS implies that the informal fruit and vegetable trader must have:

1. Removal Permit issued by the Department of Agriculture Land Reform and Rural Development.
2. Be aware and comply with the Municipal by-laws
3. Should avail their stock regularly for inspection.
4. Have trading license
5. Have Own stall

Some of the informal traders do not comply with any of the aforementioned measures; while some of them comply with only some of the above-listed measures. An SPS compliance index was established for the dependent variable and lower censored at zero and upper censored at 1 OR between 0 and 100%. All the informal traders who complied with all the measures were scored 100%; while those who do not comply with any of the criteria were scored 0. There were those who had a score index of between 0 and 100%. The dependent variable (Yi) therefore has two characteristics of being continuous and also limited (0 -1). Hence the Tobit Regression Model was used for the regression analysis.

The Tobit Regression Model

The Tobit regression model was specifically used to analyse the factors which influence factors influencing SPS compliance among the informal fruit and vegetable traders in the city. The Tobit regression model is appropriate since the dependent variable is in the form of proportion or percentage. Thus, it cannot be less than zero and cannot be more than one or 100.

The use of probability models is conceptually preferable to conventional linear regression models in the analysis of levels of outcome variables because parameter estimates from the former overcome most weaknesses of linear probability models namely: providing estimates which are asymptotically consistent and efficient (McDonald & Moffit, 1980). The general model is a model involving the estimation of the probability of a given set of indicators (Y_i) as a function of a vector of explanatory variables (X_i).

The Tobit regression model, a hybrid of the discrete and continuous models. As with Logit and Probit models, the estimation of a Tobit model is greatly dependent on the underlying distribution of the error term in the latent variable model. Therefore, in the estimation of the Tobit model, it is assumed that the error term has a normal distribution. The model is expressed in equation 1 below following McDonald and Moffit (1980).

$$Y_i = \begin{cases} y_i^* = \beta X_i + u_i & \text{if } y_i^* > 0 \\ = 0, & \text{if } y_i^* \leq 0 \end{cases} \qquad (1)$$

$$y_i^* = \beta X_i + u_{i,} \qquad N(0, \sigma^2) \qquad (2)$$

Where: i = number of respondents i.e. (1, 2....)

The observable variable Y_i is defined to be equal to the latent variable whenever the latent variable is above zero and zero otherwise.

Y_i^* = Number of markets where the farmer sells cattle out of the eight available markets.

$y_i^* > 0$ implies that y_i^* is observed

$y_i^* \leq 0$ implies that y_i^* is not observed (a or 0 = limit).

X_i is a vector of explanatory/independent variables

B   is a vector of unknown coefficients and

u_i is an independently normally distributed error term.

It can be shown that

$$E[y/x] = \Phi(\alpha)a + (1 - \Phi(\alpha))(\mu + \sigma\lambda(\alpha)) \tag{3}$$

Where $\alpha = (a - \mu)/\sigma$, $\lambda(\alpha) = \phi(\alpha)/(1 - \Phi(\alpha))$,

$\mu = \underline{\beta}\underline{x}$ and ϕ and Φ are the standard normal density and distribution functions respectively. $\lambda(\alpha)$ is called the inverse Mills ratio. Therefore, the marginal effects are

$$\partial E[y^*/\underline{x}]/\partial\underline{x} = \underline{\beta}. \quad \text{and} \tag{4}$$

$$\partial E[y/\underline{x}]/\partial\underline{x} = \underline{\beta}\,\Phi((\underline{\beta}\underline{x} - a)/\sigma). \tag{5}$$

It is worth mentioning that the marginal effect on $E[y^*/\underline{x}]$ is the usual formula for a linear model, but the marginal effect on the mean of the censored variable y is a positive multiple of $\underline{\beta}$. In deriving the log-likelihood function for the censored regression model, it is assumed that the limit value a $= 0$, (censored at 0).

$$\ln Y = -1/2 \sum_1 (\ln(2\Pi) + \ln(\sigma^2) + (y_i - \underline{\beta}\underline{x}_i)^2/\sigma^2) + \sum_0 \ln(1 - \Phi(\underline{\beta}\underline{x}_i/\sigma)) \tag{6}$$

Where the first sum $\sum_1$ is over the non-censored observations and the second sum $\sum_0$ is over the censored observations (Hallahan, 1991).

The Stata Version 17 (Statistical Programme) was used to analyse the limited dependent variable model in equation 6 and the parameter estimates were determined. The iterations were "Normally exited". The parameters estimated included the intercept, the estimates (coefficients), standard error, t-values and approximate Pr>t. If the relationship parameter β is estimated by regressing the observed y_i on x_i, the resulting ordinary least square estimator is inconsistent. Amemiya (1973) has proven that the likelihood estimator suggested by Tobin (1958) for the Tobit model is consistent.

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<u>Objective four: To analyse factors influencing the use of the removal permit amongst the informal traders in the city of Tshwane.</u>

The Binary Logistic regression was used to measure the relationship that exists between the dependent and independent variables in this study. Specifically, the Logit model will be used in the analysis. The logit model is relevant since the dependent variable is binary, meaning it takes two values (1-Yes, have removal permit; 0-no, do not have removal permit). A binary logistic model is used to estimate the probability of a double response based on one or more predictor (or independent) variables (features) (Schüppert, 2009). By using logistic regression, a researcher can predict which of the two categories a person is likely to belong to and possible contributing factors (Field & Miles, 2013).

The Binary logistic regression model was employed to achieve objective three.

The model is specified as:

$$Logit\ (P_i) = ln\ (P_i\ /\ 1 - P_i) = \alpha + \beta_1 X_1 + \ldots + \beta_n X_n + U_t$$

Where;

$ln\ (P_i\ /\ 1 - P_i) =$ logit for removal permit usage (Yes=1; No=0)

$P_i =$ Yes

$1 - P_i =$ No

$\beta_n =$ coefficients

$X_i =$ covariates – Socio-economic factors in Tables 3.7. below.

$U_t =$ error term

<u>Objective five. To develop a framework for promoting informal fruits and vegetable traders' SPS knowledge, awareness and compliance in the study area.</u>

Data from the research coupled with information from key informant interviews were used to develop the framework. The key informants included 2 members from the Informal Traders Association for fruit and vegetables and 2 non-association members. The key informant interview was unstructured and designed to get a general view of the informal traders in phytosanitary measures. The views were only used by the researcher to have a more depth understanding of the traders' environment. The views were used as a supplement in the framework development. Experts in the field study from UNISA were consulted for the development of the framework. This assisted in

identifying "potential limitations, assumptions and assessing the possible impact (Clayton, 2016). The key findings from the study were used to develop the framework.

3.6 Ethical clearance

The study met the requirements of the UNISA Ethical Clearance Committee and the College of Agriculture and Environmental Science. Only common names were used during data collection because scientific names could be confusing to some of the participants. Participants were not coerced into taking part in the study, and their information was kept strictly confidential. The study included a consent form to allow participants to participate or withdraw at any time during the study. The City of Tshwane granted permission for the study to be carried out. A trade union, such as "Barekisi Forum," which exists to protect the interests of traders and assist in negotiations with municipalities in the event of a dispute, was notified. During data collection, two enumerators assisted the researcher. The City of Tshwane will receive feedback in the form of a thesis summary highlighting the key study findings. A workshop will be organized to provide full details of the study findings if funds are available to cover informal traders' half-day off and other logistics to attend a feedback session. An informal trader's environment does not allow them to take a day off to attend events such as workshops without receiving financial compensation for that day.

3.7 Summary of the data analysis

Table 3. 3 Summary of the study

Objectives	Research questions	Data requirements	Data analysis
1. To assess the compliance of phytosanitary measures among the informal traders; and the presence of information synergy from the government to traders.	Are informal traders compliant with phytosanitary measures in the study area? And is there a synergy of information from the government to traders?	Removal permit, Phytosanitary certificate, own stall, comply with municipal by-laws, trading license, surveillance of stock for inspections. Understanding of legislation, Acts, Policies, ownership and use of removal permits, presence of flow of information from government structures to traders	Descriptive statistics
2. To assess determinants of informal fruits and vegetable traders' phytosanitary measures knowledge level	What is the level of informal traders' knowledge of quarantine pests of fruit and vegetables in the study area?	Level of knowledge and demographics and socio-economic aspects of participants	Ordered logistic regression
3. To analyse factors influencing SPS compliance among the informal fruit and vegetable traders in the city.	What are the factors influencing SPS compliance among the informal fruit and vegetable traders in the city?	Compliance index and demographics and socio-economic aspects of participants	Tobit regression
4. To identify and analyze factors influencing the use of removal permits among the traders	What are the factors influencing the use of removal permits among informal traders?	Removal permit use & socio-economic characteristics of the traders	Binary Logistic regression
5. To develop a framework for promoting informal fruits and vegetable traders' SPS knowledge and compliance awareness	What model can best promote informal fruits and vegetable traders' SPS knowledge and compliance awareness?	Data from the interviews and findings of the study.	Framework

3.8 Chapter Summary

Chapter 3 discussed research design and methods. The following topics were also discussed: the study area, population, sample size, technique, primary and secondary data, data collection tools, and data analysis model.

3.9 Independent variables for the inferential analyses

Table 3. 4 Demographics.

Description	Value	Expected sign
Trading product	1-Fruits, 0-vegetables	+
Gender	1-male, 0-female	+
Traders age	Continuous	
Racial group	1-black, 2-coloureds, 3-White 4- Indians 5- other (specify	-
Nationality	1-South African 2- Non-South African	+
Marital status	1- single 2- married 3- divorced 4- Widow	+
Educational level	1-No education 2-Primary 3-Secondary 4 Tertiary 5- post-tertiary	+
Years of residence	Continuous	+
Dependents	Continuous	+
Number of dependence	Continuous	-
Language	1-Sepedi, 2- Zulu, 3- Xhosa, 4-Venda, 5- Tsonga, 6-Ndebele 7- other (specify)	

Table 3. 5 Operations of informal traders' information.

Description	Value	Expected sign
Product	1-Fruits 2- vegetables 3- both 4- other	-
Trading years	1- less than a year, 2- 1 to 3 years, 3 - 4 to 6 years, 4- 7 to 9 years, 5 - more than 10 years	+
Trading license	0-No, 1- Yes	+
Own stall	0-No 1- Yes	-
Trading challenges	Harassment 2-Government support 3- finances, 4-Training 5-(other specify)	-
Trading union	1- Yes, 0- No	+
Product supplier	1-Market, 2-Producer 3- Other (specify)	-

Satisfaction Level	1-Satisfied, 2-Slightly satisfied, 3-More satisfied,4- Neutral	-
Subsidy	0-No 1- Yes	-
Price	Continuous	-
Encouragement	1-Certainly, 2-Uncertainly 3-No Comment	+
Profit	1-Yes 0-No	+
Trading time	0-Morning, 1-during day, 2-afternoon	+
Trading future	1-Yes, 0-No	+

Table 3. 6 Compliance with Phytosanitary measures.

Description	Value	Expected Signs
Dependent variable		
Compliance level index	1-Highly compliance, 2- moderate compliance, 3 low compliance, 4 Never	-
Independent variables-index		
Phytosanitary measure	0-Inspected,1- tested,2-Treated, 3-processed	+
Inspection	1-always, 2- seldom, 3- never	+
Reason for Inspection	1-Pest 2- Quality 3- Both	-
Tools	0-No 1 - Yes	
Symptoms	1-Easy 2- difficult 3- Slightly	-
Unique codes	1-Production unit code, 2- Packhouse codes, 3- Food Business codes	+
Marking requirements	1-Yes, 0-No	-
Product transportation	1-open trucks, 2-refrigerated containers, 3- covered bins, 4-other specify	-
Challenges	1-Yes, 0-No	-
Visits by government officials	1-Weekly 2- Monthly 3- Never	+
Samples	1-Yes, 0-No	+
Have permit	1-Yes, 0-No	-
Have Certificate	1-Yes, 0-No	-

Comply	1-Yes, 0-No	-

Table 3. 7 The synergy of information from government

Description	Values	Expected signs
Information	1-Yes, 0-No	+
Workshops	1- Available, 2-non Available	+
Symposiums	1-Attendance, 2-Non Attendance	-
Roadshow	1- Available, 2-not Available	-

Table 3. 8 Knowledge of Quarantine Pests of fruit & vegetables.

Description	Value	Expected Sign
Knowledge	1-Yes, 0-No	+
Knowledge how	1- TV 2- Radio 3- Newsletter 4- Other	+
Trading stall	1- Yes, 0-No	-
Training	1-Never, 2-Quarterly, 3-Yearly	+
Trainer	1- Government 2- Private entity 3- other	+
Information	1-Yes, 0-No	+
Format	1 booklet 2- electronically 3- other	+
Awareness	1- Never, 2-Slightly, 3-More	+
Traps	0-No, 1 - Yes	**-**
Surveillance	0-No, 1 Yes	-
Protection	0-Cloth, 1-Chemical spray, 2-cool temperature, 3-Other	-
Reporting experience	1-Yes, 0-No	+
Safeguarding	1-Refrigerate,2- Cover,3-Spray, 4-Other	+ or -
Dispose	1- Burry,2-Throw away, 3-Do nothing	+ or -
Quality	1- Fresh, 0-Old	+ or -

Table 3. 9 Removal permits factors.

Description	Value	Expected Signs
Knowledge	1-Yes, 0- No	+
understanding	1-Yes, 0- No	+
Permit effect	1-Yes, 0- No	+
Permit ownership	1-Yes, 0- No	+
Reason no permit	1- No money, 2-Nobody told me,3- nobody requested it	-
advice	1. Never 2- Seldom 3- Always	-
Area	1- Gauteng 2- Other	-
Requested	1- Always 2- Never	+
Knowledge	1-Yes, 0- No	+
Cost of the removal permit	1- I do 2- I don't	+
Idea	1-government, 2- farm, 3- Market	-
Validity	1-Per consignment, 2-monthly, 3-yearly	+
Interpretation skills	1-Yes, 0-No	+
Dependent variable		
Description	**Values**	
Removal permit	1-Availability, 0-Non Availability	

3.10 Summary of the study variables

Table 3. 10 Summary of the study variables

Variable name	Variable type	Variable values	Expected sings
Gender	categorical	1-male, 0-female	-
Trader age	Continuous	1-Teen, 2-youth, 3-Old	-
Racial group	Categorical	1-black, 2-coloureds, 3-White 4- Indians 5- other (specify	-
Nationality	Categorical	1-South African 2- Non-South African	+
Marital status	Categorical	1- single, 2- married, 3- divorced, 4- widow	-
Education level	Categorical	1-No education 2-Primary 3-Secondary 4 Tertiary 5- post-tertiary	-
Years residing	Continuous	1- Less than 10 years, 2- more than 10 years	-
Dependents	Continuous		-
Number of dependents	Continuous		-
Employment	Categorical	1- Self-employed, 2- employed	+
Language	Categorical	1-Sepedi, 2- Zulu, 3- Xhosa, 4-Venda, 5- Tsonga, 6-Ndebele 7- other (specify)	-
Product	Categorical	1-Fruits 2- vegetables 3- both 4- other	-
Trading years	Categorical	Harassment 2-Government support 3-finances, 4-Training 5-(other specify)	-
Trading license		1-Yes, 0 -No	+
Own stall	Categorical	0-No 1- Yes	-
Trading challenges	Categorical	Harassment 2-Government support 3-finances, 4-Training 5-(other specify	+
Trading union	Continuous	1- Yes, 0- No	+
Product supplier	Categorical	1-Market, 2-Producer 3- Other (specify)	-
Satisfaction Level	Categorical	1-Satisfied, 2-Slightly satisfied, 3-More satisfied,4- Neutral	+
Subsidy	Continuous	1-Yes, 0 -No	+
Price	categorical	1-affordable, 2-expensive	

Trading time	Categorical	1-Morning, 2-during day, 3- afternoon	-
Trading future	Categorical	1-Yes, 0-No	-
Knowledge	Continuous	1-Yes, 0 -No	+
Technology	categorical	1- TV 2- Radio 3- Newsletter 4- Other	+
Trading stall	Numerical	1-Yes, 0-No	
Training	Categorical	1-Never, 2-Quarterly, 3-Yearly	+
Trainer	Categorical	1- Government 2- Private entity 3- other	+
Information	Continuous	1-Yes, 0-No	+
Format	categorical	1 booklet 2- electronically 3- other	-
Awareness	Categorical	1- Never, 2-Slightly, 3-More	-
Traps	continuous	1-Yes, 0-No	+
Protection	Categorical	1-Cloth, 2- Chemical spray, 3- cool temperature, 4-Other	+
Reporting experience	Continuous	1-Yes, 0-No	
Safeguarding	categorical	1-Refrigerate,2- Cover,3-Spray, 4-Other	+
Dispose	Categorical	1- Burry, 2- Throw away, 3- Do nothing	-
Product Quality	categorical	1- Fresh, 0-old	+
Compliance level	Categorical	1-Highly compliance, 2- moderate compliance, 3 low compliance, 4 Never	+
Phytosanitary	Categorical	1-Inspected, 2-tested, 3-Treated, 4-processed	+
Inspections	Categorical	1-always, 2- seldom, 3- never	+
Inspection purpose	Categorical	1-Pest 2- Quality 3- Both	-
Tools	Continuous	1-Yes, 0-No	-
Symptoms	Categorical	1-Easy 2- difficult 3- Slightly	-
Unique code	Categorical	1-Production unit codes, 2-Pack house codes,3- Food Business codes	+
Marking requirements	Continuous	1- Yes, 0-No	+
Product transportation	Categorical	1-open trucks, 2-refrigerated containers, 3-covered bins, 4-other specify	+

challenges	continuous	1- Yes, 0-No	+
Visits	Categorical	1-Weekly 2- Monthly 3- Never	+
Samples	continuous	1 - Yes, 0 -No	
knowledge	continuous	1- Yes, 0 -No	-
understanding	continuous	1- Yes, 0 -No	+
Permit effect	continuous	1- Yes, 0 -No	+
No permit	Categorical	1- No money, 2- Nobody told me, 3- nobody requested it	-
Advice	Categorical	1. Never 2- Seldom 3- Always	+
Area	Categorical	Gauteng or Other	+
Request	Categorical	1- always, 2-Never	+
cost	Categorical	1- I do 2- I don't	+
Idea	Categorical	1-government, 2- farm, 3- Market	+
Validity	Categorical	1-Per consignment, 2-monthly,3- yearly	+
Interpretation skill	Continuous	1- Yes, 0-No	+
information	Continuous	1-Yes, 0 -No	+
Experience	Categorical	1-No experience 2- experienced	-
Workshops	categorical	1- Available, 2-non Available	+
Symposiums	categorical	1- Available, 2-non Available	+
Roadshow	categorical	1- Available, 2-non Available	+

CHAPTER 4

SOCIO-DEMOGRAPHICS, COMPLIANCE WITH PHYTOSANITARY MEASURES AND INFORMATION SYNERGY

4.1. INTRODUCTION

In this chapter, the descriptive analysis results of socio-economic demographics, phytosanitary practices and information available for the informal traders in the study area were presented and discussed. The research focused more on the informal trader's practices of phytosanitary measures (SPS) as well as the compliance level to the Phytosanitary measures and the government information sharing and its by-laws on informal trading in the City of Tshwane. The analysis was done to summarise the data collected, and also to assess if there were compliance practices currently used and information dissemination to the informal traders of the fruit and vegetables.

4.2 Socio-economic demographics

4.2.1 Study Area

In South Africa, provinces are mandated to play a role in regulating and supporting the informal sector but the process is slow (Skinner & Haysom, 2016). However, the informal sector has been receiving a lot of attention in terms of policy developments. Gauteng Province released the Gauteng Informal Business Development Strategy 2015, but the strategy has not been developed into a White Paper, suggesting it is not a priority.

