Cape Peninsula University of Technology

An economic and investment analysis of apiculture in the Cape Winelands District Municipality, South Africa

By

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DECLARATION

I, **Mzwanele Lingani**, declare that the content of this thesis represents my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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Signed **Date**

ABSTRACT

In recent years, the global bee population has been on the decline due to challenges such as shortage of forage caused by an increase in new housing developments, and an increased use of pesticides on forage. There is therefore a need to understand the economic contribution and investment appraisal within different beekeeping systems in South Africa. Literature has shown that beekeeping provides positive returns in other countries. The study sought to conduct an investment and economic analysis of beekeeping in the Cape Winelands District Municipality in the Western Cape Province of South Africa. The aim was to establish viable options among the production systems and establish the production category that generates the highest net margins. Data was collected from 51 beekeepers from six local municipalities of the Cape Winelands District Municipality using questionnaires. Beekeeping farms were categorized into three, according to the number of beehives owned (150, 500 and 1 000 beehives per farmer). Gross margin analysis for honey, pollination and the combination of both honey and pollination services revealed that beekeepers with 150 beehives achieved a return on variable costs of 57.34%, 114.22% and 365.60% respectively. Likewise, the return on gross margin analysis for the combination of honey and pollination services for 500 and 1 000 beehives resulted in 216.35% and 180.52% respectively, which conformed to the findings of previous studies. The net present value (NPV) for the split production of honey and pollination for 150 beehives was -R923 051.75 and -R595 680.18 respectively, with an undetermined internal rate of return (IRR) and payback period due to indefinite negative cumulative net cash flow. However, the NPV for the combination of honey and pollination was R143 367.40 with an IRR of 17.70% and a payback period of 3.14 years. For 500 and 1 000 beehives, the NPV was R361 091.17 and R2 074 082.94, with an IRR of 17.67% and 34.95% and a payback period of 3.15 and 2.22 years, respectively. The findings suggest that the split production of honey and pollination services is only profitable for 500 and 1 000 production units, whereas the combination of honey and pollination yields positive profits for all three production units. Beekeepers are advised to combine honey production and pollination services for positive return on investment. Additionally, further research can be conducted on the economic contribution of the sub-sector to the GDP of the country including gross value addition.

Keywords: Apiculture, Cape Winelands, investment, economic contribution, net present value

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DEDICATION

This thesis is dedicated to all those who have contributed directly and indirectly in my life. Firstly, this work is dedicated to my late parents, Siphiwo and Nombuyekezo Lingani. May their souls continue to rest in peace! Secondly, this thesis is dedicated to the Lingani family (AmaXesibe) in Engcobo. Lastly, this thesis is dedicated to myself for never giving up even though it was tough at times to balance academic work and my salaried employment.

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LIST OF ACRONYMS

CASP	-	Comprehensive Agricultural Support Programme
CPUT	-	Cape Peninsula University of Technology
DALRRD	-	Department of Agriculture, Land Reform and Rural Development
EU	-	European Union
GDP	-	Gross Domestic Product
GH₵	-	Ghanaian Cedi
GM	-	Gross Margin
IRR	-	Internal Rate of Return
NAMC	-	National Agricultural Marketing Council
N	-	Naira
NFI	-	Net Farm Income
NPV	-	Net Present Value
R_s	-	Nepalese Rupee
SABIO	-	South African Bee Industry Organisation
SARS	-	South African Revenue Service
SBCA	-	Southern Cape Bee-Industry Association
SPSS	-	Statistical Package for the Social Sciences
UK	-	United Kingdom
USA	-	United States of America
US	-	United States
WCBA	-	Western Cape Bee Industry Association
WCDOA	-	Western Cape Department of Agriculture

CHAPTER ONE: INTRODUCTION

1.1 Background

Sain and Nain (2017) define beekeeping or apiculture as the art or/and science of harvesting and processing of honeybee colonies of desired species. Honeybees are kept in customised or standard boxes at appropriate sites and several colonies are managed all year round for production of honey and the provision of pollination services. The indigenous wild bees known as *Apis mellifera* or honeybees are kept by humans for commercial honey production and pollination services. The bees need pollen and nectar to sustain colonies and the excess honey is harvested by beekeepers (Johannsmeier, 2016). In South Africa, beekeepers manage only two indigenous species of bees, namely *Apis mellifera capensis* and *Apis mellifera scutellata,* and both species differ in geographic distribution and behaviour (Masehela, 2017)**.** The management of *scutellata* (North of the boundary) and *capensis* (South of the boundary) bee species in South Africa is separated by a boundary line which runs from the Atlantic Ocean north of the Western Cape near Vredendal, through parts of the Northern Cape and then through the north of the Eastern Cape until it reaches the Indian ocean at Willowvale (Department of Agriculture, Forestry and Fisheries, 2013).

According to the Department of Agriculture, Forestry and Fisheries (2011), honeybees produce honey which is used for various purposes such as cooking, baking, as a replacement for sugar and jam, with most of it used for medicinal purpose. South African honey production was estimated at 1 500 tons in 2006; however, there was a demand of between 2 700 to 3 000 tons, with the difference being imported (Macaskill, 2016). Natural honey importation has increased between 2000 and 2018 from 399 tons to 4 400 tons (Quantec, 2019). This shows that the demand for honey has over the years increased drastically as the import value in 2018 was R87 million. The estimated import price per kilogram of R19.88 in 2018 is far cheaper than the domestic prices, due to its low quality as it is believed that imported honey, especially from China, is not 100% pure honey. National Agricultural Marketing Council (2008) noted that the value of honeybee products in South Africa is estimated at R100 million with direct employment of 3000 people. Apiculture includes four different categories of beekeepers, namely hobbyists, bee-removers, professional and commercial beekeepers.

The National Agricultural Marketing Council (2008) notes that in 2005 there were more than 2 000 beekeepers in South Africa: 2 000 hobbyists (owning 1-100 beehives), 150 commercial (owning 100-1 000 beehives) and 20 professional beekeepers (owning 1 000-7 000 beehives). The contribution of honeybees to the South African economy under the management of beekeepers has resulted in positive benefits such as the provision of pollination services, which results in the reproduction of flowers, through to the production of honey used for human consumption. Kanniainen *et al.* (2013) notes that even though there is

a limited role for honey in the consumer's consumption basket, everyone depends on pollination services as they are said to increase the yields of many crops.

According to the Department of Agriculture, Forestry and Fisheries (2019), about 2 550 apiarists are registered in South Africa, working with 176 215 colonies. The number improved from 105 000 colonies as reported in 2016 (Department of Agriculture, Forestry and Fisheries, 2016). The statistics show that even though there was an occurrence of American Foulbrood disease and a reduction in colonies in the Western Cape, other provinces have not been affected. Langenhoven (2018) indicates that in South Africa, the amount of honey harvested per hive is very small compared to other countries in the southern hemisphere. The decrease in kilograms harvested is due to the unavailability of forage. Furthermore, due to drought and the shortages of forage, there is a need for apiarists to have alternative feed for their bees which increases the cost of management of these insects (Masehela, 2017).

The Food and Agricultural Organisation (2018) states that approximately 75% of fruit and seed crops globally depend on pollination for sustained quality production and yield. In the past, pollination was provided by nature at no cost, but an increase in food demand has resulted in increased demand for these insects. However, due to the changes in farming practices and the use of chemicals, the honeybee population declined drastically. Gallai *et al*. (2009) calculated R2.4 trillion as the economic value of global pollination, which in 2005 represented 9.5% of agricultural production for human consumption. It was noted by Kanniainen *et al*. (2013) that there was a decline of 29% for 2008 and 2009 respectively in the number of colonies, which might have affected not only honey production but also production of certain crops as the latter depends on bees.

Honeybees provide returns to apiarists from three different sources such as natural honey sales, provision of pollination services to crop farmers and other honeybee-related products. A study conducted by Lee *et al*. (2017) indicated that in 2016, pollination services accounted for about 41.1% ($338 million) of beekeepers' income in the United State of America followed by honey production. This contributed $336 million, and 18.1% ($149 million) of sales accounted for other related honey products. Lee *et al*. (2017) further assert that those beekeepers who concentrate on pollination services harvested a small amount of honey. The figures show that there has been a shift of focus by beekeepers as pollination services have contributed a much larger share of income compared with sale of natural honey. Interestingly, a study conducted by Devkota *et al*. (2016) in Nepal revealed that 100% of beekeepers in the district of Chitwan managed honeybees exclusively for the production of honey, with only 50% mentioning that they were aware of pollination services.

Even though beekeeping seems to generate positive margins in other countries, in South Africa, it is becoming more problematic for small-scale and commercial beekeepers to make a profit due to the increase in input prices, especially fuel, coupled with prices for natural honey which have not increased proportionally. Lundall-Magnunon (2018) further added that retail stores add more pressure on beekeepers by selling cheap imported honey which lowers the price of locally produced honey. Most studies have documented challenges faced by beekeepers such as the decline in colonies due to the use of pesticides and climate change, together with cheap honey imports (85%) from China, and the unavailability of forage. There is limited to no information regarding production figures in South Africa, especially about the return on investment in the apiculture whether through pollination, honey or related honey products. The question therefore remains about the viability of apiculture in South Africa, given the adversities mentioned.

1.2 Problem statement

Bee populations around the world have declined compared to the 1980s, and with the problems currently faced by the industry, such as unavailability of forage caused by human population density, new housing development, fungus and diseases, one needs to understand the current economics associated with the investment in the sector. In this regard, the Western Cape Department of Agriculture (WCDoA) has commissioned Agrifusion to look at the sustainability of the honeybee population and beekeeping in the Western Cape in view of the adversities already mentioned. Agrifusion (2017) found that there were 1 828 beekeepers managing 137 872 colonies in South Africa, which increased by 28% in 2019 (Department of Agriculture, Forestry and Fisheries, 2019); but interestingly for the Western Cape, the number of beekeepers has decreased by 64%.

Agrifusion (2017) in the same study noted that there has been a shift in beekeeping farming systems, as beekeepers worked to a ratio of 50:50 (meaning that 50% of beehives were used for pollination whereas the other 50% was used for honey production) with a forecast target of 80:20 respectively by 2030. The Western Cape Department of Agriculture through the Comprehensive Agricultural Support Programme supported 17 beekeepers from 2013 – 2018 with a total amount of 2 447 beehives scattered throughout Overberg, Cape Winelands, Little Karoo and Garden Route regions (Western Cape Department of Agriculture, 2019a). Following the continued investment in beekeepers and the decline of colonies, together with limited information on the economics of bees, there is a need to conduct an investment and economic analysis associated with keeping bees for honey and pollination services to determine the viability of apiculture.

1.2.1 Objectives of the study

The study aims to conduct an economic and investment analysis of beekeeping in the Cape Winelands District Municipality of the Western Cape. More precisely, the study has five objectives, which are to:

- Determine the gross margin and specified margin of beekeeping farms associated with honey production, pollination services and honey products.
- Determine the different cost structures associated with beekeeping and calculate the net present value over a period of 5 years for different categories.
- Determine the sensitivity analysis of different production beekeeping systems for risk purposes.
- Describe social, economic and business entity characteristics of beekeeping farms.
- Determine the correlation between production system and turnover.

1.2.2 Research questions

- What are the gross margin and specified margin related to apiculture?
- What are the cost structures and net present value related to beekeeping over a period of 5 years?
- What is the sensitivity of quantity and price changes to gross margin given different production beekeeping systems?
- What are the socio-economic and business entity characteristics of beekeeping farms?
- Is there a correlation between beekeeping production system and turnover?

1.3 Justification of the study

In many cases, particularly in research carried out in South Africa, the focus is on the technicalities of beekeeping production, and there has been quite thorough research on pollination services and their contribution to the national economy. However, there has been no study that looked at the viability of different production systems of apiculture. There has been no research that tabled the total capital expenditure for a certain number of hives, and while there is an assumption from a draft report from Casidra that one needs at least 350 beehives to be viable, this assumption has not been proved.

Moreover, when beekeepers request funding especially from the Western Cape Department of Agriculture, they generally do so based on this assertion in listing the number of beehives they need, even though there is no quantitative research to support it. This therefore means that there is a need for a researched economic and investment analysis of different production

systems in the apiculture industry. This study therefore assists apiarists, the industry, and government investment decision-making related to beekeeping production by providing a relevant economic guideline.

1.4 Delineation of the study

The study only focuses on small-scale and commercial beekeeping businesses located in the Cape Winelands District Municipality. It focuses on businesses that produce honey and/or pollination services, and sell related honeybee products, including processing if necessary. The study conducts an economic and investment analysis only of beekeeping farms located in the Cape Winelands region. A questionnaire is utilised for the collection of data with each respondent completing it individually; the information cannot be generalised to other regions of South Africa.

1. 5 Organisation of the study

The study consists of six chapters, of which chapter one provides some background on beekeeping in general and the rationale behind the study, including the problem statement, and the research objectives and questions. The second chapter presents theoretical considerations based on a review of the related literature. A discussion of the study area, methods and instruments used in the research study are presented in chapter three. Key findings and discussion are presented in chapter four and five, while conclusion and recommendations are discussed in chapter six.

CHAPTER TWO: REVIEW OF THE RELATED LITERATURE

2.1 Introduction

The context of the study is provided in this chapter by first looking at previous research conducted on investment and economic analysis of apiculture. Additionally, the overview of the beekeeping industry is discussed in detail to understand the South African beekeeping industry including its formation. The global trade of honey, including South Africa's share or rank and beekeeping production and profitability in also discussed. Lastly, the chapter discussed investment techniques and profitability estimation.

2.2 Related research on beekeeping

Although not many studies have been conducted on investment and the economic analysis of beekeeping, a few studies in the field are part of this literature review. A study of beekeeping as an optional source of livelihood in Uganda (Ahikiriza, 2016) made use of secondary data on 163 beekeepers. It found that 75% of beekeeping income from the respondents was derived from honey, whilst beeswax and propolis accounted for 24% and 1% respectively. Furthermore, 49% of respondents noted that they produce honey for both sales and consumption, whereas 47% reported that they produce honey for only sales. Around 46% of the 163 beekeepers noted that they produce honey for home consumption. It was further reported that honey production contributed 75% of the total beekeeping income. Beekeepers managed on average 21 beehives and only 21% of the respondents reported that they owned Langstroth hives. The study listed beehives, gumboots, beekeeping suit, gloves and a smoker as items owned by beekeepers whist post-harvest equipment was not common among the respondents.

Secondly, a study by Abejew and Zeleke (2017) found that out of 260 beekeepers interviewed in Ethiopia on honeybee production characteristics and behaviour, 66% of the respondents harvested honey once in a year. It was further reported that 20% and 14% harvested honey twice or three times per year respectively, depending on where the apiaries were located. It was found that beekeepers needed to have accurate knowledge about the correct time for honey harvesting to prepare and plan for technical support for beekeepers who did not own equipment and tools. Lastly, the apiarists interviewed harvested honey between October and November as this was the peak period for many flowering plants.

A study by Breeze *et al.* (2019) collected data on crop pollination preferences from 1 708 beekeepers and 426 crop farmers in ten European countries. The results indicated that 71% of the interviewed beekeepers were hobbyists, while the rest (29%) were professional beekeepers. This is similar to the Western Cape as a database kept by the Department of

Agriculture, Land Reform and Rural Development indicates that 41% of beekeepers are hobbyists with the rest being bee removers, and small-scale and commercial beekeepers (Department of Agriculture, Forestry and Fisheries, 2019). The respondents (Breeze *et al*., 2019) reported that they managed on average 71.5 hives, with 14.3 years average experience. It was found that there was a positive correlation between experience and the number of beehives owned.

It was interesting to note that the respondents in the study by (Breeze *et al*., 2019) listed a total of 80 different crop types for which they avoided providing pollination services. The apiarists point out that yield, accessibility and the availability of the crop were the main driving factors, amongst others, for this avoidance. In addition, beekeepers noted that they avoided certain crops due to the use of pesticides, toxicity of the nectar and lack of payment by crop farmers. The beekeepers interviewed also noted that they would keep more beehives if yields were greater and forage for the sustenance of colonies was more available.

Pokhrel (2009) interviewed 65 beekeepers in a Nepalese district. The study compared gross income from crop production and beekeeping. The findings showed that the respondents received income from honey sales, wax production and pollination. It was also reported that crop pollination resulted in a 10% to 40% increase in the yield of certain crops. Moreover, respondents harvested honey twice to seven times per year (average of 3.9 times) with a mean yield of 28.7 kilograms per colony. It was found that 72.3%, 20% and 7.7% of apiarists marketed raw, filtered and processed honey respectively. A higher income (78.35%) was found to be derived from beekeeping than the 21.65% that was derived from the production of crops, which shows that beekeeping was a better enterprise than crop production in terms of gross income.

Kalanzi *et al.* (2015) found that beekeeping was mostly practiced by males (93.9%) as compared to 6.1% of females; 56.3% of apiarists in the study had experience of less than 10 years. The majority of beekeepers still made use of traditional hives. Beekeepers interviewed sold raw honey, and there was a small number of commercial processors. It was further found that 69.8% of beekeepers received prices which were insufficient for the high quality of honey produced, which resulted in adulteration of the honey. The study also listed pests, lack of equipment, low honey prices and the use of chemicals as the main constraints to the beekeeping value chain (Figure 2.1). According to beekeepers, the intermediaries were constrained by difficulties in transport, non-cash payments and low yield of honey, whereas the processors were constrained by adulteration, expensive equipment and an unreliable supply of honey (Figure 2.1). A study in Uganda by Mujuni *et al.* (2012) also listed lack of equipment, bad weather, pests, chemicals and transport as challenges faced by apiarists.

