



Ministry of Planning and Sustainable Development
The Economic Development Board
Level 17, Tower D
International Waterfront Centre
Wrightson Road,
Port of Spain

The Development of the Honey Industry in Trinidad and Tobago

Economic Development Board

May 2014

Ms. Shalini Budhu

Dr. Rikhi Permanand

Table of Contents

Contents	Page
Abbreviations and Acronyms	3
Acknowledgements	4
Executive Summary	5
Introduction	7
Marketing Analysis	8
Comparator Countries	15
a. New Zealand.....	15
b. Jamaica.....	16
c. Mexico.....	18
Situational Analysis of Trinidad and Tobago	21
Financial Analysis	34
Conclusions and Recommendations	38
Glossary	43
Appendices:	
❖ Appendix 1	46
• Conversions	
❖ Appendix 2: Excel Spreadsheets	48
• Hobby Apiary Financials	
○ Hobby Apiary : Low Yield	
○ Hobby Apiary: Medium Yield	
○ Hobby Apiary: High Yield	
• Medium Apiary Financials	
○ Medium Apiary : Low Yield	
○ Medium Apiary: Medium Yield	
○ Medium Apiary: High Yield	

- Large Apiary Financials
 - Large Apiary : Low Yield
 - Large Apiary: Medium Yield
 - Large Apiary: High Yield
- Supplemental Schedules:
 - Labour Schedule
 - Amortization Schedule
 - Description and Costs of Equipment Needed for Establishment of an Apiary

Abbreviations and Acronyms

AOPB	Association of Professional Beekeepers
AIFBA	All-Island Bee Farmers Association
EDB	Economic Development Board
EU	European Union
FDA	U.S Food and Drug Administration
FFBees	Federated Farmers Bee Industry Group
FOA	Food and Agricultural Organization of the United Nations
IFICF	International Food Information Council Foundation
IRR	Internal Rate of Return
JFCA	Jamaican Federation of Commercial Apiculture
MFP	Ministry of Food Production
MPI	Ministry of Primary Industries
NAMEDEVCO	The National Agricultural Marketing and Development Corporation
NBA	National Beekeepers Association of New Zealand
NHB	National Honey Board
NHS	National Honey Show
NPV	Net Present Value
TAS	Tobago Apiculture Society
THA	Tobago House of Assembly
TTBA	Trinidad and Tobago Beekeepers Association

Acknowledgements

This report could not have been possible without the assistance of the following persons:

- Mr. Ian Fletcher – Inspector of Apiaries, MFP
- Mr. Bede Rajaram – President of the TTBA
- Mr. Mohamed Hallim – Vice- President, Agricultural Society of Trinidad and Tobago (ASTT)
- Mr. Nandlal Maharaj – Supplier of Beekeeping Equipment
- Mr. Haden Sinanan – Beekeeping Extension Officer, MFP

Executive Summary

The National Food Action Plan (2012-2015) developed by the Ministry of Food Production has identified honey as a strategic crop to be developed. Local honey has its comparative advantage due to its high quality. Consumers are becoming more aware of the health benefits associated with high quality honey and this has led to an increase in consumption. Honey quality is directly related to the price.

Trinidad and Tobago has won numerous awards in the National Honey Show (NHS), in London which provides evidence for the high quality of local honey. In 2001, the EU enforced the submission of a residue monitoring plan from all **third countries** (non-EU countries) wishing to export honey into the European Union. Because of the lack of local testing facilities and costs associated with attaining certification abroad, beekeepers in Trinidad and Tobago have been unable to participate in the NHS and export their honey since 2001. This has resulted in all local honey being used for domestic consumption.

Demand severely outweighs supply and the current state of the local honey industry can be described as a hobby industry as many beekeepers produce honey as a past-time activity or as a source of additional income. Very few beekeepers, if any at all produce honey on a full-time basis. Many factors such as lack of foraging areas designated for beekeeping, lack of testing facilities, inability to properly secure incentives and even lack of regulation and enforcement of laws have hampered the development of the industry. The decentralization of the Apiary Unit within the Ministry of Food Production has led to a disconnect between beekeepers and the government making it even more difficult for beekeepers to obtain proper assistance.

This report aims to identify the economic viability and potential of this sector. It also focuses on the critical challenges facing this industry, develops an understanding of the honey market; both internationally and locally, provides economic models for the viability of beekeeping operations and puts forward recommendations to develop this industry.

Given the findings in this report, the EDB recommends that the government should focus in the first instance on the local supply of honey and the development of the honey sector into a small scale niche industry by:

- Focusing on the increase in honey production to satisfy local demand.
- Provide Educational training courses for beekeepers which include technical training, business training, marketing/branding
- Facilitate the production of local beekeeping equipment
- Restrictions on the imports of bee products
- Set up local testing facilities to ensure local honey remains of a high quality
- Connecting beekeepers to the government so that there will be a more efficient flow of information from the local industry to the government and vice-versa.

Depending in the successful development of the domestic industry, consideration should be given to exporting, initially to the regional markets.

Introduction

Beekeeping in Trinidad and Tobago was one of the first agricultural sectors to be regulated with the Beekeeping and Bee Products Act (Act 28 of 1935, amended by Act 7 of 1949) and the establishment of a government apiary in 1902. Unfortunately, today, the beekeeping industry is severely underdeveloped with the majority of beekeepers producing honey as a hobby or part-time job rather than a full time business venture. Currently there are approximately 300-400 registered beekeepers in Trinidad and Tobago with a total of approximately 7000 bee colonies.

The underdevelopment of the honey industry can be attributed to several factors with the main contributing factor being neglect towards the industry such as the decentralization of the apiaries unit, little reserved forage lands for beekeepers and no testing facilities which makes it impossible for those beekeepers wanting to export honey. Due to these factors, local demand is far greater than local supply and all honey currently produced is used for domestic consumption. However, with intervention and support, there is potential for honey production to be a viable industry within Trinidad and Tobago.

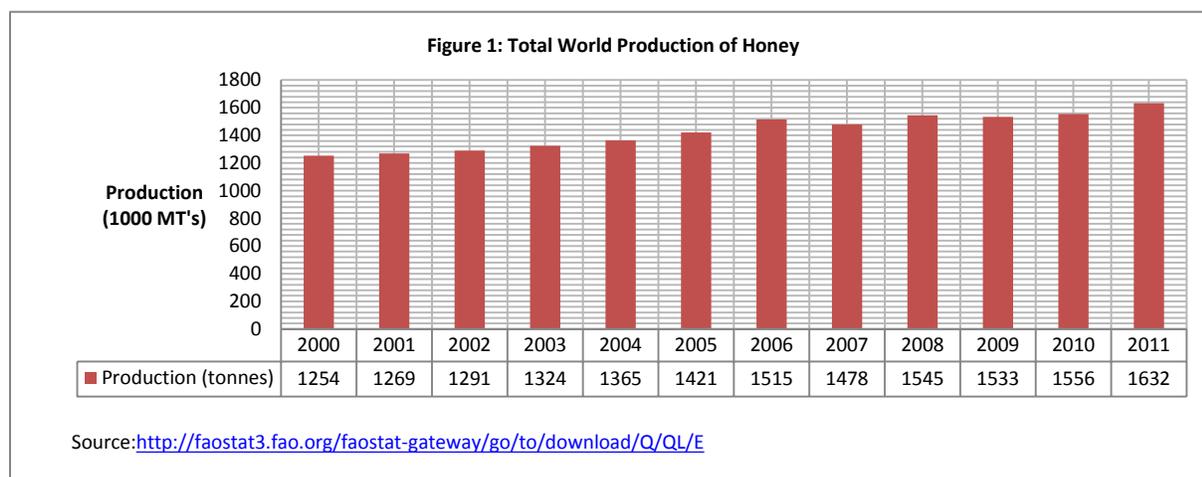
The Economic Development Board (EDB) is an advisory board to the Minister of the Ministry of Planning and Sustainable Development and is charged with the responsibility of managing the economic diversification programme away from oil and gas and for the development of five economic spaces, referred to as the Growth Poles of Trinidad and Tobago. The EDB has identified seven industrial clusters for sustainable economic development, one of which is Food Sustainability. All clusters are focused on export except Food Sustainability, which is primarily focused on the domestic market with the intention of reducing the nation's food import bill, estimated at TT\$4 billion in 2012. The National Food Production Action Plan 2012-2015 has identified Honey as a strategic crop. The increasing trend of high quality honey consumption amongst local and international consumers, places Trinidad and Tobago's honey in an advantageous position. Evidence for the high quality of Trinidad and Tobago's honey comes from numerous awards won in the National Honey Show in London.

The main thrusts of this paper are to get a better understanding of the current apiculture industry in Trinidad and Tobago as well as the potential for exports and niche marketing opportunities of Trinidad and Tobago's honey in order to determine the sustainable economic viability of the industry and to support the most appropriate organizational structure for developing the industry, if applicable.