STUDY AREA
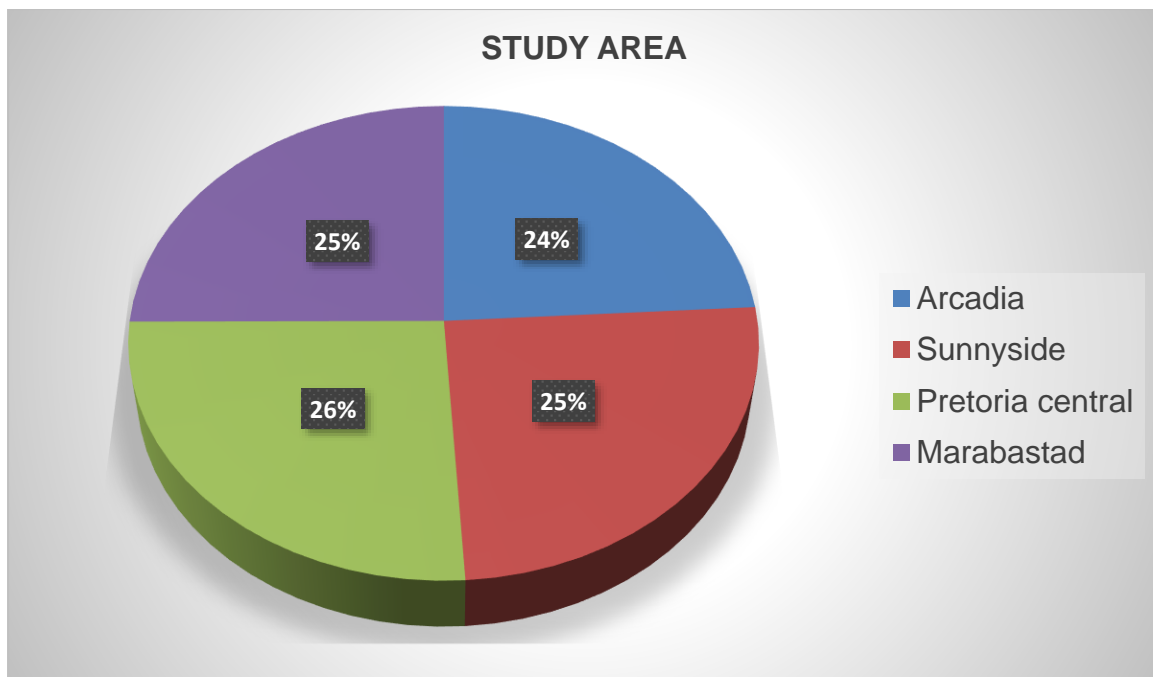
Source: Author (2022)

Figure 4. 1 Informal traders' sample size distribution.

Results in Figure 4.1 indicated the sample size distribution where the research took place, this was in Gauteng Province, and four Suburbs within the city of Tshwane namely Arcadia, Sunnyside, Pretoria central and Marabastad were part of the study. In the four suburbs Pretoria central which included Bosman station and Bloed taxi rank dominated by 26 % followed by Marabastad with 25 %. Sunnyside and Arcadia which are on the outskirt were also part of the study. The two suburbs are separated by a street (Ceillier's street). Sunnyside resulted in 25% while Arcadia resulted in 24% representation. The study was fairly represented considering that each suburb constituted almost a quarter of the sample.

4.2.2 Gender

Table 4. 1 Gender in the study.

Gender	Frequency	Percent
Female	113	53.3
Male	97	46.2
Total	210	100.0

Source: Author (2022)

In South Africa, there is a great need to create jobs, as a means to reduce poverty. There is a criticism that the over-regulation of the labour market is killing economic growth, job creation and job sustainability (Womack, 2021). A study by Ogando, Roever and Rogan (2017) found that in most Latin American and Sub-Saharan African countries, a larger share of women was in the informal employment sector than men. In this study, the total number of participants was 210 fruit and vegetable informal traders both male and female. In this study, the results in table 4.1 indicated that more females (53.3%) are trading in the streets than males (46.2%). A study by Labour Organization (2018) is in contrast with this study as it indicated that in developing countries, informal employment is a greater source of employment for men than for women. Women have surpassed men in the informal sector as a result of a lack of formal employment and rising living costs. According to the findings, women in the study area see the need to work to support their families, which accounts for the majority of informal traders.

4.2.3 Age Categories

Globally, the proportion of informal workers in total employment is higher among young workers (15-24 years old) and older workers (65 years or older) than among adult workers (25-64 years of age). The proportions of young and old workers are lowest in developed countries and highest in developing countries (International Labour Organization, 2018).

Table 4. 2 Age of the informal traders

Age Group	Frequency	Percent
21 -29	63	30.0
30 -39	72	34.3
40 - 49	57	27.1
50 -59	18	8.6
Total	210	100.0

Source: Author (2022)

The economically active population is made up of all working-age people who are either employed or unemployed. The age groups of the participants are depicted in Table 4.2 above. According to the findings, the 30 – 39 age groups dominated the study (34.3%), followed by the 21 – 29 age groups (30%). The third category (40-49) had 27.1%, and the last (50-59) had 8.6%. According to the findings, the study area had a higher proportion of youth involved in informal fruit and vegetable trading. The finding is supported by Yu's (2013) study, which discovered that South Africa faces a challenge of high youth unemployment, which necessitates various policy measures to address it.

The findings could be explained by Rogan and Skinner (2017), who discovered that youth unemployment is high in South Africa, forcing them to seek alternative income earning opportunities in the informal sector. The findings in the study area suggest that youth chose informal trading to alleviate unemployment because the government is not creating more formal job opportunities, resulting in their dominance in street trading.

4.2.4 Race

Santos et al. (2010) defined race as a term commonly used to describe a group of people who share certain morphological characteristics. During the research, the four major racial groups in South Africa (Black, White, Indian, and coloured) were targeted. According to a previous study by Rogan and Skinner (2017), the informal sector employs a disproportionate number of black and coloured workers, as well as women.

The study targeted all racial groups of fruit and vegetable informal traders, but the results revealed that 210 (100%) participants were black from all four suburbs. Black empowerment in Tshwane may be one of the most pressing issues confronting the government. According to (Shabalala, 2014), black people migrated from their homelands into the City of Tshwane and find themselves employed in the informal sector to improve their livelihoods, create business opportunities, and generate income, and many poor households in South Africa's townships rely on home-based informal economic activities as their primary source of income. The marginalization of black Africans, the majority of whom were treated as a necessary labour force residing in 'homelands' and subject to influx control, resulted in widespread informal black urbanisation (Lemon, 2021).

4.2.5 Origin of participant

Table 4. 3 Nationality of the participant

Nationality	Frequency	Percent
South Africa	119	56.7
Non-South African	91	43.3
Total	210	100.0

 Source: Author (2022)

The respondents in this study are South Africans and Non-South Africans. A questionnaire was used to interview informal traders face to face. The origin of participants in this study referred to their country of origin. The term "country" is not the only one that appears to be less than ideal when describing the situation in which a country occurs. South African informal traders of fruits and vegetables dominated the streets (56.7%), while non-South Africans accounted for only 43.3%, according to Table 4.3. By-laws are strictly enforced against the 43,3% of foreign nationals involved in fruit and vegetable trading. According to Pieterse and Pieterse (2017), Metropolitan Police enforcement of bylaws has been difficult, especially against "illegal" traders who lack a trading license. Furthermore, Alfaro-Velcamp & Shaw, (2016) state that foreign nationals face difficulties obtaining immigration documents such as work permits and permanent residency visas, which are either unavailable or prohibitively expensive. The study's findings may imply that South African citizens have an advantage over

non-South Africans when it comes to trading on the street because South Africans only need an identity document to obtain a trading license.

4.2.6 Marital status

Han et al. (2014) classify marital status into three categories: single, married and marriage problems (including separation, divorce, and bereavement). Participants' marital status in Tshwane's four suburbs was classified as single, married, divorced, or widowed during the study.
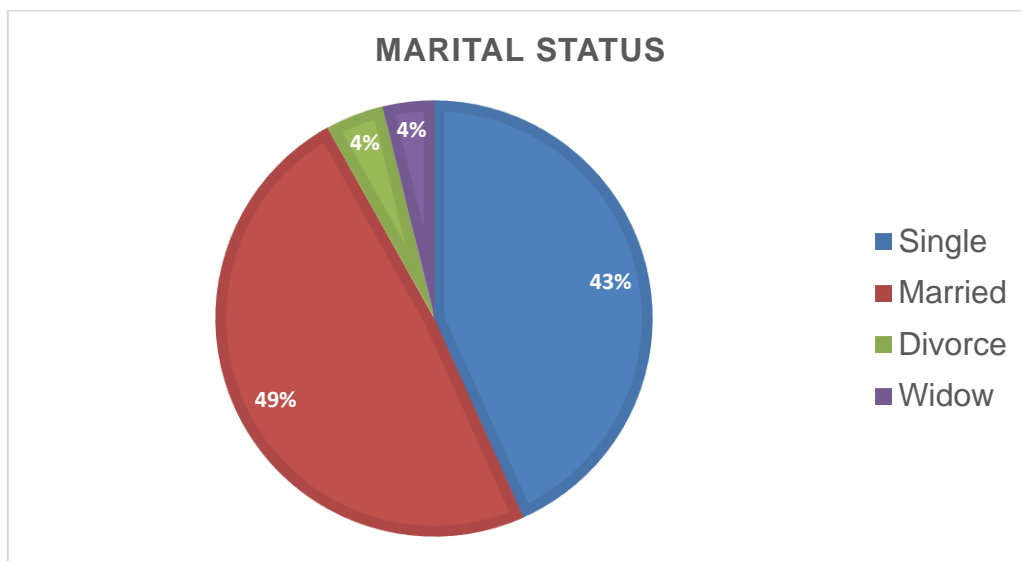
Source: Author (2022)
Figure 4. 2 Marital status of the informal traders

According to the findings shown in Figure 4.2 above, married participants dominated (48,6%), single participants covered 43.3%, divorced occupied third place (4,3%), and widows occupied fourth place (3,8%). Even married people are entering the informal sector as a result of unemployment. Trahan (2017) discovered that income-seeking behaviour is influenced by marital status. Individuals with children, who are mostly married, have a higher level of responsibility, as one might expect; thus, earning an income is critical in order to provide for their families. This is in line with the findings of this study, which discovered that married people are more likely to engage in street trading. The majority of married participants in this study engaged in informal trading, which could be attributed to the high cost of living in larger cities such as Tshwane.

4.2.7 Educational level
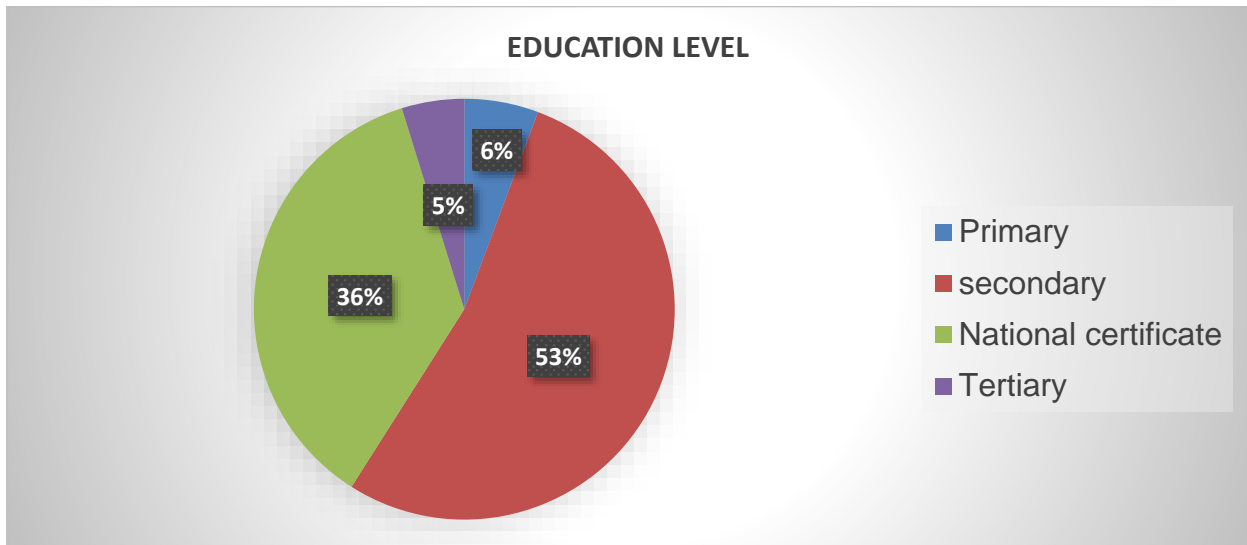
EDUCATION LEVEL

Source: Author (2022)

Figure 4. 3 Educational levels of informal traders

Education is the human capital acquired by a person after attending schools or educational institutions, which is typically validated by a formal and widely accepted qualification (Heise & Meyer, 2004). Furthermore, education is the most important requirement of life because it teaches society how to think, work properly, make decisions, and have practical knowledge while remaining sensitive (Roh, 2018). In this study, informal traders' education levels were classified as primary education, secondary education, a national certificate from a college, and tertiary education. According to Figure 4.3, informal traders with primary education were few (5.7%), while those with secondary education dominated (53.3%), national certificate holders were at 36.2%, and tertiary qualification holders were the fewest (4.8%) in the study. According to the findings of this study, there is an urgent need for education and training policies that will increase the educational levels and productivity of informal traders. According to the study, the level of education in South Africa is very low and some training interventions may be limited as a result of low education levels.

4.2.8 Home language
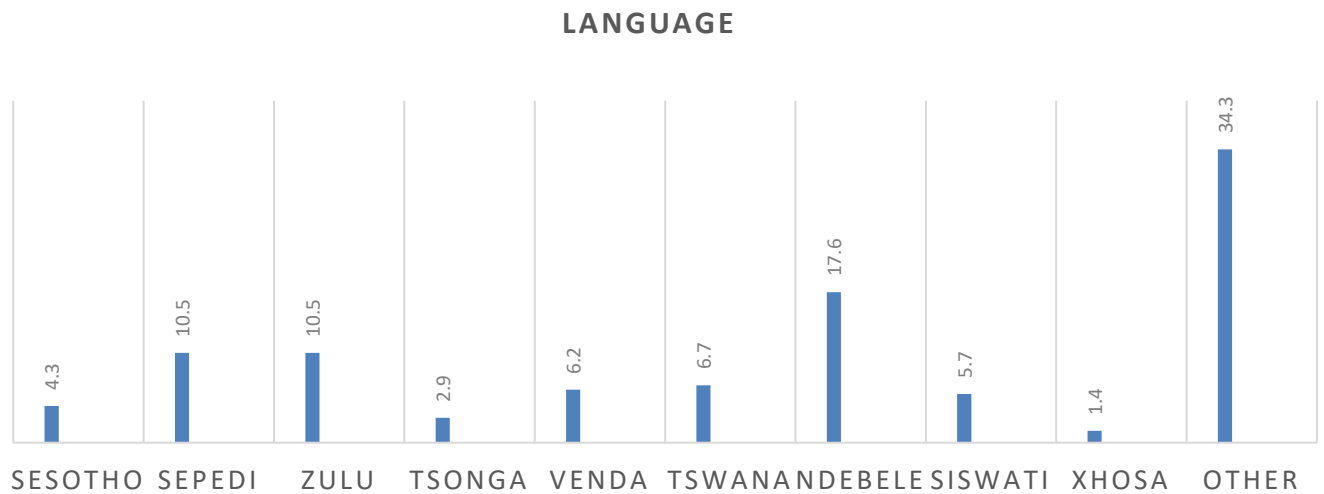
Source: Author (2022)

Figure 4. 4 Home languages of the informal traders

In many ways, language is a person's "second skin": it is through language that we function as humans in this world. The right to use one's preferred official language is thus recognized in the South African Bill of Rights, and the Constitution recognizes that people's languages are resources that should be used ('National language policy,' 1982). There are approximately 25 different spoken languages in South Africa alone, 11 of which have been granted official status under Section 6 of the Constitution (Act No. 108 of 1996) because they are used by approximately 98 percent of the total population. In South Africa, IsiNdebele, isiXhosa, isiZulu, and siSwati (Nguni language group); Sesotho, Sepedi, and Setswana (Sotho language group); Tshivenda, Xitsonga, English and Afrikaans are the 11 official languages. South Africa became a multilingual country as a result of this ('National language policy,' 1982). According to the study by Atamturk et al. (2018), the English language is becoming an increasingly important language as a medium of instruction in South Africa when compared to the local varieties, despite the fact that English speakers account for only about 10% of the population.

The results of the participant's home languages are shown in Figure 4.4 above. During the city research, the Nguni language group dominated the study with 35.2%, followed by the Sotho language group with 21.5 percent. Tshivenda was at 6.2 percent,

Xitsonga was at 2.9 percent, and other languages interviewed in English were at 34.3 percent. The study was dominated by other languages spoken by informal traders who arrived in South Africa from their home countries and were primarily interviewed in English. According to Mkhize and Balfour (2017), language rights in Africa, including South Africa, are aimed at protecting minority languages against dominant languages such as English, French, Portuguese, and so on. However, in this study, the most commonly used languages were English and Tswana. According to the findings, people left their homes to seek employment in the city, so Nguni language speakers have a higher number of informal traders.

4.3 Operation information of the informal traders.

4.3.1 Product trading

PRODUCT TRADING
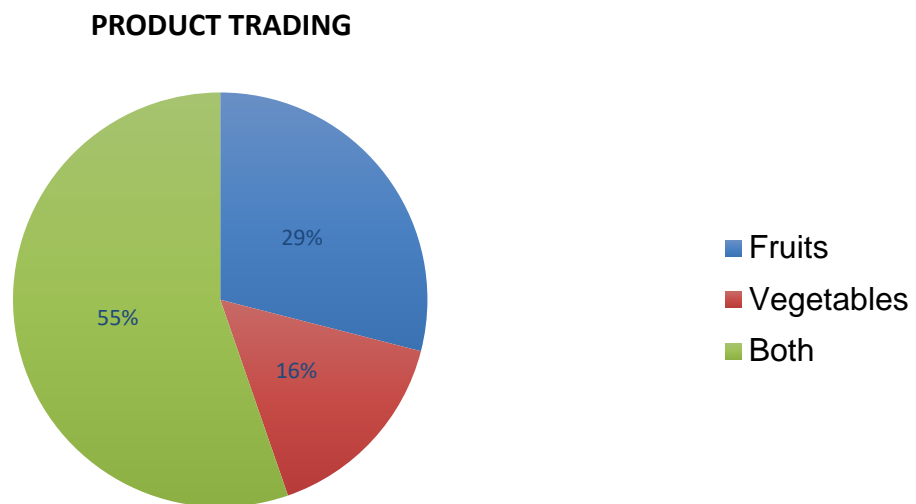
Source: Author (2022)

Figure 4. 5 Products traded

In the study, fruits (bananas, apples, oranges, and mangoes) and vegetables (onions, carrots, cabbage, tomatoes and potatoes) were traded. Because these products are mostly perishable, their value fluctuates dramatically throughout the supply chain at rates that are frequently caused by high temperatures and humidity (Blackburn and Scudder, 2009). According to Liu and Liu (2020), perishable products include fresh fruits and vegetables, flowers, food, and other products with a short lifespan, with a physical state that deteriorates in value and the customer's perception. The texture of fruits and vegetables is the most important quality characteristic. According to the

findings of this study, the majority (55%) of informal traders trade with both fruits and vegetables, while more than a quarter (29%) trade only with fruits and fewer (15.7%) traders trade only with vegetables. Because the majority of these fruits and vegetables are quarantine pest hosts, proper handling and storage are critical. According to the findings of a study conducted by Goshme (2019), perishable commodities require careful handling between harvest and consumption to minimize the deterioration of produce as much as possible. In this study, product handling is critical because fruits and vegetables are perishable and their quality can affect income. According to the study, informal traders in the study area were trading both fruits and vegetables to increase their income.

4.3.2 Selling prices
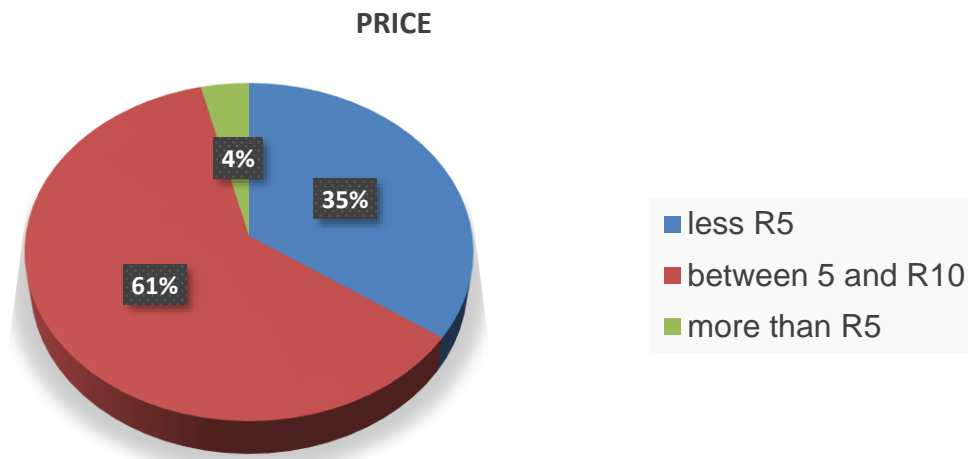
PRICE

Source: Author (2022)

Figure 4. 6 Price of products

Armstrong and Vickers (2020) looked at the price as a competitor. A price can be a commercial exchange, in which a seller provides a product to a buyer in exchange for something else (usually an amount of money). The product could be tangible goods or services (Borchert & Vink, 2010). In this study, informal traders sell goods to consumers or individuals who buy them for consumption; these products are fruits and vegetables sold on the streets, which contribute to the local economy. Figure 4.6 shows the selling price, which can be per item or in bulk depending on the needs of the customer. By-products at a price between R5 and R10 (61.5%) dominated the

price range given, followed by some (35%) products selling for less than R5 and very few (3.8%) products selling for more than R5. According to a study conducted by Albari and Safitri (2018), consumers consider a variety of factors when making purchasing decisions, and the price of the product is classified into three dimensions: fair price, fixed price, and relative price. Most traders agreed on a price range of R5 to R10, indicating a reasonable price range. The price range was reasonable and could accommodate the fruits and vegetables of low-income households.