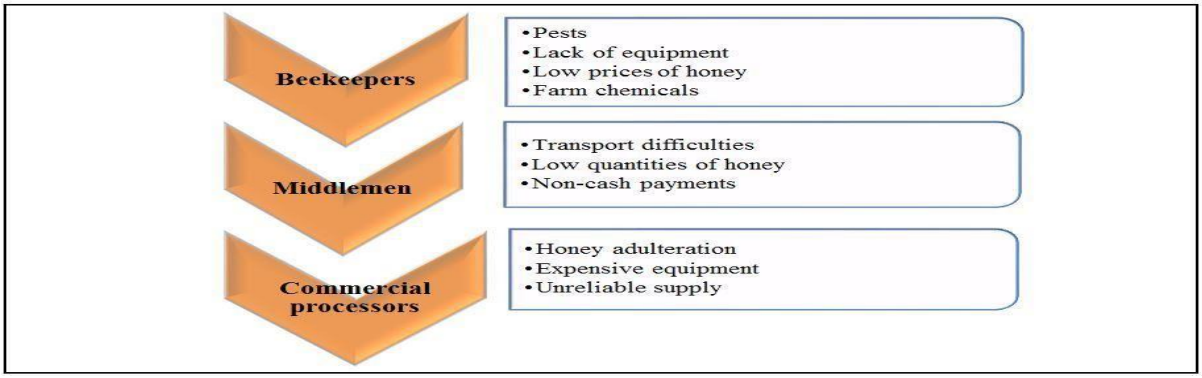

Figure 2. 1: Challenges faced by different players in the honey value chain in Uganda
Source: Kalanzi *et al.* (2015)

Mwakatobe *et al*. (2016) found that the participation of Tanzanian youth and women in beekeeping was 20.9% of 110 beekeepers interviewed. The results further highlighted that there was no instance where youth and women were involved in beekeeping without the assistance of men. It also noted that lack of capital, skills and knowledge were the driving factors that hindered youth and women from participating in beekeeping. It was further found that investment in beekeeping led to the purchase of other assets such as houses, motor bikes and radios, which affirmed the significant contribution of beekeeping to household economies. Additionally, beekeeping income was used for the payment of school fees, medical services, food and clothing.

With regards to investment and returns, it was reported by Aboud (2014) that out of 12 beekeepers interviewed in Ghana, 61.6% were found to source capital for beekeeping from personal savings and borrowing. The respondents also reported that they made use of family for manpower in the beekeeping business. For the estimate of gross returns and return on investment, the study made use of the gross margin and net returns whereby total revenue was subtracted from the total cost of the enterprise whilst the gross margin was calculated by deducting the direct cost from gross sales. The average total fixed cost for a 10-beehive enterprise was found to be GH₵177.68 (Ghanaian currency), equivalent to R521.83 (currency conversion as of 28 August 2020). The total variable cost and total cost of an enterprise was calculated to be GH₵692.50 and GH₵870.18 respectively, which converts to R2 033.80 and R2 555.62 in South African currency respectively. The return on investment was found to be 281.07%, which was a viable option regardless of the number of hives managed.

Similarly, 96 beekeepers were interviewed in Sudan with the objective of estimating honey yield from four different types of tree species, namely *Acacia seyal, Acacia nilotica, Ziziphus spina-Christi and Eucalyptus spp*. In addition, the study estimated return on investment per hectare in US dollars. The findings showed that the average yield from four different tree

species was 13 kilograms. *Acacia seyal* was found to be more productive in terms of yield out of the four tree species. From the four different species, it was reported that the average number of hives per hectare was estimated at 15 with an average honey price of $4 per kilogram. *Acacia nilotica* was found to have the highest return on investment (69%) of the four species even though it had the third-highest yield (Elzaki & Tian, 2020).

Most countries in Africa and Asia are still making use of the traditional method of honey production (A method where tree trunk or logs are used as beehives). This is evident from various studies that compared the impacts and economic returns in producing honey from traditional and modern hives (Irungu *et al*., 2016; Al-Ghamdi *et al*., 2017; Onwumere *et al*., 2012). Most studies have shown that modern hives using modern methods for honey production yield more honey than traditional methods. Al-Ghamdi *et al.* (2017) found that modern hives were 72% productive than traditional hives. Modern hives yielded 6.6 kilograms per year while traditional hives yielded 3.7 kilograms. Findings by Onwumere *et al.* (2012) found that revenue generated from traditional hives was 32% less than that of modern hives.

2.3 An overview of the beekeeping industry in South Africa

The production of honey in South Africa is estimated at an annual turnover of R3.2 billion with a total production annual yield of 2 000 tonnes (South African National Biodiversity Institute, n.d.). According to the European Commission (2017), the world's largest honey producer is China with an estimated yield of more than 400 000 tonnes, followed by the EU with 600 000 beekeepers and 17 million hives producing 250 000 tonnes of honey each year. Global market performance according to Workman (2019) shows that South Africa ranks 52nd on honey exports with an annual amount of $2.4 million; the country imports about 3 986 tonnes of honey each year from China. The National Agricultural Marketing Council (2008) estimated that the value-add of the pollination services by honeybees to the fruit industry is estimated at R189 million yearly and this would further be increased if other crops were to be added on the calculation; this figure equates to 6.3% of what is received by the beekeepers for this service.

It is estimated that there are more than 2 000 beekeepers in South Africa managing a total of 106 000 beehives, with 20 of these being professional beekeepers managing 1 000 – 7 000 hives and a total of 37 000 colonies (National Agricultural Marketing Council, 2008). The Marketing Council further estimates that there are 150 commercial beekeepers managing between 100 and 1 000 beehives with 43 000 colonies, and lastly more than 2 000 hobbyists with an estimated 26 000 beehives; these beekeepers manage 1 to 100 colonies. Between 2016 and 2019 there was an increment of 48.8% in the number of beekeepers in South Africa: the number increased from 1 246 to 2 550 registered beekeepers managing a total of 79 901

and 176 215 colonies between 2016 and 2019 respectively (Department of Agriculture, Forestry and Fisheries, 2016; 2019).

2.4 South Africa's export profile compared to the world's honey exporters

According to Phaleng (2016), the world's top ten honey exporters account for about 62% of the global world exports in terms of value. Figure 2.2 shows that China's export value stands at $249.3 million, followed by New Zealand with a difference of just $3.1 million. Argentina has an export value of $175 million whereas Brazil accounts for just over $95 million, while south African exports are valued at just over $2.4 million, which is not significant enough as South Africa is the net importer of honey. Four of these world's top 10 honey exporters are in Europe, two each in Asia and South America, with one country in Oceania and in North America. China was the largest producer of honey in 2006, with a production of natural honey of 306 500 tonnes and a global share of 23%, followed by Argentina with a global production share of 7% and production yield of 93 415 tonnes annually (National Agricultural Marketing Council, 2008). Canada, Ethiopia and Iran, which were not among the current world export leaders in 2006, all had a share of 3%.

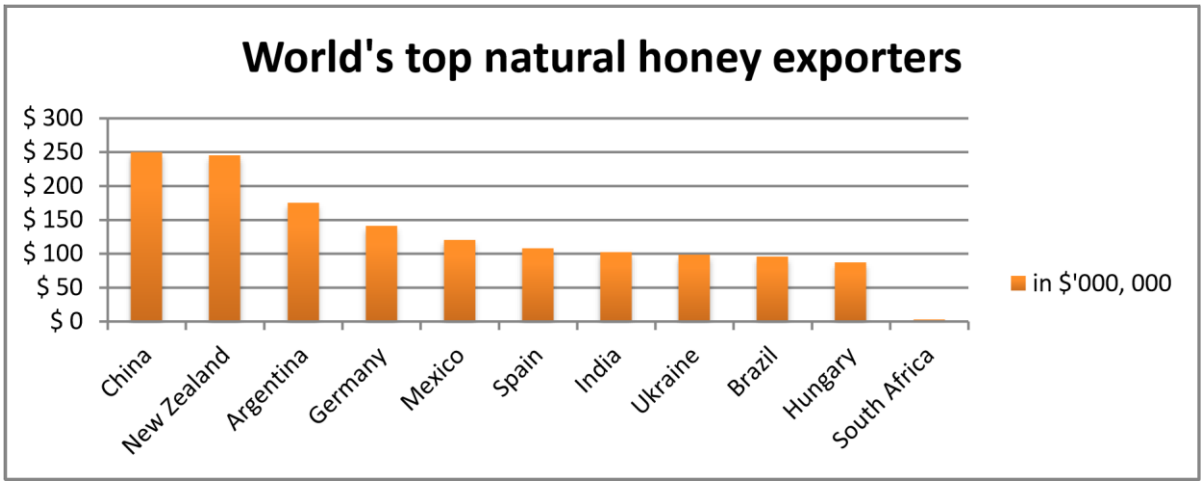

Figure 2. 2: World honey exporters in relation to South Africa

Source: Adapted from Workman (2019)

2.5 World's top honey importers versus South Africa

The global demand for natural honey has increased due to an increase in population and health concerns as consumers have moved from the use of sugar to honey, and South Africa is not different. Figure 2.3 shows that the USA, Germany and Japan are the world's top importers of honey; USA imports in a period of 12 years have increased by 32% with Germany being the only country with a decrease of 5% in terms of honey imports. Spain and Belgium

recorded the highest import quantities of honey with 198% and 172% respectively during the period 2006 – 2018 and South Africa's demand for honey has doubled over the period as the imports of honey have doubled (Norbeto, 2018). Eight countries from the top 10 world importers represent Europe with one country from Asia and North America; there is no representative from Africa, and South Africa is ranked at 24 with only 3 986 tonnes. Many countries feature as top exporters and importers because they re-export imported honey.

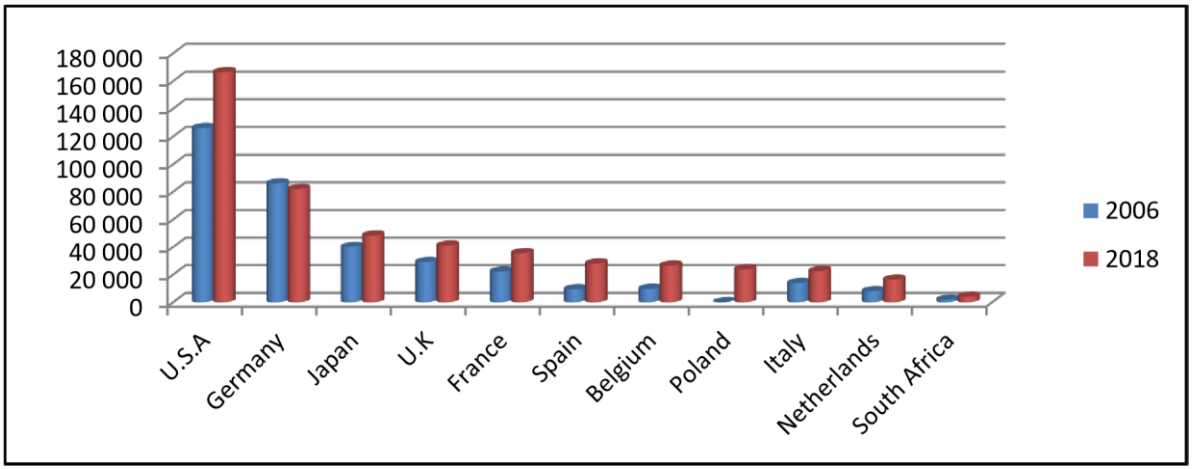

Figure 2. 3: World's top honey importers in tonnes

Source: Adapted from Norbeto (2018); National Agricultural Marketing Council (2008)

2.6 South Africa's import/export trade values

South Africa's imports since 2008 have increased from just over R11 million to R87 million, with a net export value of -R55.7 million recorded for 2018. The main honey supplier is China, with a market share of 98.8% in South Africa (Quantec, 2019). Following China is Malaysia with a market share of 0.5%; New Zealand and Zambia together have a South African market share of 0.3%. The number of tonnes imported to South Africa in 2018 was 4 407 and the exports for the same year were estimated at 475 tonnes. Figure 2.4 indicates that the value of exports increased from R2.5 million to R31.9 million. South Africa had a world export share of 0.05% in 2016, with the leading export destination being Namibia, Botswana and China, even though 98.8% of the imports come from China. A large share of South Africa's exports goes to the neighbouring countries because of the free entry in these countries. Bhana (2018) highlights that the low production values and increasing value of imports are due to the lack of forage and product prices. A further reason (Bhana (2018) for the import of natural honey is that it is cheaper for South Africa to import honey than to produce it. Figure 2.4 further shows that the 4 407 tonnes imported were valued at R19.89 per kilogram, far cheaper than the export value of R67.26 per kilogram, which suggests the reasons for higher import quantities than exports.

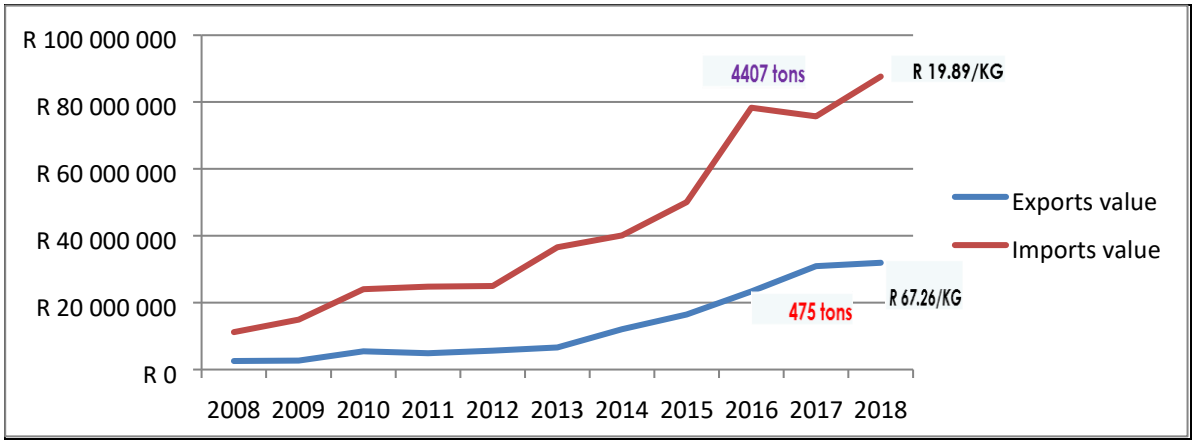

Figure 2. 4: Imports and exports values of natural honey

Source: Adapted from SARS/Quantec (2019)

2.7 Economics of honey production and pollination services

Amulen *et al*. (2019) state that honeybees provide an important service to the ecosystem via pollination, enhancing food security and increasing yields in most crops. Keeping bees is said to be a central part of livelihood diversification as it adds to household incomes, food and medicine. Amulen *et al*. (2019) state that beekeeping has a low investment cost, labour requirements are minimal, and the beekeeper does not need to have land ownership; it is the pathway in poverty reduction for the rural poor, particularly women and youth. It is further noted by Dia *et al*. (2018) in a study conducted in Adamawa State in Nigeria that a beekeeper can generate a turnover equivalent to R3 113 per farmer (₦78 900.00 in Nigerian currency) with a gross margin of R2 328. This is profitable in Nigeria according to the study due to cheap production cost. The study further calculated a profitability ratio of the enterprise and the results showed that per R1 invested, a beekeeper can generate a return of R0.023 (₦0.57 in Nigerian currency). Similarly, a study conducted by Devkota *et al*. (2016) in Nepal reveals that beekeepers interviewed had realised a gross income of R559.35 (Rs4 475 in the Nepalese rupee) and a production cost of R315.74 or an equivalent of Rs2 526 in Nepalese currency per hive, indicating higher revenue and lower production costs.

A study by Bobic *et al*. (2018) on 850 beekeepers on whether it is beneficial to go the conventional or the ecological way of keeping bees showed that most of the surveyed farmers sold their honey at the doorstep, and these farmers were said to harvest on average 29.5 kg per beehive. The study showed that the production cost for professional beekeepers were lower than the small-scale beekeepers and that variable cost accounts for 82% of the total cost with only 17.39% accounted for fixed cost. The study concluded that the difference in monetary terms between conventional and ecological production of honey is the sales channel of honey. An interesting point made by Sumner and Boriss (2006) is that beekeepers

focusing on pollination services tend to get a small amount of revenue from honey, which could be because most of the honey produced is also used as feed.

It is evident that an apiarist can generate a yearly profit of R12 231 per year from honey sales given that the farmer has 35 beehives and that the labour accounts for 66% of the production cost; however, a study by Peter (2015) had labour cost which was low in monetary terms. Likewise, a study by Vaziritabar and Esmaeilzade (2016) yielded the same results of positive net margin; the study compared gross margin between traditional and modern beehives which showed that a net income of $18 749.8 was realised for the farmers using traditional beehives, given a total yield of 208 kg of harvested honey, with $10 313.5 net income for the modern beehives if the yield was 23.18 kg. It can be summarised that honey production and pollination services give positive benefits to the beekeepers.

The gross margin analysis in a study conducted in Nigeria on 100 respondents (Oluwatusin, 2008) compared gross margin and net returns between Langstroth and TopBar hives. It showed that a gross margin of ₦11 673.87 and ₦5 690.79 was realised from the use of Langstroth and TopBar respectively, converted to a margin of R504.60 and R245.56 per hive in South African currency. The returns after all the costs had been deducted were ₦11 279.21 and ₦5 393.25 for Langstroth and TopBar respectively, converted to R486.71 and R232.72 correspondingly. The findings revealed that Langstroth hives are more profitable than TopBar hives. Additionally, also in Nigeria, Tijani *et al.* (2011) reported that per hive that gross margin and net income were ₦10 405.52 (R449.72) and ₦8 973.74 (R387.84) respectively. Moreover, it was highlighted that labour and the purchase of beehives account for 19.32% and 34.56% respectively. A profit of €12.27 (R108.83) was calculated by Ćejvanović *et al.* (2011) for data collected from 57 beekeepers in Bosnia and Herzegovina. The study further reported a yield of 13.53 kilograms per hive.

Saner *et al.* (2004) stated that variable cost and fixed cost accounts for 46.85% and 53.15% of total honey production. The calculations were performed for a 101-150 colony enterprise, and it is noted that fuel or transport accounts for 16.29% of the total cost of production. Beekeepers in the study also highlighted that bees were fed on a 1:1 ratio of sugar water and patties in a period of six weeks before nectar flow. In Turkey, a study found that beekeepers sold honey to different markets. About 35% of the beekeepers sold honey to wholesalers, while the rest sold honey to retailers, beekeepers union and industry firms.

2.8 Bee Industry Organisation in South Africa

The South African Bee Industry Organisation (SABIO) represents the interests of the beekeeping industry in South Africa. The national body has been in existence since 1921 even though the name has been changed many times; before 1921, three regional

associations were already in existence, and these were the former Transvaal, Natal and Western Province bodies (South African Bee Industry Organisation, 2020). SABIO acts as an umbrella body for all affiliated bodies and is responsible for the promotion of the whole industry and liaises with other stakeholders on behalf of its members. According to the constitution of the national body, membership is allowed for regional associations, individual beekeepers, businesses and corporate members (South African Bee Industry Organisation, 2020).