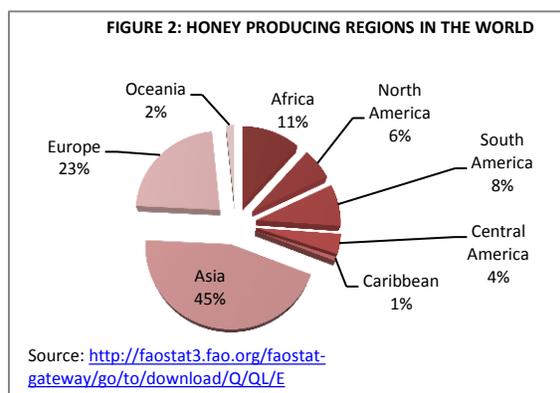
Marketing Analysis

World Honey Production

Figure 1 shows that global honey production has increased by 33% from 1.2 million MT's in 2000 to 1.6 million MT's in 2011; an average increase of 2.7% per annum.



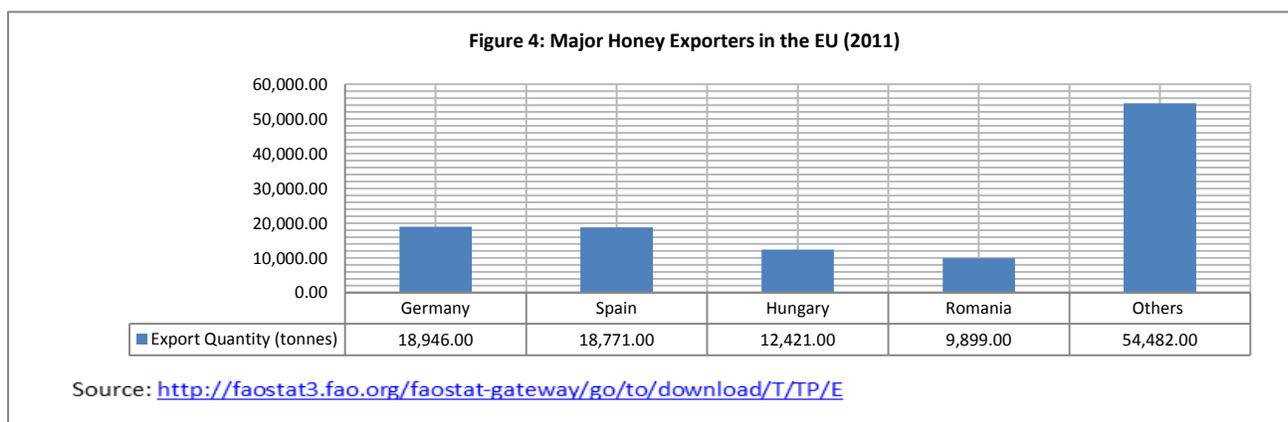
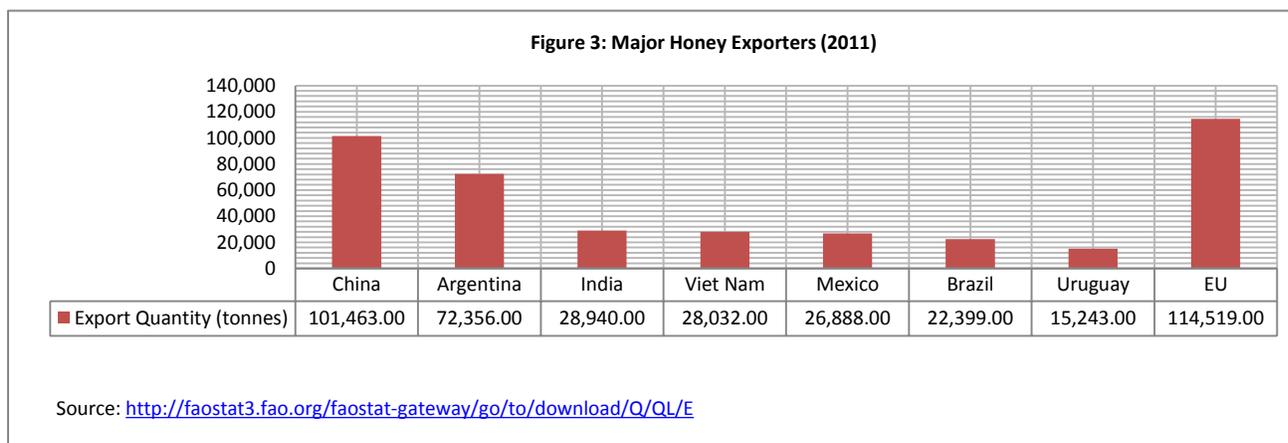
Approximately 79% of the world's honey is produced in Asia (45%), Europe (23%) and Africa (11%) as shown in figure 2. China and the European Union are the top honey producers and account for 40% of the market share of global production. The Caribbean produces only 1% of global honey, though its tropical climate provides a variety of nectar sources ideal for honey production by bees. Within the Caribbean, Cuba and the Dominican Republic are the major producers accounting for approximately 90% of honey production in the Caribbean.



Top Importers and Exporters of Honey

In 2011, the total volume of the world's honey supply was 492,708 MT's. Figure 3 displays the largest honey exporters and these countries account for 83.2% or 409,840 MT's of total world honey exports. In 2011 the EU was the largest exporter of honey, accounting for 23.2% of global exports and in that same year China was the second largest exporter, exporting 20.6% of global honey exports.

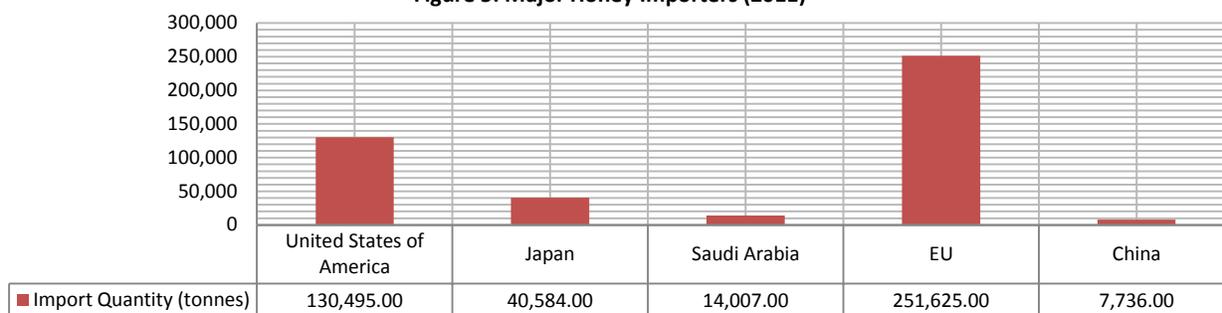
Although the EU is considered to be a major exporter, only a few countries within the EU are self-sufficient and contribute to the majority of the EU's exports. Figure 4 shows that Spain, Germany, Romania and Hungary account for 52.4% of the EU's exports and 12.2% of the world's exports.



Global honey imports totaled 497,202 MT's in 2011. The major honey importers, shown in figure 5, account for 89.4% or 444,447 MT's of total world imports. The EU has the highest per capita honey consumption in the world and according to USAID (2012) in 2010 the EU produced enough honey to fulfill only 60% of its domestic demand.¹ The EU faces competition from extra-EU countries that are able to supply honey at lower prices and the main destinations for European honey are West European countries.²

¹ USAID (2012), "The World Market for Honey"
 Available: http://www.fintrac.com/cpanelx_pu/Ethiopia%20CIAFS/12_06_4949_CIAFS%20_1%20Honey%20Final%20Oct%202011.pdf
² Available: <http://www.fepat.org.ar/files/eventos/759630.pdf>

Figure 5: Major Honey Importers (2011)



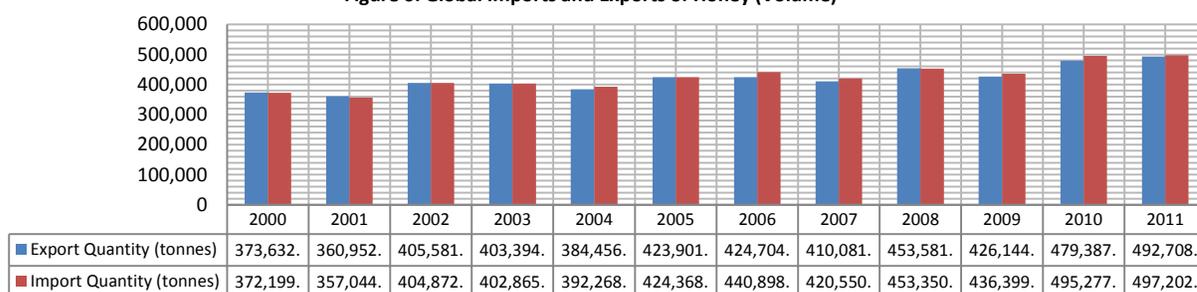
Source: <http://faostat3.fao.org/faostat-gateway/go/to/download/T/TP/E>

The Global Demand for Honey

According to the IFICF (2011)³, consumers are becoming more interested in the relationship between diet and health and this has led to an increased interest in functional foods. That is, one that provides health benefits beyond basic nutrition. In addition to being used as a food sweetener and as an ingredient in other food products, honey can be used for medicinal purposes. The IFICF has listed honey as a source for prebiotics which supports the maintenance of digestive health. Kumar et al (2010)⁴ has also noted that ‘honey contains antibacterial properties which aid in treating infections and can be used to combat a variety of illnesses such as colds and ulcers’. These medical benefits of honey have led to it being labeled a functional food by the IFICF.

Figure 6 shows that the global imports and exports of honey have remained relatively flat since 2000. Between 2000 and 2011 imports have increased at an average of 2.8% per annum while exports have increased at an average of 2.7% per annum indicating that supply and demand are in balance.