4.3.3 Trading license
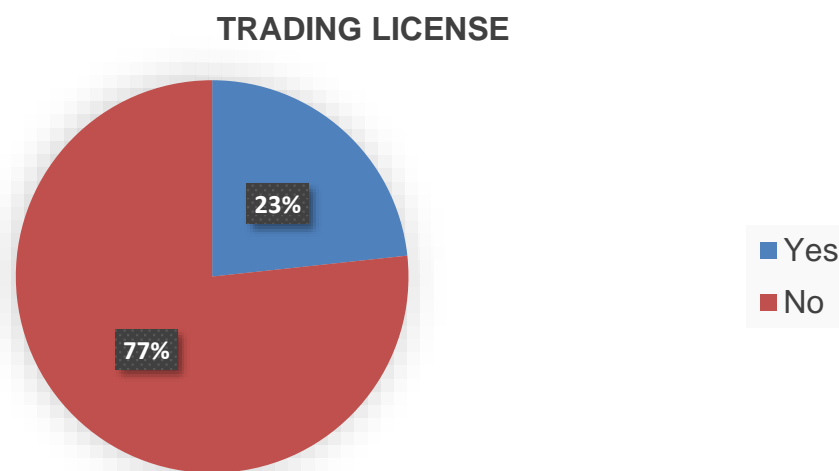
TRADING LICENSE

Source: Author (2022)

Figure 4. 7 Trading license of the informal traders

Another barrier to trading in the formal economy may be the need for a trading license. There is an average of 20.1% licensing procedures in Sub-Saharan Africa. These procedures include obtaining licenses and permits, completing notifications, and inspections, and submitting the required documentation (Verick, 2006). According to the municipality by-laws in South Africa, every informal trader in the City of Tshwane must have a trading license. This is done to ensure compliance and to avoid product seizures and arrests during the raids by city police. Only authorized personnel or officials from the municipality in Tshwane can issue a trading license. Only 23.3% of the 210 informal traders have a valid trading license, while the remaining 67.7% do not. According to a study conducted in India by Roever (2016), the majority of informal traders lacked a trading license, which can lead to harassment, confiscation of

merchandise, and eviction by police. Furthermore, the Roever (2016b) study provides an interesting contrast in that some vendors had licenses, but they were temporary and could be revoked at any time by the authorities. In contrast, Wiego (2014) found that street vendors in South Africa are protected by national law (The Businesses Act 71 of 1991) and local by-laws enacted by each municipality. Traders do not need a license to trade under national law, but it does give local governments the authority to make by-laws governing where and how they can trade and under what conditions.

The majority of informal traders in this study area lacked trading licenses, implying that they are either unaware of the importance of trading licenses or cannot afford them. Some traders felt that the process of applying for the license was time-consuming. This idea may be supported by the recent 2020 Covid19 lockdowns, in which most informal traders were unable to operate on the streets because municipalities demanded Covid19 trading permits. Obtaining such permits proved to be a time-consuming process for the traders.

4.3.4 Union affiliation
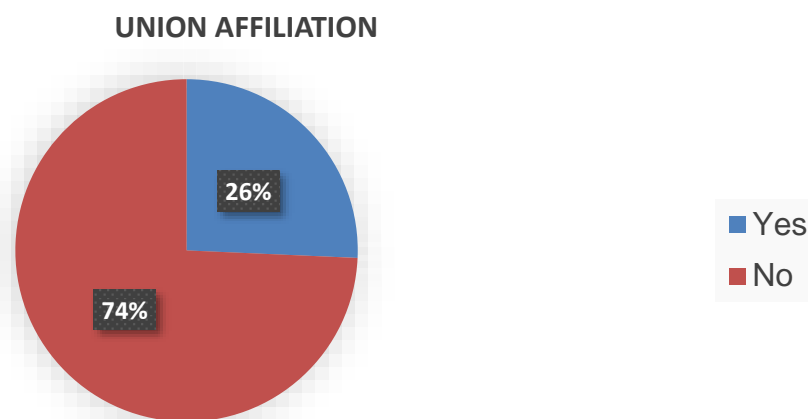
UNION AFFILIATION

Source: Author (2022)

Figure 4. 8 Union affiliation of informal traders

In general, the primary function of trade unions is to negotiate on behalf of their members. According to Chamberlain & Ncube (2014), the union is in charge of resolving grievances and communicating them to the employer. The union's role in this study is to convey to the municipality the grievances of informal traders. The informal traders in Tshwane were discovered to be members of the union of their

choice. The researchers wanted to know if the informal traders belonged to any unions. Unions are viewed as dealmakers, with the responsibility of negotiating service provider terms and conditions. According to Figure 4.8, 26% of informal traders are members of a union called Barekisi forum, while 74% are not members of any union. Curtin (2018) discovered that a lower proportion of street vendors had a union representative, indicating that working conditions were not represented in their pursuit of labour market equality. Workers in the informal economy, according to Goldman (2003), should exercise their right to free association by joining organizations of their choice without fear or intimidation to be represented. The low union membership may indicate a lack of knowledge about labour issues.

4.3.5 Product sourcing
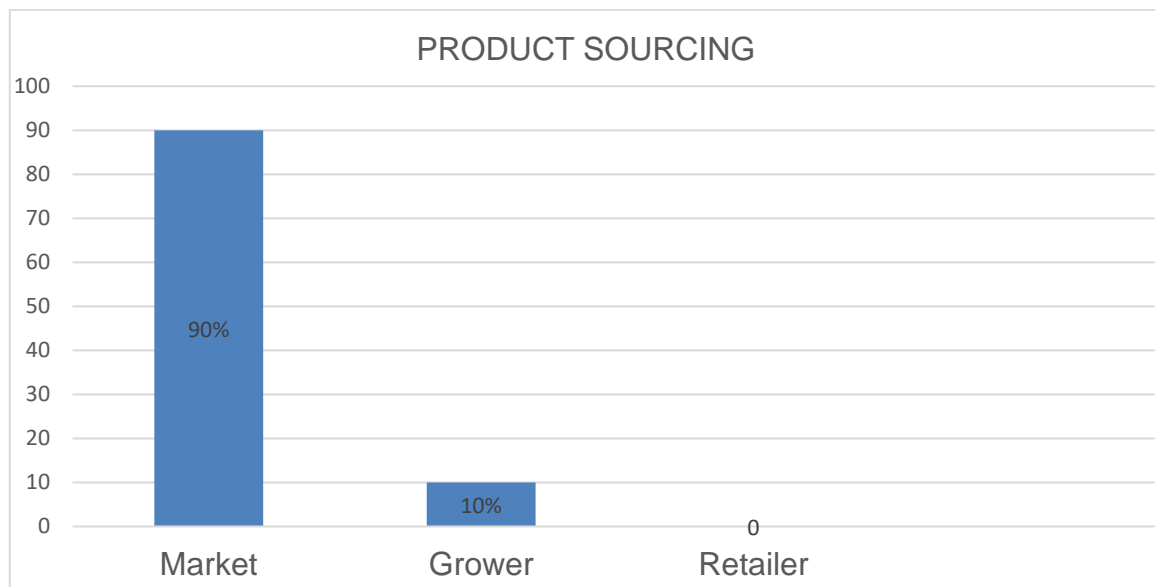
Source: Author (2022)
Figure 4. 9 Product sourcing

Participants in this study come from various regions, provinces, and countries. Quarantine pests may be spread and introduced into the new area during product sourcing. The sourcing location must be registered with the Department of Agriculture, Land Reform, and Rural Development and assigned a unique code. According to the findings, informal traders purchase from the Tshwane market in Marabastad as well as directly from growers in and around Gauteng.

The market's proximity suggests that traders preferred to get their produce nearby and at a reasonable price. This meant they had to travel a shorter distance from the market to their stalls. The shorter distance reduces the amount of damage caused by handling and transportation. Furthermore, markets such as Tshwane have basic resources such as marketing agents, export and import agents, packaging, grading and price analysis tools. In a study conducted by Barska and Wojciechowska-Solis (2020), locally produced labelled products provided information about the product's origin, freshness, socioeconomic environment, and distribution process.

According to Figure 4.9, 90% of informal traders prefer to buy from the market, while 10% prefer to buy directly from the grower. Buying directly from a farmer or grower has advantages, according to the Speciality Products (2020) study, because informal traders prefer to buy riper, fresher, and higher-quality fruits and vegetables. However, this contradicts the findings of the study, as only 10% of traders buy directly from the grower. This finding could be attributed to the distance between farms and traders, which would increase transportation costs.

4.3.6 Level of satisfaction

LEVEL OF SATISFACTION

	Neutral	Slighly	satisfied	More than satisfied	Not satisfied
	7.1%	20%	60.5%	11.9%	0.5%

Source: Author (2022)
Figure 4. 10 Informal trader's level of satisfaction

According to Joshy et al. (2020), service quality is an important component of customer perceptions of service, and customers are satisfied when the perceived service meets or exceeds their expectations. The market and the grower can both sell

the same products, attracting informal traders. There are numerous market agents selling and competing to keep their customers.

Approximately 7,1% of traders were neutral about their level of satisfaction with their suppliers, while 20% indicated that they were slightly satisfied, while the majority (60,5 percent) of traders were satisfied, 11,9% were more than satisfied, and only a very few (0,5%) were completely dissatisfied with the products. The informal traders' high level of satisfaction with their suppliers was consistent with the findings of the Hasan et al. (2019) study, which discovered that the quality of service received plays an important role in predicting, explaining, and indicating customer satisfaction. This finding could be attributed to the suppliers' high level of service, resulting in the highest number of satisfied informal traders.

4.3.7 Profit and loss

Table 4. 4 Profit of informal traders

Profit	Frequency	Percent	Valid Percent
Yes	172	81.9	81.9
No	38	18.1	18.1
Total	210	100.0	100.0

Source: Author (2022)

The informal traders are involved in an informal business in the hope of making a profit to improve their livelihood and that of their families. The business requires them to work every day, sometimes for long periods in uncomfortable conditions. The key question was asked to determine whether or not they are profitable. A Yes or No response was requested, and it was discovered that the majority (81.9%) of traders were making a profit, while 18.1 % were not. Street trading is a cutthroat business. According to the findings of Ntuli (2020), informal traders' business is also associated with a very low-income margin. Participants in the study stated that their weekly income ranged between R300 and R500. According to this study, the lower number of those who were not making a profit was due to a variety of factors including location, sales, and storage.

4.4 Phytosanitary measures compliance

4.4.1 Knowledge of Quarantine pests

Table 4. 5 Knowledge of informal traders on Quarantine of pests

Knowledge	Frequency	Percent
Yes	133	63.3
No	77	36.7
Total	210	100.0

Source: Author (2022)

The informal traders may encounter two types of pests found in fruits and vegetables. There are quarantine pests that are harmful and require isolation and monitoring, as well as non-quarantine pests that do not require isolation. As a result, traders must understand the distinction between quarantine and non-quarantine pests. Plants can harbour potentially harmful pests. The issue could be that some commodities that serve as hosts for quarantine pests are not infested in their early stages of maturity (Armstrong, 2019).

This makes it critical for informal traders to understand quarantine pests and their hosts to avoid infestations at that stage. A plant pest is defined as any species, strain, or biotype of plant, animal, or pathogenic agent that is harmful to plants or plant products (DoE, 2014). A quarantine pest is a pest of economic importance to the area threatened by it that is either not yet present or is present but not widely distributed and officially controlled (Picard et al., 2018).

The introduction and spread of potentially harmful alien plant pests and plant products in South Africa may have a negative impact on biosecurity, agricultural and forestry production, food security, and trade competitiveness (DoE, 2014). During the research, it was discovered that the majority of participants (63.3%) are familiar with quarantine pests, while only 36.7% are not. It is critical that all informal traders understand and are aware of the quarantine pests. Although most traders are aware of quarantine pests, 36.7% are unaware, and this lack of knowledge could contribute to the spread and introduction of quarantine pests, which could be harmful to their business and the health of their customers.

4.4.2 Source of information about Quarantine pests

KNOWLEDGE OF QUARANTINE PESTS
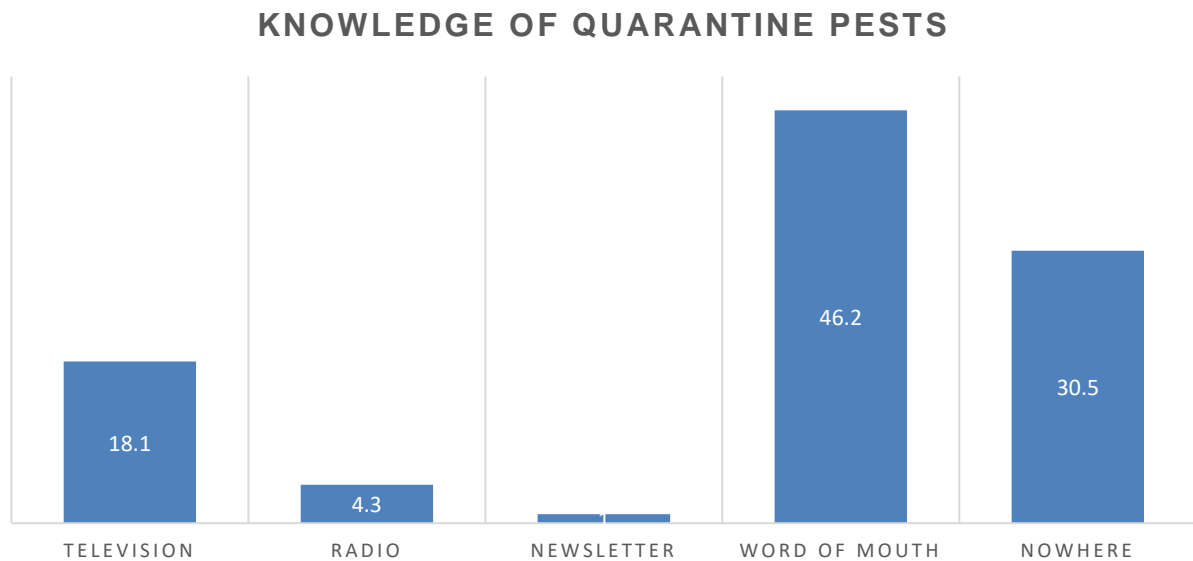
Source: (Author 2022)
Figure 4. 11 Source of Information on quarantine pests

Savolainen (2017) defines information sharing as a process that includes two major components: giving information to others and receiving information that has been provided by the information giver. Sharing information is an important strategy for increasing organizational competence and knowledge. Sharing information across organizations became easier with the use of information and communication technology. However, sharing information can be a difficult task. There are also online platforms that allow users to spread knowledge and share information by posting text and visual elements in the form of posts. It enables users to respond to other people's posts by commenting or voting (Jasser et al., 2020), making it easier to share and receive information. Participants in this study were aware of and used a variety of information-sharing platforms.

According to the findings, 30.5% of traders did not have access to quarantine pest information, and 18.1% relied on television for information. Only a small percentage of traders (4,3%) relied on the radio for information, while the vast majority (46,2%) relied on word of mouth. In contrast to these findings, Mheidly and Fares (2020) discovered that media is a powerful avenue for information dissemination and serves as a portal for communication between governments, institutions, and people. Nowadays, the

public uses technology to find accurate information, scientific facts, government decisions, and public reactions. According to the findings of this study, informal traders rely on each other for information rather than media technology. This could also be due to a lack of current technological gadgets.

4.4.3 Pests Management
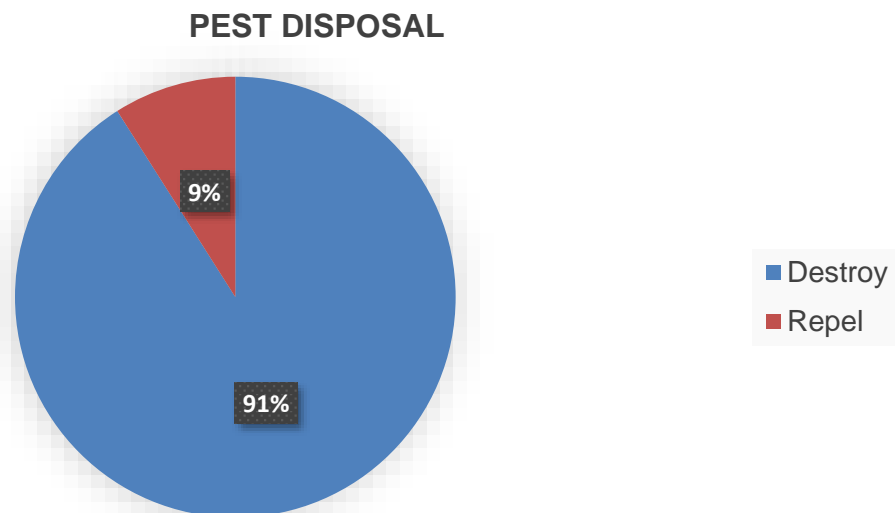
PEST DISPOSAL

Source: Author (2022)

Figure 4. 12 Pest disposal method

Pest infestation costs more than 45 percent of global food production, according to Nguye et al. (2018). Pests can be dealt with in a variety of ways to prevent their spread and infestation. Unknown pests should ideally be collected and sent to a laboratory for identification. During the identification process, it will be determined whether the pests are quarantine pests or not. According to the informal traders, they only repel or destroy any unknown pests. The majority of traders (91 percent) said they destroy them, while only a few (9 percent) said they repel them.

According to the research of Blaser et al. (2018), risk management measures such as inspection programs, adoption of international regulations, and trade policies should be in place due to pest movement because this can initiate an in-depth pest risk analysis, including evaluation of the pest's potential. However, these measures work best when all stakeholders are involved and engaged in the process; in this case, informal traders should be able to identify quarantine pests and collaborate with

inspection officials. Pest risk management will be impossible without the cooperation of informal traders. The gathering of information is an essential component of all stages of Pest Risk Analysis (PRA). It is critical to determine the identity of the pest(s), its current distribution, and its association with host plants and commodities early on (IPPC, 2001). According to the findings, a lower percentage of those who repel pests lack knowledge about early warning, as the pest has the potential to populate and infest the area. The majority of traders, on the other hand, destroy the pests; however, the greatest risk is that they are not properly destroying the pests. Furthermore, the method of destruction varies from trader to trader, posing a significant threat to their business and the city as a whole. Integrated pest management (IPM) has been promoted as an environmentally friendly pest control method (Rezaei et al., 2019). The findings indicate that there is a knowledge gap in pest identification and disposal.

4.4.4 Pest infestation protection

Fruits and vegetables must be protected from pests that can lay eggs that hatch and develop into larvae, causing massive economic losses. Their consequences include direct yield losses and the loss of export markets as a result of quarantine restrictions (Mihretie, Abera & Weldehawariat, 2020). The storage of the commodity is critical in order to avoid pest infestation.