Presently, the national body has an approximate total of 99 registered members (regional associations, individual beekeepers and businesses) with only 4 corporate members. Across the country, there are 10 regional associations affiliated with SABIO in six provinces; Western Cape and Gauteng have both three associations each and the rest are in KwaZulu Natal, Mpumalanga, Eastern and Northern Cape. The national industry organisation together with the regional associations have annual general meetings. All these organisations have their own constitutions and membership fees. According to the Agricultural Pest Act of 1983, it is a requirement for those who work with bees to register with the Department of Agriculture, Land Reform and Rural Development (DALRRD) before 31 March each year (BHIVE, 2020).

The Western Cape Bee Industry Association (WCBA/WKBV) is one of the three first associations formed in 1911. The WCBA is an affiliate of SABIO and is responsible for the protection of the *Capensis* honeybee and the promotion of the industry in the Western Cape amongst other objectives (Western Cape Bee Industry Association, 2020). The association partners with other stakeholders, especially for research development and other initiatives related to beekeeping, and the implementation of the policies and regulations is the apex priority of the organisation. The Western Cape Industry Association collaborated with the Western Cape Department of Agriculture in 2017 to draft a strategy on the sustainability of the honeybee and apiculture in the Western Cape. One of the suggestions in the strategy report was a merger of the Western Cape Bee Industry Association, Southern Cape Bee Industry Association and Knysna Beekeepers Association in the Western Cape as this shows that there is a lack of unity in the industry (Agrifusion, 2017).

2.9 Capital investment

According to Kaptan (2001), the term “investment” refers to the allocation of money resources to assets with an expectation that these assets will yield returns over a period of time (capital budgeting). Elliot (1999) notes that capital includes cash or liquid assets, buildings, livestock, machinery or any other asset with a useful life that is more than a year and meets a specific value. Furthermore, it is expected that the investment in assets is therefore envisaged to yield future income in the form of interest, dividends and or the appreciation in the asset value of

the principal asset. Capital budgeting is used interchangeably with capital decision making, long term investment and the administration of fixed assets (Khan and Jain, 2007). It is explained by Khan and Jain (2002) that the worth of an investment proposal is the key aspect in capital budgeting. Capital investment analysis is performed to evaluate long-term capital investment. Investment decision analysis takes into account the net present value, internal rate of return and payback period method to determine the best alternative investment.

Capital should be invested in assets only if the value is created by the shareholders, that is when the value of economic benefits from the assets surpasses the cost of acquiring the benefits; capital should be invested in assets that maximise the value created (Agar, 2005). Capital investment requires disbursement of irreversible funds by the business in exchange for future expected benefits, therefore proper research is imperative (Baker & Powell, 2009). It is highlighted by Van Reenen and Marais (2010) that farmers are confronted with complicated decisions in capital investment as they have long-term implications, due to capital being tied up in the assets for a long period. Although Amulen *et al.* (2019) mentioned that beekeeping has a low investment, other studies stated that beekeepers require large sums of capital and tough decisions need to be made on the number of hives and the types of vehicles needed.

2.9.1 Net present value method

Net present value (NPV) is defined as an investment's present value cash inflows less present value of the outflows. It is referred to as the net present value because the method deducts present outflows from present inflows to determine the benefits of the investment. The discount rate is used as the rule in the analysis of the NPV as it acts as an opportunity cost of the invested capital (DeFusco *et al*., 2015). Positive net present value is preferred as it indicates that the investment yields benefits that are more than the opportunity cost and therefore increase the net worth of the business.

2.9.2 Internal rate of return method

The internal rate of return (IRR) is defined by DeFusco *et al.* (2015) as the discount rate which makes the net present value of the investment equal to zero. The rate of return therefore equates the cash inflows to cash outflows, and it is "internal" because it does not take external factors into account. The method suggests that IRR which is more than the opportunity cost must be accepted and if the value equals the opportunity cost, then that means the net present value is zero.

2.9.3 Payback period method

Because capital investment makes use of cash for the operation, it is expected that the investment amount is paid back to the investor. The payback period is defined as the expected time between the date of an investment and the time it takes to recover, or recoup invested cash. This method takes into account the initial cost of an investment and its annual net cash inflows (DeFusco *et al*., 2015).

2.9.4 Capital budgeting

Van Reenen and Marais (2010) clearly defines the term “capital budgeting” as a method used in evaluating the feasibility of the planned capital project or the comparative profitability of an alternative capital project. It is important to highlight that the cash flow budget becomes one of the primary tools used to determine the amount of capital needed (Elliot, 1999). Figure 2.5 illustrates the relationship between capital budgeting and the goal of a firm which is to maximise the value of the business and management of finances. It is therefore explained by Dayananda *et al.* (2002) that the structure of capital (debt and equity) is dealt with by the concept of financing decision while dividend decision relates to the form where generated returns are passed to the shareholders. Investment decision looks at how much capital is needed and what types of assets to invest in. It is further explained that funds, whether borrowed or own capital, are invested in either short-term or long-term assets regardless of tangibleness. Therefore, capital budgeting is concerned solely with long-term investments.

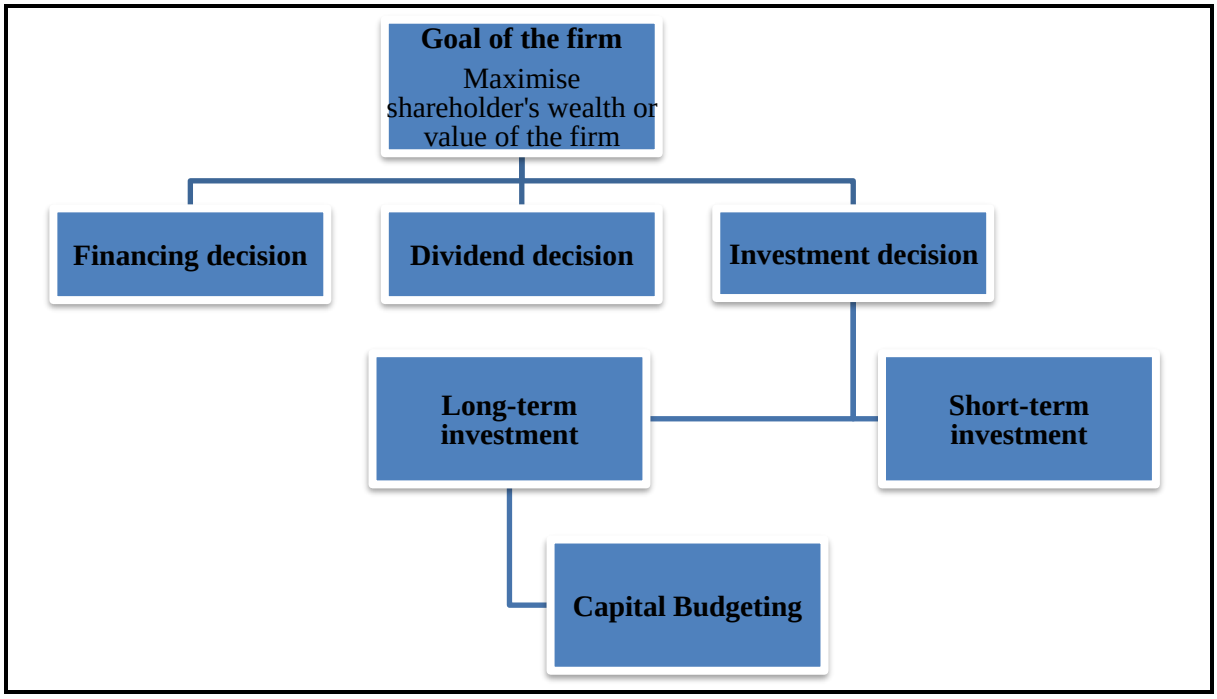

Figure 2. 5: Corporate goal, financial management and capital budgeting

Source: Dayananda *et al*. (2002)

2.10 Profitability estimation in farming: the use of budgets

A budget is defined as “a written plan for future action, expressed in physical and financial quantities” (Standard Bank, 2013; Van Reenen & Marais, 2010). According to Born (2004), budgets generally include variable costs (operating cost), fixed cost and expected returns from production. McGrann (1995) states that budgeting can provide details about individual enterprises and information about the whole farm. There are four different types of budgets that are in use in agriculture, namely enterprise budget, whole farm budget, partial budget and the cashflow budget (McGrann, 1995; Riggs et al., 2012). Smathers (1992) and Standard Bank (2013) put forward the idea that all these different types of budgets in agriculture play a different role in making decisions.

Van Reenen and Marais (2010) point out that since budgets aid in planning, they are based on three things, namely forecasts, assumptions and experience. Budgets are subject to change because the future cannot be predicted especially concerning output quantities and product prices. Without the support of a budget, decision-making is based on guesswork or is a guessing game. Standard Bank (2005) emphasises that the usefulness of a budget depends on the correctness of the production input use, their quantities, the costs of the inputs, yield and the price of the output produced that are included in the budget.

2.10.1 Enterprise budgeting

The enterprise budget is the overarching budget of the four that are in use in agriculture since it forms the basis for other farm budgets such as whole farm, partial or a cash flow budget. The three budgets cannot be developed without the enterprise budget. According to Greaser (1991) an enterprise budget lists all the production inputs and their associated estimated costs needed to produce the unit of crops or livestock. An enterprise budget is developed on a per hectare or per head basis depending on whether the enterprise is a crop or livestock (Soha, 2014). An enterprise budget is a useful tool or instrument for planning and for continuing financial management of a farm business. A study by Kibirige (2014) in the Eastern Cape Province estimated the profitability of maize and cabbage enterprises using an enterprise budget to measure the performance of the two enterprises. Prerequisites for a sustainable farm enterprise such as the number of hectares; machinery and equipment (fuel usage, repairs and maintenance) to be used and labour as man-days or man-hours, to name a few, are necessary to be accounted for when developing an enterprise budget.

McGrann (1995) indicated that it is important for farmers to understand the terms or terminology that are documented in the enterprise budget, terms such as product income or gross value of production, directly allocatable costs, indirectly allocatable costs and gross margin. Product income is the value or amount of rands received in return for the product

produced. Directly allocatable cost is defined by Standard Bank (2005) as the portion of variable costs that can be allocated to an enterprise without having to keep detailed records; indirectly allocatable cost can be allocated to an enterprise if detailed records are kept. According to Standard Bank (2013), the gross margin of an enterprise is the product income value derived from an enterprise minus directly and indirectly allocatable costs incurred in producing that enterprise. McGrann (1995) suggests that if a farmer does not understand the terminology in the budgets, the information may be used incorrectly, meaning that the farmer may implement wrong decisions. Figure 2.6 shows the process flow of compiling an enterprise budget with the items thereof included.

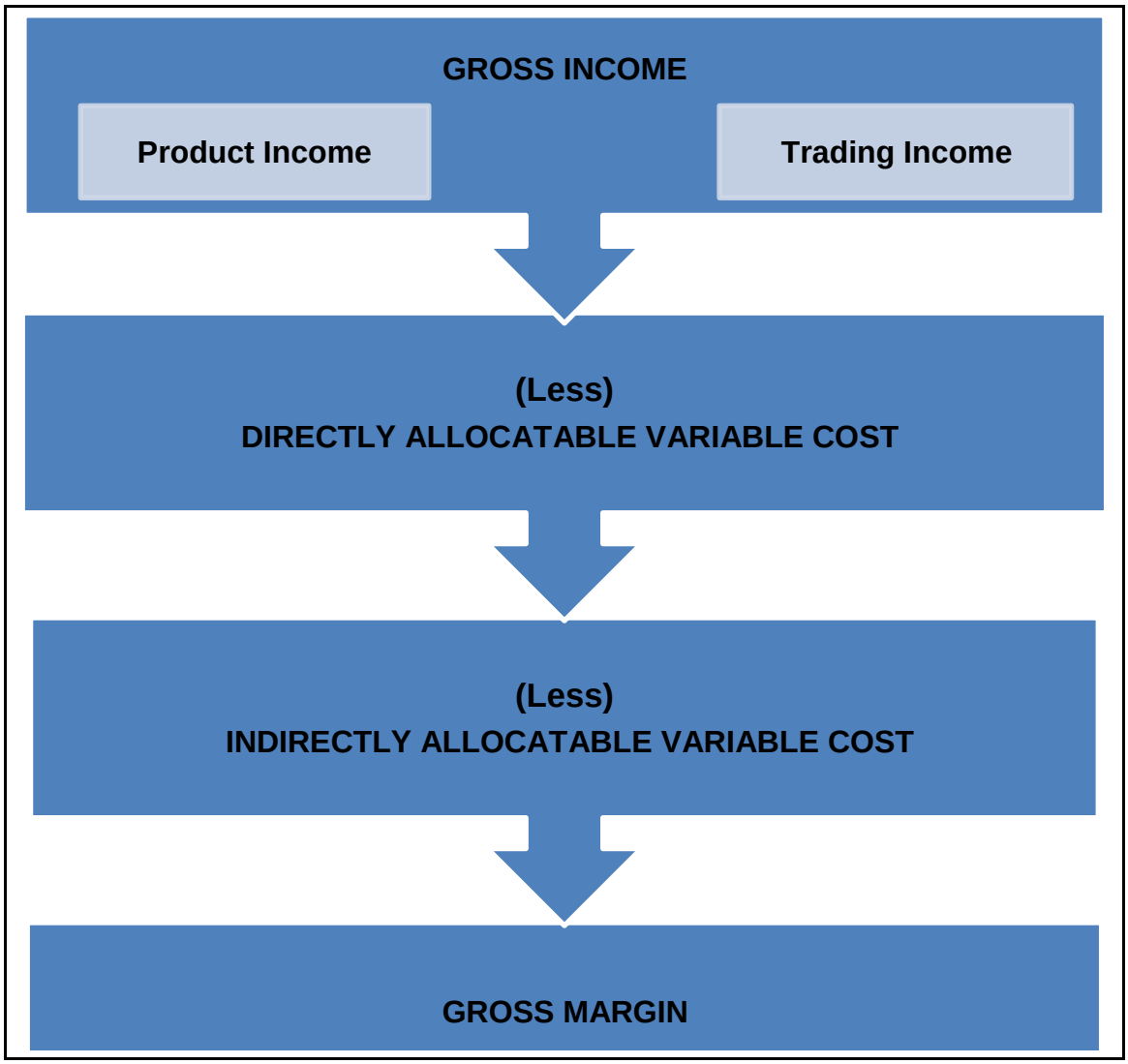

Figure 2. 6: Gross margin computation

Source: Own compilation adapted from Van Reenen & Marais (2010)

2.10.2 Whole farm budget

A whole farm or total farm budget may consist of several enterprises depending on the farm. Soha (2014) reported that this type of budget is a “quantitative expression of the total farm plan” and the unit of analysis in this case is the entire farm. Smathers (1992) states that a whole farm/ total farm budget is a summary of income, expenses and profit of the whole farm. For income, all the sales of all the enterprises of the farm are listed with their associated amounts; the same is recorded with expenditure (Alimi & Manyong, 2000). A simplified definition of a whole farm budget is defined by Doye (n.d.) as a classified and detailed summary of the major physical and financial features of the whole farm.

Doye (n.d.) put forward an idea that the whole farm/complete or total farm budget should start with the inputs the farmer has available for use in the farm and it is crucial to start with fixed items when drawing up this type of budget. Standard Bank (2013) highlights that the whole farm budget is usually drawn up annually based on annual production. This budget enables the farmer to calculate the solvency, profitability and liquidity of the whole farm and this is important because it can assist the farmer to consider an alternative combination of enterprises, and production methods. This type of budget is based on enterprise and partial budgets. The whole farm budget is different from an enterprise or partial budget in that the latter budgets do not take into consideration factors such as the existing medium- and long-term assets and capital that is available for the business (Standard Bank, 2013).

2.10.3 Partial budgeting

Partial budgeting is regarded as a planning and decision-making tool for comparing benefits and cost of alternatives in agriculture; it considers resources that are planned to be changed. Partial budgeting allows the farmer to get a better grip on how a decision will affect the profitability of an enterprise, and eventually the profitability of the farm itself (Soha, 2014). A partial budget is not applicable to the whole production of a farm business, but rather only evaluates the profitability of a certain enterprise that affects only a part or certain parts of a farm business (Soha, 2014). When compiling a partial budget, only relevant costs are taken into consideration such as relevant fixed costs and variable costs. Thus, total cost and total income are irrelevant. To compile an accurate and sensible partial budget, it is necessary to require data such as yield expectations, price expectations and production costs, which can be found in enterprise budgets (Standard Bank, 2013). It does not consider the resources in the farm businesses that are left unchanged.

2.10.4 Cash flow budget

According to McGrann (1995) an estimate of cash receipts and expenses expected during a certain period, whether yearly, quarterly or monthly is defined as a cash flow budget. The cash flow budget can as well include other income and expenses not related to the farming business. The focus of the cash flow budget is on cash (accessible money) that can be drawn out of a cash box or from the bank to pay for salary or debtors (Edwards, 2008). Cash flow also centres on cash that is received from customers or clients, and is the cash that can be seen in the cash box or in a bank statement**.** Therefore, a cash flow can be used as a method for analysing the revenue and costs of a company. This budget allows businesses to assess income against expenses. It is noted that the management of cash resources is fundamental towards growing a business's bottom line. Likewise, lending institutions normally make use of a cash flow budget to determine whether to grant a loan or prolong the credit term for a business, and the latter makes cash flow monitoring even more important**.**

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter provides a brief background and description about the study area, study population and research design. The chapter further provides information about the data collection and sampling procedure, ethical issues or consideration and as well data management and analysis.

3.2 Description of the study area

Cape Winelands District Municipality (Figure 3.1), formally known as Boland District Municipality, is one of the 6 district municipalities of the Western Cape Province and it forms part of the 44 district municipalities in South Africa. The Western Cape is situated in the south-western tip of the African continent with borders with the Northern Cape and Eastern Cape (Cape Winelands District Municipality, 2019). The province covers an area of 129 370 km^2, 10.6% of the total land in South Africa, whereas Cape Winelands District is adjacent to the Cape Metropolitan area, and enfolds 22 309 km^2 (Municipalities of South Africa, 2019). Cape Winelands District Municipality (2016) indicates that the district is the second-largest economy in the Western Cape after the City of Cape Town, with a contribution of R27.75 million to regional gross domestic product.