Figure 6: Global Imports and Exports of Honey (Volume)



Source: <http://faostat3.fao.org/faostat-gateway/go/to/download/T/TP/E>

³ International Food Information Council Foundation (2011), “Functional Foods”

Available: <http://www.foodinsight.org/Content/3842/Final%20Functional%20Foods%20Backgrounder.pdf>

⁴ Biswajit, Bhowmil, D., Chandira, M.R, Chiranjib, & K.P Sampath Kumar (2010). Journal of Chemical and Pharmaceutical Research, 2(1):385-395

The international markets have become flooded with low quality honey, particularly Chinese honey which was found to contain harmful antibiotics. This has resulted in Chinese honey being banned from the EU between 2002 and 2004, until China agreed to reduce its level of contaminants. This scandal has also led to the US reducing its imports of Chinese honey. Unfortunately, it has been reported that contaminated honey still enters the international market by way of **honey laundering**.

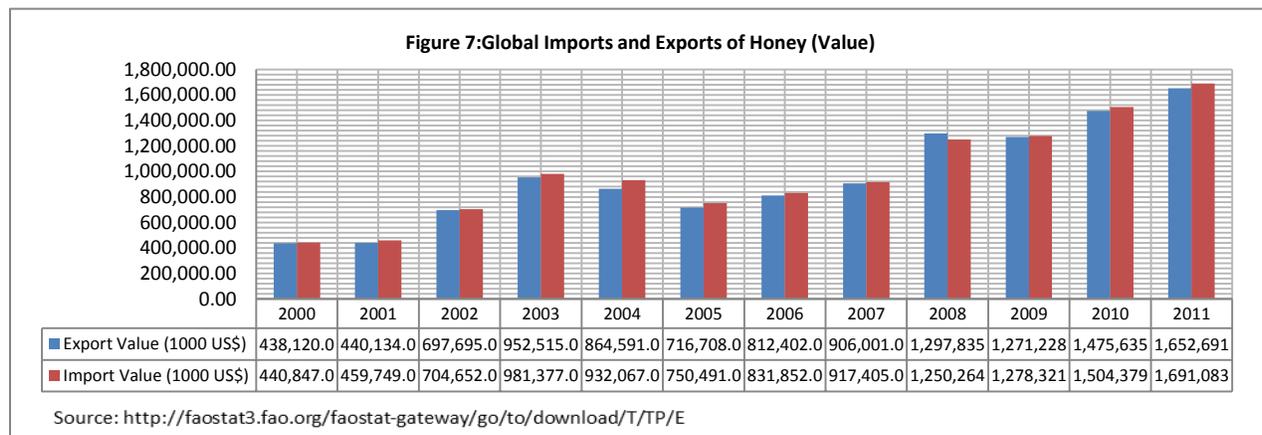


Figure 7 shows that global honey import values have increased from US \$441 million in 2000 to US \$ 1691 million in 2011; a 284% increase while global honey exports values have increased from US \$ 438 million in 2000 to US \$ 1652 million in 2011; a 277% increase. The drastic increase in import and export values (figure 7) compared to the relatively constant import and export quantities (figure 6) suggest that there has been increasing consumption of high quality honey, which command higher prices than lower quality honeys. This increase in consumption may be driven by the health benefits of honey and the health scares of cheap Chinese honey as mentioned above.

Honey Consumption

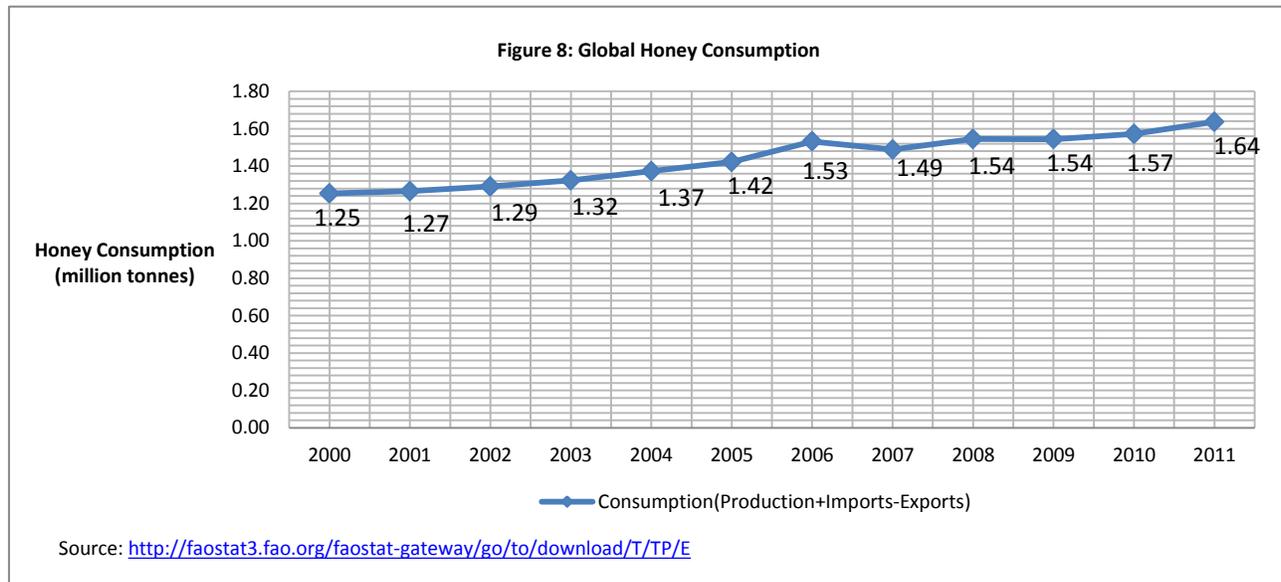
Honey is one of the few foods which is both a primary product and a 'value-added product'. Honey can be consumed directly without any significant processing and throughout history, honey has been used for a variety of purposes including direct consumption as a sweetener, as an ingredient for other foods and for medicinal purposes. The high value attributed to honey can be seen from its use as an offering to the gods in some cultures.

Today, the consumption of honey can be divided into two major categories: 'table consumption' and 'industrial consumption'. Table consumption refers to domestic consumption of honey within households. Approximately 85% of the total distributed honey in the world market is being used as 'table honey'.⁵ Industrial honey refers to

⁵ Noronha Vaz, T., Nijkano, P., Raston, J., "Traditional Food Production and Rural Sustainable Development(2009)", 205-208

honey that is used in the food industry as a 'value-added ingredient' in products such as cereals, snacks, spreads etc. Honey used for industrial purposes are usually of a lower quality than those produced for table consumption.

Figure 8 shows that the global consumption of honey has been increasing from 1.25 million tonnes in 2000 to 1.64 million tonnes in 2011; an average increase of 31.2% over the period or an annual increase of 2.6%. One of the reasons for the increase in consumption of honey could be attributed to the health benefits associated with high quality honey. According to the NHB, within the U.S there was an increase in household consumption of honey from 16% in 2012 to 31% in 2013 by those who considered honey to be healthier for them.



Market Value of Honey

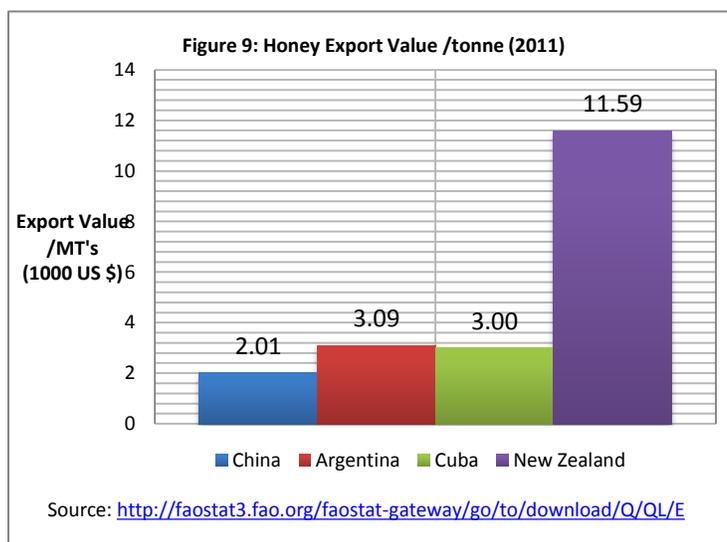
Honey is produced from bees collecting the nectar of flowers and according to the NHB, there are over 300 different honey varieties in the US alone; each originating from a different floral source. Honey can be classified into three main types: **monofloral, polyfloral and blended**. While blended honey is the most commercially available and the cheapest, according to USAID (2012), monofloral honey typically has a higher market value due to its distinct flavor. Popular monofloral honey varieties include Orange blossoms, Sourwood and Tucatan and such honey is usually classified depending on its source of origin. Polyfloral honey prices lie in between that of blended and monofloral honey varieties.

The origin of nectar sources, the processing of the honey after the removal from the beehive and the pesticides/insecticides used in growing and maintaining the nectar sources are all factors which contribute to the quality of honey and all influence its price. Additionally, the packaging of honey (e.g. honey bear bottle) also contributes to its price. Another important determinant of honey prices has been colour. According to the USAID(2012), 'darker coloured honey are used for large scale commercial purposes while lighter coloured honey

are marketed for direct consumption and demand a price premium.⁶ The colour of honey is related to the flavour and generally, lighter coloured honey has a mild taste while dark coloured honey has a strong and more robust taste.