PEST INFESTATIONS PROTECTION

44.3			48.1
		7.1	
COVER BY CLOTH	SPRAY CHEMICALS	STORE IN COOL TEMPERATURE	COVER BY BOX
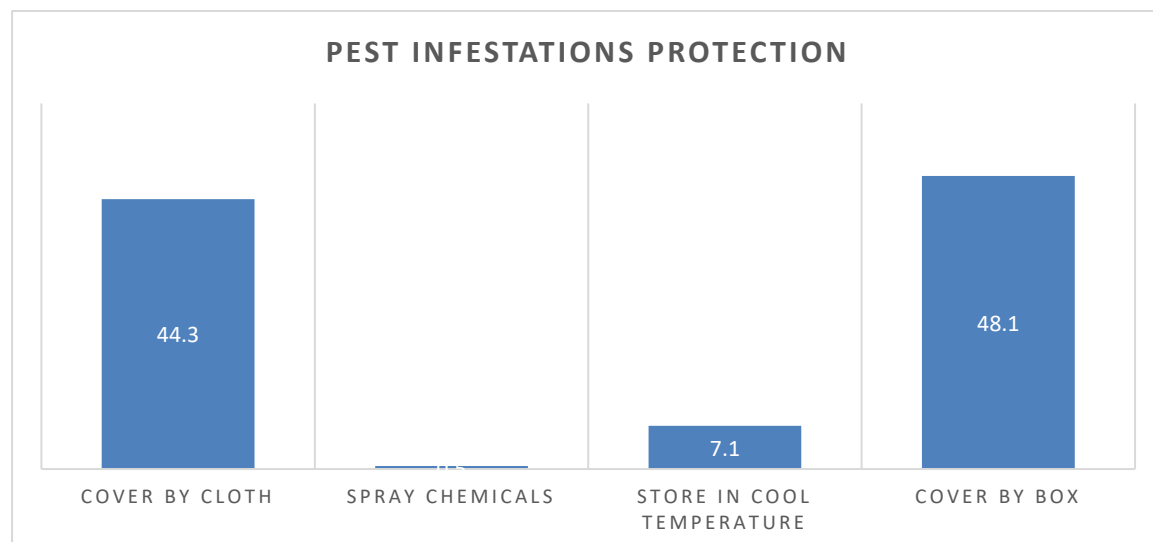
Source: Author (2022).

Figure 4. 13 Protection against pest infestation

According to the findings, because informal traders have limited space during trading, 44.3% cover their products with a cloth, 48.1% cover by box, and 7.1% store under cool temperature (shade), while only 0.5% spray a chemical. When a pest finds a favourable environment, it is easy for it to populate and spread. In contrast, Ekman (2015) argued that monitoring, which includes the use of traps baited with chemical male attractants known as 'parapheromones,' is the best way to avoid infestation. The other study, conducted by Jang and Moffitt (2019), found that packaging methods such as shrink wrapping and the use of designated boxes prevent re-infestation. The findings indicate that the informal traders' protection method is ineffective in controlling the spread of quarantine pests. Pest populations have long been managed using chemical pesticides. According to Anguelov et al. (2017) IPM has been promoted as an environmentally friendly pest control method. Methods included in IPM strategies include mating disruption (MD), sterile insect technique (SIT) and mass annihilation technique (MAT).

4.4.5 Training on pest identification

Training leads to increased knowledge; knowledge is a mental component of an individual's mind that plays an important role in both hidden and open behaviour (Dubey & Srivastava, 2007). Inadequate or incorrect knowledge leads to under or over-adoption of innovation, which is costly in business. Informal traders must receive formal training to identify pests as well as the symptoms of fruits and vegetables. Training should be provided to them, and only a qualified Agriculture / Entomology trainer will be able to provide such training.

According to the findings of this study, there is a lack of training, as only 1.4% of traders were trained and 98.6% were never trained in pest identification. Lack of training in pest identification is a concern in this study area because informal traders will never be aware of quarantine and non-quarantine pests that infest the products.

4.4.6 Pest training providers
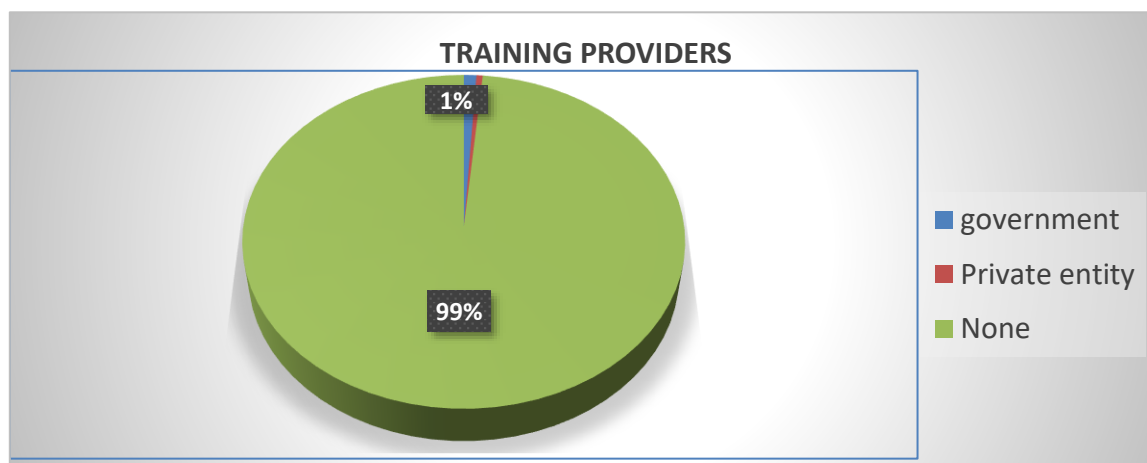
Source: Author (2022)

Figure 4. 14 Training providers

Training should ideally include a lot of demonstrating, practising, and reinforcing previously shared concepts (Tomas & Caluyua, 2018). Government agencies can help to improve competencies and skills in the logistics sector (McKinnon et al., 2017). This includes educating informal traders on how to identify potential quarantine pests that can harm the environment.

In the overall sample, 99 percent of participants said they had never received pest identification training from a government or private entity, 1% said they had received training from government institutions and 0% said they had received training from a private entity. A large number of untrained informal traders suggests that this could be due to a lack of awareness and knowledge about who to approach for training purposes. The other reason is a lack of training opportunities for informal traders.

4.4.8 Stalls pests' management

Table 4. 6 Pest traps usage

Pest trap	Frequency	Percent
Yes	59	28
No	151	72
Total	210	100,0

Source: Author (2022)

Detection of economically significant quarantine pests is critical to agricultural sustainability. Trapping system development is a growing process that results in better agriculture. Murtaza et al. (2019) discovered that various types of sticky traps are used to monitor sucking pests such as aphids, whiteflies and thrips. Light traps and pheromone traps are both effective and widely used for catching moths. Pest sucking and chewing are very destructive and common in many crops, including cotton, cabbage, brinjal, okra, tomato and onion.

Adult flies can be trapped, and infested materials sampled to detect quarantine pests. Various traps, including bait sprays, the Sterile Insect Technique (SIT), biological control, and the Male Annihilation Technique (MAT), were developed and used in an infested area to reduce the fruit fly population, limiting damage and spread (Benedict, 2021). Furthermore, according to Dunn and Follett (2017), SIT has been the most widely used as an eradication strategy, based on the assumption that the insects can be reared and sterilized in large numbers. According to the findings, the majority of informal traders (72%) did not have a pest trap around their trading stall and only 28% had a trading stall. According to the findings, informal traders are unaware of the importance of having pest traps around their selling stalls. Traps for pests aid in the detection of both new and well-known pests. This will also help to control the occurrence of pests.

4.4.9 Pest surveillance

Table 4. 7 Pest surveillance awareness

Pest surveillance	Frequency	Percent
Yes	13	6,2
No	197	93,8
Total	210	100.0

Source: Author (2022)

Pest surveillance is an effective method of detecting pest infestations. Castilla et al. (2021) state that specific and targeted pest surveillance systems are designed to prevent pest introduction and movement for trade and quarantine purposes (FAO, 2016) and to reduce the threat of plant pests to food security. To detect plant pests

and ensure food security, general or passive surveillance is required. There are two protocols in the surveillance program. Protocol one: Detection of ports of entry (POE) and Protocol two: Detection of fruit production areas and lines. Protocol one addresses the potential introduction of exotic fruit flies at POE and surrounding areas such as urban areas.

To establish trapping points in urban areas and towns near the border post, a 5 km grid system is used. Protocol two addresses the establishment of exotic fruit flies in fruit production areas where the most damage can occur, as well as the introduction of fruit flies in production areas and nearby national roads (Barnes & Venter, 2006). In Table 4.7 above, the informal traders who participated in this study were asked if they had ever heard of pest surveillance in Tshwane. According to their responses, the vast majority (93.8%) of traders had never heard of it, with only 6.2% having heard of it previously. Food security necessitates general or passive surveillance. This reduces the threat of plant pests to food security by preventing the introduction and movement of pests for trade and quarantine purposes, and surveillance reduces the threat of plant pests to food security (Singh & Burbade, 2021). The findings of this study could be attributed to informal traders' lack of information and awareness.

4.4.10 Understanding of Phytosanitary measures

UNDERSTANDING OF PHYTOSANITARY MEASURES
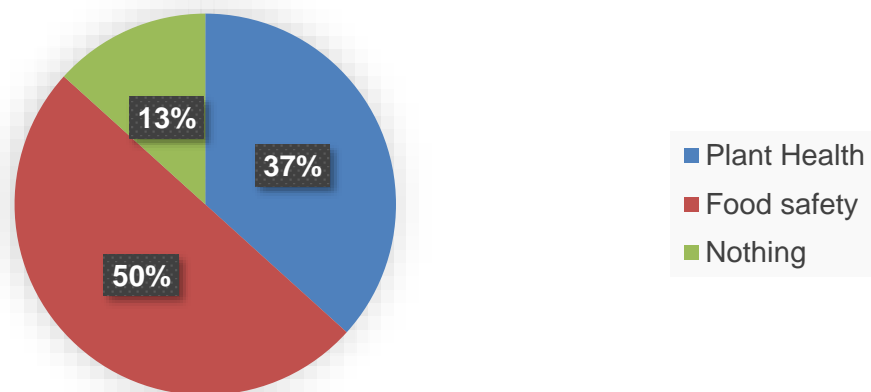
Source: Author (2022)

Figure 4. 15 Phytosanitary measure

A phytosanitary measure is defined as any legislation, regulation, or official procedure designed to prevent the introduction and/or spread of quarantine pests. The regulations apply to both domestically produced food and local animal and plant diseases, as well as products imported from other countries. Trade restrictions may result from phytosanitary measures (IPPC/ISPM/FAO, 2007). Murina and Nicita (2017) discovered that SPS measures impose a disproportionately high burden on low-income countries, as trade agreement members in developed countries reduce the difficulties associated with SPS compliance.

The majority of low-income informal traders do not adhere to SPS measures. According to the findings of the study, 37% of participants understood the concept of phytosanitary measures as more about Plant Health Regulation, 50% of informal traders understood it as a food safety issue, and 13% of traders did not understand phytosanitary measures. According to the findings, some informal traders in the study area needed to be educated about the phytosanitary measure in general.

4.4.11 Practice of Phytosanitary measures

Phytosanitary measures are quarantine and biosecurity measures used to protect human, animal, or plant life or health from pests and diseases introduced, established, and spread. SPS measures should be used only where they are justified for protection and must be based on scientific principles and risk assessment, according to a study (ADB, 2018). According to Ghiran (2012), the simplest way to accept compliance guidelines is to imagine them as approved directives to assist organizations in risk management.

To avoid the introduction of pests into the City of Tshwane, informal traders must follow phytosanitary practices. The phytosanitary measures used in the study were inspection, testing, and treatment. It was discovered that the majority of informal traders (95,2 percent) inspect their products, 4,3% treat them, and 0.5% test their products. According to Silvia (2021), inspections are intended to protect human, animal, or plant life and health in the event of specific sanitary and phytosanitary conditions. These findings imply that informal traders could be encouraged to inspect

the product for signs of pest infestation, resulting in the highest number of compliances.

4.4.12 Personnel inspecting products

AUTHORISED INSPECTORS
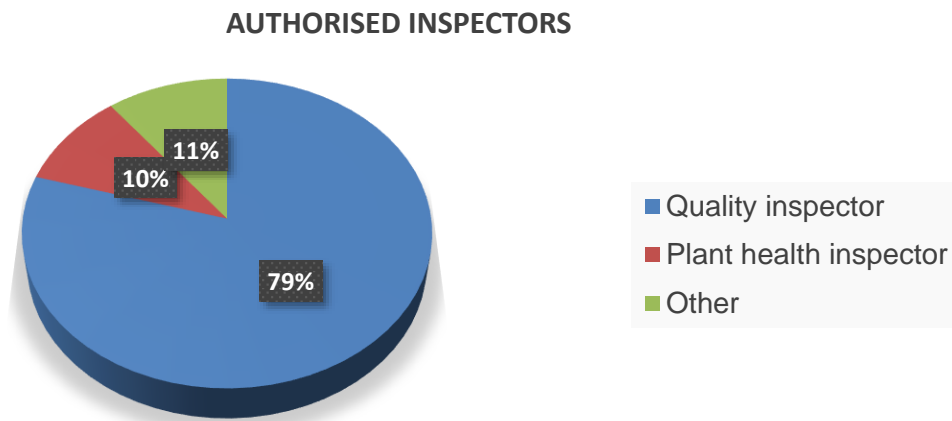
Source: Author (2022)

Figure 4. 16 Authorised inspectors inspecting products

Agricultural inspections must be conducted by fully qualified personnel, according to Act 36 of 1983, "Agricultural Pest Act." Inspection begins with document evaluation and progresses to physical inspection of plant products. The phytosanitary/plant health inspections and the quality inspections are not the same. Plant health inspections are concerned with quarantining pests and diseases, whereas quality inspections are only concerned with the final quality of the fruit. Inspections are required and vary according to the nature of the permit conditions (Department of Agriculture, Forestry, and Fisheries, & Fresh Produce Exporters' Forum (FPEF), 2010).

The inspection should be performed in an inspection room that is fully equipped with an inspection table, a conveyor belt, and adequate lighting. Inspection strategies such as monitoring and conformity should be used to ensure that customers receive higher quality conforming products (Khan et al., 2020). According to the informal traders, their products were inspected by quality inspectors (79%), plant health inspectors (10%), and other private entities like Prokon (11%). According to the findings, when compared to Plant health inspectors and other inspectors such as Prokon, the informal traders in this study were the most aware of the quality inspectors. This could be because

Tshwane markets have permanent quality inspectors with whom the informal traders are familiar.

These inspectors look for pests as well as quality. Pre-processing, segmentation, feature extraction, and classification of fruit and vegetable quality based on colour, texture, size, shape, and defects are among the inspection methods used (Bhargava & Bansal, 2021). Another research question addressed in this study was the frequency with which traders inspect the product. According to the responses, 92.9% of informal traders always inspect their products before purchasing, while 7.1% rarely inspect. According to the findings of the study, the lower number of those who inspect rarely poses a high risk. This could be due to a lack of knowledge about phytosanitary inspections. To avoid the spread of pests, traders must inspect products for pest symptoms such as eggs, larvae and adult pests.

4.4.13 Pest infestation observation

SYMPTOM OBSERVATION

Legend: ■ Easily ■ Difficult ■ Slightly easy

Pie chart values: Easily 45%, Difficult 30%, Slightly easy 25%
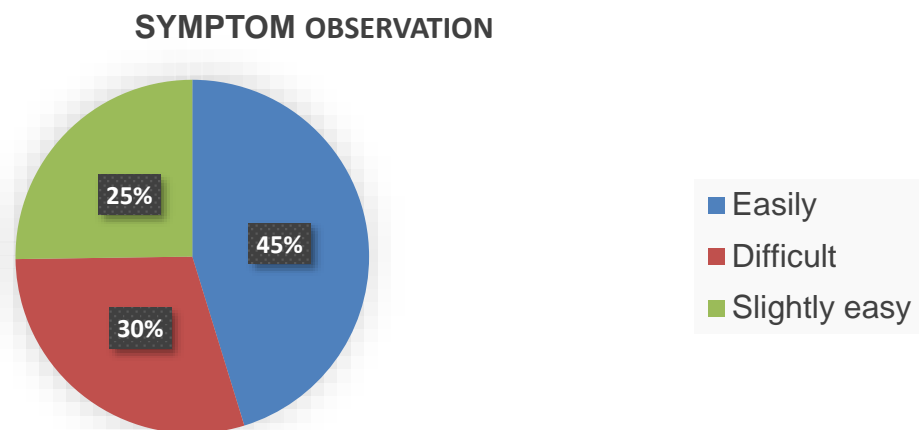
Source: Author (2022)

Figure 4. 17 Pest observation by informal traders

Fruit flies, for example, prefer green, soft, young, and tender fruits to lay their eggs on. Females lay eggs by inserting their ovipositor into the fruit. A watery fluid leaks from a puncture and hardens into a brown resinous deposit on the fruit's surface (Abrol, 2017). 'Field diagnosis' refers to the process of detecting a plant health

problem without the use of specialized laboratory equipment. This entails carefully observing symptoms on a plant and associating those symptoms with potential causes. The accuracy of the diagnosis is primarily determined by one's knowledge of the plants as well as the known problems in the area (Taylor, 2018). According to Hong et al. (2015), materials such as the Generic Pest Forecast System (GPFS) model are designed as a simple generic tool for pest prediction for both arthropods and pathogens.

The informal traders' knowledge of observing pest infestation symptoms varied; 45% of traders found it easy to identify the symptoms, 25% found it slightly difficult and 30% found it extremely difficult. The findings indicate that informal trainers were never trained to observe the symptoms of pest infestations, so they find it difficult to do so. They must be trained in order to improve their knowledge of pest infestation observation. Pests will be less likely to spread as a result of this. Given the high likelihood of future pest outbreaks due to climate change, training informal traders in observation techniques is critical.

4.4.14 Marking requirements

MARKING REQUIREMENTS

52.4	21.4		24.7
PUC	PHC	FBO	NONE
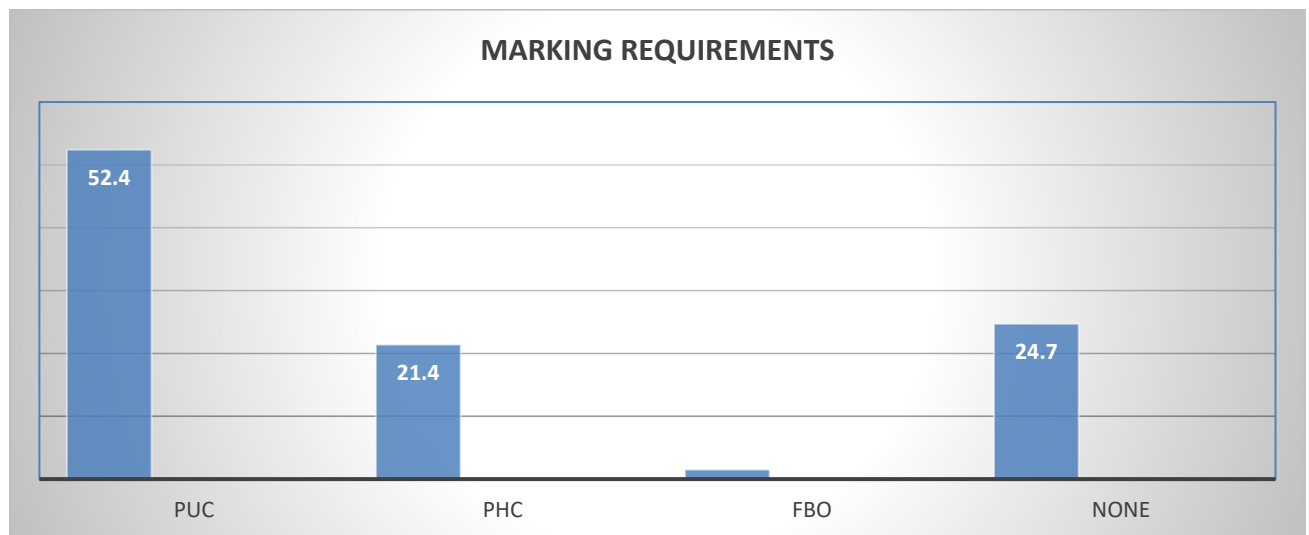
Source: Author (2022)

Figure 4. 18 Marking requirements

This can include product labels, which are physical elements that identify items, such as a tag, a sticker, or printing on product packaging that provides information about the product inside. These are typically attached to the packaging of each packaged product, but they can also be printed or affixed (Food and Agriculture Organization of the United Nations - FAO, 2017). The following information is included on the product labels in this study: Food Business Organisation (FBO), Production Unit Code (PUC), Pack House Code (PHC), and Additional information (best before date, harvesting date, weight, quantity and address). Traceability is aided by the marking requirements. Traceability is a business process that helps trading partners track the movement of a product from the field to a retail store or food service operator. Each Traceability Partner must be able to identify the product's direct source (supplier) and the direct recipient (customer) (United Nations, Food and Agriculture Organization - FAO, 2017).