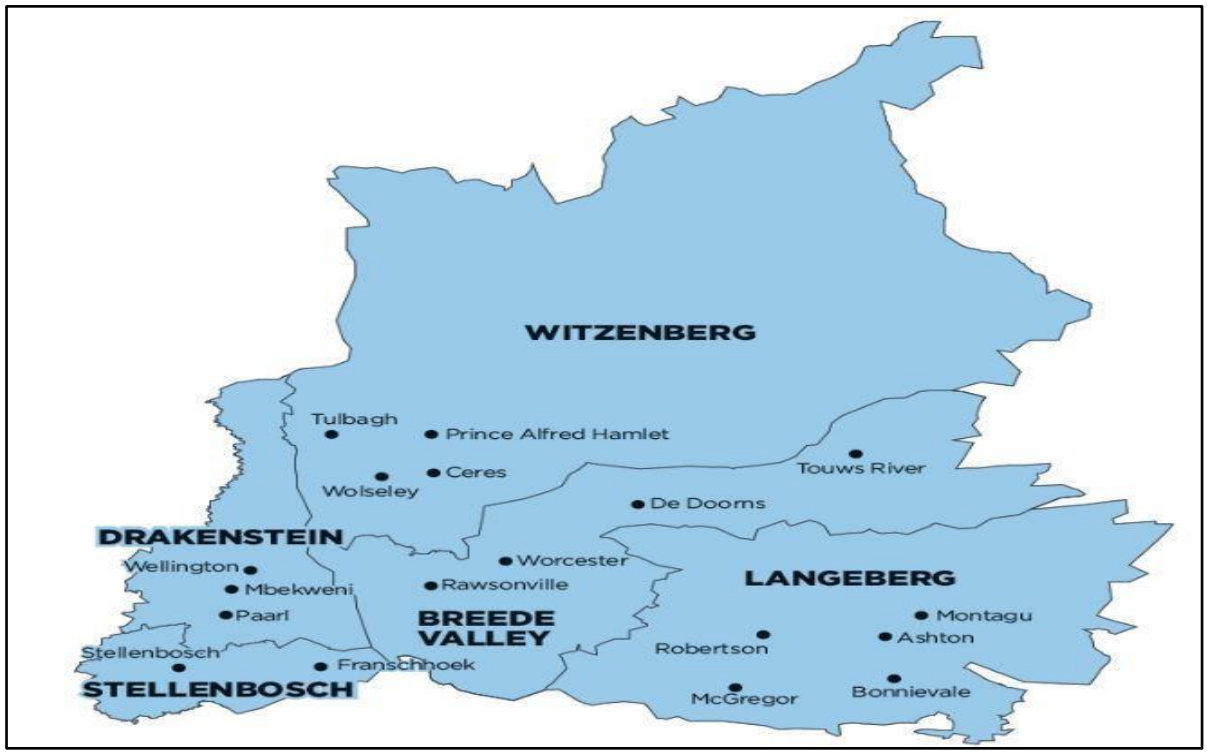

Figure 3. 1: Map depicting the location of the Cape Winelands District Municipality

Source: Municipalities of South Africa (2019)

The Cape Winelands is placed between the West Coast and Overberg coastal regions. The Cape Winelands District Municipality comprises approximately five local municipalities, namely Drakenstein, Stellenbosch, Witzenberg, Breede Valley and Langeberg, with a total population of 787 486 and an annual population growth of 2.16% (Municipalities of South Africa, 2019). It was indicated by Cape Winelands District Municipality (2016) that approximately 18.2% of the households in the district falls within the income range of R0-42 000; those households between the levels R42 001-R360 000 constitute 69.3% of the total households and the rest (12.5%) are households earning a total of R360 001 and more. The unemployment rate in the district is at 21%, while the percentage for economically active population is 42%. It is noted that the agricultural sector contributes about 25% of the district's employment opportunities. Agriculture is the backbone of the economy in the district with 80 000 hectares of cultivated and irrigated areas producing deciduous fruit, grapes and vegetables with an agricultural and hunting export value of just over R5.3 billion (Cape Winelands District Municipality, 2016).

3.3 Research design

Mouton (2011) referred to research design as a blueprint or a plan of how the researcher intends in conducting the research. Firstly, exploratory research was conducted through February 2019 until March 2020 with the members of the Western Cape Bee Industry Association, the Department of Agriculture Land Reform and Rural Development (formerly known as the Department of Agriculture, Forestry and Fisheries), and other experts in the field. The reason for this step was to understand processes related to beekeeping at large from investment, production to marketing, and to determine the number of beekeepers in the Western Cape. Exploratory research assisted in asking the right questions of the respondents and to understand the locality of the beekeepers.

A non-experimental quantitative research design was used for the study because numerical data is collected and generalised across the study population. Additionally, this type of research design does not plan to have an intervention after the study is completed and there is no random placement of participants. Furthermore, to understand the relationship between some other quantitative variables a correlation research method was used.

Secondly, following the exploratory research, a survey method (questionnaire) was decided upon with the use of a cross-sectional research design. The use of the survey method was decided because it is cost-effective and flexible. Terre Blanche *et al*. (2006) define cross-sectional research design as a design where data is collected at one point in time. The study used the cross-sectional research design because there is no intention of collecting the same information from the same respondents again. The compiled questionnaires were first

administered by the researcher face-to-face to record correct information and assist the respondents to clarify unclear questions.

3.4 Research study population

The Department of Agriculture, Land Reform and Rural Development keeps a database of all the registered beekeepers in South Africa. It is expected that each beekeeper registers with the department on a yearly basis between 1 January and 31 March. According to the 2019 database, there are 621 registered beekeepers in the Western Cape and this number includes hobbyists, small-scale and commercial beekeepers. Approximately 73% of the beekeepers in the Western Cape are hobbyists, mostly located in the Cape Metropole district. Small-scale and commercial beekeepers constitute 27% of the beekeepers in the Western Cape, scattered in the Cape Winelands, Overberg, Swartland, Garden Route and Little Karoo. Cape Winelands District has the majority (52%) of small-scale and commercial beekeepers in the Western Cape. A list of 67 beekeepers from the Cape Winelands was drawn from the database for survey interviews. Furthermore, a total of 16 beekeepers were withdrawn from the survey as they were not in business and some not interested in taking part in the study.

3.5 Sampling procedure

The study made use of the non-probability sampling method, which included small-scale and commercial beekeepers in the district of Cape Winelands. The reason for the use of nonprobability sampling method was the fact that the probability of including participants in the study could not be determined. Furthermore, non-probability sampling methods were employed due to time frame and budget constraints. A total of 51 beekeepers were interviewed, which means that all the available beekeepers were interviewed and all the local municipalities within the Cape Winelands were included.

3.6 Data collection procedure

The study collected primary data with the aid of a questionnaire, which was pre-tested in February 2020 and used as an instrument for data collection. Financial information was collected from beekeepers for the purpose of calculating profitability and investment analysis. Closed-ended and open-ended questions were constructed to get answers that were more detailed during data collection. The questionnaire was in English and a total of 70 survey questionnaires were printed to have extra copies in the case some of the questionnaires were destroyed during the process. The researcher collected primary data from six apiarists at the beginning of March 2020 face-to-face or in person; however, the process was stopped due to Covid-19. The rest of the interviews were conducted telephonically from April 2020 to June

2020 due to the announcement of the national disaster caused by Covid-19 in March 2020. The face-to-face sessions took about an hour per beekeeper, whereas telephonic interviews took about thirty minutes.

3.7 Ethical clearance

Most universities in South Africa require that research projects that involve humans and animals be reviewed by an independent research ethics committee to protect the integrity and the welfare of the respondents and the institution respectively (Terre Blanche *at al*., 2006). The Cape Peninsula University of Technology (CPUT) has strict rules with respect to research studies that involve humans and animals. Therefore, all research projects must go through an ethical process to obtain permission for data collection for the research project to conform to the ethical requirements of the institution. The study was granted permission by the Faculty of Applied Sciences Research Ethics Committee and an ethical clearance certificate was received to gain access to the beekeepers in the Western Cape. Additionally, the proposal was also presented to the members of the Western Cape Bee Industry Association during their Annual General Meeting in March 2020 and the organisation also granted permission for the study.

3.8 Data management and analysis

The collected data was organised and checked for gaps, with a few mistakes corrected. All the questions were answered appropriately, while additional information that might assist was emailed to the researcher by certain respondents. The cleaned, coded data was entered into Microsoft Excel and later transferred into two software programs, Moonstats and Statistical Software for Social Scientist (SPSS) for the purpose of comparison. The two programs assisted with the univariate and bivariate analysis for socio-economic characteristics, production and entity information. Univariate analysis included frequency tables, bar graphs and pie charts whilst bivariate analysis made use of the correlation coefficient using Pearson's product moment and Spearman's rank order. For the calculations of the total investment per type of beekeeping system, gross margin analysis, capital and enterprise budgets were computed and further break-even, sensitivity analysis and cashflow budgets were compiled. Beekeeping farms were categorised according to the number of beehives owned (150, 500 and 1 000 beehives) for analysis purposes.

Farm managers need to evaluate alternative investment options and determine profitability thereof (Gloy & LaDue, 2003). The viability and feasibility of the long-term investment are determined by the net present value calculations (NPV) and gross margin as stated by Van Reenen & Marais (2010). The gross margin is useful in determining the profitability of an

enterprise. Projected cash flow was compiled together with the capital budget/capital expenditure of the initial investment in the beekeeping enterprise, which was later used for the calculations of both net farm income and net present value and internal rate of return with the repayment terms. The following formulas were used for the calculations of gross margin, net farm income, farm profit, net present values, internal rate of return and repayment period.

$$GM = (P_y * Q_{ys}) - \sum^{n}_{i=1}(P_{xi} * Q_{xi}) \text{.................................... (1)}$$

Where *GM* is the gross margin of an enterprise with P_y and Q_{ys} representing product market price and quantity of the output sold respectively. P_{xi} and Q_{xi} denote the cost of variable input and quantity of the input used.

$$NFI = \sum^{n}{}_{t} (I_p , \Delta_{Inv}) - C_v - C_o \text{... (2)}$$

NFI is the total gross margin of all the enterprises combined less overhead cost; I_p represents the product income and Δ_{Inv} is the change in inventory with C_v and C_o being variable cost and overhead cost respectively.

$$F\pi = \sum^{n}{}_{t} (I_p , \Delta_{Inv}) - (C_r - C_o) - (C_d + C_r) \text{........................ (3)}$$

Fπ denotes farm profit calculated as net farm income less interest on borrowed capital and rented assets. C_d and C_r are the cost of debt and rented or hired assets; these two variables are added in equation 2.

$$NPV = \sum_{t=0}^{n} \frac{Rt}{(1+i)^t} - I \text{.. (4)}$$

NPV is the net present value of present cash inflows and outflows over a given period of time. R_t represents the net cash flows over period *t* and *i* denotes the discount rate whereas *I* stand for the initial investment amount.

$$IRR = \sum_{t=0}^{n} \frac{Rt}{(1+i)^t} = 0 \text{.. (5)}$$

IRR is the internal rate of return used to calculate the profitability of the investment in an enterprise. IRR makes the NPV of all discounted net cash flows over a period to equal zero. From equation 5, R_t denotes net cash flows over period *t* whilst *i* represents the discount rate.

$$Payback\ Period = \frac{I}{Rt} \text{.. (6)}$$

The payback period is the time (years) it takes the enterprise to repay the capital invested in the project from its net cash flow. Based on equation 6, *I* represents an initial investment in the project while *Rt* denotes net cash flow resulting from the project.

Income and cost budget, the calculation of the net farm income, farm profit and net present value were used together with sensitivity analysis for the risk analysis of the enterprise production. In addition to this information, a demographic profile of the beekeepers assisted in understanding how the beekeepers in the Cape Winelands District Municipality are mapped, including their socioeconomic information.

According to Sayad (2020), bivariate analysis explores the relationship between two variables simultaneously and determines if there exists an association between two variables. The analysis further looks at the strength, differences and significance of the differences between the two attributes. Bivariate analysis has many types of analysis with correlation analysis included. Correlation analysis uses two correlation coefficients, namely the Pearson product-moment and Spearman rank coefficient correlation (Senthilnathan, 2019).

The Pearson product-moment correlation demonstrates the strength of the association between two continuous variables. The correlation is appropriate for use if it can be assumed that the variables are almost distributed normally. A Spearman rank-order correlation demonstrate the strength of the association between two continuous variables (Terre Blanche *et al*., 2006). The rank order is appropriate for use if it cannot be assumed that the variables are approximately normally distributed. The correlation analysis between services rendered by beekeepers and the annual turnover is computed to look at the relationship between the two attributes.

CHAPTER FOUR: APICULTURAL ECONOMIC AND INVESTMENT ANALYSIS

4.1 Introduction

The purpose of this chapter is to present findings of the main objectives of the study. This chapter therefore presents findings of the first three objectives of the study. The first two objectives were to determine gross margin, capital expenditure and investment analysis of different production categories of beekeeping farms. Lastly, the chapter summarises findings of the third objective, which was to determine different production beekeeping system sensitivity analysis.

4.2 Beekeeping financial analysis

This section presents results of the first objective of the study by comparing gross specified margins for beekeeping farms owning 150, 500 and 1 000 beehives for the separate production of honey, provision of pollination services and the combination of providing pollination and honey production.

4.2.1 Enterprise budget analysis for 150 beehives

An enterprise budget was developed for the determination of the gross margin between the production of honey, pollination and as well the combination of both pollination services and honey production. This determination includes revenue generated and expenses incurred for the production of either honey or pollination services. Table 4.1 illustrates an enterprise budget analysis for a 150-beehive enterprise for three different production methods with values presented on each production hive.

Table 4.1: Income and cost budget for a 150-beehive enterprise

INCOME AND COST BUDGET: 150 BEEHIVE ENTEPRISE			
	Honey/Beehive	**Pollination/Beehive**	**Honey & Pollination/Beehive**
Gross income	**R 750 .00**	**R 1 280 .00**	**R 2 587 .00**
Honey	R 750 .00	R 0.00	R 1 311 .00
Pollination	R 0.00	R 1 280 .00	R 1 276 .00
Directly Allocatable Variable Cost	**R 455 .67**	**R 509 .00**	**R 547 .11**
Fuel	R 133 .33	R 153 .33	R 163 .33
Pest control	R 15 .67	R 15 .67	R 15 .67
Maintenance	R 80 .00	R 93 .99	R 108 .33
Labour	R 200 .00	R 220 .00	R 233 .11
Feed (sugar)	R 26 .67	R 26 .67	R 26 .67
Gross Margin above Variable Cost	**R 294 .33**	**R 771 .00**	**R 2 039 .89**
Interest on Working Capital	**R 33 .03**	**R 36 .90**	**R 39 .67**
Gross Margin above Specified Cost	**R 261 .30**	**R 734 .10**	**R 2 000 .22**

The variable costs incurred by beekeepers regardless of the production method include fuel, labour, feed, control of pests and maintenance of beehives. The gross income can either be received from the sales of honey, the provision of pollination services or the combination of both for 150 beehive beekeeping enterprises. Gross margin is calculated by deducting variable costs from the gross income of an enterprise as stated in chapter three. The study findings are presented on a per beehive basis and showed that beekeepers who focused on selling honey only had a turnover of R750.00 with associated costs of R455.67 per beehive whilst those who provided pollination services only had a gross income of R1 280.00 with incurred costs of R509.00 per beehive. In this regard, it is evident that pollination services is a better option than the production of honey. Similarly, apiarists who combined both honey production and pollination services had a better revenue per beehive of R2 587.00 and variable cost amounting to R547.11.

Income derived from the combined production of honey and pollination services had a 50.68% and 49.32% share of honey and pollination respectively of the gross income per beehive. It can further be noted that variable costs accounted for 60.76%, 39.77% and 21.15% of the revenue for honey, pollination and the combination of honey/pollination services respectively. Net gross margin, which is calculated by deducting expenditure and interest from sales of honey production, pollination services and the combination of both honey and pollination services resulted in R261.30, R734.10 and R2 000.22 per beehive respectively. It is noted that regardless of the method of production, beekeeping provides positive gross margin with a return on directly allocatable variable costs of 57.34%, 114.22% and 365.60% for the production of honey, pollination and the combination of honey with pollination respectively. The return on variable costs incurred for the three methods of production indicates that for every R1 invested in variable cost, the beekeeper made a return of R0.57 on honey, R1.14 on pollination and R3.65 on honey with the provision of pollination services respectively.

The gross income and gross margin per hive of R750 and R294.33 respectively for the production of honey conforms with the results of Ćejvanović *et al.* (2011) on an economic model for sustainable beekeeping production in Bosnia and Herzegovina. The latter study found that the gross income and gross margin per hive realised by beekeepers was R1 287.69 (€62.16) and R463.83 (€22.39) respectively. The difference in income and gross margin in the two study areas could be due to honey yield per hive among other determinants because the difference in yield per hive between the two study areas of Bosnia and Herzegovina was just over 18 kilograms. Furthermore, a study by Peter (2015) on socio-economic factors in Eastern Cape, South Africa found the gross margin per beehive of R349.48. It was noted in the Cape Winelands study that there was a 131.7% difference in variable cost because labour, fuel, pest control and maintenance as compared to the study by Peter (2015) with the exclusion of feed.

4.2.2 Enterprise budget analysis for 500 and 1 000 beehives

The gross margin analysis for 500 and 1 000 beehives was computed to determine the performance of gross margin between the two categories of apiarists. Table 4.2 shows the cost and returns for the production of honey with the provision of pollination services for apiarists managing colonies of 500 and 1 000 beehives. The values in the table are presented per beehive and respondents managing colonies of 500 and 1 000 beehives all combine honey production and pollination services.

Table 4.2: Income and cost budget for a 500 and 1 000-beehive enterprise

ENTEPRISE BUDGET OF A 500 & 1000 BEEHIVE ENTEPRISE		
	500 Beehives (R/Hive)	**1 000 Beehives (R/Hive)**
Gross income	**R 2 160.00**	**R 2 470.00**
Honey	R 960.00	R 1 170.00
Pollination	R 1 200.00	R 1 300.00
Directly Allocatable Variable Cost	**R 667.50**	**R 858.33**
Fuel	R 378.50	R 486.84
Pest control	R 26.00	R 33.35
Maintenance	R 40.00	R 51.38
Labour	R 223.00	R 286.77
Gross Margin above Variable Cost	**R 1 492.50**	**R 1 611.68**
Interest on Working Capital	**R 48.39**	**R 62.23**
Gross Margin above Specified Cost	**R 1 444.11**	**R 1 549.45**

Beekeepers with 500 beehives received an income of R2 160.00 per beehive, with 44.44% and 55.56% of income realised from honey and pollination services respectively. Likewise, beekeepers with 1 000 beehives received an income of R2 470.00 on each beehive with 47.40% and 52.60% of revenue realised from honey and pollination services respectively. The directly allocatable variable cost incurred by beekeepers with 500 and 1 000 beehives accounted for 34.77% and 34.75% of the gross income correspondingly. It can further be indicated that 31.33% and 31.32% of the direct cost portion for a 500 and 1 000-beehive enterprise represents fuel and labour respectively. According to the results, the return on variable costs incurred for a 500-beehive enterprise resulted in 216.35% whilst that of a 1 000-beehive enterprise was 180.52%, a decrease of 35.83%. The return on variable costs per beehive for the study suggests that for every R1 invested in variable cost the beekeepers realised R2.16 and R1.80 per hive for 500 and 1 000 beehive business respectively.