Figure 9 provides evidence for the relationship between the quality and price of honey.

Blended Chinese honey is considered to be low quality and is exported at US \$ 2010/MT. Honey originated from Argentina and Cuba is usually polyfloral and of 'good' quality and are exported at US \$3090/MT and US \$3000/MT respectively. New Zealand produces a monofloral type of honey; Manuka Honey which is exported at US \$ 11590/MT; almost five times higher than that of Chinese honey and three times that of Argentinean and Cuban



honey. Manuka Honey originates from the Manuka bush which is native to New Zealand. This plant is known to contain special properties which provide numerous health benefits; one being for use as a wound dressing which was approved by the FDA in 2007.

Other Products from Beekeeping

In addition to honey, there are other primary bee products which can be produced by beekeepers and marketed.

1. Beeswax

This is the second most important hive product next to honey. Although beeswax is commonly used in the manufacture of candles, it has gained popularity in the skin care and cosmetics industry in face creams, make-up, etc. A German study (2003) found that moisturizers which contained beeswax were superior to those that did not as it resulted in higher skin improvements among subjects.⁷

2. Pollen

Foraging bees bring back pollen to the hive which is used as food for bee larvae. Bee Pollen is high in protein and carbohydrates and is sometimes sold as a nutritional supplement.⁸

⁶ USAID. "The World Market for Honey". September 2012.

⁷ Frosch, P.J. Peiler, D., Grunert, V. and Grunenberg, B. "Efficacy of barrier creams in comparison to skin care products in dental laboratory technicians--a controlled trial" (2003)

Available: <http://www.ncbi.nlm.nih.gov/pubmed/16295040>

⁸ <http://www.med.nyu.edu/>

3. Royal Jelly

This is another type of bee food but this is reserved for the queen bee. Royal jelly is considered to have positive effects on human health such as boosting the immune system. However, more research is needed to confirm these benefits.

4. Propolis

Propolis is a resinous mixture that honey bees collect from tree buds, sap flows, or other botanical sources. Propolis can be used for medicinal purposes. However, Propolis is still the focus of research and there is insufficient evidence to rate the effectiveness of propolis.

Comparator Countries

1. New Zealand

The beekeeping industry in New Zealand started off as a hobby amongst European settlers but has now developed into a well-established industry. The country is comprised of two main landmasses; the North Island and the South Island which covers an area of 268,680 km sq. New Zealand produces some of the highest quality monofloral honey varietal; the most popular being the very special Manuka Honey. The latter is obtained from New Zealand's native Manuka Bush and has been approved by the FDA in 2007 for use as a wound dressing, making it one of the most expensive honeys in the world. The UK is the main destination for New Zealand honey exports and China has been emerging as an important market.⁹

Data for New Zealand in 2013 show a total of 4,279 hives with the majority of beekeepers owning less than 50 hives. According to the Apiculture Monitoring Plan (2013) approximately 85.7% or 3671 beekeepers own less than 50 hives, 8.8% or 379 beekeepers own 51-500 hives, 2.8% or 122 beekeepers own 501-1000 hives and 107 beekeepers or 2.5% own more than 1000 hives. The honey industry is made up of private family-owned enterprises which produce honey from their own beehives or purchase wholesale honey from other beekeepers. Additionally, many beekeepers have begun to form co-operatives which process, package, brand and sell the honey.

The Ministry of Primary Industries (MPI) regulates the beekeeping industry through two main acts; Food Act (1981) and the Animal Products Act (1999). Beekeepers are required to abide by specific regulations which depend upon the purpose of the beekeeping operation (e.g. honey for local sale vs. honey for export). In order to ensure honey produced is clean and safe for consumption, beekeepers must operate through a Risk Management Programme (RMP) which must be verified annually or a Food Safety Programme. These are risk-based programmes which minimize the hazards associated with the processing of honey and other bee products.

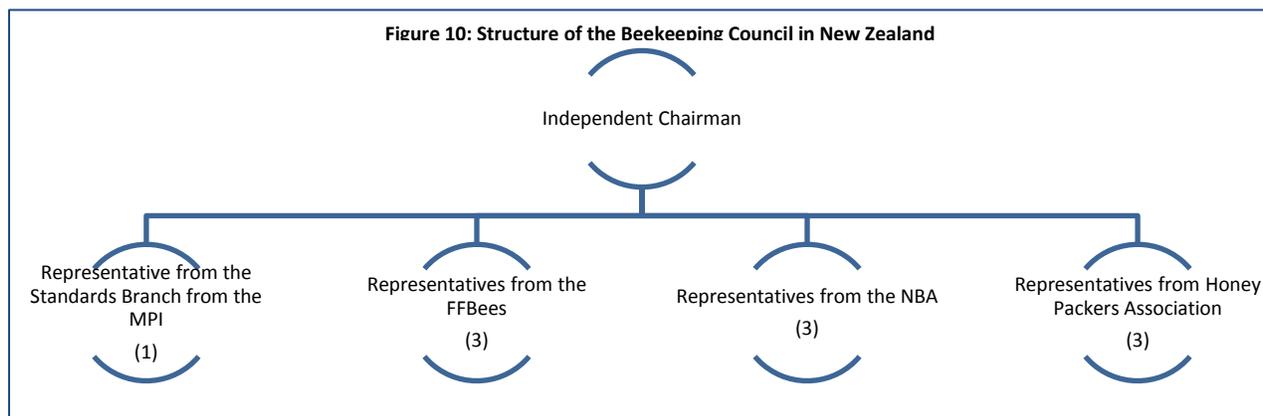
The beekeeping industry within New Zealand is represented by:

- National Beekeepers Association of New Zealand (NBA)
- New Zealand Honey Packers and Exporters Association – An association affiliated with the NBA that represents commercial beekeepers
- Federated Farmers Bee Industry Group (FFBees)
- Bee Products Standards Council

⁹ Ministry of Primary Industry, Apiculture Monitoring Plan 2013.
Available: <http://www.mpi.govt.nz/Default.aspx?TabId=126&id=2112>

The **NBA** and the **FFBees** are national representatives for beekeepers and acts as a voice for farmers when lobbying with the government. They have decided to join together to form the Beekeeping Industry Advisory Council (BIAG) in order to combine the interests of both associations and represent it as a single voice to the government.¹⁰ They also act as a support system to beekeepers by providing them with advice, up-to-date information about the industry and current issues regarding the industry. One of the most popular and successful event run by the NBA is the Bee Aware Month in August for which the main aim is to promote the importance of bees and gain funding for research on bees thus leading to the further development of the sector.

The **Bee Products Standards Council** acts as a consultancy group between the New Zealand bee products industry and the government. It must also work with the MPI to develop food safety standards and other technical standards that are necessary for bee products. It was formed with the encouragement of the New Zealand Food Safety Authority (NZFA)¹¹ in 2005. The structure of the council is displayed in figure 10 .There is one independent chairman, 3 representatives from each association and 1 representative from the Ministry of Primary Industry.



2. Jamaica

Although Jamaica is one of the largest honey producers in the Caribbean, it has been estimated that less than 70% of the local demand of honey is currently being met and the percentage is even lower for other hive products.¹² According to the Agricultural Development Strategy developed by the Ministry of Agriculture and Fisheries, honey has been identified as one of the eight main priority areas for the government of Jamaica and beekeeping organizations have become proactive in developing the industry. Jamaica is one of the few countries with the capability to export honey to the EU¹³ because the country has a residue monitoring plan which meets the EU requirements.

¹⁰ <http://nba.org.nz>

¹¹ NZFA – The New Zealand Food Safety Authority was the governmental body responsible for food safety in new Zealand. In April 2012 it was merged into the Ministry of Primary Industries.

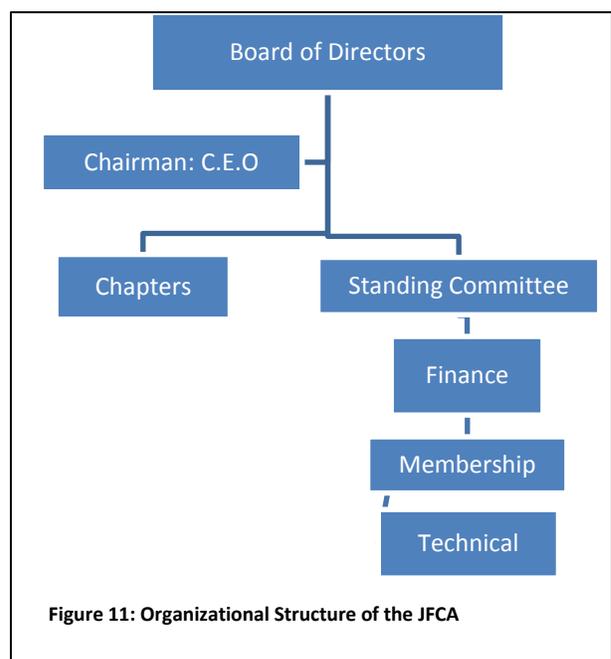
¹² All Island Bee Farmers Association, “The Unique Taste of Jamaican Honey”

¹³ Bradbead, N., Bees for Development “*Technical assistance to Caribbean Beekeepers and clusters*” (2011)

Industry regulations are guided by the Bee Control Act and government plays a major role in reinforcing laws and regulations. Extension Officers from the Apiculture Extension Services monitor the industry by carrying out inspection of apiaries and supervise the establishment of new beekeeping operations. Because these officers are trained and practicing beekeepers, they also serve as consultants for current and prospective beekeepers by providing expert advice on management practices. An Integrated Pest Management System was developed by the Apiary Unit to combat of pests and disease through investigations and surveys of apiaries, port surveillance, public awareness campaigns and innovations. Government have also been involved with the development of the beekeeping industry through projects such as the Apprenticeship program which trains beekeepers and the Beekeeping Revolving loans which provide low interest rate loans for the procurement of bees and equipment. Similar to Trinidad and Tobago, Jamaica also restricts the importation of beekeeping products. According to The Bees Control Act¹⁴, no bees, honey or beekeepers stock can be brought into the island without the permission, in writing, of the Chief Plant Protection Officer.