In this study, 24.7% of traders stated that the products did not have any marking requirements. For the purposes of traceability, 52,4 percent of participants indicated that their product package had a Production Unit Code (PUC), while 21.4% indicated that the packaging had the Pack House Code (PHC). Approximately 1% of traders indicated that the packaging bore the Food Business Organisation logo (FBO). Most informal traders buy in bulk (more often labelled) but sell in small packages that are not labelled.

According to Wyrwa and Barska (2017), the information on food packaging, as one component of marketing information, influences consumers' opinions about the product. If there is no information on the packaging, it will be very difficult to trace the origin of a product if the need arises. Because informal traders primarily target low-income households, marketing information about their products may be unimportant. The findings suggest that informal traders may be unaware of the significance of the marking requirements on packaging material.

4.4.15 Transportation

TRANSPORTATION

(Bar chart values: open truck 54.4; Refrigerated truck 0.5; Truck with canopy 8.6; Other means 37.6)
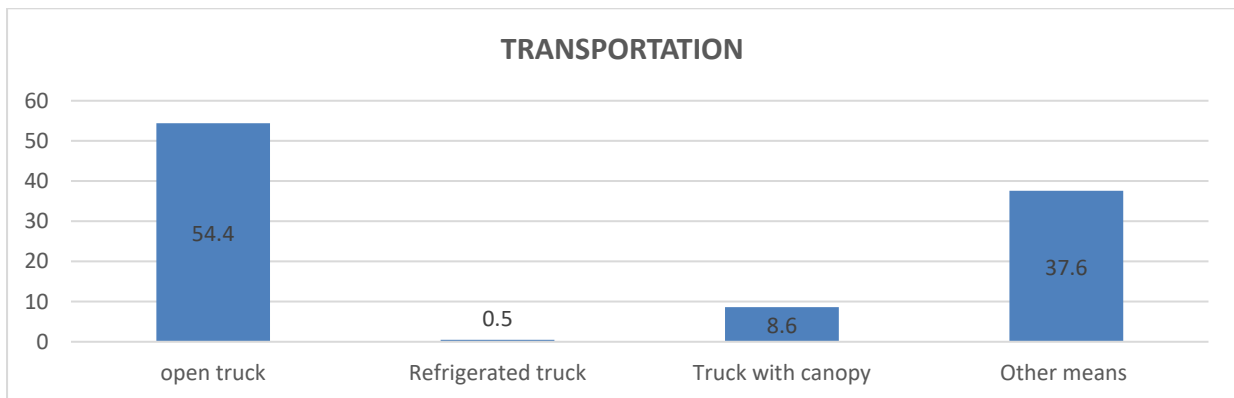
Source: Author (2022)

Figure 4.19 Transportation of products

According to Vilakazi and Paelo (2017), truck transports 99% of fruit loads from fruit production regions to ports. Approximately 70–90% of agricultural produce (including perishables) is transported by road in Africa (World Bank, 2015). Moving fresh produce between two points (of origin and use) necessitates several transportation steps. During transportation, produce is vulnerable to physical damage and microbial contamination. Produce quality, temperature, and humidity are three major factors influencing fresh produce safety during transportation. Tomatoes and peaches, for example, are more susceptible to cross-contamination by plant and human pathogens. Fruit that is damaged or overripe should not be transported; instead, it should be removed from shipping containers before transport. Temperature and humidity are important factors in produce safety. Cooling is critical for keeping produce cool during storage and transportation, which slows the growth of many pathogens found in produce (Malekian et al., 2015).

According to the information gathered for this study, 54,4% of informal traders use open trucks, 8,6% use trucks with open canopy, 0.5% use refrigerated trucks, and 37,6 % use other methods such as trollies because the distance is very short, and they found it to be cheaper. Suraraksa and Shin (2019) had a different finding that emphasized the use of a cold chain to preserve the quality of the products under the controlled temperature range for distribution and transportation of fresh products. The findings of this study indicate a lack of resources to acquire and use a better mode of transportation during product transportation.

4.5 Removal permit

4.5.1 Removal permit knowledge
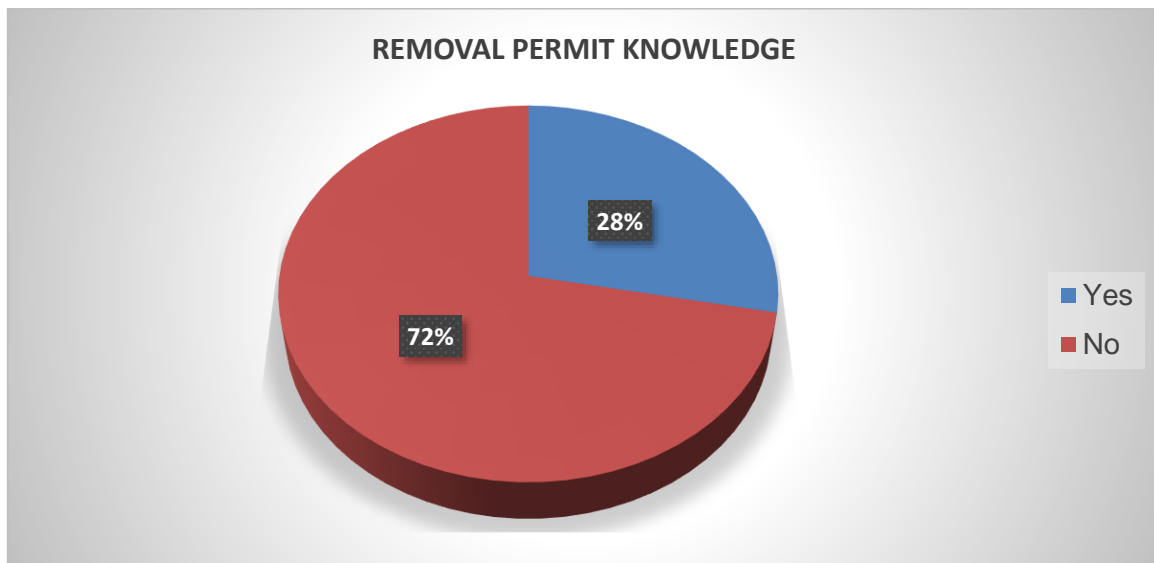
Source: Author (2022)

Figure 4. 20 Informal trader's knowledge of removal permit

To compete in global markets, producers all over the world require access to the best plant varieties and cultivars. This frequently entails transporting plants across international borders. During such movements, quarantine agencies such as the DALRRD should reduce the risk of introducing and spreading exotic pests and pathogens with imported plant material by ensuring that consignments are covered by a removal permit and a phytosanitary certificate (Martin et al., 2016). A removal permit is required for the removal of agricultural products from one province to the other for trade purposes. This product should undergo the (orchard sanitation programme, male annihilation programme and bait application programme).

These conditions will describe the actions to ensure the minimum chance of infestation before removal during transportation (Barnes & Venter, 2006). In terms of the Control Measures R.110 of 27 January 2017, Government Gazette 41257, no person in South Africa is allowed to move any fruit fly-infested fruit or material from an infested area to a non-infested area without authorisation using a removal permit. Any unauthorized movement has the potential to spread the fruit fly. Inspection Services, a division of the Department of Agriculture Land Reform and Rural Development, is in charge of

issuing an official order with a prescribed list of good agricultural practices, performing on-farm inspections, and issuing removal permits ('Notice in terms of the Control Measures R110 of 27 January 2017, no date). As a result, it is critical for the informal trader to be knowledgeable and to have a removal permit. According to the study's findings, 28 percent of informal traders were aware of a removal permit, while the vast majority (72 percent) were unaware of one. Furthermore, 99% of informal traders lacked a removal permit, while only 1% did.

According to the findings, the high number of those without a removal permit clearly indicates that they were unaware of it, and it is possible that they did not even know where to obtain it or its purpose, implying that the majority lacked awareness and ownership. According to Tariff No.11.3.1 I, an inspection for the purpose of issuing a removal permit costs R240.00 for 30 minutes or a portion of that time, including travel. Around 171 informal traders stated that they were unsure where to apply for the permit. Around 39 traders indicated that they knew where to apply for it. These findings indicate that informal traders in the study area were unaware that they needed a copy of the removal permit and never approached the Department of Agriculture, Land Reform and Rural Development to inquire about one. The findings indicate a greater need for removal permit training.

4.5.2 Purpose of the removal permit
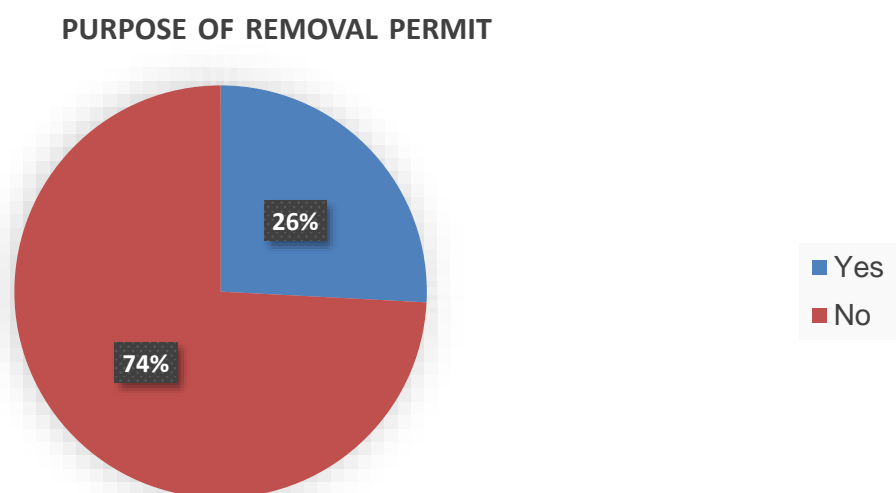
Source: Author (2022)

Figure 4. 21 Understanding the purpose of the removal permit

A removal permit's purpose is to regulate the movement of plants and plant products from infested to non-infested areas. This (removal permit) is used to prevent pests and diseases from spreading from one area to another (Manrakhan et al., 2018). During this study's research, the informal traders were evaluated to see if they understood the purpose of a removal permit. According to the findings, 74% of informal traders are unaware of the purpose of the removal permit, while 26% are aware of it. These findings could be attributed to informal traders' lack of knowledge and understanding of the purpose of removal permits, as the majority of them in the study area do not understand its purpose. As a result, informal traders are unlikely to detect infestations from other areas because information about the movement of their products is unknown.

4.5.3 Importance of removal permit

REMOVAL PERMIT IMPORTANCE
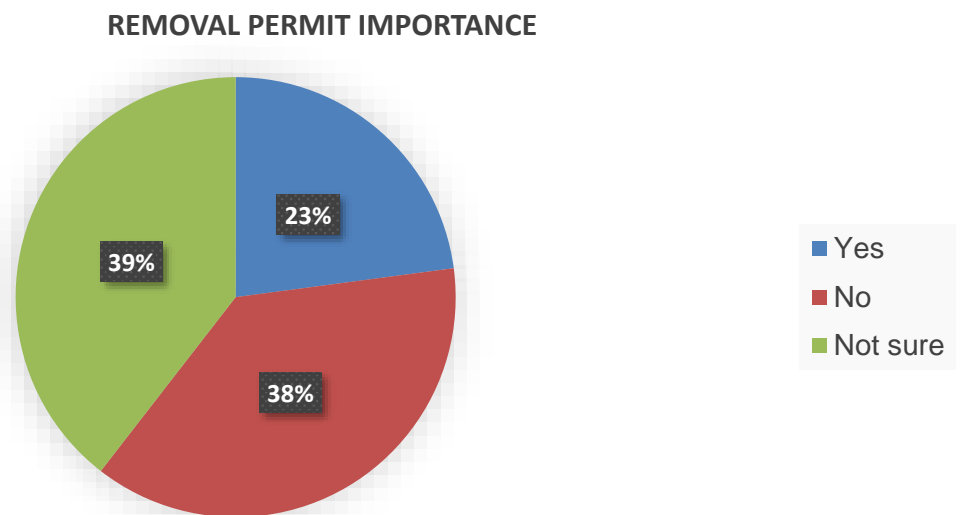
Source: Author (2022)

Figure 4. 22 Removal permit importance

Fruit and vegetables should ideally be covered by street vendors selling to the public within the quarantine area to prevent fruit flies from ovipositing. Only products from producers who have removal permits may be sold. Vendors should keep track of how much they sell and how much they buy from the producer (Manrakhan et al., 2006). In this study, informal traders were asked if a removal permit would have an impact on their businesses. In response, 39% of traders said they were unsure, 38 percent said

a lack of a removal permit would not affect their business, and 23% said it could. The belief was that knowledgeable customers would be able to buy from them if they knew they had a removal permit. In practice, if a producer does not comply by using pest control methods, the buyer will be unable to remove the product from the market. According to the findings, the informal traders in the area are unaware of the significance of a removal permit to their businesses. This demonstrates that, under the current circumstances, the removal permit will be difficult to appreciate.

4.5.4 Reason for not having removal permit

REASON FOR NOT HAVING REMOVAL PERMIT
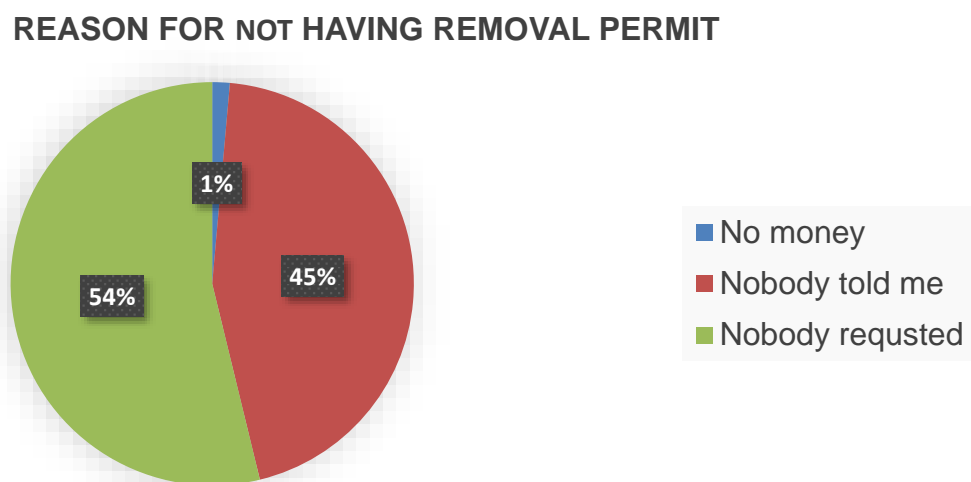
Source: Author (2022)

Figure 4. 23 Reason for not having a removal permit.

A lack of information and knowledge can be detrimental to a successful business. One of the questions posed to informal traders was "what is the reason for not having a removal permit?" Different reasons were given for not having a removal permit 54% of traders said no one requested it, 45% said no one told them about it, and only 1% said they didn't have the money for it. It should be encouraged that the informal traders obtain a copy of the removal permit. This will help with traceability if necessary. According to the findings, informal traders were unable to obtain information about a removal permit, so no one requested or informed them about it. According to the findings, there is no monitoring and evaluation that enforces compliance for informal traders. Due to a lack of incentives, traders are unlikely to have a removal permit.

4.5.5 Cost of removal permit knowledge

A tariff book is used by the Department of Agriculture, Land Reform, and Rural Development to charge for services rendered. A removal permit costs R200, according to Tariff No. 11.3.1 (ii) of the DALRRD Tariff Book. The majority of fruit and vegetable participants (informal traders) in this study stated that they are unaware of the cost of a removal permit, with only 1% indicating that they are aware of the cost. This clearly demonstrates that informal traders lack awareness and knowledge.

4.5.6 Knowledge of removal permit validity

REMOVAL PERMIT VALIDITY
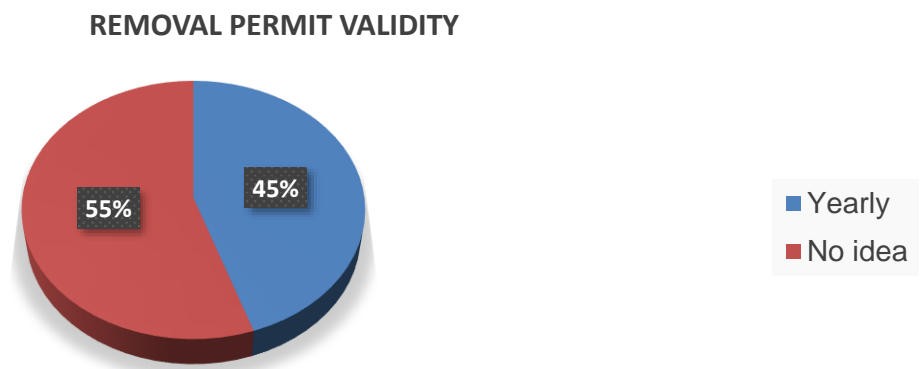
Source: Author (2022)

Figure 4. 24 Removal permit validity

The validity of a removal permit will always vary depending on the commodity type. Citrus, for example, had a longer production cycle than other commodities/products. Every plant product that can host pests, according to DALRRD, should have a removal permit for that season. According to Figure 4.24, the majority of informal traders (55%) were unaware of the validity of the removal permit. While 45% said the removal permit is only valid for a year. According to the findings, the informal traders in the study area are unaware of how long a removal permit is valid. It is critical for informal traders to understand the validity of a removal permit in order to obtain an updated copy of it. This will give them a better understanding of the permit system and ensure that the product they trade with comes from a good agricultural practice area.

4.5.7 Removal permit interpretation

PERMIT INTERPRETATION
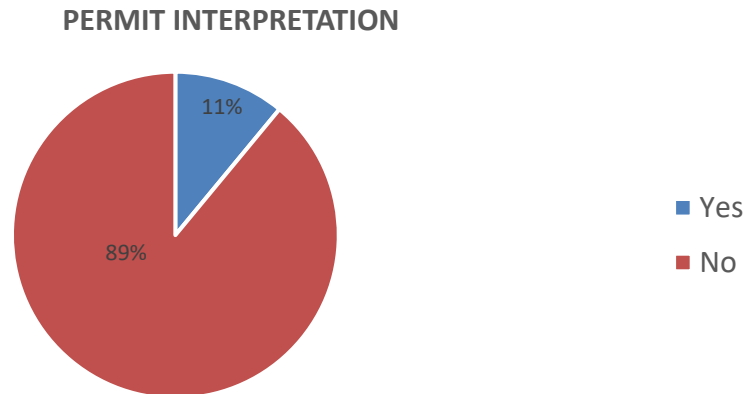
Source: Author (2022)

Figure 4. 25 Removal permit interpretation

A removal permit is a legal document issued by a duly qualified official of the Department of Agriculture, Land Reform, and Rural Development. This document contains information about the origin of the product, commodity name, farmer name and address, and finally where the product was removed or transported from and to which destination, and it can only be used for that purpose. According to Maruf, Saleh, and Haffari (2021), interpretation is a difficult task in and of itself because it requires a thorough understanding of the source text, a high level of proficiency and a good knowledge of the target document. As a result, the informal traders in this study should be able to interpret the removal permit. This is required in order to determine the originality of the product and ensure that the products they sell comply with the removal permit conditions. The results of knowledge on the interpretation of a removal permit interpretation are depicted in Figure 4.25 above. Only a minority (11%) of informal traders said they could interpret a removal permit, while the vast majority (89%) said they couldn't. According to the findings of Zhang, Wei and Zhou's (2020) study, document summarization or interpretation is the task of rewriting a document into a shorter form while retaining its important content. The informal traders will face the same expectations, as the main task will be to understand and know what information will be in the removal permit. The findings indicate that informal traders in this study area lack the ability and knowledge to interpret a removal permit.

4.6.1 Plant Health officials' contact frequency with traders

The Department of Agriculture Plant Health – division should ideally conduct awareness campaigns in Tshwane to share information with traders. This should be done in collaboration with the municipal government. According to the study, almost all informal traders in the study area have no contact with the Department of Agriculture.

Table 4. 8 Contact with the Department of Agriculture

Contacts	Frequency	Percent
Yes	2	1
No	208	99
Total	210	100

Source: Author (2022)

Only 1% of those polled said they had contact, while 99% said they didn't. These findings suggest that informal traders are unaware of the DALRRD's involvement and role in their daily operations.