The findings show that gross income (R2 160.00 and R2 470.00) and profit (R1 492.50 and R1 611.68) per hive respectively on each item are more than the figures reported by Peter (2015) and Ćejvanović, *et al.* (2011) because pollination services were not included in both studies. Most of the studies reviewed on beekeeping only focused on honey production and income realised per hive on pollination was unavailable. According to the current study, it can be noted that the production of honey and providing pollination services is profitable with a positive return on investment.

4.3 Beekeeping cost structure and investment analysis

The results of the second objective of the study are presented in this section. This section therefore presents capital cost and investment analysis for a 150, 500 and 1 000 beehive enterprise for honey production, pollination services and related honeybee products. For the investment analysis, 500 and 1 000-beehive enterprise are combined for the analysis, as these enterprises are not development beekeepers.

4.3.1 Capital expenditure of 150 beehives

Capital items required for the 150-beehive business includes a myriad of items which are needed regardless of the type of system the apiarist has decided upon. The cost structure of a 150-beekeeping enterprise is summarised by Figure 4.1. The structure of the capital expenditure lists all the items needed for a 150-beehive business.

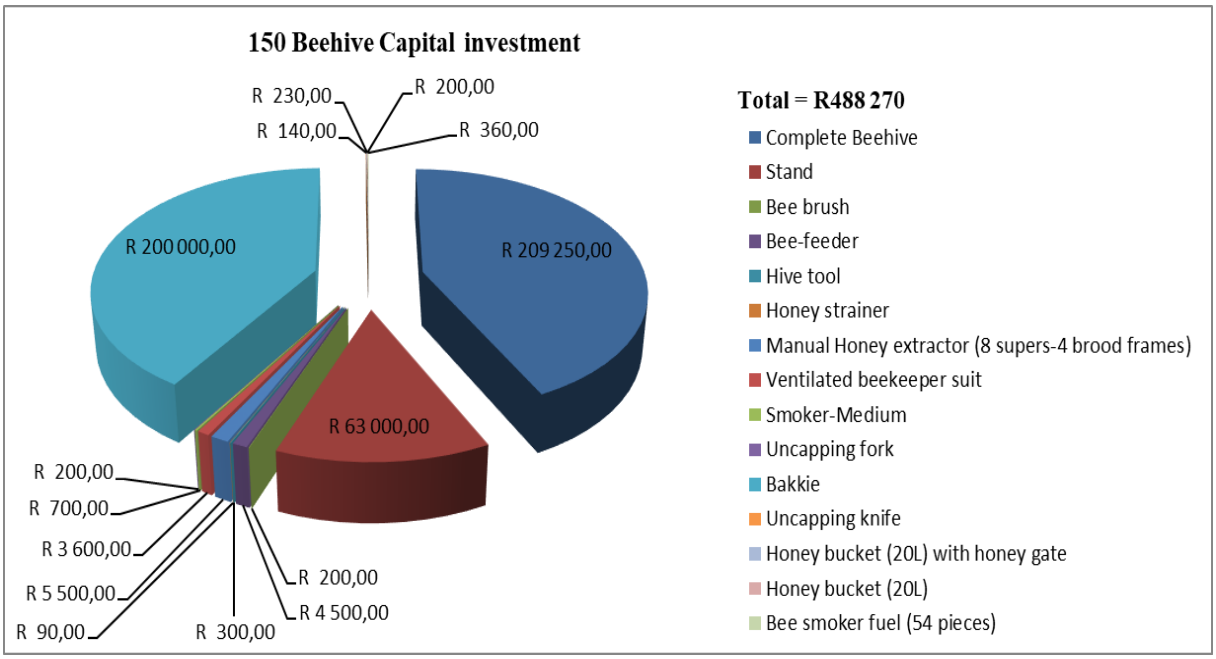

Figure 4. 1: Capital investment for 150 beehives

The capital requirements of a 150-beehive beekeeping enterprise amounted to R488 270.00. It was shown that 84% of the capital investment was for the purchase of beehives and a vehicle for the transportation of hives to sites. Depending on the preferences of the beekeeper, beehive stands accounted for an additional 13% of the total capital expenditure of the enterprise. The remaining 3% of the cost structure was for other important capital items such as the hive tools, an extractor, extracting equipment and honey storage buckets.

The production of honey and the provision of pollination services for 150 beehives require that the beekeepers have access to a mode of transport, whether a light-duty vehicle or a small truck. It can be noted that large sums of capital are required for beehives and transportation.

Many beekeepers with beehives fewer than 150 prefer to lease transport even though at times this limits their movement. The 150-beehive enterprise assumes that there are only two workers; tools and clothing value (rands) in the capital requirement is for the said number of workers. The extraction machine needed is a manually handled extractor that can manage four brood frames at a time. Beekeepers make use of smoke fuels which come in different packages; however, many beekeepers make use of wood chips, hay, weed and pine straw, to name a few.

4.3.2 Capital expenditure of 500 beehives

The capital items required for the beekeeping enterprise with 500 beehives are substantially more than that of a 150-beehive enterprise. The cost structure of a 500-beekeeping enterprise is summarised in Figure 4.2. The structure of the capital expenditure lists all the items needed for a 500-beehive business.

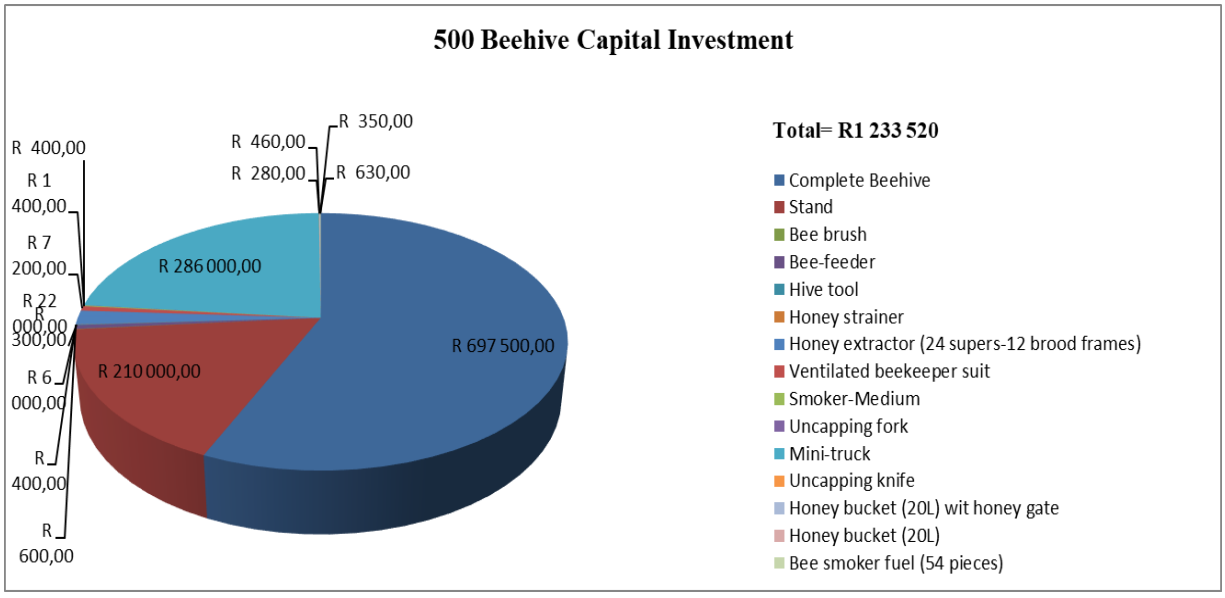

Figure 4. 2: Capital investment for 500 beehives

The capital investment required for a 500-beehive beekeeping enterprise amounted to R1 233 520.00. The beehives and a vehicle constitute 80% of the total cost, which is 4% less than the capital requirement of 150-beehive enterprise. Beehive stands and other miscellaneous beekeeping tools or items account respectively for an additional 17% and 3% of the total capital expenditure of the enterprise.

The production of honey and pollination services for 500 beehives requires transportation, which is no different to a 150-beehive enterprise, although there will be a difference in the number of trips needed to and from the sites. Since there will be more honey from 500 beehives, an electric 24 super-12 brood frames extractor would be needed with an assumed four workers and items that would be enough for the number of workers mentioned. For 500 beehives, a mode of transportation is compulsory, and beekeepers can decide on having 50% casual workers. There could be more honey buckets for storage in the production of honey from 500 beehives, depending on the apiarist. The percentage of the investment cost structure for 150 and 500 hive apiaries shows a 4% difference (decrease) on beehives and transport whilst the beehive stands also show an increase of 4% (increase). These differences could be because the 500-beehive enterprise does not need additional transport.

4.3.3 Capital expenditure of 1 000 beehives

Items needed for a 1 000-beekeeping enterprise might be more expensive; although they need the same items, they will need more as compared with the 150 and 500 beehive enterprise. The cost structure of a 1000-beekeeping enterprise is summarised in Figure 4.3. The structure of the capital expenditure lists all the items needed for a 1000-beehive business.

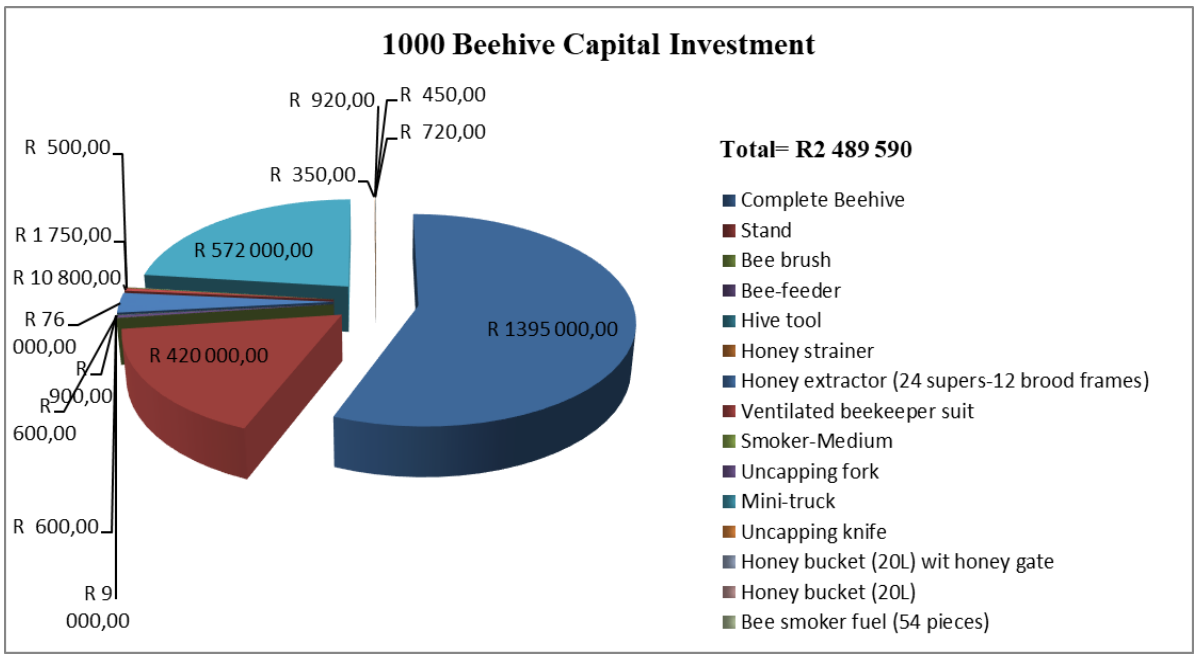

Figure 4. 3: Capital investment for 1 000 beehives

The 1 000-beehive enterprise requires a capital investment of R2 489 590.00. The cost structure shows that 79% of the total cost is required for the purchase of 1 000 beehives and two mini trucks used for transporting hives from sites. Approximately 17% of the capital requirement is for beehive tools whilst 4% is for harvesting and extracting equipment. Apiarists with 1 000 beehives for honey and pollination services are regarded as commercial beekeepers. It is assumed that six workers are needed, and all the tools and clothing will be for the mentioned number of workers. The production of honey for 1 000 beehives requires two electric 48 super/24 brood frame extractors.

4.3.4 Investment analysis for a 150-beehive enterprise

The cumulative cash flow for a period of five years together with the net present value for different categories assists in the determination of the better investment option. Figure 4.4 illustrates the five-year cumulative net cash flow and investment analysis of a 150-beehive enterprise for honey, or pollination, or the combination of honey and pollination.

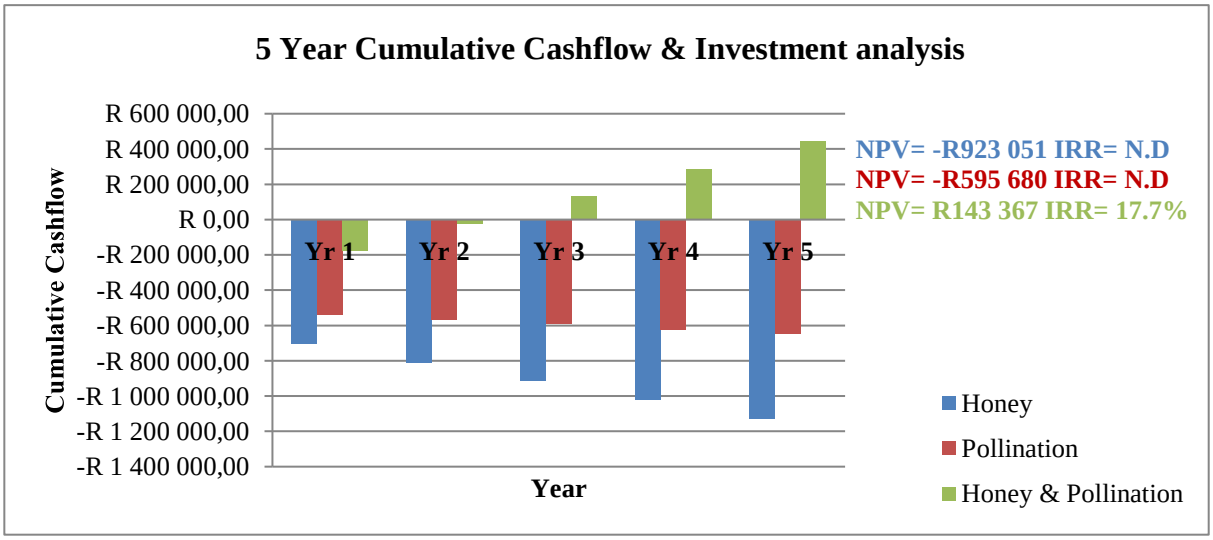

Figure 4. 4: Cumulative cash flow and investment analysis for 150 beehives

The investment appraisal of the study makes use of the net present value, payback period and the internal rate of return. Cumulative cash flow sums up net cash flows from the outset or year of inception to determine the strength of the enterprise. The investment of R488 270.00 and R482 250.00 for the split of honey production from pollination services as outlined in the cost structure in Section 4.2.1 in a five-year period result in a negative cumulative cash flow of R1 128 770.00 and R649 350.00 correspondingly. The cumulative cash flow for the combination of honey and pollination results in a positive cash flow of R442 230.00.

Based on the cumulated cash flow of three different production systems, the results for NPV, IRR and payback period provided different scenarios. The net present value (NPV) calculates

the present value of the annual net cash flows (Van Reenen & Marais, 2010). NPV indicates how much a business adds to shareholder's capital; the positive NPV indicates that the venture is profitable. The NPV discounted at 7.25% for the split production of honey and pollination services was -R923 051.75 and -R595 680.18 separately, meaning that the investment in the production of honey and pollination services for a 150-beehive enterprise will not yield any value for the business, therefore both investments should be rejected. However, the combination of both honey production and pollination services resulted in a positive NPV of R143 367.40, which implies that the investment in the venture creates value for the business.

Brigham and Houston (2015) assert that the internal rate of return is the discount rate that forces NPV to equal zero. The internal rate of return (IRR) is thus used to determine the worthiness of investing in an enterprise. In addition, the payback period determines the time required for the business to recover the financial resources spent on an investment. The IRR for the NPV of -R923 051.75 and -R595 680.18 for honey production and pollination is undefined due to the discount rate being too small to make the NPV=0. This implies that the investment in both enterprises would never yield any return for the business because the payback period is undetermined. Despite the unattractiveness of the investment in split production of honey and pollination services, the combination of honey production and the provision of pollination services provides an IRR of 17.70% with a payback period of 3.14 years. The internal rate of return of 17.70% implies that every R100 invested in the enterprise returns R17.70 to the enterprise.

4.3.5 Investment analysis for a 500 and 1 000 beehive enterprise

Apiarists with 500 and 1 000 beehives follow a combination of honey production and pollination services, hence the combined analysis. Figure 4.5 presents the accumulated five-year net cash flow of a 500 and 1 000-beehive enterprise for the combination of honey production and pollination services.