There are currently two beekeeping associations on the island; the All-Island Bee Farmers Association (AIFBA) and the Jamaican Federation of Commercial Apiculture (JFCA). Both associations consist of different scale beekeepers but the JFCA is more concentrated with commercial beekeepers while the AIBFA is more involved with hobby beekeepers.¹⁵ The AIFBA is a non-profit company, made up of 13 Parish Bee Farmer Associations, with the aim of encouraging honey production, co-operative marketing as well as providing training, equipment and materials to beekeepers. Each Parish Bee Farmer Association is led by a president, who represents his/her respective parish in the executive council of the AIBFA. Monthly meetings are conducted in the normal course of business and general meetings are conducted to elect officers. In 2008, a joint venture was formed between the AIFBA and the Boston Diaspora Venture LLC (BDV) creating the AIBDV Honey Company Ltd. This venture aims to link Jamaicans home and abroad thus establishing a foreign market for Jamaican honey and encouraging entrants into the country. The company will collect, process and market quality Jamaican honey from beekeepers of AIBFA who are ensured a market for their honey at competitive prices. These beekeepers are not only suppliers to the company but are also owners through the AIBFA. The honey will be packaged in a bottling factory owned by the AIBFA in Jamaica and then exported.

The Jamaican Federation of Commercial Apiculturists (JFCA) is a limited liability company owned, managed and controlled by beekeepers. The vision of JFCA is “A



¹⁴ Available: http://www.moa.gov.jm/Beekeeping/the_bees_control_act.php

¹⁵ B. Nicola, Bees for Development, “*Technical Assistance to Caribbean Beekeepers and clusters (2011)*”

*beekeeping industry that is in the control of bee farmers, highly profitable for producers, self-sustaining, self-regulating and off the national budget.”*¹⁶ The federation provides the necessary support for bee farmers in order for them to produce large volumes, high quality honey and other hive products from which the federation purchases at competitive prices. JFCA possesses and manufactures honey into value added products from which the incomes and profits are beneficial to the shareholders (beekeepers) of the federation.

The organizational structure of the JFCA is displayed in figure 11. The federation is led by a Board of Directors who meets annually and the Chairman acts as the C.E.O of the company. Chapters are local organizations of members who have beekeeping businesses in prescribed geographical areas and they meet at least once every three months. The Standing committee is comprised of Finance, Membership and Technical which provide support for the members.

3. Mexico

Mexico has a long history of honey production which originated with the Mayan culture. Today, Mexico is one of the leading honey producers and exporters of honey. It is the main honey producer in Central America, accounting for 86% of honey production in that region and in 2011 it accounted for 3% of world's honey production¹⁷. Approximately 57% of honey production in Mexico is concentrated in the southern states of Campeche, Chipas, Quintana Roa, Tabasco and Yucatan with Yucatan being the leading producing honey state in Mexico.

Honey was previously produced by the **stingless melipona** bees but large portions have died since the arrival of Africanized bees in Mexico in 1986. Similar to Trinidad and Tobago, today, much of the honey bees in Mexico are Africanized bees and beekeepers in Mexico have learnt how to manage and utilize these bees in honey production. Despite their defensive nature, these bees are considered to be harder workers and more resistant to pests and diseases compared to the European bees. **Queen rearing** has been an innovation approach to the management of these bees and beekeepers from Sinaloa, Mexico have queen-rearing operations.¹⁸

According to the USDA Foreign Agricultural Service Gain report (2011), Mexico is a top producer of *organic* foods and the third largest producer of **organic honey** in the world. Organic honey is mainly produced in the dry season from October to May and most of the honey harvested is considered to be polyfloral due to the high density of flowers available in Mexico. In 2010, more than 448 *organic beekeepers* were managing between 10 -100 hives, with the majority of producers being co-operatives and small-scale beekeepers. Organic organizations must be certified by a certifying agent approved by the Mexican government.

¹⁶ Jamaican Federation of Commercial Apiculturists
Available: <http://www.jfcalimited.com/>

¹⁷ FAOSTAT

¹⁸ Ratnieks, F., Visscher Kirk, P., 'Living with Africanized bees: Sinaloan beekeepers adapt pollination to Africanized bees (1996)', California Agriculture 50 (4): 24-28

Limited information was found on the management structure of the beekeeping industry in Mexico, but in 2013, the government of Mexico published an organic labeling program and a new regulatory framework for the entire organic industry which affected producers, processors and retailers.¹⁹ Only products that fulfill the Organic Products Law standards would be able to carry out the national trademark label. This will help to improve product recognition amongst consumers. Organic producers achieve higher prices for their honey compared to non-organic producers.

In addition to beekeepers being certified as organic producers, some are also Fair Trade certified. This means that producers are guaranteed a minimum price for their honey to cover costs of sustainable production. This is especially important due to the volatile nature of the honey market. In Mexico, many co-operatives which comprise of small-scale beekeeping have benefited tremendously from Fair Trade. One such co-operative is the PROISCH ARIC (Productores Indígenas Serranos de Chiapas Aric) which has partnered with Wholesome Sweeteners for sale of their high quality honey at premium prices.

Summary of a comparison between Comparator Countries and Trinidad and Tobago

Characteristic	Country			
	New Zealand	Jamaica	Mexico	T&T
Size (km sq.)	268,680	10,991	1,972,550	5,128
Average Production ²⁰ (litres/year) (2012)	7,269,500 (10,385 MT's)	546,000 (780 MT's)	41,089,464 (43,089 MT's)	70,000 ²¹
Number of beekeepers ²² (2012)	3806	1924	No information found for 2012. In 1996 the beekeeping population was 45,000 beekeepers.	450
Honey Type	Monofloral Varieties	Polyfloral Varieties	Polyfloral Varieties	Polyfloral Varieties
Types of Beekeepers	Most beekeepers own less than 50 hives, with few commercial beekeepers owning more than 1000 hives.	Commercial and hobbyist.	Mainly commercial co-operatives	Most beekeepers own 10-20 hives, considered as hobbyist beekeepers

¹⁹ UDSA Foreign Agricultural Service Gain Report, "New Program for Certification and Labelling for Mexico's Organic Agriculture Industry (2013) "

²⁰ FAO STAT (Measurements were obtained in metric tonnes which was converted into litres)

²¹ Ministry of Food Production Action Plan (2012), Trinidad

²² Data for this was sourced from:

Apiculture Monitoring Plan (2013)

<http://hughsmithja.weebly.com>

<http://www.beekeeping.com/countries/mexico.htm>

Ministry of Food Production Action Plan (2012)

Characteristic	New Zealand	Jamaica	Mexico	T&T
Bee Type	European	European	Africanized	Trinidad: Africanized Tobago: European
Governance	<u>Government Acts:</u> Food Act (1981) Animal Act (1999) <u>Beekeeping Associations:</u> NBA FFBees Federated <u>Bee Products Standards Council</u>	<u>Government:</u> Bee Control Act Beekeeping Unit <u>Beekeeping Associations:</u> AIFBA JFCA	Little information found	<u>Government Act:</u> Beekeeping and Bee Products Act <u>Beekeeping Associations:</u> TTBA TAS AOPB
Testing Facilities	Yes	Yes (able to export to the EU. Jamaica has a residue monitoring plan which meets EU requirements ²³)	Yes	No
Imports and Exports	Both import and export	Imports Restricted. Ability to export and in the process of creating the capacity to export.	One of the largest exporters in the world.	Imports Restricted. Does not have ability to export. All honey is sold locally.

N.B. A hobby beekeeper own less than 30 hives and commercial beekeepers own hundreds or thousands of hives.

²³ B. Bradbear, Bees for development, "Technical Assistance to Caribbean beekeepers and cluster" (2011)

Trinidad and Tobago Situational Analysis

Although the apiculture sector was one of the first sectors to be regulated in Trinidad and Tobago, the beekeeping industry has become virtually non-existent with few professional beekeepers remaining in the industry. Beekeeping has become somewhat of a hobby with the majority of beekeeping owning less than 30 hives and production has been declining due to factors such as poor climatic conditions, lack of bee pastures as well as a general neglect towards this agricultural sector by the general public. Despite the current state of the industry, Trinidad and Tobago's honey has won several international awards which provide evidence for both its quality and demand on an international stage. The Ministry of Food Production has declared honey a strategic crop for product development.

The primary objective of the EDB is to determine the economic viability and sustainability of this industry and if appropriate to define the most effective commercial model for the honey industry. Due to the limited statistical data on the beekeeping industry within Trinidad and Tobago, the EDB's approach has been to consult professionals within the industry to gain a better representation of the current apiculture sector in Trinidad and Tobago.