4.6.2 Government support service access and availability
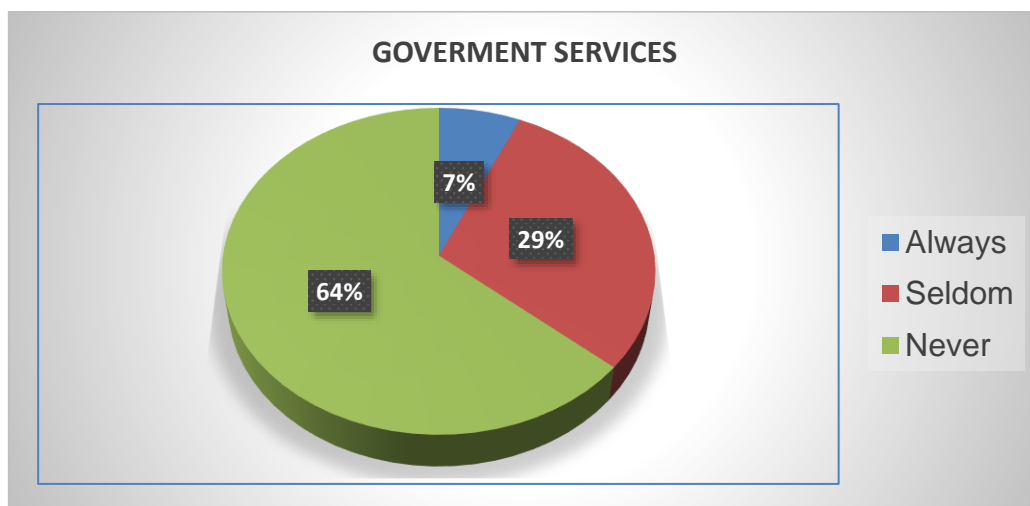
Source: Author (2022)

Figure 4. 26 Service delivery support services

The South African public sector includes the local sphere of government. This is close to citizens and thus critical in its role of providing essential goods and services as well as developing local areas (Ndevu & Muller, 2017). The study used a representative

survey to investigate the levels of satisfaction with basic services among informal traders. The assessments are based on the informal trader's first-hand knowledge of the municipalities in which they live.

According to the study findings, the majority (64%) of informal traders in Tshwane never received government support services, while just over a quarter (29%) received them only occasionally, and only 7% received them always. Stalls and cleaning were provided as part of the assistance. The government's primary role is not only political; it also has moral obligations to its citizens by providing services and promoting the general welfare of society (Ayandibu & Houghton, 2017).

According to the findings of a study conducted by Nkrumah-Abebrese and Schachtebeck (2017), some of the survival challenges include low income, poor working conditions, and difficulty understanding municipal by-laws governing street trading. According to the findings, there is a chasm between the government and the informal traders, and the majority of traders indicate a lack of service delivery from the government. Another gap was traders' lack of knowledge about other support services available to them. The Small Enterprise Development Agency (SEDA) in South Africa promotes the growth of small businesses. SEDA's mandate is to raise living standards and alleviate poverty among various groups of society by creating job opportunities in order to address the unemployment problem. According to Ayandibu and Houghton, (2017) in addition to assisting individuals, the agency places a special emphasis on cooperatives, in which a group of entrepreneurs share profits and responsibility for the business.

In this study, all of the participants (210) stated that they do not have or do not receive any government assistance. The government has some support measures in place through SEDA, and the lack of use of these services could be attributed to traders' lack of access to these services. Micro and Small Enterprises (MSEs) are critical to the economic development of any growing economy. Informal MSEs contribute 13 percent of GDP in low-income countries and 47% in high-income countries (Asad, et. al., 2016). Support for the development and growth of informal traders is critical, as business support services enable entrepreneurs to develop and access networks that are beneficial to the survival of their business (Inolia, 2016). According to the findings

of this study, informal traders are unaware of government sectors that provide assistance and subsidies to small businesses.

4.7 Chapter Summary

The socio-economic demographics, compliance practices, and information available for informal traders were all highlighted in this chapter. The participants were fruit and vegetable informal traders from four different neighbourhoods in the city: Arcadia, Sunnyside, City Centre, and Marabastad. The findings indicate that the government still has work to do to help informal traders. The findings revealed a problem with phytosanitary measure compliance. There was a lack of support, information, and enforcement of municipal laws among the gaps. Informal traders were not familiar with quarantine pest detection, disposal, and removal permits. The chapter highlighted critical phytosanitary measures gaps that require the government to intervene.

CHAPTER 5

QUARANTINE PESTS KNOWLEDGE DETERMINANTS

5.1. INTRODUCTION

This chapter presents and discusses the model estimates' results. It presents the empirical findings of an investigation into the factors influencing informal traders' knowledge level of fruit and vegetable pests. The dependent variable used was quarantine pests' knowledge level (0-poor, 1-fair, 2-good, 3-very good, 4-excellent) and the independent variables used were socio-economic variables in Tables 3.2, 3.3 and 3.6 as discussed in chapter 3.

5.2 The results and discussion of the Ordered Logistic Regression Model

In this chapter Ordered logistic regression was used due to the nature of the dependent variable. The dependent variable had an order that ranged from 1 to 5. Model fitting data can be found in Table 5.1. The -2 LL is a likelihood ratio that represents the unexplained variance in the outcome variable. As a result, the better the fit, the lower the value. The Likelihood Ratio chi-square test is an alternative goodness-of-fit test. However, as with most chi-square-based tests, it is likely to enter inflation mode as the sample size grows larger. Table 5.1 shows that the model information fit is significant (Chi-square at 34.606, P-value: 0.000), indicating that the final model predicts significantly better than the previous model.

Table 5.1 shows the Goodness of Fit (also known as the hypothesis test). As shown in the table below in the Sig column, the p-value is 1.000, which is not statistically significant. Based on this metric, the model fits the data well. These two goodness-of-fit measures do not always yield the same result. Significant results differ from 510 and 1.000, which are both not statistically significant, as shown in the table below.

There are three pseudo-R-squared values (Cox and Snell, Nagelkerke and McFadden). R-squared in OLS regression is not the same as R-squared in ordered logistic regression. In this study, their interpretations are less important.

Table 5. 1 Parameter estimates (n = 210)

Parameter Estimates		
Variable	**Estimates**	**P-value**
Knowledge level	-8.389	0.003
Knowledge level	-6.128	0.028
Knowledge level	-5.221	0.061
Parameters		
Area	-0.475	**0.001***
Age	0.204	0.217
Education	-0.176	0.410
Trading product	-0.115	0.494
Stall ownership	0.608	**0.079****
Pest identification training	0.695	0.627
Training provider	0.643	0.447
Awareness pamphlets	-0.095	0.953
Pest source information	0.349	0.254
Pest trap tools	-0.321	0.305
Pest surveillance technique	0.725	**0.025****
Surveillance frequency	0.066	0.297
Pest protection	-0.031	0.761
Pest disposal method	-1.352	**0.000***
Model Fitting information		
-2 Log Likelihood	418.439	
Chi-Square	34.606	
Sig	0.002	
Goodness of fit		
Chi-Square	412.893	
Df	0.574	
Sig	1.000	
Pseudo R Square		
Cox and Snell	0.153	
Nagelkerke	0.172	
Mcfadden	0.075	
Level of Significant: 1%*, 5%**, 10%***		
Dependent variable: Knowledge level Poor, Fair Good & Very Good		

Source (Author 2022)

5.3 Significant variables

Area variable was statistically significant at a 1% level (P-value: 0.000), and the location of the informal trader influenced the trader's quarantine pest knowledge level. The coefficients estimate was negative (-0.475), the negative estimate shows the lower log odds of falling at a higher level of the quarantine pests' knowledge level. This

indicates that as the location of the informal trader changes within the four areas in the study, there is a likelihood of falling at a lower level of quarantine pest knowledge. The baseline location was Marabastad, meaning that movement from other areas to Marabastad had the lower log odds of an informal trader quarantine knowledge level movement from lower to a higher level. This means that other areas, such as Pretoria Central, Sunnyside, and Arcadia, have a high level of quarantine pest knowledge. The study's four study areas were Pretoria Central, Sunnyside, Arcadia, and Marabastad.

Stall ownership variable was statistically significant at a 10% level (0.079), and the coefficient estimate was positive (0.608). The positive estimate shows the higher log odds of falling at a higher quarantine pests knowledge level. This indicates that as the ownership status of the informal trader changes from non-ownership (baseline) to ownership, there is a likelihood of falling at a higher level of quarantine pest knowledge level. The expectation is that informal traders who owned stalls would be in a better position to access other resources such as knowledge and finance as they enjoy some level of stability while trading.

According to Pyrko et al. (2017), knowledge helps a person to become more competent in the context of a specific practice. Practice includes the collection of frameworks, ideas, tools and information. The results support this notion, those who had tools of the trade such as stalls displayed the likelihood of having a better knowledge of quarantine pests. Most traders did not own a stall in the study area, ordinarily, every trader is supposed to own a stall, this could suggest budget constraints or poor service delivery from the municipality side. A contrary study in Papua Guinea on street vendors reported that market stalls were readily available and open to the public (Rooney, 2019).

Pest surveillance variable was statistically significant at a 1% level (0.025), and the coefficient estimate was positive (0.725). The positive estimate shows the higher log odds of falling at a higher quarantine pest's knowledge level. This indicates that when the trader has pest surveillance techniques (baseline: no pest surveillance techniques) there is a likelihood of falling at a higher level of quarantine pest knowledge level. The expectation is that informal traders who are employing some techniques would do so as a result of having access to some level of formal or informal knowledge or

resources. It is therefore not surprising that traders who were having some surveillance techniques had a higher likelihood of falling in the category of higher quarantine pest knowledge level. This is evident as the common fruit fly pests in the *Darcus* group still have less development of surveillance and trapping systems which play a crucial role in monitoring (Manrakhan, 2016). According to Suckling et al. (2016), the odds of informal traders are declining at a higher level of knowledge due to a holdover from a previous era represented by a scarcity of surveillance and eradication tools.

Pest disposal variable was statistically significant at a 1% level (P-value: 0.000). The coefficients estimate was negative (-1.352), the negative estimate shows the lower log odds of falling at a higher level of the quarantine pests' knowledge level. The expectation is that traders who went out of their way to spend on the disposal of the pets would display some higher knowledge level likelihood. However, this was not the case in the study, traders who had invested in disposal methods of the pests did not necessarily display a better likelihood of having a better knowledge level when compared to those who did not (baseline: no disposal method).

Contrary to the expectation in the study, the findings could suggest that although some traders were employing some disposal methods, they could have been using inappropriate methods or tools. This was explained better by Rijal et al. (2018) study findings in Nepal that showed that there is a big gap in the use of appropriate methods when disposing of pests even among farmers themselves. The lack of proper knowledge and information about pest biology and economic threshold led to the use of inappropriate preventative sprays for pest control. This finding could explain the possible reasons for the results of the study.

5.4 Non-significant variables

Several factors were expected to play a positive role in the likelihood of traders falling into the higher quarantine pest knowledge level category. These factors were age, education, type of product traded, pest infestation training, source of training, access to pest information, pest trap, tools ownership, number of surveillance and the

availability of pest protection tools. These factors did not influence the knowledge level of the informal traders although they are important in the pest quarantine process.

5.5 Chapter Summary

Because of the nature of the dependent variable, ordered logistic regression was used. The knowledge level of quarantine pests was used as the dependent variable (0-poor, 1-fair, 2-good, 3-very good, 4-excellent) The model information fit is significant (Chi-square at 34.606, P-value: 0.000), indicating that the final model predicts significantly better than the previous model. Four independent variables were found to be significant, while ten were found to be non-significant. The expectation was that informal traders' knowledge of fruit and vegetable pests would be above average; however, it was discovered that not all of the factors influenced the traders' knowledge level.

CHAPTER 6

FACTORS INFLUENCING SPS COMPLIANCE

6.1 INTRODUCTION

The purpose of this chapter was to present and discuss the findings of an empirical study conducted to assess the factors influencing SPS compliance among the informal traders in the study area. To assess the factors influencing the SPS compliance of informal traders in the study region, the indices were used as dependent variables in the Tobit regression model, along with independent variables specified in Table 3.4 of (chapter 3). The results from the analyses using the model are presented in Table 6.1 below.

6.2 Results and discussion of the Tobit Regression Model Analysis

The results of the Tobit regression model in Table 6.1 was chosen as the best model fit because the parameter estimates and the other measures including P-values, LR chi2, Prob > chi2, and the Log-likelihood were better. This confirms that the dependent variable, the SPS compliance index was a limited variable hence the Tobit model is appropriate for the analyses of objective 3. The results of the Tobit model were therefore presented and discussed.

Table 6. 1 Results summary of Tobit model analyses (n= 210)

Results summary of Tobit model analysis			
Component	Coef.	t-value	P-value
Gender	-1.53	-1.01	0.315
City duration	-.68	-0.73	0.469
Protest problem	2.18	1.41	0.161
Stock satisfaction	1.24	1.23	0.220
Pest identification training	-19.8	-3.12	**0.002***
Spoiled products	-3.13	-1.61	0.109
Phyto compliance	2.24	1.23	0.218
Phyto practice	3.61	1.94	**0.054***
Unique code	-.91	-1.46	0.145
Product Challenges	1.33	1.85	**0.065***
Removal permit	-3.47	-2.05	**0.041***
Constant	47.2	5.55	**0.000***

Source: Author (2022)

Tobit Regression model estimates

```
Number of obs      =   210
Uncensored         =   210
Left-censored      =    0
-censored          =    0
LR chi2(11)        =  31.47
Prob > chi2        = 0.0009
Log likelihood     = -795.96336
Pseudo R2          = 0.0194
```

6.3 Results and discussion of the significant independent variables of the Tobit model.

Out of the eleven independent variables considered in the Tobit regression analysis, four were found to have statistical significance on the SPS compliance among the informal traders in the city; while seven of the variables had insignificant effluence on SPS compliance. The statistically significant variables are Pest identification training, Phytosanitary practice, Product challenges and Removal permit. The non-statistically significant variables include the number of dependents, city duration, protest disturbance, phytosanitary measure, production unique codes, participant gender, and disposal methods. The significant variables are discussed below.

Pest identification training

The coefficient of pest identification training by informal traders was negative (-19.80103), with a t-value of -3.12 and was statistically significant at the 1% level (P-value: 0.002). All other factors held constant a unit increase in pest identification training of informal traders resulted in a decrease in SPS compliance from the traders in the study area. This means that an increase in pest identification training had a negative impact on the level of compliance among informal traders. This means that if the informal traders attended training, they still did not comply. The reason for the negative relationship may that the training package might have not been properly aligned to address the non-compliance culture among the informal traders. Training has implications for productivity, commitment to work and personal development (Ganesh & Indradevi, 2015). Furthermore, a study by Rodriguez and Walters (2017) found that training and development help organizations and employees achieve a variety of goals, including improving morale, sense of security, engagement and

overall competencies. For the pest identification training of the informal traders to encourage SPS compliance, there is the need for the government to prioritize the training and package it well including delivery to achieve the desired compliance objective.

Phytosanitary practice

The estimated phytosanitary practice coefficient was positive (3.612555) with a t-value of 1.94 and significant at a 5% level (P-value 0.054). This means that the phytosanitary practice among the informal traders is likely to increase SPS compliance with all other factors held constant. This suggests that some of the informal traders complied with phytosanitary measures. Practising phytosanitary measures increases the likelihood of compliance because the majority (95.5%) of the informal traders in this study inspected their products before purchasing. This practice eliminates the possibility of selling infested products while also limiting pest spread. This finding is consistent with the finding of Dohino et al. (2017) that phytosanitary treatments are required for quarantined commodities to be exported from infested areas to areas where the pest does not exist and cannot establish. Another type of phytosanitary practice is phytosanitary irradiation, which is useful because it is well tolerated by most fruits and vegetables. This practice aids in the preservation of plant health and ensures that viable pests do not cross national borders (Roberts & Follett, 2017).

Product challenges

The estimated coefficient of product challenges was positive (1.333502) with a t-value of 1.85 and significant at a 10% level (P-value: 0.065). This meant that the product challenges encountered by informal traders had a positive and significant impact on the compliance level. A positive coefficient implies that informal traders who face challenges when purchasing their products have a higher chance of complying than those who do not face challenges. This includes complying with phytosanitary measures such as having a removal permit and inspecting their product, as well as having a trading license. According to the study by Choudhary et al. (2020), the problems of adulteration make the food items we use in our daily lives unsafe and unhygienic for use due to poor handling, and this can have a huge impact on our health without our knowledge. The post-harvest coating is required for products such as plums to be of higher quality. The results showed that Chitosan coating was effective

in reducing weight loss, respiration rate and decay rate (Bal, 2018). This result is acceptable because the majority of respondents faced a challenge of low-quality products, followed by lower-graded products. Even though the informal traders faced product challenges, some of them made an effort to comply to minimize financial losses.

Removal permit

The estimated coefficient of an informal traders' removal permit was negative (-3.473345) with a t-value of -2.05 and significant at the 5% level (P-value 0.041). With all other variables held constant, an increase in informal traders knowing what a removal permit is decreased SPS compliance. This suggests that those who are aware or know of the removal permit did not attempt to obtain it. This casts doubt on their level of compliance. Permits are one of the most effective and widely used tools used by state agencies to regulate transportation operations (Gungor, 2019). Any unauthorized mode of transport has the potential to spread the fruit fly. For this study, informal traders do not comply because they move goods from one location to another without a removal permit. The findings of the study indicate that only 28% of informal traders were aware of a removal permit, while the vast majority (72%) were not. A study on cannabis cultivation in California (Schwab et al., 2019) discovers strong evidence that the farms most likely to begin the permit process are larger, existed prior to the start of the "green rush," and expanded at a faster rate between 2012 and 2016. For this study, 99 percent of informal traders did not have a removal permit, while only 1 percent did, and government officials never requested it during stall visits, indicating a lack of awareness among government officials, which will exacerbate informal traders' noncompliance.

6.4 Chapter Summary

The goal of this chapter was to evaluate the factors that influence the level of SPS compliance of informal traders in the study area. Because of the nature of the dependent variable, the Tobit regression model was used. The compliance level index to SPS among the informal fruit and vegetable traders was used as the dependent variable. Pest identification training, a pest removal permit, phytosanitary practices, and product challenges had a significant effect on informal traders' SPS compliance levels. Seven variables were statistically insignificant, implying that they had no effect

on compliance. The non-significant variables included the number of dependents, city duration, protest disturbance, phytosanitary measure, production unique codes, gender and disposal methods.

CHAPTER 7

FACTORS INFLUENCING THE USE OF REMOVAL PERMIT

7.1. INTRODUCTION

This chapter presents and discusses the model estimates' results. It presents the empirical findings of the factors influencing the use of removal permits among informal traders. The Dependent variable used was the availability of the removal permit (Yes = 1, No = 0) and the independent variables used were socio-economic factors as discussed in Chapter 3.

7.2 Results and discussion of Binary Logistic Regression Model

In this chapter Binary logistic regression was used due to the nature of the dependent variable. The dependent variable was binary in nature. The Omnibus Tests of Model Coefficients were used to determine whether the new model is better than the baseline model. Chi-square tests were used to compare the Log-likelihoods (specifically the -2LLs) of the baseline and the new model. The table below shows that the omnibus test of a model coefficient is significant at the level of $P < 0.05$ on the step, block, and model fits the data well. The model summary indicates the -2 Log-likelihood which is expressed as the likelihood ratio and represents the unexplained variance in the outcome variable. Therefore, the smaller the value, the better the fit. The Likelihood Ratio chi-square test is the alternative test of goodness-of-fit.

There are two pseudo-R-squared values (Cox and Snell R square and Nagelkerke R square) shown in the table below. The Cox & Snell R Square and the Nagelkerke R Square values indicate the amount of variation in the dependent variable explained by the model (from a minimum value of 0 to a maximum of approximately 1) Binary logistic regression does not have an equivalent to the R-squared found in regression. For this study, their interpretations are of less importance.