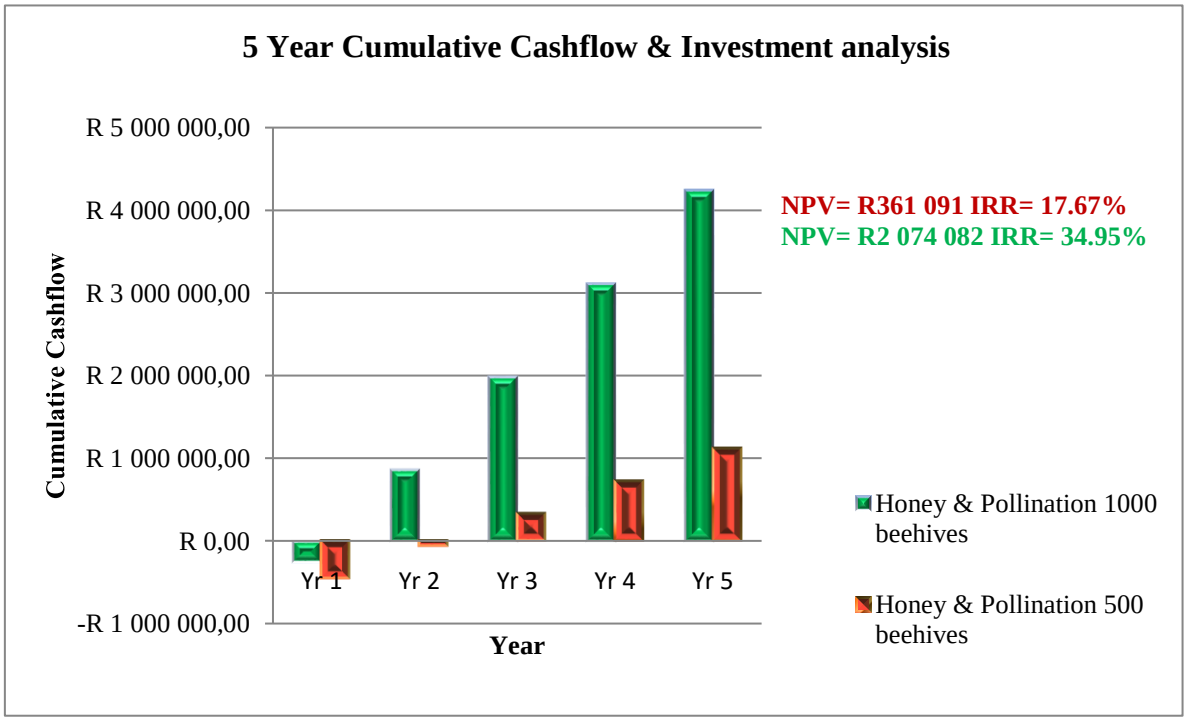

Figure 4. 5: Cumulative cash flow and investment analysis for 500 and 1 000 beehives

The investment of R1 233 450.00 and R2 489 590.00 for 500 and 1 000 beehives enterprise resulted in a positive net cash flow of R1 115 480.00 and R4 233 398.00 at the end of the fifth year. Both the production of honey and the provision of pollination shows that both enterprises are viable. Positive cumulative cash flow means that the enterprise generates more revenue than expenditure whereas a negative cumulated or net cash flow indicates that the enterprise generates less income than expenditure. De Ionno *et al*. (2006) notes that cumulative net cash flow represents the gross amount of net cash flows over a specific period and provides an indication of positive or negative cash position.

The results in the study area revealed that the combination of both honey production and pollination services yielded positive returns over a period of five years. The NPV for 500 and 1 000 beehives over a period was R361 091.17 and R2 074 082.94 respectively, indicating that the investment creates value for the enterprise. The calculated internal rate of return (IRR) for 500 and 1 000 beehives resulted in an IRR of 17.67% and 34.95% correspondingly, meaning that the investment yielded a return of R17.67 and R34.95 per R100 of the investment respectively. The payback periods for both investments over a five-year period are 3.15 and 2.22 years respectively, suggesting that the more the number of beehives an enterprise owns the shorter the payback period and the higher the return on investment. It can be noted that in this scenario it is better to manage 1 000 beehives than 500 beehives as the payback time is shorter and returns are much higher.

4.4 Beekeeping sensitivity analysis

This section presents results of the third objective of the study as outlined in chapter one. Profit and loss variations are presented for price and quantity scenarios for the separate production of honey, pollination and the combination of honey production and pollination services. This analysis only included the 150-beehive enterprise. The 500 and 1 000-beehive enterprises were omitted because the net profit was not sensitive to price and output changes.

4.4.1 Sensitivity analysis for a 150-beehive enterprise

Sensitivity analysis was computed for the purpose of determining the sensitiveness of the net profit to changes of output and prices and as well to determine the output qualities required for the break-even point. Table 4.3 presents profit/loss margin variations as prices and yield increase or decrease with an inclusion of a break-even yield given prices and quantities. The calculation of the sensitivity analysis includes gross income from activities, cost of sale and general expenditure.

Table 4.3: Sensitivity analysis for a 150-beehive enterprise

SENSITIVITY ANALYSIS FOR 150 BEEHIVES (Net profit/Loss)					
Honey production	**Less 10%**	**Less 5%**	**Actual**	**Add 5%**	**Add 10%**
Yield change at 20%	**R 67.50**	**R 71.25**	**R 75.00**	**R 78.75**	**R 82.50**
900	-R 158 500	-R 155 125	-R 151 750	-R 148 375	-R 145 000
1 200	-R 138 250	-R 133 750	-R 129 250	-R 124 750	-R 120 250
1 500	-R 118 000	-R 112 375	-R 106 750	-R 101 125	-R 95 500
1 800	-R 97 750	-R 91 000	-R 84 250	-R 77 500	-R 70 750
2 100	-R 77 500	-R 69 625	-R 61 750	-R 53 875	-R 46 000
Break-even yield (Kg)	**3 248**	**3 077**	**2 923**	**2 784**	**2 658**
Pollination	**Less 10%**	**Less 5%**	**Actual**	**Add 5%**	**Add 10%**
Yield change at 20%	**R 1 152.00**	**R 1 216.00**	**R 1 280.00**	**R 1 344.00**	**R 1 408.00**
90	-R 116 170	-R 110 410	-R 104 650	-R 98 890	-R 93 130
120	-R 81 610	-R 73 930	-R 66 250	-R 58 570	-R 50 890
150	-R 47 050	-R 37 450	-R 27 850	-R 18 250	-R 8 650
180	-R 12 490	-R 970	R 10 550	R 22 070	R 33 590
210	R 22 070	R 35 510	R 48 950	R 62 390	R 75 830
Break-even yield	**191**	**181**	**172**	**164**	**156**
Honey & Pollination	**Less 10%**	**Less 5%**	**Actual**	**Add 5%**	**Add 10%**
Yield change at 20%	**R 2 328.30**	**R 2 457.65**	**R 2 587.00**	**R 2 716.35**	**R 2 845.70**
90	-R 23 420	-R 11 778	-R 137	R 11 505	R 23 146
120	R 46 429	R 61 951	R 77 473	R 92 995	R 108 517
150	R 116 278	R 135 681	R 155 083	R 174 486	R 193 888
180	R 186 127	R 209 410	R 232 693	R 255 976	R 279 259
210	R 255 976	R 283 140	R 310 303	R 337 467	R 364 630
Break-even yield	**100**	**95**	**90**	**86**	**82**

According to Statistics How To (n.d.), sensitivity analysis determines the relationship between a dependent variable and other parameters (yield and prices). It looks at what happens to the dependent variable when other variables change. The analysis of the 150-beehive enterprise determined the profit margin movements as prices and yield changed. Yield and prices are assumed to change by 5% and 20% increments/decrement respectively to observe changes in profit margin. The profit margin for honey production remained negative regardless of a 10% and 40% increase in both price and yield. The rendering of pollination services with 150 beehives resulted in a positive profit margin if the yield is increased by 20%; however, if prices decrease by 10% yield would have to increase by 40% for positive profits. The combination of honey production and the provision of pollination services results in a negative profit if yields are decreased by 40%.

The honey bulk price of R75 per kilogram and the yield of 1 500 kilograms at the associated total cost of R219 250.00 resulted in a loss of R106 750.00 for honey production of the 150-beehive enterprise. The break-even yield required to cover the total cost of the enterprise is estimated at 2 923 kilograms. However, this break-even is lower by 265 kilograms if bulk prices are increased by 10%. Break-even yield for pollination services is realised when the number of beehives increases by 14.66% to 172 with the same price charged per pollination service offered. Profit margins for the combination of honey and pollination are positive across the different scenarios unless the yield is decreased by 40% with the same unit price. The breakeven yield required to cover overall expenditure is estimated at 90 beehives. It is evident that apiculture in the study area works well if pollination is combined with honey production.

CHAPTER FIVE: SOCIO-ECONOMIC CONTRIBUTORS OF APICULTURE

5.1 Introduction

The chapter presents findings of the fourth and fifth objectives of the study. It presents information about the demographics and socioeconomics of the beekeeping businesses. The findings about the last objective of the about the relationship between two variables being production system and turnover is also presented.

5.2 Socio-economic characteristics and contributors

This section presents the results of the fourth objective of the study as outlined in chapter one, which is the last objective of the study. This section considers the demographics of the beekeepers as well as entity characteristics. The section also considers the beekeepers' own perceptions of the viability of apiculture.

5.2.1 Regional location of beekeepers

The beekeepers interviewed were scattered around the entire Cape Winelands District Municipality and were from all the local municipalities in the region. Figure 5.1 shows the distribution of beekeepers within the Cape Winelands municipality.

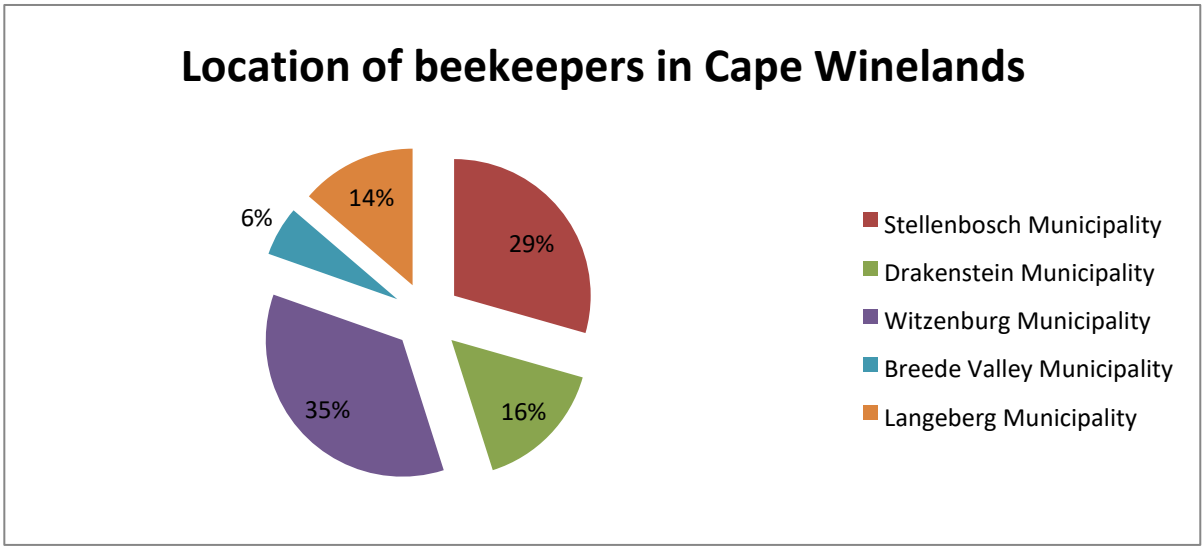

Figure 5. 1: Distribution of beekeepers in the Cape Winelands District Municipality

The majority (64%) of the respondents were in the Stellenbosch and Witzenberg local municipality. Three local municipalities, namely Langeberg, Breede Valley and Drakenstein had the least participants. The reason for this large number in Witzenberg and Stellenbosch is that most of the fruit and vegetable production in the district is concentrated in these two

local municipalities. Fruit and vegetable production provides nectar to honeybees and allows apiarists to provide pollination services, even though some beekeepers move some of their beehives to other districts such as West Coast and Overberg for pollination in the canola and blueberry farms. The three local municipalities, namely Langeberg, Breede Valley and Drakenstein, had the least participants because these regions are involved in wine and vegetable processing and other enterprise that do not provide a nectar source for honeybees.

5.2.2 Gender, marital status and age of the beekeepers

The gender, marital status and the age of the beekeepers were analysed and found to show meaningful statistics about beekeeping. Table 5.1 summarises gender, marital status and age profile of the participants.

Table 5.1: Gender, marital status and age of the respondents

	FREQUENCY	**PERCENTAGE**
Gender		
Male	46	90%
Female	5	10%
Total	51	100%
Marital Status		
Married	42	82.35%
Single	7	13.73%
Other	2	3.92%
Total	51	100.00%
Age of the beekeeper		
<25 years	1	1.96%
25-30 years	2	3.92%
31-39 years	8	15.69%
40-49 years	11	21.57%
50-59	19	37.25%
60-70+	10	19.61%
Total	51	100.00%

Most of the beekeepers were males, over the age of 50 years and married. The age and gender of the beekeepers in the study area conform to a study conducted by Mwakatobe *et al.* (2016) in Tanzania on women and youth participation in beekeeping. Many studies

associate apiculture with men due to the physical nature of the business. However, agriculture in general is dominated by males except for subsistence (production of food for household consumption) and small-scale farming (production of food for market, however with limited access to land, credit, market and inputs) which are mainly located in rural areas. Over 80% of respondents in the study area reported that they were married, similar to the findings of Abejew and Zeleke (2017) in Ethiopia. Peter (2015) is of the opinion that married people tend to be more stable in agricultural activities as opposed to unmarried persons.

The findings of the study are similar to other studies conducted on apiculture in other countries, such as a study on economic contribution and socioeconomics of beekeeping and honey production in Iran which found that 97% of respondents were males and over 80% were over 40 years of age (Vaziritabar & Esmaeilzade, 2016). The study further reported that 96% of beekeepers involved in the study were married. In Turkey, an economic analysis conducted by Saner *et al.* (2004) of beekeeping in sustainable development reported that the average age of respondents was 43.35 years. Furthermore, another study in Turkey by Vural and Karaman (2009) on the effects of beehive type on honey production also found an average age of 43.88 years, whilst it is reported by Kalanzi *et al.* (2015) in a beekeeping socio-analysis study in Uganda that the average age of 60 beekeepers in 6 regions was 46.7, with the majority (95.8%) of respondents being males.

5.2.3 Education level and beekeeping status

Education level of those involved in agriculture in many cases is said to have an impact on the success of the business. The presentation of the level of education by all groups of beekeepers is shown in Figure 5.2.

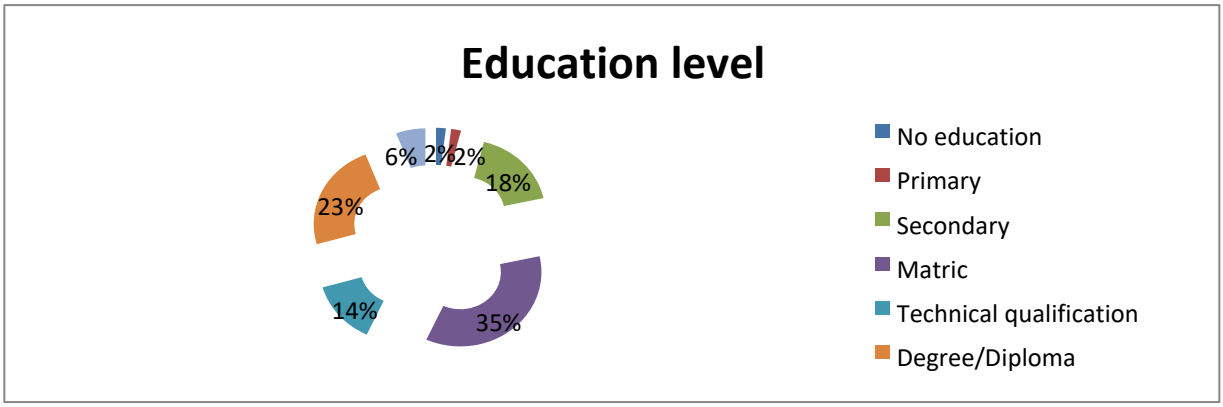

Figure 5. 2: Education level of the beekeepers

The respondents with matric certificates and further education or training were dominant as compared to those with secondary (without matric certificate), primary and no formal education. Beekeeping in the study area was mostly (78.43%) practiced by apiarists with matric certificates and further education/training. Similarly, results of a study conducted in

Pakistan also showed that 53% of beekeepers had both primary and secondary education while 47% of respondents had matric and post-matric qualification (Qaiser, *et al*., 2013). Conversely, another study in Kenya had opposite results as about 84.5% of beekeepers interviewed were illiterate and some had primary education (Irungu *et al.,* 2016). Apart from the education level of beekeepers, Findlay *et al.* (2015) conducted a study in the USA and reported that beekeepers trained or educated in beekeeping had better management skills than those without beekeeping education. Peter (2015) reported that a lot of training in South Africa have been conducted over the years, by professional beekeepers and academic institutions such as Agricultural Research Council.

5.2.4 Experience of the participants in beekeeping

Beekeepers with a considerable experience in South Africa act as mentors to the hobbyist and other development beekeepers. Number of year (experience) in the beekeeping by the participants is presented by means of a pie chart on Figure 5.3. Beekeepers with over five years of apicultural experience were the majority compared to apiarists with less than five years.

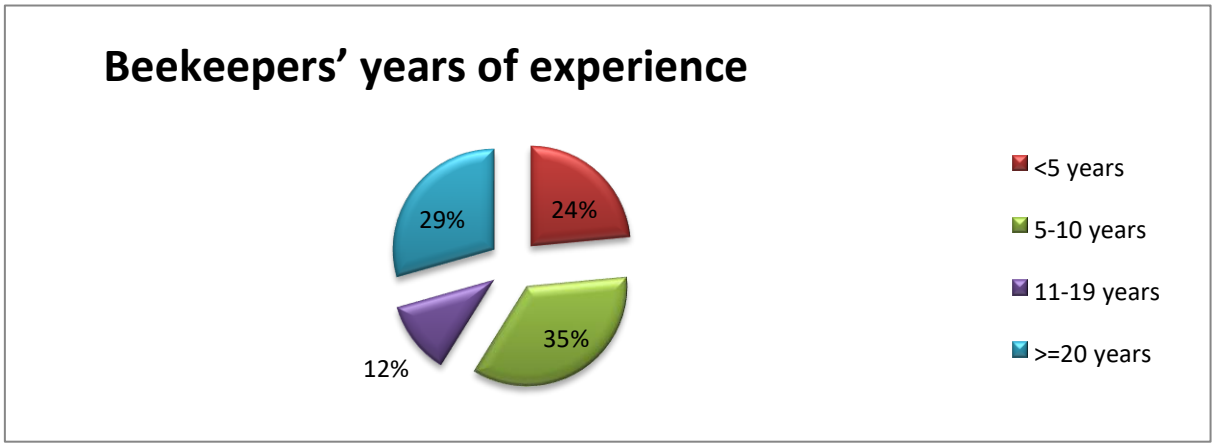

Figure 5. 3: Beekeepers' years of experience

The experience and knowledge of a beekeeper are vital in bringing innovation and sustainability in the apicultural business. This study found that the majority (60%) of beekeepers had apicultural experience of less than 10 years. Two studies in Nigeria and Uganda concur with this study regarding beekeeper experience. The results of 116 and 60 respondents surveyed in Kwara State, Nigeria and Uganda revealed that 82.61% and 56.30% had experience of less than 10 years respectively (Yusuf, *et al*., 2014; Kalanzi, *et al*., 2015). However, another study in Nigeria on beekeeping economics found that only 18% of the respondents had beekeeping experience of less than 10 years, while most beekeepers (70%) had an experience of between 10 and 20 years (Tijani *et al*, 2011).