Consultations with Trinidad and Tobago Beekeepers Association (TTBA) and the Ministry of Food Production (Inspector of Apiaries)

These consultations provided a detailed picture of the current beekeeping industry in Trinidad and Tobago. They addressed the current issues faced by beekeepers as well as some future plans for the industry. Below are the key points arising from these consultations.

- The first government apiary was established in 1902 utilizing Italian bees at the Royal Botanical Gardens, St. Clair. This was successful until the arrival of Africanized bees in 1979 which displaced the then European bees which inhabited the island.
- Beekeepers were not equipped to handle the defensive nature of these bees and the number of beekeepers plummeted drastically throughout the years. At present, the number of registered beekeepers in Trinidad is approximately 450 according to the National Food Action Plan (2012-2015). Trinidad now consists of approximately 100% Africanized bees.
- The rearing of Africanized bees should ideally be done at least 15-16 miles away from residential areas and has resulted in apiaries being located further into forested lands, which are virtually inaccessible.

Flat lands were refused to beekeepers due to hunting trails which are frequently used both locals. The forested reserve areas that are accessible to the beekeepers are of poor undulating terrain.

- In 1997 the government agreed, via Cabinet Minute No. 189 of January 23rd 1997, to beekeepers using the designated areas of forest reserve lands for beekeeping activities. To date the agreement remains unfulfilled.
- Presently there are many unregistered beekeepers in Trinidad and many are forced to squat on private lands because they are unable to access funding due to the lack of security of tenure.
- The majority of beekeepers in Trinidad and Tobago are considered to be hobbyists beekeepers owning less than 30 hives. These beekeepers are usually part-time beekeepers and have other jobs. Currently there are approximately less than 10 large scale beekeepers, owning over 300 colonies each.
- A colony can produce 4 gallons (15.14 litres) of honey during the dry season which can be sold at TT\$3500. Currently, local honey is sold for approximately TT\$175-TT\$200 for the 750 ml bottle. These high prices for local honey can be accounted for the fact that demand outweighs supply. One reason for low honey supplies within Trinidad and Tobago has been due to unfavourable weather conditions. It should be noted that prices for locally sold honey far exceeds the price that would be obtained if honey was to be sold on the foreign markets.
- The blooming of several plants (nectar sources) occurs during the dry season which typically occurs from January to June gives rise to honey production. In the wet season (July-December), honey production severely declines due to the unavailability of nectar sources. In recent years there have been unfavourable climatic conditions leading to a decline in honey production. An extended rainy season in 2011 caused honey production to severely decline.
- It was suggested that in the rainy season, migratory beekeeping can be utilized to move colonies to areas where nectar sources are in bloom at those times of the year in order to increase production. The Mora forests can be considered an area where there are available nectar sources during the rainy season. Another option for nectar sources are mangroves.
- Hive yields can be improved by increasing foraging areas. Foraging areas refers to forested areas where there are available nectar sources. The more nectar sources available, the more honey which can be produced by the bees.

- Management techniques are also important for hive yields. Beekeepers must be knowledgeable in managing Africanized bees due to their defensive nature.
- The TTBA launched an initiative with San Antonio green market in Santa Cruz to educate the public of North Trinidad about the important of honeybees for food production as well as their important role in nature.
- In accordance with “The Beekeeping and Bee Products Act” it is illegal to import honey into Trinidad and Tobago. This is because there are no measures in place to accurately measure the quality of foreign honey and any importation of ‘poor’ quality honey can lead to the industry being prey to foreign diseases. Within recent times there have been imports of foreign honey into the islands which are sold at local groceries. It was further stated that it is the responsibility of Chemistry, Food and Drugs to confiscate illegally imported honey.
- One of the major setbacks to the Apiculture Industry is the lack of quality and standard control. To date, there is neither an Apiaries Unit nor a testing honey laboratory available to beekeepers in Trinidad and Tobago.
- Trinidad and Tobago has experienced several outbreaks of diseases such as the Sac Brood disease and the European Foul Brood disease. Additionally, the Varroa destructor (a honeybee mite) was found on the islands and severely affected the bee colonies. Specifically, it affected the European bees more than the Africanized bees as Africanized bees are more resistant to pests and diseases than European bees.
- A beekeeper must be careful when using pesticides to control the mites as it can affect the taste and quality of honey.
- In 1988, the Ministry of Agriculture decentralized its operations, dismantling the Apiaries Unit and established the Regional Administrative Offices in North and South Trinidad. This resulted in a serious negative impact upon the beekeeping industry in Trinidad. The staff from the apiaries unit was reassigned and given additional duties while the Inspector of Apiaries also had other duties to fulfill. Tobago’s beekeeping industry was not affected as the Tobago House of Assembly (THA) assumed the responsibility for beekeeping on that island.
- Because of the lack of quality control, our local honey cannot compete on a global scale as it is unable to meet international regulations for export. For example, in order to export honey to the EU a number of

criteria must be met. One requirement is a residue monitoring plan which involves the testing of specific harmful chemicals present in honey.

- Based on our award-winning locally produced honey, there is a demand for our honey in Europe. Trinidad and Tobago have collectively won 58 awards during 1987-2000. Thus, Trinidad and Tobago has the advantage of a recognized high quality honey.
- Approximately 100% of honey produced in Trinidad is from Africanized bees while honey produced from Tobago is from the European bees. Africanized bees have not invaded Tobago because the wind and soil type in Tobago does not allow the bees to fly between islands.
- In order to test our honey it would have to be sent to foreign labs for a high fee. Argentina and Germany currently charge 200 British Pounds per sample while Brazil, which is considered to have higher standards, charges US\$35.00 per sample. In May 2013, Brazilians were invited to Trinidad to discuss the establishment of a testing lab.
- The management council that guides the apiculture industry consist of:
 - Inspector of Apiaries
 - Chemistry, Food and Drugs
 - Beekeeping Extension Officers, MFP
 - Active Beekeeping Associations
 - Customs And Excise Division
- Currently, the Inspector of Apiaries holds two positions within the Ministry; The Inspector of Apiaries and the Agricultural Officer in the Ministry of Food Production, Land and Management Division. The Inspector is charged with the responsibility of meeting the requests of the beekeepers, ensuring that the beekeepers and the general public are aware of the nature of the bees and techniques in handling them as well as managing the abatement (eradication) of the bees. Under the Inspector of Apiaries are beekeeping officers who act on behalf of the Inspector to monitor the hives on the field. Currently there are 7 beekeeping officers who are rotated amongst different sites. Approximately two or three hives can be visited per week and a gap is necessary between site visits to prevent the transmission of possible diseases.
- During 1995-2000 two beekeeping officers were sent abroad for expert training on how to manage the Africanized bees; one was sent to the US and the other to England.

- The Governor’s Apiary in Chaguaramas is currently conducting research on the **grafting** of queens from which an indigenous bee can then be developed. This can only be achieved after a period of crossing generations.
- Since 2000, Trinidad and Tobago have hosted annual beekeepers’ safaris which are organized by the UK-based organization Bees for Development. Tobago was the first Caribbean country to host such an exclusive beekeepers’ holiday to the Caribbean and this has added a new dimension to national tourism. Forty-six ‘safarians’ participated in 8 safaris between 2000 and 2010.²⁴

Consultations with Research Centers in Trinidad and Tobago

One of the limitations of the honey industry is the inability to test the quality of local honey in order to meet international standards. A number of research centers throughout Trinidad and Tobago were consulted in order to determine what is currently in place for honey analysis:

Centre	Analysis conducted
Caribbean Agricultural Research and Development Institute (CARDI)	Does not perform testing
Caribbean Industrial Research Institute (CARIRI)	The following tests are currently performed on honey: <ul style="list-style-type: none"> ✓ Chemical and biological analysis ✓ Sucrose and Fructose Content ✓ Moisture Content ✓ Heavy Metal Residue <p>According to a report by bees for development (2011)²⁵, ‘all testing for honey and residues could be done here’ as the facilities are generally good and there are trained laboratory technicians.</p>
Trinidad and Tobago Bureau of Standards (TTBS)	Does not perform testing
University of the West Indies (Food And Agriculture)	In the process of developing equipment for pollen index analysis.
NAMEDEVCO	In the process of establishing a honey processing facility. Limited information found as this is a new project.