Table 7. 1 Parameter estimates of Binary logistic regression (n=210)

Variables	B	Sig
Gender	0.602	**0.096***
Age	-0.469	**0.069***
Country of origin	-0.674	**0.069***
City duration	0.308	0.242
Form of employment	1.050	0.138
Pest Sampling	0.683	**0.020*****
Pest surveillance	0.113	0.134
No. of Dependents	0.843	0.126
Street safety	0.406	0.278
Constant	**-1.367**	**0.437**
Omnibus Tests of Model Coefficients		
Chi square	30.440	
Sig	**0.001*****	
Model Summary		
2 Log likelihood	208.383	
Psedo R square		
Cox & Snell R Square	0.136	
Nagelkerke R square	0.199	
Classification N =210		
Notes: level of significance: 1% *, 5%**, 10%***		
Dependent variable: Removal permit (Yes – 1, No – 0)		

Source: Author (2022)

7.2 Factors affecting removal permit use

7.2.1 Significant variables

Variable Gender was statistically significant at a 10% level (P-value: 0:096). This means gender had an influence on whether an informal trader had a removal permit or not. The logistic estimate associated with the gender of the informal traders was positive (0.602), implying that being a female increased the odds of having a removal permit. Females are generally dominant in informal trading, more experienced and exposed, and therefore the odds of them having a removal permit is greater by 0.602 times. It was expected that females should have greater odds than men and the results of the study conformed to this expectation.

Elder and Kring (2016) found that if more young people attend and stay in school for longer periods of time, there is a greater likelihood of lower labour force participation rates for both genders. Nonetheless, young men's labour-force participation rate

remained 16 percentage points higher than that of young women. Parenthood exacerbates the disparities, pushing young men into the labour force and young women out of it. This contradicts our findings because neither female shows signs of having been exposed to removal permit-related information.

A study conducted in Tanzania found that older male vendors consider hawking, which entails walking and shouting in busy streets, degrading, whereas female vendors consider it unsafe and inappropriate for women (Steiler & Nyirenda, 2021). This contradicts our findings, as neither female exhibits signs of exposure to removal permit-related information. However, informal trading remains an accessible business venture for most women without the capital to start big businesses. The importance of start-up capital was confirmed in a survey of Swazi entrepreneurs. Women entrepreneurs have lower start-up capital and are less likely to get it from the formal sector than men, indicating a potential area for policy intervention (Brixiová & Kangoye, 2016). This, on the other hand, suggests that only male traders may have exposure to information about most resources and removal permits related information.

Variable Age was statistically significant at a 10% level (P-value: 0:069). This means age had an influence on whether an informal trader had a removal permit or not. The logistic estimate associated with the age of the informal traders was negative (-0.469), implying that a unit increase in an informal trader's age decreases the traders' odds of having a removal permit by 0.469 (other factors held constant). The expectation was that age will influence whether a trader will have a removal permit or not. The assumption is, that the older the trader, the more experience and exposure they have and therefore likely they are to have a removal permit. The fact that age did not matter in having a permit suggests that both young and old traders can be exposed at different levels as such younger traders can have permits due to their exposure to permit information and likewise the older traders could have permits due to the same exposure of information.

In Kenya-Nairobi, a study by Dragsted-Mutengwa (2018) discovered that the majority of street traders are between the ages of 20 and 40, which is considered young. They stated that when they were unable to find a formal job in Kenya's increasingly informal labour market, they turned to street trading as a fallback option. According to the

findings, younger traders have a better chance of receiving information and being exposed to a removal permit.

According to Gough (2016), a large proportion of young people work in the informal sector, are more entrepreneurial than adults, and can expand their businesses. This is in line with the study, which indicates that young traders have an advantage in terms of information distribution, especially on social media. On the other hand, older workers have experience and knowledge from previous jobs and lives, as well as a strong work ethic (Liang et al., 2018). The findings suggest that the younger traders have greater odds of getting a removal permit. The results are encouraging, considering the high unemployment rate of young people in South Africa. This suggests that the stakeholder who may intervene may target the youth.

The variable Country of origin was statistically significant at a 10% level (P-value: 0:069). This means the country of origin had an influence on whether an informal trader had a removal permit or not. The logistic estimates associated with the nationality of the informal traders were negative (-0.674), implying that being a South African by origin decreased the traders' odds of having a removal permit by 0.674 (other factors held constant). The expectation was that country of origin will influence whether a trader will have a removal permit or not. The assumption is that traders from South Africa are knowledgeable about municipality by-laws and have access to more information and consequently, they have greater odds of having a removal permit.

The fact that country of origin did not play a role in the matter of having a permit suggests that both South African and non-South Africans can be exposed at different levels as such South African traders can have permits due to their exposure to permit information and likewise the non-South Africans traders could also have permits due to the same exposure of information at hand. The results outcome is not surprising considering that, informal traders in a Polokwane, South Africa study indicated that most informal traders did not have support from the Municipality (Mabitsela, 2017). The lack of government support will immensely contribute to traders not having access to permit information.

According to Manjokoto and Ranga (2017), in a desperate attempt to save meagre incomes, most Zimbabweans resorted to informal cross-border trade (ICBT) and slept in the open while in SA. Local authorities harassed them by searching for and seizing

unregistered goods. These findings will immensely contribute to traders not having access to permit information.

There has been enough research indicating the plight of non-south Africans sometimes at the hands of those who should protect them and as such, this would discourage them to seek information. The criminalization of immigrants can also be seen in the illegal market for the purchase of immigrant documents to remain legally in South Africa (Alfaro-Velcamp & Shaw, 2016). In contrast, foreign nationals who do not have immigration documents are not expected to be knowledgeable and have information about removal permits.

Variable Pests Sampling was statistically significant at a 1% level (P-value: 0:020). This means the traders who once had pests' samples taken at their stalls by the municipality officials had greater odds of having a removal permit. The logistic estimate associated with the sampling frequency of the informal traders was positive (0.683), implying that traders who participate in pests sampling have greater odds of having a removal permit by 0.683 times (other factors held constant). The expectation was that those who participate in the sampling of pests will have greater odds of having a removal permit.

This is primarily because such traders would have access to the relevant application information as they interact with officials who will be taking samples. The assumption is that traders who agree to pests sampling in the first place are knowledgeable and informed therefore they are most likely to have a removal permit. The sampling exercise itself can be seen as a livelihood threat by the traders especially if quarantine pests are found in the stock and as such most might refuse to participate in the sampling. The stock will have to be discarded right away and that simply translates to a loss for a trader.

The fact that sampling of pests played a role in the matter of having a permit suggests that sampled traders could provide important information at different levels if there is an infestation of a quarantine pest in the area. According to the findings of the study regular inspections and effective monitoring programs of fresh produce are also necessary to protect public health (Al-Nasir et al., 2020). This finding is in line with the study's finding that traders who make their stock available for sampling may have information on removal permits. It is therefore important that sampling happens

frequently so that most traders can have a probability of participating and consequently also access permit removal information. It is impossible to assess every single element of a population during the investigation, so a group (smaller in number than the population) is chosen for the assessment. However, even if few traders are chosen every time, it can make a difference in the long run (Alvi, 2016). Another expectation is that Informal traders who are visited by government officials to sample their products should be compliant with phytosanitary measures, and such traders are expected to have exposure and information on removal permits; however, according to this study, the majority of such traders do not have such information.

7.2.2 Non-significant variables

Several factors were expected to play a positive role in the likelihood of traders falling into the higher quarantine pest knowledge level category. These factors were city duration, a form of employment, pest surveillance, Number of dependents and street safety. These factors did not influence the knowledge level of the informal traders although they are important in the pest quarantine process.

7.3 Chapter Summary

The factors that influence the use of a removal permit were examined using binary logistic regression. The two values observed were yes or no, denoted by codes 1 and 0. The omnibus test of a model coefficient on the step, block, and model fits the data well at the level of P 0.05. Four independent variables were found to be significant, while five were found to be non-significant. The expectation was that informal traders would be exposed to and knowledgeable about removal permits, but this was not the case. Some of the independent variables had little effect on the information on removal permits provided by informal traders, according to the findings.

CHAPTER 8

FRAMEWORK FOR PROMOTING INFORMAL FRUITS AND VEGETABLE TRADERS' SPS COMPLIANCE

8.1 INTRODUCTION

To protect the environment and fair trade, informal traders and the province should be SPS compliant. This chapter discusses stakeholders and key factors influencing compliance. A model was created to improve the knowledge level of informal traders, as well as to ensure compliance and awareness. This will also aid in the reduction of pest spread and introduction into the area. Furthermore, the framework aims to improve informal traders' knowledge of phytosanitary measures.

8.2 Key factors and stakeholders influencing compliance.

8.2.1 Regulators

City of Tshwane

To trade within the City of Tshwane, the issuance of trading licenses and selling stalls to informal traders are primarily regulated by the city. They should also make certain that all registered informal fruit and vegetable traders have trading stalls and a copy of the removal permit. They should collaborate with the DALRRD in order to train and educate traders. The study found the city lacked in issuing the license, enough stalls and there were no incentives for traders to have a removal permit.

Department of Agriculture

The Agricultural Pests Act (Act 36 of 1983) was passed into law to prevent the spread and introduction of pests. Enforcing this is the responsibility of the Department of Agriculture, Land Reform, and Rural Development. There are three major divisions that are important: Plant health services, inspections, and a removal permit office are all available. Plant Health provides commodity-specific removal permit conditions, and inspection services: conduct farm inspections for removal permit issuance and removal permit issues the removal permit. The study found that traders were not aware of these offices and their role in informal trading.

8.2.2 Farmers/ growers

Farmers may live outside the province. As product growers, they should apply to DALRRD for a season's worth of removal permits. The removal permit should be issued after an inspection of the orchards or blocks. This removal permit is valid for a shipment being transported from one province to the next. Every transporter who transports this perishable product should be given a copy of this removal permit. During key focus group discussions, the traders indicated that most products' origin is outside Gauteng province.

8.2.3 Transporters

Transporters should always carry a copy of the removal permit with them, and they should use closed trucks or refrigerated containers to avoid spreading pests from one area to the next. This should be normalised for the local market now when they are no outbreaks as a preventative measure. So that, when the outbreaks come it will be easy for plant health enforcement to curb the spread in the transport sector.

8.2.4 Market Agent

When the products arrive, they must ensure that they comply with SPS measures, that the marking requirements are traceable, and that a copy of the removal permit is attached to the consignment and made available to traders upon request. Most traders did not understand the role of marking requirements and as such will not be able to appreciate its value.

8.2.5 Inspectors

Inspectors from both quality and plant health should be present at the market to verify the documents attached to the consignment. Every consignment entering the market should be inspected to ensure sanitary and phytosanitary compliance. They must inspect the product for both quality and pests. This ensures that infested products are not received and sold in the market and that pests are not spread or introduced as a result of the process.

8.2.6 Informal traders

In addition to having a stall and a trading license, Informal traders must be aware of pest symptoms and be able to identify them. They should inspect their product and double-check the marking requirements, which will indicate the source of the produce, PUC, PHC, and FBO. Informal traders must present their products for sampling and inspections, follow SPS measures, and have a copy of their removal permit to show municipality officers during their visit.

8.3 Framework
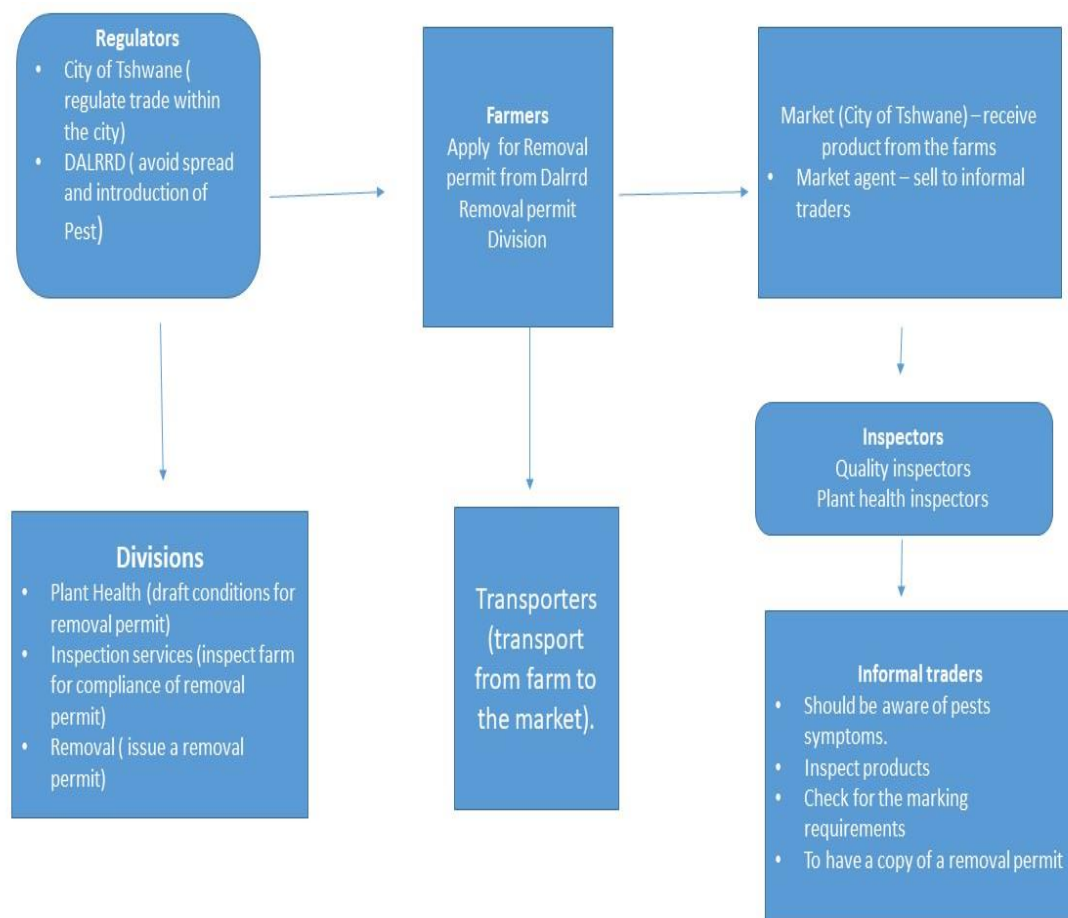
Figure 4. 27 Framework model

Source: Author (2022)

8.4 Chapter Summary

The framework from this study is the process that the government (DALRRD and City of Tshwane) should enforce for informal traders' compliance. In my opinion, the government should make informal trader training mandatory and then issue a trading licence to improve knowledge and compliance. This framework will ensure that traders own and understand the importance of a removal permit, as well as where to apply for a removal permit and the origin of the product they are selling. The government already has regulations in place to control the movement of agricultural goods from farmers to formal and informal traders. The regulations are just not being implemented in the informal trader's sector which is a huge concern for the economy. The recent coronavirus showed the world how important tracing is in controlling the spread of viruses. In the same breath, tracing and knowing what should be traced is crucial in the informal trading sector. This will save traders from possible losses if an outbreak of pests that could be as massive as the coronavirus in the future. Depending on how dangerous the pest is, human lives can be saved and the economy at large.

CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS

9.1 Recapping the purpose of the research

For the enforcement of phytosanitary measures, countries can issue a general authorization for the import of agricultural products or may demand an import permit with specific requirements. Fresh fruits and vegetables have the potential of carrying invasive agricultural pests. The main objective of conducting this study was to analyze the informal traders' SPS knowledge of fruit and vegetable and compliance in the City of Tshwane. The role of the DALRRD is to enforce the Agricultural Pest Act (Act 36 of 1983) whose purpose is to avoid the introduction and spread of pests not only from one country to the other but also from one province to the other. Through the use of removal permits the Department of Agriculture Land Reform and Rural Development is aiming to regulate the movement of Agricultural products from one province to the other through surveillance programs using traps. The aim is to monitor quarantine pests and non-quarantine pests. This study focused on informal traders trading with fruits and vegetables in the four suburbs namely: Arcadia, Sunnyside, Tshwane central and Marabastad which are situated in the City of Tshwane Gauteng Province.

9.2 Conclusion

Objective 1: To assess the compliance of phytosanitary measures among the informal traders; and the presence of information synergy from the government to traders.

- According to the study's findings, informal traders' compliance was low and uncertain due to a lack of government training.
- The findings in this study area indicated that there was no collaboration between the municipality and DALRRD to address, train, and improve the knowledge, awareness, and compliance of informal traders with phytosanitary measures.
- The traders were unaware of the roles of the government's key phytosanitary offices, which all informal traders dealing in agricultural products should be aware of.

Objective 2: To assess the determinants of the knowledge level of quarantine pests of fruit and vegetable informal traders.

The Variables, trading area, stall ownership, pest surveillance, and disposal methods were found to be significant and were the main factors associated with the quarantine pest knowledge of the informal traders in the study based on the ordered logistic regression.

- The informal traders did not know the difference between quarantine and non-quarantine pests.
- The informal traders did not know about quarantine pests and their hosts meaning they would not know how to avoid infestations.
- During trading, the informal traders are limited to a small space so protecting against pest infestation is difficult.
- The majority of informal traders indicated that they do not have pest traps around their stalls and they never heard of pest surveillance before.

Objective 3: To analyse factors influencing SPS compliance among the informal fruit and vegetable traders in the city.

According to the results of the Tobit regression model, the following variables were significant and were considered to be the main factors associated with SPS compliance in the study: pest training, removal permit purpose knowledge, implementation of best practices, and product quality challenges.
- There is a lack of understanding of phytosanitary measures.
- Informal traders were unaware of the significance of the packaging material's marking requirements.
- The informal traders lacked the resources to acquire and use a better mode of transportation for product transportation.

Objective 4: To identify and analyze factors influencing the use of removal permits among the traders

For the analysis using binary logistic regression, the following variables were found to be significant: gender, age, country of origin, and pest sampling. There is no

monitoring and evaluation from the government departments that enforce compliance for informal traders.

- There is an increased demand for training in the area of removal permits.
- Informal traders lack awareness and knowledge.
- The informal traders in this research area lack the ability and knowledge to interpret a removal permit.

Objective 5: To develop a model for promoting informal fruits and vegetable traders' SPS knowledge, awareness and compliance.

- Based on the outcome of the study a framework showing the strategic areas of intervention and the linkages was developed in chapter 8 to make sure that informal traders in the city of Tshwane are compliant with the SPS and phytosanitary measures in the future.

9.3 Recommendations

Based on the findings and the results of the study a conclusion was drawn. The study makes the following recommendations:

Objective 1: To assess the compliance of phytosanitary measures among the informal traders; and the presence of information synergy from the government to traders.

Based on the results of the study the informal traders' compliance with SPS was low. It is therefore recommended that the level of compliance with SPS measures among the informal traders should be improved through training by the Municipal authority. There is also the need to improve collaboration between the municipality and DALRRD to address, train, and improve the knowledge, awareness, and compliance of informal traders with phytosanitary measures. These will enable the traders to be aware of the roles of the government's key phytosanitary offices, which all informal traders dealing in agricultural products should be aware of.

Objective 2: To assess the determinants of the knowledge level of quarantine pests of fruit and vegetable informal traders.

The Variables, trading area, stall ownership, pest surveillance, and disposal methods were found to be significant and were the main factors associated with the quarantine pest knowledge of the informal traders in the study based on the ordered logistic regression. It is recommended that training interventions informed by the above variables should be tailored made in consideration of the different suburbs and the waste management techniques employed by traders when pests are identified. Such training should make it possible for the traders to know the difference between quarantine and non-quarantine pests; know about quarantine pests and their hosts and know how to avoid infestations; encourage the traders to have their own pest traps around their stalls, and educate the traders' pest surveillance. It is also recommended that informal traders be trained to inspect their products, have inspection tools, present their stock for sampling, and ensure that the packaging used is labelled for traceability purposes. They should also be trained to observe symptoms and identify quarantine pests.

Objective 3: To analyse factors influencing SPS compliance among the informal fruit and vegetable traders in the city.

Significant variables found by the Tobit regression model analyses in the study were pest training, removal permit purpose knowledge, implementation of best practices, and product quality challenges. It is recommended that Municipality and DALRRD interventions are required to target the above variables in order to improve informal traders' SPS compliance. Informal traders could also be encouraged to inspect the product for signs of pest infestation; as well as make the traders aware of the significance of the packaging material's marking requirements.

Objective 4: To identify and analyze factors influencing the use of removal permits among traders.

The results of the binary logistic regression analyses on the above objective found the significant variables for the use of a removal permit as gender, age, country of origin, and pest sampling. It is therefore recommended that both the DALRRD and the municipality should provide training to informal traders that take the afore-mentioned

socioeconomic factors into account. There should also be monitoring and evaluation from the government departments that enforce compliance for informal traders.

Objective 5

- It is recommended that the developed framework be used to guide all stakeholders involved in product movement from one province to another to ensure compliance with SPS measures at the local level.
- It is recommended that Tshwane market agents demonstrate that they receive products with removal permits, which can be made available to informal traders upon request.