5.2.5 Beekeepers' membership status and statutory registration

The statutory registration and membership of the beekeeping businesses is important to understand in order to map out the number of beekeepers registered and as well, the association of their choice. Figure 5.4 illustrates the statutory registration of beekeepers (with the Department of Agriculture, Land Reform and Rural Development) and the membership status of the apiarists with the national and regional associations.

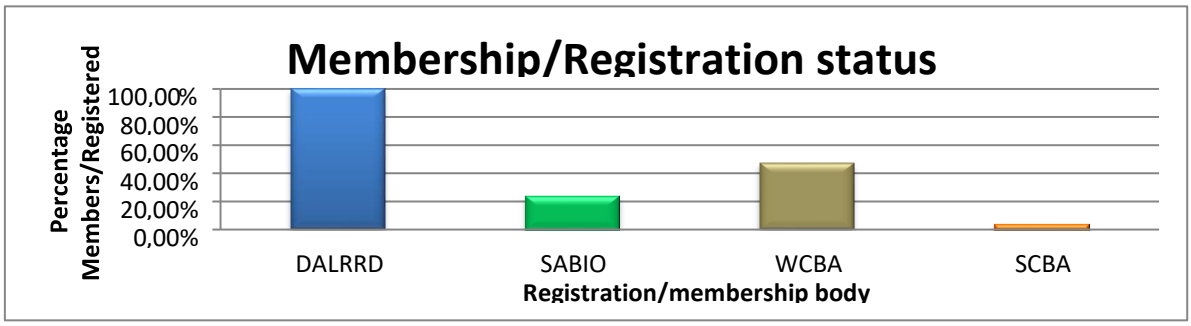

Figure 5. 4: Beekeepers' registration and regional membership

Beekeepers are required to register with the Department of Agriculture, Land Reform and Rural Development. Further than the mandated registration, entities are voluntarily allowed to be members of the local and the national beekeeping bodies. The surveyed respondents (100%) who are registered with the Department of Agricultural, Land Reform and Rural Development cited that it was mandatory and a legal requirement to register as per the Agricultural Pest Act of 1983. Respondents felt that South African Bee Industry Organisation membership was expensive and there was no benefit in being part of the organisation, hence the low membership rate of 23.53%. The respondents further cited that they did not intend to register with the organisation.

Conversely, the Western Cape Bee Industry Association and Southern Cape Bee Industry Association are community-based organisations and the respondents reported that it was vital to subscribe with the organisation for information sharing. The surveyed beekeepers also felt that the organisations needed to communicate more with all the ranges of beekeepers, as some did not know about the existence of these organisations especially small-scale beekeepers.

Apart from memberships, legally registered private companies accounted for 35.29% of the beekeeping businesses in relation to 3.92% of partnerships. It is interesting to note that the majority of respondents (60.78%) are trading as sole proprietors regardless of the number of beehives owned.

5.2.6 Business start-up investment

In recent years, government grants have been made available to aspiring and professional beekeepers for expansion and the development of hives. Figure 5.5 depicts the form of beekeeping capital investment by the respondents. Most of the beekeepers used their own savings for their business start-up whilst the rest made use of loan, grants and other forms of investments**.**

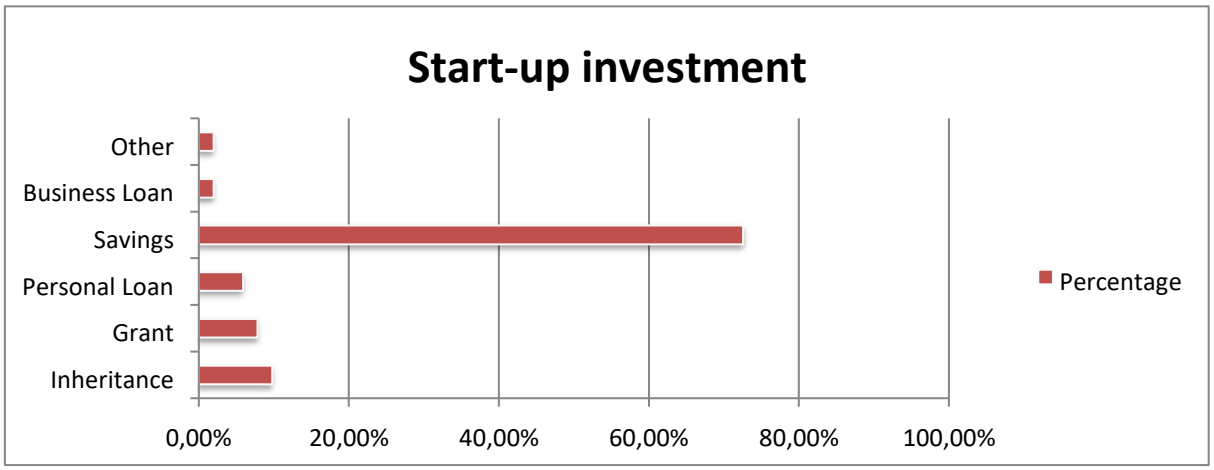

Figure 5. 5: Beekeeping business start-up investment

Businesses must start somewhere, whether the beekeeper is emerging or is a professional. In addition to the source of start-up capital, about 37.25% of the beekeeping entities in the study area have been in the industry for less than a period of five years in comparison with 35.29% of respondents whose businesses have been operating for a period of between five to 15 years. Around 27.45% of respondents noted that their business had been operating for over 15 years. The apiarists' business backing depends on a myriad of factors and since most beekeepers start as hobbyists, it helps in terms of learning more about beekeeping before large sums of money are invested. Most beekeeping businesses started small through own savings, however over the time in businesses they take out loans for expansion and other short-term obligations.

In a study on beekeeping adoption and associated technology in Uganda's two regions, 95% and 100% of respondents reported that their startup capital was through own savings (Mujuni, *et al*., 2012). Likewise, it has been shown by Eforuoku and Thomas (2015) that 61.1% and 22.1% of respondents funded the beekeeping business through own savings and business loan respectively. The results of the studies by Mujuni *et al.* (2012), Eforuoku and Thomas (2015) are in line with this study's findings regarding the beekeepers in the Cape Winelands district municipality.

5.2.7 Business turnover

This section discusses the turnover or revenue of the interviewed beekeeping businesses. Business turnover per annum by the apicultural business is demonstrated by Figure 5.6. Most beekeepers had an annual turnover of less than R500 000.

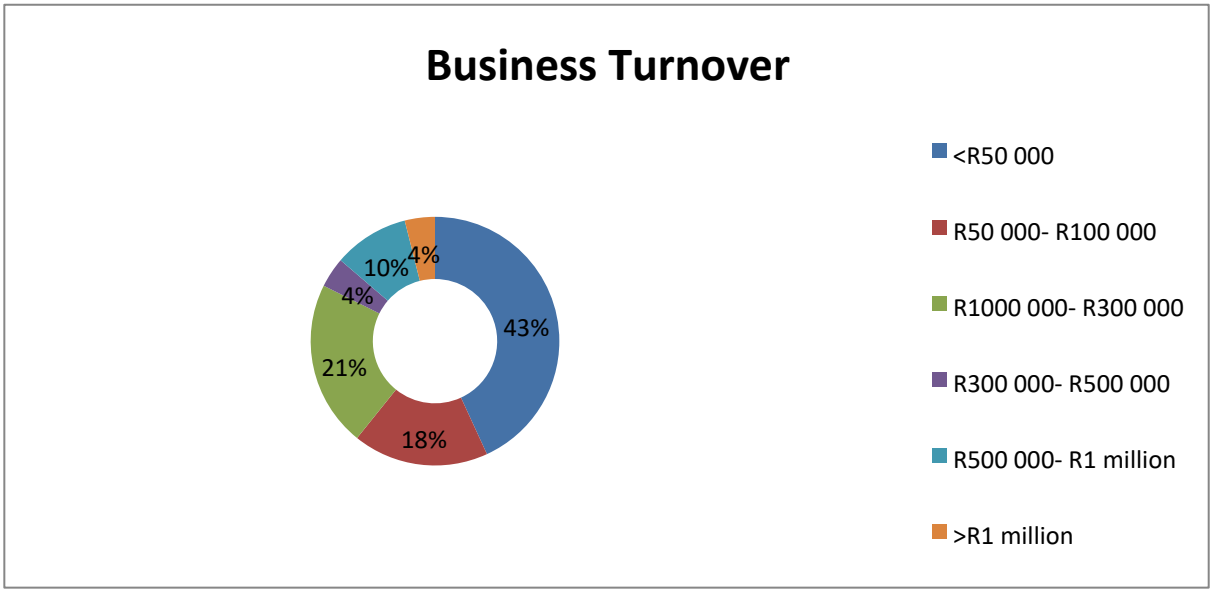

Figure 5. 6: Illustration of business turnover

The low percentage of beekeepers who had a turnover of R500 000 to over R1 million confirms that the higher the number of colonies owned, the higher the turnover derived from apiculture. The results are also supported by the findings of similar studies that gross income and profit are influenced by colony size (Tijani, *et al*., 2011). Additionally, Peter (2015) notes that the gross income of a beekeeping business is determined by honey produced and the number of hives managed by the apiarist. Likewise, it can be noted that the ratio of pollination services vis-à-vis honey production increases as the number of colonies managed increases.

5.2.8 Honeybee colonies in the Cape Winelands district

This section discusses the distribution of honeybee colonies across the wider Cape Winelands region in order to understand where many apiarists are located. The summary of the number of honeybee colonies owned by the respondents in the Cape Winelands Municipality is depicted in Figure 5.7.

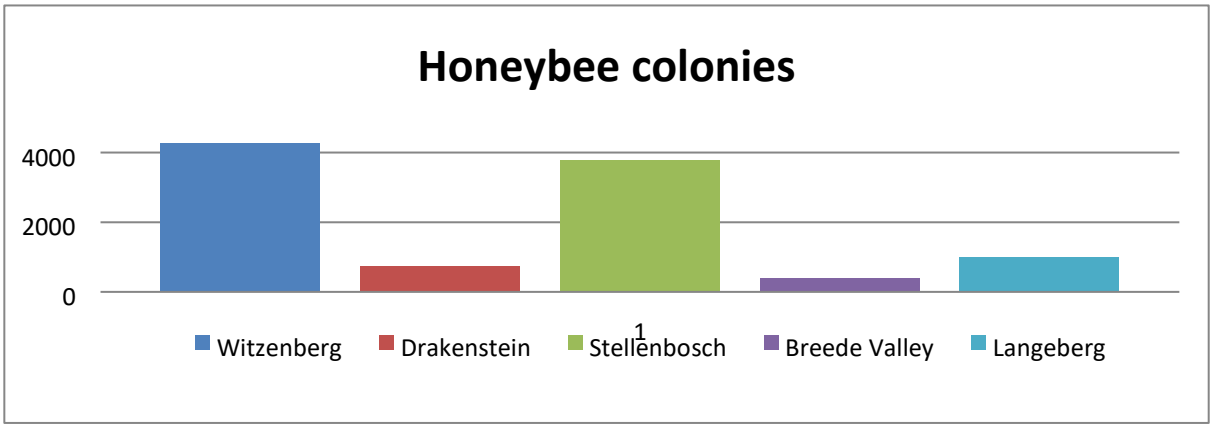

Figure 5. 7: Distribution of honeybee colonies in the Cape Winelands

The majority (79.16%) of colonies in the study area were managed by beekeepers in both the Witzenberg and Stellenbosch Local Municipality. The number of colonies managed by Cape Winelands beekeepers is 80% more than the colonies reported by Peter (2015) in a study conducted in six district municipalities of the Eastern Cape Province, which also suggests that beekeepers in the Western Cape own a larger number of colonies as compared to the Eastern Cape. Surveyed beekeepers reported that there was no need to have many beehives, as a good business model that included the production of honey, provision of pollination services and honey processing was the key. The interesting point made by some apiarists was that being a bee-entrepreneur is paramount in the apicultural industry for business sustainability.

5.2.9 Products and services rendered in the district by beekeepers

Apiarists decide on services and products to be rendered depending on the location and scale of production. Most beekeepers started small with fewer beehives producing honey only and as they expand, pollination services were added to the business. Figure 5.8 illustrate services and products offered by the beekeepers.

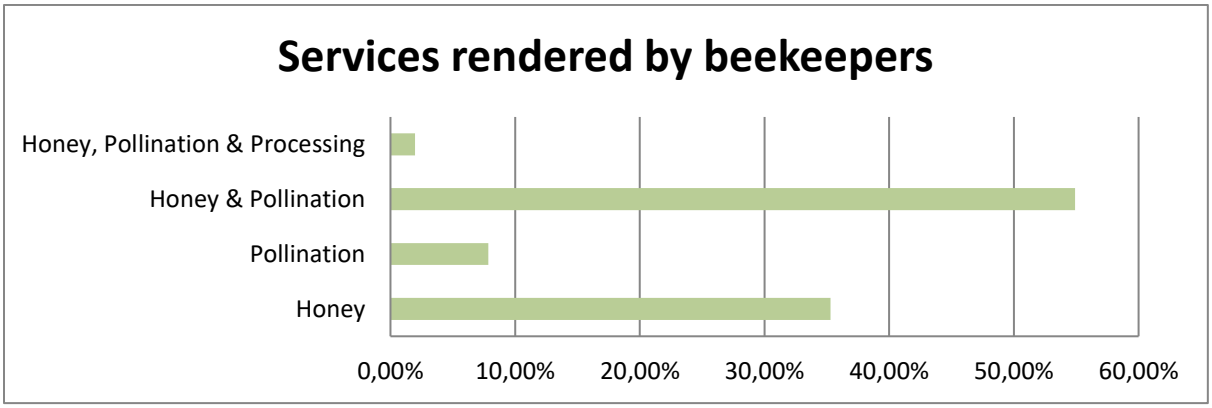

Figure 5. 8: Products and services rendered by beekeepers

The majority (54.90%) of respondents in the study area revealed that they offered a combination of pollination services and honey production. Respondents noted that honey production only or pollination services only were not viable options. The results in the study area are also supported by Pokhrel (2009) who found that 65% and 35% of the respondents in two areas were combining honey production and pollination services. Some beekeepers prefer to produce honey and sell to other commercial beekeepers with contracts to retailer market rather than having own contracts. The ratio of pollination services to honey of the respondents ranges from 50:50 to 80:20 depending on the size of the colonies managed and the availability of sites.

5.2.10 Extraction of honey by beekeepers

The removal of honey takes place once the honey crop is ready for the harvest from the hive frames. There are different types and sizes of extracting machines available. The majority of beekeepers (72.55%) reported that they use an extractor whilst the rest do not have a machine. Those beekeepers without an extractor take their frames to beekeepers who own an extractor for extraction at a fee that ranges between R4-R5 a kilogram of honey harvested. These beekeepers normally have a small number of beehives.

Regardless of the number of colonies managed, 72.55% of respondents had an extracting machine and the type and size of the machine differed depending on the number of frames required on each extractor per harvest. In Limpopo, a report on rural apicultural development found that 65% of beekeepers still use the traditional methods of extracting honey while 35% of beekeepers responded that they made use of manual and electric extractors (Nkwele Agribusiness Planning and Investment (Pty) Ltd, 2016). The traditional techniques of extracting honey include squeezing and cooking honey cakes, to name a couple.

5.2.11 The viewpoint of apiarists on apicultural viability

The financial viability of a business in this study refers to the ability of the beekeeping business to generate enough income to pay off short and medium-term financial obligations while at the same time being capable of growing. Beekeepers in the Cape Winelands were asked about their perception of the financial viability of beekeeping. The majority of beekeepers (78%) in the study area stated that they believed beekeeping was a financially viable venture whilst only 22% pointed out that beekeeping was in fact not a financially viable venture despite having personal and business loans.

The majority of beekeepers (78%) who perceived beekeeping as a viable venture noted that a beekeeper needs to be experienced and have more beehives and an available site. The

beekeepers also felt that the focus needs to be on pollination instead of honey and this conforms to the study findings on profitability of different systems. Apiarists further noted that the beekeeping business must be managed in the correct manner. It was interesting to note that many apiarists mentioned that challenges (theft, vandalism and honey badgers) in apiculture must be minimised at all costs, with many respondents noting that being an entrepreneur before being a beekeeper is the only option to be viable. Moreover, the reason that beekeeping is a financially viable venture is due to the demand for honeybees because there are new tree plantings. Between 2018 and 2021, hectares planted with nectarines and cherries increased by 5, 1% and 41% respectively whilst apples, pears and blueberry plantations increased by 3,2%, 3,4% and 17% (Hortgro, 2021).

It was reported by the respondents that access to beehive sites, damages to hives, theft and honey badgers were some of the factors that resulted in the venture becoming unviable. Government policies such as the removal of gum trees resulted in the reduction in forage and therefore less honey harvests. Beekeepers also reported that there was no documented information about the measurements and viable units. It was noted that many beekeepers were not aware that short-term insurance was available underwritten by Santam to cover the beekeepers against damage from veld fires and bee stings, to name a few. Almost all the respondents highlighted that the industry lacked unity, and that is why there was a low percentage in membership within the national organisation and provincial or regional associations.

5.2.12 Forage and nectar sources

Honeybees need a source of food or nectar to survive, therefore this section reports what forage and nectar sources were noted by the beekeepers. The demonstration of the forage and nectar sources by the beekeeping farms is presented in Figure 5.9. Most of the respondents noted that they collected nectar from canola crops, and pear, apple and gum trees.