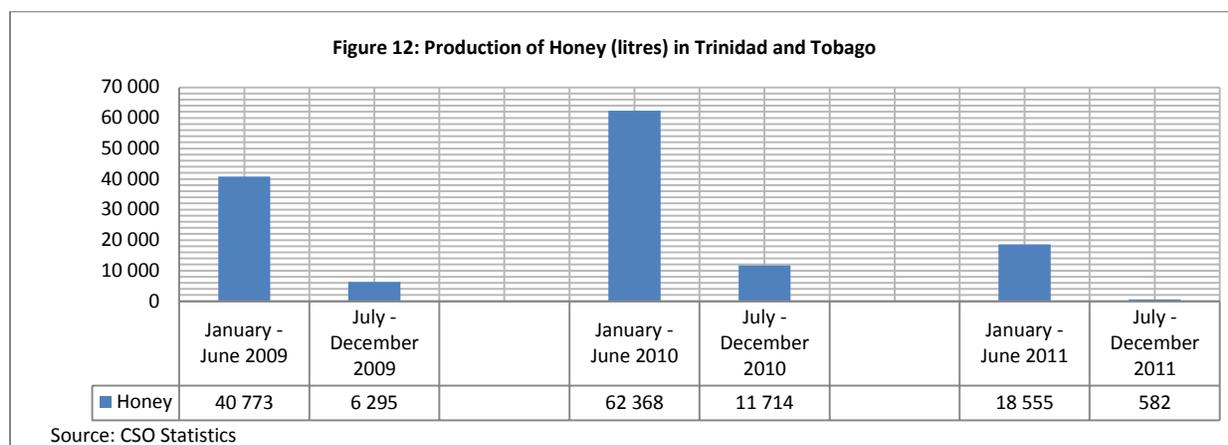
Table 1: Current Analysis conducted for Honey in Trinidad and Tobago

²⁴ S. Gladstone. “Beekeeping in Trinidad and Tobago: 1901 to 2010” (2010).

²⁵ Bees for Development, ‘Technical Assistance to Caribbean beekeepers and clusters’ (Dec 2011)

Honey Flow in Trinidad and Tobago

In Trinidad and Tobago the dry season (January-June) is considered the main **honey flow** in the country as shown in Figure 12 where production in the dry season was the highest in all three years. On the other hand, there was a steep decline between July to December (the wet season) in all three years. Between June and July production declined by 84.5% in 2009, 81.2% in 2010 and 96.9% on 2011. Furthermore there are huge fluctuations in production between each year which has been due to unstable and unfavourable weather conditions. For example honey production increased from 47068 litres in 2009 to 74082 litres in 2010; a 57.4% increase and then declined to 19137 litres in 2011; a 74.2% decrease. The severe decline in production in 2011 was caused by unusually heavy rains in that year.



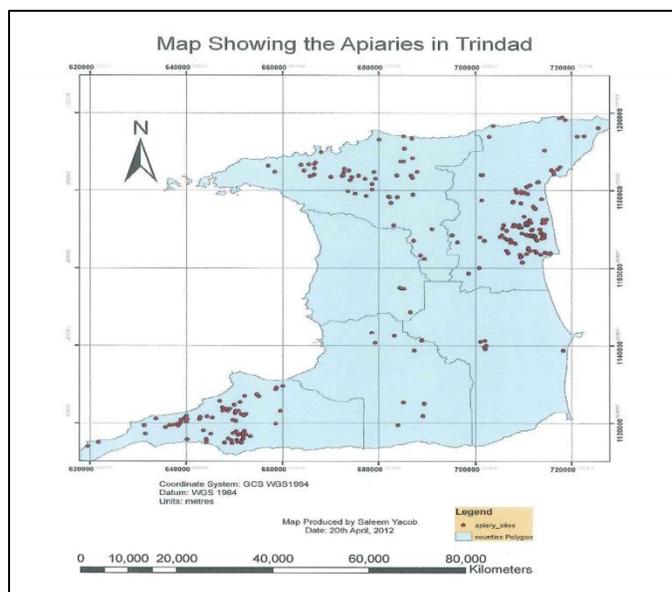
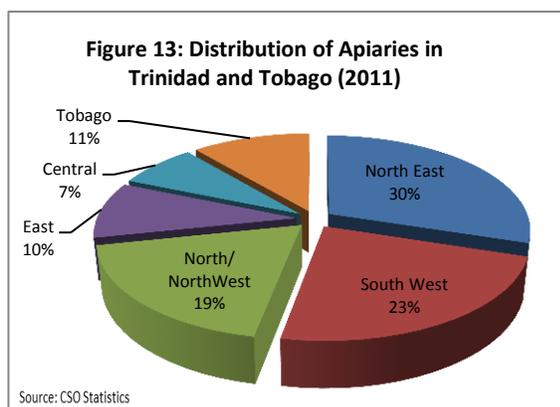
The honey flow period is considered the times of the year in which nectar sources are in bloom so that bees can collect nectar to produce honey. Different flowers bloom at different times of the year and the vast majority of flora in Trinidad and Tobago booms during the dry season. There can also be a minor honey flow in the rainy season if there are 'dry spells' weeks during that season. These minor flows usually occur during August. The major types of vegetation from which honey is produced include forest and fruit trees, weeds, shrubs and mangrove plants²⁶.

As honey flow periods depend upon climatic conditions, honey flow periods vary from country to country. In temperate regions there are no honey flows in the winter and one major honey flow during the spring/summer seasons. In tropical and sub-tropical regions, there can be multiple main honey flows and minor honey flows. For example, in Dominica there is only one major honey flow in December to late July while in Puerto Rico there is a main honey from February to May/April and a minor flow occurs anytime between July-December for a few weeks. This minor flow is contributed by only a few species of trees.²⁷

²⁶ First Regional Training Workshop for Beekeepers Proceedings (1992)

²⁷ First Regional Training Workshop for Beekeepers Proceedings (1992)

Distribution of Apiaries in Trinidad and Tobago



With reference to Figure 13 and the adjacent Map, the North/North West, North East and South West are the dominant areas for beekeeping in Trinidad.

The North East, South West and North comprise of approximately 70% of the apiaries and Tobago approximately 11% of total apiaries within Trinidad and Tobago. Sangre Grande in the North East is the main honey producing area with 144 apiaries while South West consists of Penal/Debe, Siparia, Point Fortin and Princess Town with a combined total of approximately 111 apiaries. The North/North Western region consists of Tunapuna/Piarco, San Juan/Laventille, Diego Martin, Arima and Port-of-Spain with an estimated 90 apiaries. Tobago has very few beekeepers; approximately 20 beekeepers and an estimated total of 350 colonies. Most of these beekeepers are concentrated in the South Western regions of Tobago.

Within Trinidad there are between 350-400 registered beekeepers on the island and an estimated total of 7000 colonies. Many beekeepers remain unregistered due to land issues, which increase the actual number of beekeepers on the island to more than 400. In Trinidad and Tobago, beekeepers can be divided into small scale, medium scale and large scale beekeepers. Small scale beekeepers are considered as those who own less than 40 hives, medium scale are those who own between 40-100 hives and large scale are those who own more than 100 hives. The majority of beekeepers are considered small-scaled and own between 10 and 30 hives. There are approximately 6 large scale beekeepers located in the North East who own more than 300 colonies, 3 located in the St. George County (North/North West region) and approximately 3-4 large scale beekeepers who own more than 300 hives are located in the South West.

Beekeeping Associations

There are three (3) active associations within Trinidad and Tobago:

1. Trinidad and Tobago Beekeepers' Association (TTBA)
2. Tobago Apicultural Society (TAS)
3. Association of Professional Beekeepers (AOPB)

The TTBA consists of beekeepers concentrated in the Northern region of Trinidad; the TAS overlooks beekeeping in Tobago while the AOPB consists of beekeepers in South-West Trinidad as well as other counties. In 2005, all three entities formed a coalition to facilitate the staging of the Fourth Caribbean Beekeeping Congress Association and this has led to a high degree of cohesions amongst all three bodies.²⁸

Current Incentives for Beekeepers

The incentives below are currently available by the Ministry of Food Production (MFP) for beekeeping:

Machinery and Equipment

50% off the purchase price of:

- I. Trailers up to a maximum of \$4000.
- II. Machinery and equipment to a maximum of \$50,000 per annum per farm every 5 years.

List of eligible machinery and equipment:

- ✓ Hive tool
- ✓ Hive stand
- ✓ Honey settling tank
- ✓ Honey settling tank covers
- ✓ Boardman feeder
- ✓ Nuke Box

The eligibility criteria for beekeepers accessing vehicular incentives: minimum of 30 colonies.

Starter Colonies

The MFP also provides starter colonies in 3-frame hives. In order to be eligible to access these starter colonies, beekeepers must first participate in training sessions provided by the MFP which provide knowledge of management techniques for Africanized bees. Training sessions take place twice a year.

²⁸ S. Gladstone, "Beekeeping in Trinidad and Tobago: 1901:2010", November 2010.

Review of the Trinidad and Tobago Beekeeping and Bee Products Act

a) Legal Framework

The beekeeping industry in Trinidad and Tobago is governed by Beekeeping and Bee Products Act, Ch.67-53 (Act 28 of 1935 Amended by 7 of 1949). The main purpose of the act is to *“regulate and control beekeeping, the importation or exportation of bees, bee products and bee supplies and to prevent the introduction and spread of bee diseases.”*

Within Trinidad and Tobago there is very little management of the apiculture industry. This Act enlists an Inspector of Apiaries under the control of the Chief Technical Officer (Agriculture) to be appointed for the purpose of managing the beekeeping industry in Trinidad and Tobago. Under the Inspector of Apiaries are beekeeping extension officers who act on behalf of the Inspector. Figure 14 shows the management structure in Trinidad according to the Act.