9.3 Recommendations for further studies

The primary goal of the study was to investigate informal traders' SPS knowledge of fruits and vegetables as well as compliance in the City of Tshwane. Furthermore, the study assessed the knowledge level of quarantine pests among informal fruit and vegetable traders, assessed the compliance of phytosanitary measures among informal fruit and vegetable traders, identified and analyzed factors influencing the use of removal permits among traders, assessed the level of synergy in pest control among three spheres of government (municipalities, Provincial) and developed a model for promoting informal fruit and vegetable traders.

According to the study, additional research can be conducted to determine whether City of Tshwane officials and DALRRD officials are working together to minimize the spread and introduction of quarantine pests. Another study could be conducted to determine whether City of Tshwane officials are aware of the movement of agricultural products containing quarantine pests. Those goods are being transported from one province to another without a permit. This will help to prevent the spread and introduction of quarantine pests in areas with low pest prevalence. Agricultural workshop, training, seminar, and symposium organizers must include DALRRD and the city of Tshwane municipality. Informal traders' knowledge of the importance of quarantine pests, awareness of SPS measures and comprehension of a removal permit will be improved as a result.

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ANNEXURES

1. Summary of the study variables

no	Variable code	Variable name	Variable type	Variable values	Expected sings
A 1	GEN	Gender	categorical	1-male, 2-female	+ or -
A 2	TR-AG	Trader age	Continuous	Teen,2-youth, 3-Old	+ or -
A 3	RAGR	Racial group	Categorical	1-black, 2-coloureds, 3-White 4- Indians 5- other (specify	-
A 4	NAT	Nationality	Categorical	1-South African 2- Non south African	+ or -
A5	MAR	Marital status	Categorical	1- single, 2- married, 3-divorced, 4- widow	
A 6	EDU-LVL	Education level	Categorical	1-No education 2-Primary 3-Secondary 4 Tertiary 5- post tertiary	+ or -
A 7	YRs-RES	Years residing	Continuous	1- Less than 10 years, 2- more than 10 years	+ or -
A 8	DEPEND's	Dependants	Continuous		+ or -
A9	DEPEND NO	Number of dependents	Continuous		+ or -
A10	EMP	Employment	Categorical	1- Self-employed, 2- employed	+ or -
A 11	LG	Language	Categorical	1-sepedi, 2- Zulu, 3- Xhosa, 4-Venda, 5- Tsonga, 6-Ndebele 7- other (specify)	+ or -
B1	TRAD-LIC	Product	Categorical	1-Fruits 2- vegetables 3- both 4- other	
B2	TRAD-C	Trading years	Categorical	Harassment 2-Goverment support 3- finances, 4-Training 5-(other specify)	+ or -
B3	TRAD-LIC	Trading license		0-Yes, 1-No	
B4	O-STALL	Own stall	Categorical	0-No 1- Yes	+ or -
B5	TRA-C	Trading challenges	Categorical	Harassment 2-Goverment support 3- finances, 4-Training 5-(other specify	+ or -
B6	TRA-U	Trading union	Continuous	0- Yes, 1- No	
B7	PROD –SUP	Product supplier	Categorical	1-Market, 2-Producer 3- Other (specify)	+ or -
B8	SATIS-LVL	Satisfaction Level	Categorical	1-Satisfied, 2-Slightly satisfied, 3-More satisfied,4- Neutral	
B9	SUB	Subsidy	Continuous	0-Yes, 1-No	+ or -
B10	PRC	Price	categorical	1-affordable, 2-expensive	
B11	TRAD-T	Trading time	Categorical	1-Morning, 2-during day, 3-afternoon	+ or -
B12	TRAD-F	Trading future	Categorical	0-Yes, 1-No	
C1	KNWL	Knowledge	Continuous	0-Yes, 1-No	+
C2	TECH	Technology	categorical	1- TV 2- Radio 3- Newsletter 4- Other	
C3	TRAD-S	Trading stall	Numerical	0-Yes, 1-No	
C4	TRNG	Training	Categorical	1-Never, 2-Quartely, 3-Yearly	+ or -

C5	TRNER	Trainer	Categorical	1- Government 2- Private entity 3- other	
C6	INFO	Information	Continuous	0-Yes, 1-No	+
C7	FRMT	Format	categorical	1 booklets 2- electronically 3- other	
C8	AWRN	Awareness	Categorical	1- Never, 2-Slightly, 3-More	
C9	TRP	Traps	continuous	0-Yes, 1-No	
C10	PRTCT	Protection	Categorical	1-Cloth, 2- Chemical spray, 3- cool temperature, 4-Other	
C11	RE-EXP	Reporting experience	Continuous	0-Yes, 1-No	
C12	SAF-Q	Safeguarding	categorical	1-Refrigerate,2- Cover,3-Spray, 4-Other	+ or -
C13	DSPS	Dispose	Categorical	1- Burry, 2- Throw away, 3- Do nothing	
C14	PROD-QUAL	Product quality	categorical	1- Fresh, 2-old	+
D1	COMP-LVL	Compliance level	Categorical	1-Highly compliance, 2-moderate compliance, 3 low compliance, 4 Never	+
D2	PS	Phytosanitary	Categorical	1-Inspected, 2-tested, 3- Treated, 4- processed	+ or -
D3	ISNP	Inspections	Categorical	1-always, 2- seldom, 3- never	+ or -
D4	INSP- PURP	Inspection purpose	Categorical	1-Pest 2- Quality 3- Both	+ or -
D5	TLS	Tools	Continuous	0-Yes, 1-No	
D6	SYMPT	Symptoms	Categorical	1-Easy 2- difficult 3- Slightly	+ or -
D7	UNQ-CDE	Unique code	Categorical	1-Production unit codes, 2-Pack house codes,3- Food Business codes	+ or -
D8	MARK-REQ	Marking requirements	Continuous	0- Yes, 1-No	+
D9	PROD-TRANS	Product transportation	Categorical	1-open trucks, 2-refrigerated containers, 3-covered bins, 4-other specify	+ or -
D10	CHALL	challenges	continuous	0- Yes, 1-No	+
D11	VST	Visits	Categorical	1-Weekly 2- Monthly 3- Never	
D12	SAMP	Samples	continuous	0- Yes, 1-No	
E1	KNWL	knowledge	continuous	0- Yes, 1-No	+ or -
E2	UND-STD	understanding	continuous	0- Yes, 1-No	+ or -
E3	P-EFFCT	Permit effect	continuous	0- Yes, 1-No	+ or -
E4	NO-PRMT	No permit	Categorical	1- No money, 2- Nobody told me, 3- nobody requested it	+ or -
E5	ADV	Advice	Categorical	1. Never 2- Seldom 3- Always	+ or -
E6	AR	Area	Categorical	Gauteng or Other	+
E7	REQ	Request	Categorical	1- always, 2-Never	+ or -
E8	CST	cost	Categorical	1- I do 2- I don't	
E9	IDE	Idea	Categorical	1-government, 2- farm, 3- Market	+ or -
E10	Val	Validity	Categorical	1-Per consignment, 2-monthly,3- yearly	+ or -
E11	INTER-SK	Interpretation skill	Continuous	0- Yes, 1-No	+

F1	IFO	information	Continuous	0-Yes, 1-No	+
F2	EXP	Experience	Categorical	1-No experience 2-experienced	+ or -
F3	WRK-SHP	Workshops	categorical	1- Available, 2-non Available	+ or -
F4	SYM	Symposiums	categorical	1- Available, 2-non Available	+ or -
F5	RD-SHOW	Roadshow	categorical	1- Available, 2-non Available	+ or -

2. Possible timelines for the research

Dates	Activities
February 2019	Proposal finalization
April 2019	Presentation of the proposal
August 2019	Proposal corrections and data collection instrument design
October 2019	Unisa Ethics application
December 2019	Data collection preparation
January - August 2020	Data collection (fieldwork)
October -December 2020	Data analysis
March 2021	Write up
February 2022	Submission of the thesis

3. Budget

Research activities	No of units	Price per unit	Total
Registration	1	R16 500	R16,500
Copying	6	R140	R840
Methodology textbook	1	R660	R660
Language editing	1	R14,500	R12,500
Printing	1	R8000	R8000
Transport	1	R10, 800	R10,800
Laptop and Statistical analysis	1	R23,000	R21,000
Research enumerators/ assistants	2	R7,000	R14,000
Binding	6	R350	R2,100
Other: specify Lettering character	1	R900	R900.
Conference attendance: Travel costs, conference fees	1	R12, 000	R12,000
TOTAL			**R103,300.00**

4. QUESTIONNAIRE

COLLEGE OF AGRICULTURE & ENVIRONMENTAL SCIENCES

(UNISA)

DEPARTMENT OF AGRICULTURE AND ANIMAL HEALTH

Questionnaire number (_____)

Analysis of informal trader's knowledge and compliance level in fruit and vegetables Sanitary and Phytosanitary measures in the city of Tshwane, South Africa

The information obtained herewith is confidential. The name and address of respondents will not be divulged for any purpose other than for the monitoring and evaluation of this research. Names of the participants will not be linked to the information that is gathered and are required for the purpose of this research only.

A0. Area/suburb of trade

Suburb	Tick
Arcadia	01
Sunnyside	02
Pretoria central	03
Marabastad	04
Other	05

Interview details

Interview date	
Interview time	

Interviewer and data-capturer details:

Name	

Information of study

My name is Pheladi Macdonald Moloto. I am conducting research towards a PhD degree in Agriculture in the Department of Agriculture and Animal Science. I will be asking Informal traders questions on Agricultural quarantine pests. The study aims to determine the knowledge of the fruits and vegetable informal traders on quarantine pests, phytosanitary measures as well as removal permits.

Participation is voluntary. Please note that you are not being forced to take part in this study. There is no penalty or loss of benefit for non-participation. You are free to withdraw from this study at any time without giving a reason, however, you can't withdraw after the completion of the signed questionnaire. If you decide to participate you will be requested to complete the questionnaire and sign the enclosed consent form. Only the researcher, supervisors and statistician will have access to the questionnaire responses. This report may be presented at an academic conference and submitted for publication.

The completed questionnaire will be safeguarded by the researcher until the competition of the study then it will be destroyed. This study has received written approval from the municipality of Tshwane and the College of Agriculture and Environmental Science from UNISA. If you would like more information about this study please feel to contact UNISA.

Declaration of researcher
I <u>Pheladi Macdonald Moloto</u> hereby declare that I have explained to the respondent that he or she is participating freely in this research. I have also explained to the respondent that he or she may stop this interview at any point and that this decision will not affect them negatively. I have explained to the respondent that the answers he or she provides during the interview, will remain confidential.   ……………………………   ……………………………. Signature of Researcher   Date

Respondent name: _____

Date: _____

A1. Gender

1-Male	
2-Female	

A2. Age (actual) ……………………………………….

1. 18-20	
2. 21-29	
3. 30-39	
4. 40-49	
5. 50-59	
6. 60-69	
7. 70-79	
8. 80 or older	

A3. Racial group

1. Caucasian/White	
2. African/Black	
3. Indian	
4. Mixed Ancestry/Coloured	

A4. Country of origin

1. South African	
2. Non South African (Specify)	

A5. Marital status

1. Single	
2. Married	
3. Divorced	
4. Widow	

5. Other	

A6. What is your highest level of education?

Grade/standard (years) …………………

1. Never been to school	
2. Primary	
3. Secondary	
4. National certificate	
5. Tertiary qualification	

A7. How long have you been staying in the City of Tshwane?

……………… years (actual)

1. Less than 5 years	
2. 5 years to 10 years	
3. 10 years to 20 years	
4. More than 20 years	

A8a. Do you have any dependents?

(a) Yes	
(b) No	

A8b. How many …………………….

A9. How many working members in the family?

……………………………..

A10. What is your most important source of income?

1. Street vending	2. Other, specify

A11. Form of employment?

1. Self employed	
2. Employed	

A12. Working Status

1. Part-time	
2. Fulltime	

A13. Income received (actual)

1. Daily	
2. weekly	
3. Fortnight	
4. Monthly	

A14. Home language

1.N.Sotho	2.Sotho	3.Tswana	4.SiSwati	5.Ndebele	6.Venda	7.Tsonga	8.Zulu	9.Xhosa	10.English	11.Afrikaans
12. Other										

SECTION B: Logistics and Operational Issues

B1. what are you trading with?

1. Fruits	
2. Vegetables	
3. Both	

B2. How long have you been trading on the streets?

………………….. Years (actual)

1. Less than 1 year	
2. 1-3 years	
3. 4-6 years	
4. 7-9 years	
5. 10 years or more	

B3. What is the most selling product?

1. Fruits	2. vegetables	3. Both

B4. what is amount of most selling product per unit?...(actual)

1. Less than R5	2. Between R5 an R10	3. More than R10

B5. Do you have trading license from municipality?

1. Yes	
2. No	

B6. Do you own a selling Stall?

1. Yes	
2. No	

B7. Any challenge during street trading?

1. Yes	Political	Social	Financial
2. No			

B8a. Do protests affect your business?

1. Yes	
2. No	

B8b. If yes, please elaborate ……………………………………………………………………………

B9. Do you feel safe while conducting business on the street?

1. Yes	
2. No	

B11. Do street vendors look out for each other?

1. Yes	
2. No	

B12. How do you deal with competition from other street vendors?

1. Reduce price	2. Sell in bulks	3. Sell in credit	4. Other, Specify

B13. Are you a member of any trading union?

1. Yes (please provide name)	
2. No	

B14. How does your union assist you?

……….

B15. Do show share information about street vending with other street vendors?

1. Yes	
2. No	

B16. Where do you source /buy your products?

1. Market	
2. Growers	

B17. Is your supplier always the same?

1. Yes	
2. No	

B18 Where is your supplier situated?

1. In towns	
2. Out of town	
3. Other province	

B19. Are you satisfied with the product you buy?

1 . Neutral	2. Slightly satisfied	3. Satisfied	4. More satisfied	5. Not satisfied at all

B20. Do you have access to finance?

1. Yes	
2. No	

B21. Have you approached financial institution for finance?

1. Yes	
2. No	

B22. Do you receive any subsidy or assistance from government?

(a) Yes	
(b) No	

B23. Are you making profit?

1. Yes	
2. No	

B24. Best time to trade?

(a) Morning	(b) During the day	(c) Evening

B25. How many hours you work daily? ……………………(actual)

1. 1- 3 hours	2. 3 – 6 hours	3. more than 5 hours

B26. How many days you work a week?.............................(actual)

1. Less than 3 days	2. 3 – 6 days	3. Full week

B27. Do you see yourself still street trading in the coming 3 years?

1. Yes	

2.	No	
3.	Not sure	

If No, please give reason why?

(a) No money	(b) Safety	(c) Politics

B28. Will you encourage new vendors to trade on the streets?

1.	Certainly	
2.	Uncertainly	
3.	I don't know	
4.	Not at all	

B29. If uncertainly, please give reason why?

(a) Politics	(b) Safety	(c) Finance	(d) Other (specify)

B30. What change in your livelihood do you desire in this business?

1.	Find another job	
2.	Formalize the current business	
3.	Expand the business	
4.	Other, Specify	

SECTION C Knowledge of Quarantine pests of fruits & vegetables

C1. Do you know about the quarantine pests of fruits & vegetables?

1.	Yes	
0.	No	

C2. How did you know about quarantine pests?

(a) Television	(b) Radio	(c) Newsletter	(d) Word of mouth	(e) other

C3. Have you ever received training on identification of pests?

1. Yes	
0. No	

C4. Who provided the training?

1. Government	
2. Private entity	
3. None	
4. Other (specify)	

C5. Do you have information to Pests Infestations?

1. Yes	
0. No	

C6. Where do you access the pests information?

1. TV	2. Radio	3. Social media	4. Other (Specify)

C7. Do you have access to awareness pamphlets?

1. Yes	
0. No	

C8. Do you have pest's traps around your fruit stall?

1. Yes	
0. No	

C9. Have you ever heard of pest's surveillance in the city?

1. Yes	

0. No	

C10. How often is the surveillance done?

1. Weekly	2. Monthly	3. Quarterly	4. Semester	5. Yearly
6. No idea				

C11. How do you protect your products from pest's infestation?

1. Cover by cloth	
2. Spray chemical	
3. Store under cold temperature	
4. Other method (specify)	
5. Store in cool temperature	

C12. How does heat waves affected your business?

1. Slightly affected	2. Moderately affected	3. Serve affected	4. Not affected

C13. Does flooding affected your business?

1. Yes	
0. No	

C14. If you see a pests do you know what to do?

1. Report it	
2. Destroy it	
3. Collect and send to the laboratory	
4. Repel it	
5. Other (specify)	

C15. How do you dispose the spoilt products?

(a) Burry them	(b) Throw away	(c) Do nothing

C16. Do you recycle wasted products?

1. Yes	

0. No	

C17 Amount of money lost due to spoilage per month………………………..(actual)

1. Less than R500	2. More than R500	3. R1000 and more

C18. Do you have contact with any departments of Agriculture?

1. Yes	
0. No	

C19a. Do you receive service from the government departments?

(a) Always	(b) seldom	(c) Never

C19b If Yes, what kind of Service?

1. Training	
2. Monitoring	
3. Cleaning	
4. Other	

C20. which communication channel does you use frequently to receive new information about pests?

1. WhatsApp	2. Email	3. Facebook	4. Twitter	5. Other, specify

SECTION D: Phytosanitary measures

D1. What is your understanding about the phytosanitary measure?

1. Plant health regulation	
2. Food safety	
3. Animal health	
4. Nothing	

D2. Does your product comply with phytosanitary measure?

1. Yes	
0. No	

D2. Which Phytosanitary Measures do you practice?

1. Inspection	
2. Testing	
3. Treating	

D3. Which authorized personnel inspect your products?

1. Quality inspector	2. Plant health inspector	3. Other

D4. How often do you inspect products that you buy?

(a) Always	(b) Seldom	(c) Never

D5. If you do inspect, what do you inspect for?

1. Pests	
2. Quality	
3. Both	
4. Other (specify)	

D6. Do you have inspection tools?

1. Yes	
0. No	

D7. Which tool do you have?

1. Magnifying glass	
2. Knife	
3. Other: Specify	

D8. Can you observe symptoms of pests' infestation?

1. Easily	
2. difficulty	
3. Slightly	

D9. Which unique code does your products have?

1. Production unit code (PUC)	
2. Pack-house code (PHC)	
3. Food business code (FBO)	
4. None	

D10. Does the packaging have marking requirements?

1. Yes	
0. No	

D11. How do you transport your products?

1. Use open trucks	
2. Refrigerated trucks	
3. Truck with canopy	
4. Other	

D12. Distance travelled to your supplier?........................(actual)

1. 0 - 50 km	2. 51 - 100 km	3. 101 - 150 km	4. More than 150 km

D13. Amounts spend on transporting the stock?.....................................(actual)

1. R50 – R300	2. R300 – R600	3. More than R600

D14. Do you experience any challenges when buying products?

1. Yes	
0. No	

D15. Which challenges do you experience when buying your products?

(a) Low quality	(b) Infested products	(c) Less graded products	(d) Other Specify

D16. How often does government official visit your stall to do inspection and take sample for testing?

(a) Weekly	(b) Monthly	(c) Quarterly	(d) Never

D17. if they come, which products do they take samples of?

1. Fruits	
2. Vegetables	
3. Other: Specify	

Section E. Removal permit for plant and plant products

E1a. Do you know what a removal permit is?

1. Yes	
0. No	

E1b. IF yes please elaborate

E2a. Do you understand the purpose of using removal permit?

1. Yes	
0. No	

E2b. IF Yes, please elaborate …………………………………………………………………………

E3 Can removal permit affect your business?

1. Yes	

2. No	
3. I don't know	

E4. Do you have removal permit?

1. Yes	
0. No	

E5. Reason for not having removal permit

1. No money	2. No one told me about it	3. Nobody requested it	4. Other

E6. Have you ever been advised to acquire a removal permit?

1. Yes	
0. No	

E7. When you buy your product do you receive a copy of removal permit?

1. Yes	
0. No	

E8. If you receive a removal permit does it indicate origin of the products?

1. Yes	
0. No	

E9 Do you know from which province is your products?

1. Gauteng Province	
2. Limpopo	
3. Mpumalanga	
4. Other	

E10. Did the municipality officers ever asked you about a removal permit for the products?

1. Yes	
0. No	

E11. Do you have idea where to apply for a removal permit?

1. Yes	
0. No	

E12. Do you know how much it cost to get a removal permit?

1. Yes	
0. No	

E13. How long is the Removal permit valid for?

1. Month	
2. Per purchase	
3. Yearly	
4. No idea	

E14. Can you interpret a removal permit?

1. Yes	
0. No	

Thank you very much for taking time to participate and complete the questionnaire.