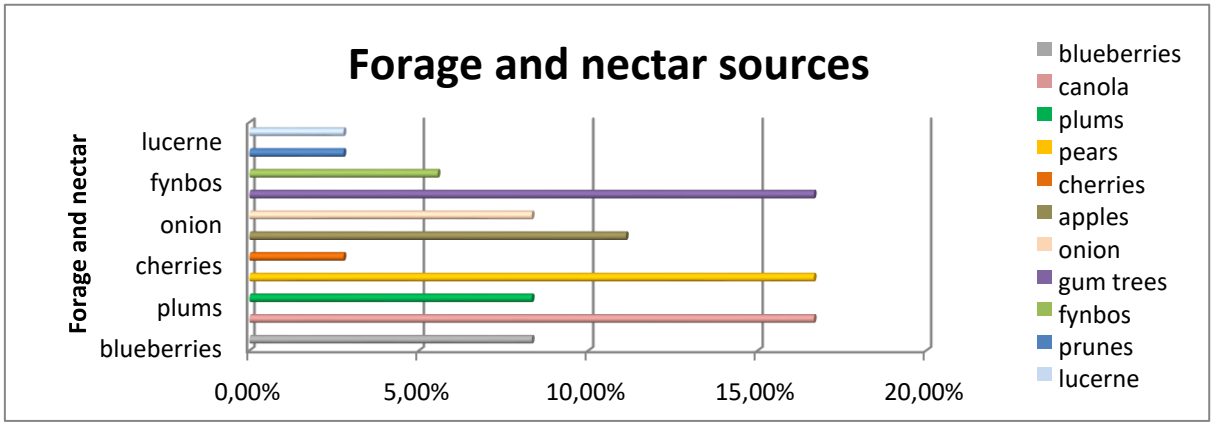

Figure 5. 9: Sources of nectar and forage

According to the South African National Biodiversity Institute (2013), honeybees forage on nectar and pollen of flowering plants and need a diversity of nectar and pollen from a myriad of plant sources. The institute also listed several honeybee nectar and forage sources including, but not limited to trees, annuals, herbaceous perennials and shrubs. When the honeybees collect nectar which is converted into honey, some portion of pollen remains in the honey. The presence of the dominant pollen in the honey is used to determine and name the honey (Adekanmbi & Ogundipe, 2009).

In accordance with the profile of the agricultural sector, the Cape Winelands district accounts for 57.76% of the 180 175 hectares of planted orchards and only 26.71% of 16 087 hectares of vegetable production (Western Cape Department of Agriculture, 2019). The results obtained from the respondents also support the assertion of this agricultural sector profile because respondents reported that most of the forage and nectar sources were fruit trees, and few were vegetable crops especially seed production. According to Hortgro (2019) apples and pear production in Cape Winelands accounts for 31.21% and 50.20% of the 24 970 and 12 674 hectares of apples and pears produced in South Africa respectively, which is why these enterprises are amongst the top nectar sources for honeybees in the study area. Furthermore prunes, plums and cherries are mostly produced in the Cape Winelands. The majority of prunes (89.71%), plums (55.84%) and cherries (65.03%) produced in South Africa are cultivated in the Cape Winelands districts. The results further support the regional production statistics as reported by Hortgro (2019).

5.2.13 Correlation between rendered services and turnover

The relationship between turnover and the type of services performed gives an idea of the type that result in high turnover. Figure 5.10 shows a scatterplot of the relationship between services offered and annual turnover.

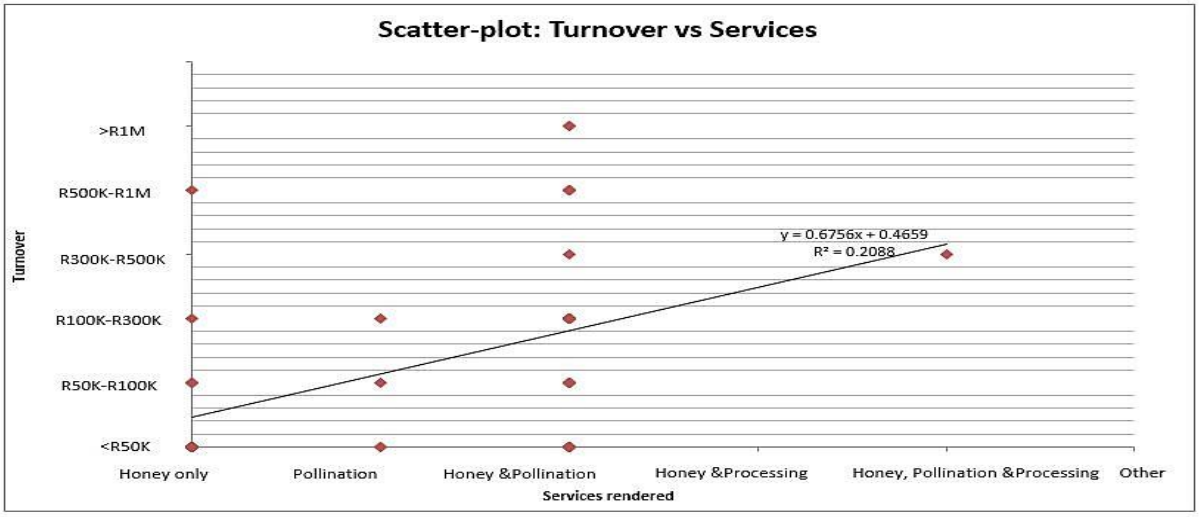

Figure 5. 10: Scatterplot of production system and annual turnover of beekeepers

The Pearson product-moment coefficient r=0.46 and p=0.001 were calculated. The r-value indicates the strength of the correlation while the p-value indicates if the correlation is statistically significant. The coefficient r=-1 indicates a perfect negative correlation, and r=1 shows a perfect positive correlation, whereas an r=0 means there is no correlation between two variables (Laerd Statistics, n.d.). The Spearman rank correlation coefficient r_s=0.50 and p=0.000 were also calculated. The r_s value indicates the strength of the correlation whilst yet again p-value indicates if the correlation is statistically significant. Spearman coefficient r_s=-1 indicates a perfect negative correlation, and r_s=1 shows a perfect positive correlation, while an r_s=0 suggests that there is no correlation.

The calculated Pearson product-moment coefficient value r=0.46 can be considered a moderately strong correlation with a p-value of 0.001, which means that the correlation between services rendered, and turnover is statistically significant. Services rendered and annual turnover are statistically significantly correlated at the 1% level (r=0.46; p=0.001). Likewise, the Spearman coefficient value r_s=0.50 is considered to be a strong correlation with a p-value of 0.000, which suggests that the correlation between the two variables is statistically significant. Therefore, rendered services and turnover per annum are statistically significantly correlated at the 1% level (r_s=0.50; p=0.000). The last objective of the study was to determine if correlation exists between the beekeeping production system and turnover. The findings of the study showed that there is a correlation between a beekeeping production system and system and turnover of the business. The findings on correlation also conforms with the results on profitability and investment analysis presented in chapter four.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The beekeeping industry in South Africa has over the years faced a myriad of challenges from limited forage, the use of pesticides by the crop farmers that reduces honeybee population, beehive vandalism, theft and cheap honey imports. Various studies in other countries have shown that there are positive returns from beekeeping however, without conducting a comparative analysis of the different beekeeping system. It was therefore important to understand the profitability and investment analysis within the apicultural industry in the Western Cape from different production systems.

Making use of profitability and investment techniques, the results of the study revealed that beekeepers owning 150 beehives need a capital expenditure of R488 270. Furthermore, it was revealed by the findings that those who are solely producing honey are generating a gross margin per hive of R261.30, whilst a better gross margin of R731, 30 is realised by beekeepers who decided to focus on rendering pollination services than honey production. It is therefore evident that providing pollination services is better than honey production. The combination of the two production systems generates more than twice (R2 000) what is generated by either of the two even though several trips are expected from this production system. Beekeepers with either 500 or 1 000 always combine the two production systems and beekeepers generate the same returns per hive as the beekeepers owning 150 beehives on their businesses.

The investment analysis revealed that the only production system with a positive net present value (R143 367.40) whether the beekeeping business owns 150, 500 or 1 000 is the one that combines honey production and pollination services. The combination of the two production systems has a short payback period of three years even though the capital expenditure is expensive. Sensitivity analysis showed that if there is a split of honey production from pollination services, losses are realised even if prices and output quantities can be increased by 10% and 40% respectively. It was revealed that there is a positive correlation between the type of production system beekeepers decides upon and annual turnover.

The production of honey and pollination services in the Cape Winelands is practiced predominantly by adult males just like any other farming activity in South Africa. Registration by beekeepers through the Department of Agriculture, Land Reform and Rural Development is important especially for national beekeeping statistics. It is noted that identification is visible of beekeepers' hives as required by the regulation. However, participation and membership in local associations is minimal and this needs urgent attention. It was evident that most beekeepers render pollination services and honey production with fruit being the top nectar source for honeybees, understandably due to the location of the district municipality.

6.2 Recommendations

- It is recommended that beekeepers with 150 beehives should combine honey production with pollination services for higher gross margin and positive returns on investment.
- It should be mandatory for all beekeepers to register and be members of local associations to strengthen the work of the national beekeeping association.
- In order to have honey production data for South Africa, it is recommended that beekeepers be mandated to share yearly honey harvest data because the national database does not have such information.
- Further research can be explored to focus on the industry economic analysis and the contribution of the different subsectors of beekeeping to the gross domestic product, including market intelligence.

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APPENDICES

Appendix 1: Beekeeper's questionnaire

QUESTIONNAIRE: BEEKEEPERS

Dear Respondent,

My name is Mzwanele Lingani, a Master of Agriculture student (216275237) at the Cape Peninsula University of Technology. Thank you for taking your time to assist me fulfil my study requirements by completing this questionnaire.

The aim of the research study is to perform an **"Economic and Investment analysis within the beekeeping farms in the Cape Winelands District of the Western Cape".** The study seeks to establish potentially viable options among the production systems within apiculture. The data that is being collected from beekeepers is only for research purposes and ethical considerations will be followed at all times in the dissemination of results. The Cape Peninsula University of Technology has strict guidelines with reference to this kind of research study to which this research conforms.

For the verification of the genuineness and ethical considerations of this research study, feel free to contact the research ethics chairperson at the Cape Peninsula University of Technology Prof Felix Nchu [NchuF@cput.ac.za; 0219696473]

Yours faithfully,
Mzwanele Lingani

Contact details:
Mr Mzwanele Lingani : Cell 074 572 2848, Email: MzwaneleL@elsenburg.com
Dr Ellana Hough : Cell 082 921 9817, Email: HoughE@cput.ac.za
Dr Morris Fanadzo : Cell 084 996 0814, Email: FanadzoM@cput.ac.za

Questionnaire Number

Beekeeper's Full name

Beekeeper's Contact Details

Nearest Town

SECTION 1: SOCIO-ECONOMIC CHARACTERISTICS OF BEEKEEPERS
Instructions: Please tick the appropriate box.

1.1 What is your gender?

Gender	Code	Tick (appropriate code)
Male	0	
Female	1	
Other	2	

1.2 What is your marital status?

Status	Code	Tick
Married	0	
Single	1	
Widowed	2	
Other	3	

1.3 What is your highest level of education?

Education level	Code	Tick
No education	0	
Primary (Grade 1-7)	1	
Secondary (Grade 8-12)	2	
Matric certificate	3	
Technical qualification	4	
Diploma/Degree	5	
Post graduate qualification	6	

1.4 What is your age?

Age in years	Code	Tick
<25	0	
25-30	1	
31-39	2	
40-49	3	
50-59	4	
60-70+	5	

1.5 What is your current employment status?

Employments status	Code	Tick
Fulltime Beekeeper/self-employed	0	
Employed Part-time	1	
Retired	2	
Student	3	
Unemployed	4	

1.6 What is your gross monthly income?

Personal gross income	Code	Tick
Between R0-R999	0	
R1 000-R2 999	1	
R3 000-R4 999	2	
R5 000-R6 999	3	
R7 000-R8 999	4	
R9000-R15 000	5	
R15 000-R20 000	6	
R20 000+	7	

1.7 How many years of experience in beekeeping do you have?

Years of experience	Code	Tick
Less than 5	0	
5-10	1	
11-19	2	
20 and more	3	

1.8 Registrations

Body	Yes (1)	No (0)	Why?
DAFF			
SABIO			
WCBIA			
SCBIA			

SECTION 2: BEEKEEPING ENTITY INFORMATION
Instructions: Please tick the appropriate box.

2.1 Which type of business/entity do you own?

Business entity type	Code	Tick
Registered (Pty) Ltd	0	
Registered Primary Co-operative Ltd	1	
Registered Business Trust	2	

Sole Proprietor	3	
Partnership	4	

2.2 How did you start the business? Source of start-up investment

Source of start-up	**Code**	**Tick**
Inheritance	0	
Grant	1	
Personal loan	2	
Savings	3	
Business loan	4	
Other	5	

2.3 How many years has your business existed?

Existence in years	**Code**	**Tick**
Less than 1	0	
Between 1-3	1	
Between 3-5	2	
Between 5-9	3	
Between 10-15	4	
More than 15	5	

2.4 What is the annual turnover of your business?

Annual turnover	**Code**	**Tick**
Between R0-R50, 000	0	
Between R50 000-R100 000	1	
Between R100 000- R300 000	2	
Between R300 000- R500 000	3	
Between R500 000- R1 000 000	4	
More than R1 000 000	5	

2.5 How many beehives do you/your business have?

Number of beehives	

3. PRODUCTION INFORMATION & ASSUMPTIONS

Instructions: Please tick the appropriate box.

3.1 What products or services do you offer?

Product/services offered	**Code**	**Tick**
Honey only	0	
Pollination only	1	
Honey & Pollination	2	
Honey & Processing	3	
Honey, Pollination and Processing	4	

Other	5	

3.2 Do you regard yourself as?

Classification beekeeping scale	**Code**	**Tick**
Hobbyist	0	
Small-scale	1	
Commercial	2	
Professional	3	

3.3 Why do you regard yourself as per your chosen answer?

……
…
……
…
……
…

3.4 Do you think beekeeping business is a profitable venture?

Profitability of the business	**Code**	**Tick**
No	0	
Yes	1	

3.5 Based on your answer on question 3.4 why do you think so?

……
…
……
…
……
…
……..
..

3.6 When is the production season for honey?

3.7 When is your pollination season?

3.8 When is the production season for processing?

3.9 Do you extract honey yourself?

Honey extraction	Code	Tick
No	0	
Yes	1	

3.10 If your answer is NO on question 3.9, how much do you pay for honey extraction/kg

3.11 Can you please answer the following production assumptions?

Production assumptions	Answer
Number of bees per hives	
Number of hives kept for honey	
Number of hives kept for pollination	
Amount of honey used for processing	
Number of harvests per year	
Yield per hive (kg)/harvest	
Price per kg for honey	
Price/beehive for pollination service	
Number of pollination services offered by year	

4. COST OF SALES & OPERATING EXPENDITURE INFORMATION

4.1 What are the direct costs for honey production?

Products/items	Quantity	Number of times per year

4.2 What are the direct costs for pollination services?

Products/items	Quantity	Number of times per year

4.3 What are the direct costs of processing?

Products/items	Quantity	Number of times per year

4.4 What are the indirect/overhead costs of the business?

Products/items	**Annual spending**

5. CAPITAL EXPENDITURE/INVESTMENT REQUIRENTS

5.1 What are the capital requirements needed for beekeeping?

Products/items	**Cost price**	**Quantity needed**

The end.

Thank you for participating in this survey.

Appendix 2: Western Cape Bee Industry Association research approval

WES-KAAPSE BYEBEDRYFS-VERENIGING **WKBV**  **WCBA** WESTERN CAPE BEE INDUSTRY ASSOCIATION

To: WHOM IT MAY CONCERN
From: Dr Tlou Masehela, WCBA Chairman
Date: 16 March 2020

SUBJECT: Approval to conduct interviews with beekeepers in the Western Cape Province

Dear Sir/Madam,

This letter serves to confirm that Mr Mzwanele Lingani, Senior Agricultural Economist, with the Department of Agriculture Western Cape Government has been granted permission by the Western Cape Bee Industry Association (WCBA) to conduct interviews with beekeepers of his choice within the province for his Postgraduate study.

Mr Lingani communicated his request for permission to conduct interviews to the WCBA in February 2020. The committee took the decision to grant him permission at its meeting held on 27 February 2020. Mr Lingani is also welcome to any WCBA events, workshops and training sessions where he can meet and network with beekeepers – subsequent, arrange or conduct interviews for his research. In addition, Mr Lingani shall be liable for any costs associated with activities or arrangements for his interviews.

The WCBA wishes Mr Lingani all the best with his research towards his M-Agric at CPUT.

Kindly direct any inquiries to Dr Masehela: info@wkbv.co.za

Sincerely,

Dr Tlou Masehela
WCBA Chairman

P: Bus/Box 1200, Bellville, 7535 M: 078 285 2553 E: info@wkbv.co.za W: www.wkbv.co.za

Appendix 3: Research statement permission

Cape Peninsula University of Technology

Statement of Permission

Data/Sample collection permission is required for this study.

Reference no.	216275237/07/2020
Surname & name	Lingani, M.
Student Number	216275237
Degree	Master of Agriculture
Title	An economic and investment analysis of apiculture in the Cape Winelands District Municipality, South Africa
Supervisor(s)	DR MORRIS FANADZO
FRC Signature	
Date	2020 Aug 03

Appendix 4: Ethics approval

P.O. Box 1906 · Bellville 7535 South Africa ·Tel: +27 21 953 8677 (Bellville), +27 21 460 4213 (Cape Town)

Ethics Approval Letter **Reference no: 216275237/07/2020**

Office of the Chairperson **Research Ethics Committee**	**Faculty of Applied Sciences**

On 28 July 2020, the Faculty Research Ethics Committee of the Faculty of Applied Sciences granted ethics approval to Lingani, M. for research activities related to a project to be undertaken for a degree (Master of Agriculture) at the Cape Peninsula University of Technology.

Title of project:	An economic and investment analysis of apiculture in the Cape Winelands District Municipality, South Africa

Comments (Add any further comments deemed necessary, e.g. permission required)

1. Human subjects are involved in the study.
2. This permission is granted for the duration of the study.
3. Research activities are restricted to those detailed in the research proposal.
4. The research team must comply with conditions outlined in AppSci/ASFREC/2015/1.1 v1, CODE OF ETHICS, ETHICAL VALUES AND GUIDELINES FOR RESEARCHERS.

Signed: Chairperson: Faculty Research Ethics Committee	**28/07/2020** **Date**

Appendix 5: Language editing

Ken Barris, PhD

Editing and research writing services

18 Doris Road, Claremont 7708, Cape Town, South Africa
ken.barris@gmail.com
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21 July 2022

To whom it may concern

This is to confirm that I have proofread the following thesis by Mzwaneli Lingani:

> An economic and investment analysis of apiculture in the Cape Winelands District Municipality.

Please note that this service covers only language usage, and not content, conceptual organisation, or changes made by the client subsequent to the editing process.

Best regards

Ken Barris

KEN BARRIS