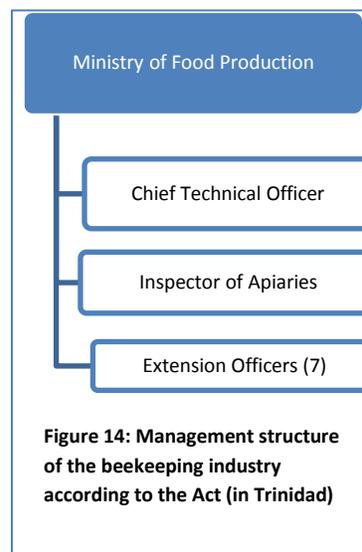


Figure 14: Management structure of the beekeeping industry according to the Act (in Trinidad)

There is no established Central Apiaries Unit within the MFP and beekeeping extension officers operate from the Regional Administration offices in the North and South of the country. There are 5 full time beekeeping officers located at the St. George and Sangre Grande county offices while there are 2 part-time beekeeping officers located in the Caroni and Mayaro county offices.

The apiculture sector in Tobago is managed by an Apiaries Officer within the Agriculture, Marine Affairs, Marketing and the Environment Division in the Tobago House of Assembly.

The Act addresses the roles of the Chief Technical Officer and the Inspector in addition to the following:

- Registration and Control of Apiaries
- Extraction, Preparation and Packing of Honey
- Prohibition of Adulteration of Honey, Beeswax and Bee Products
- Restrictions on the Importation of Bees, Bee Supplies and Bee Products
- Standard of Honey for Exportation and Control of its Exportation
- Control of Honey for Consumption Locally

b) Review of Legislation

- Location of Apiaries

There should be a guidance as to how far from residential areas and roads apiaries are to be located. According to the act this distance is determined by the Inspector. However, because Trinidad contains Africanized bees and Tobago has European bees, specific location requirements must be determined based upon the bee type on each island as Africanized bees should be located further away than European bees.

- Prohibition of Adulteration of Honey, Beeswax and Bee products

Although this section restricts the **adulteration** of honey (addition of other inferior foreign substances to honey e.g. corn syrup), there are no regulations which stipulate that honey must be tested for adulteration. The only measure taken to prevent adulteration is that honey may be inspected to ascertain its purity and can be seized if suspected to be impure. There are no specified penalties for adulteration.

- Standard of Honey for Exportation and Control of its Exportation

Honey for export is categorized into 5 different grades: White, Golden, Light Amber, Dark Amber and Unclassified. Unclassified honey cannot be exported. Grades of honey are classified depending up the reading from the **Pfund Honey Grader** which should be free from damage and practically free from foreign material. Moisture content of honey is also tested. According to the act, the test to determine whether the honey is 'practically free from foreign material' depends upon the physical properties such as the temperature, pressure and filtration material used in the extraction method. There are no regulations which enforce the testing of honey for pesticides, antibiotics, residue or any type of adulteration of honey. These tests are especially important as it is usually required by foreign countries to determine the quality of honey.

- Control of Honey for Consumption Locally

Although there are standards which must be abided by for the export of honey, there are no requirements for the testing of honey if it is to be sold for local consumption. Regulations only apply to the condition of containers in which honey is packaged as well as labeling requirements. As Trinidad and Tobago's honey is only sold for domestic consumption, many beekeepers do not test their honey and therefore food safety standards are left unregulated.

- Penalties

Strict penalties should be enforced to ensure beekeepers achieve a high quality of honey through testing for chemical residues. However, this can only be achieved if a local testing lab is present. The testing of honey for such residues is more of an option than a regulation as honey must be sent abroad in order for such tests to be conducted. Persons who are guilty of an offence where no specific penalty is stated is liable to TT\$400.00 which does provide much incentives to follow regulations.

Critical Issues facing the Industry

- As with any other agricultural sector, infrastructure poses a serious challenge. Forested lands are not easily accessible as there are no roads leading to these areas. This has posed a major transport problem for beekeepers as most apiary sites are located in forested areas. Additionally there are no streetlights and problems with the availability of electricity or water.
- There is a lack of bee forage as the government has not designated any lands for beekeeping. This is especially important as bees must be kept at certain distances away from residential areas and roads.
- Although beekeeping is not as labour intensive compared to other agricultural sectors (require one or two persons to oversee 10-20 hives) it requires much maintenance. Hives must constantly be monitored to determine periods of honey flow and possibility of **swarming**.
- Beekeeping requires specialized knowledge about techniques in handling the bees and extracting honey. There is a general lack of knowledge amongst beekeepers about the best practices to use in beekeeping and viable techniques for dealing with Africanized bees are not well understood amongst beekeepers. Furthermore, extension staff is neither adequately trained nor knowledgeable on current beekeeping techniques or honeybee diseases in the industry.
- There is improper use of chemicals and fertilizers on vegetation and flora, which leads to the contamination of hive products. This is an ongoing worldwide problem which has led to the consumption and demand for high quality honey (i.e. uncontaminated pure honey).
- In Trinidad and Tobago, honey is packaged in clear plastic bottles and labeled with the basic requirements such as the apiary number, name, address, net weight etc. Very little marketing techniques are applied when honey is packaged and bottled.

- Illegally imported honey and other bee products are being sold locally which are 50% cheaper than locally produced products.
- Since 2001, Trinidad and Tobago has not been able to export honey due to the introduction of a Residue Monitoring Plan required by the EU. Currently there are no standards of quality control of honey within Trinidad and Tobago. There are no monitoring standards or certification procedures in place to ensure that our honey is 'up to standard'.
- In addition to no rules or regulations being administered to test the quality of our honey, there are currently no honey testing labs which can provide this service. Therefore, in order to attain certification, our honey must be exported to laboratories, which is considered a costly process and uneconomical for beekeepers. Thus, beekeepers have no choice but to sell their honey locally.
- There is little co-ordination between the beekeeping sector and other sectors which relate to the apiculture industry: for example horticulture, forestry, rural development and other environmental sector.
- Although predial larceny is not as a big issue as with other agricultural sectors, many beekeepers have noted that persons specifically learn how to extract honey in order to steal it.

Opportunities for the Industry

- **Branding**
Honey in Trinidad and Tobago is considered to be multi-floral. The size of Trinidad and Tobago as well as the varied vegetation on the islands restricts any mono-floral variety to be produced. However, it is possible to brand honey based upon its geographic location as well as its main nectar composition. For example, the vegetation along the West Coast is mainly mangroves and honey which originates from this region will consist mainly (though not entirely) of mangroves. Thus the branded honey will be a type of polyfloral honey with main composition of mangroves.
- **Other Hive Products**
Other products besides honey can be produced from beekeeping activities. Beeswax, propolis and royal jelly are all hive products which can be produced and exported. Currently, in Trinidad and Tobago beeswax and pollen are marketed in small quantities and there is a greater demand for pollen than for beeswax. In addition to the hive products, queen bees can be bred to increase the size of colonies locally, in addition to export.

- **Value-added products**

In addition to the natural bee products collected by beekeepers, there are opportunities to produce value-added products out of these primary bee products. Products such as mead (an alcoholic beverage created by fermenting honey with water, fruits, spices grains etc.), batik, soaps, candles, etc. Currently, few beekeepers in Trinidad and Tobago have already begun to do batik and mead production.

- **Pollination**

Beekeepers can provide pollination services. That is, bees can be rented to other agricultural farmers to improve the yields on their crops. However, it must be determined which crops bees pollinate.

Financial Analysis

The main objective of this section is to determine the economic feasibility of establishing a beekeeping operation in Trinidad and Tobago. For this analysis, the establishment of a small size apiary, medium size apiary and a large size apiary were analyzed using the **Net Present Value, Internal Rate of Return and Payback Period.**

Net Present Value (NPV)

The NPV is the difference between the present value of cash inflows and out flows from a project. A positive NPV indicates that the investment is worth undertaking while a negative NPV indicates that the investment should be rejected. The NPV can be used to rank mutually exclusive projects.

Internal Rate of Return (IRR)

The internal rate of return is the rate at which the NPV is zero or the rate at which the investment breaks even. That is, it is the rate which equates an investment's cash outflows to its inflows. The IRR is used to determine the desirability of an investment and higher IRR's are preferred to lower ones.

Payback Period

The payback period gives the number of years it takes to recover the initial investment costs.

Three models were analyzed:

1. The establishment of the small scale apiary
2. The establishment of the medium size apiary
3. The establishment of a large size apiary

The following are common assumptions made about the 3 models:

- The apiary is located at least 200 meters (660 ft.) from the nearest residence or area where animals are housed and 100m from the nearest public road.
- Land space required is 100 sq. ft. for every 10 hives.
- The number of hives can be doubled annually by dividing existing colonies.
- Beekeepers both extract and bottle their honey for sale.
- Honey is sold in the 750ml bottles at a cost of TT \$140, when supply is not constrained. With the lack of supply, its price can rise to TT\$175 – TT\$200.
- There were no government incentives. All equipment is purchased from private sellers.
- Honey is the only hive product produced.
- Sugar syrup is fed to bees in wet season because of lack of nectar sources to produce honey.

- A small size apiary consists of 10 hives, a medium size apiary consists of 40 hives and a large size apiary consists of 320 hives.
- For new beekeeping operations, colonies are established between October and February to provide the first crop of honey for extraction in the honey flow period.
- Beekeepers have some basic knowledge in apiculture.
- Additional part-time labour is needed during the extraction periods for the extraction of honey from the hives and on off seasons for maintenance of apiaries.
- The beekeepers have access to owned lands.

MODEL 1: SMALL APIARY (HOBBYIST APIARY)

This model was based upon a 5 year analysis. The following are additional assumptions specific to Model 1.

- The apiary consists of 10 hives.
- There are no costs for a vehicle. It is assumed beekeepers already have their own form of transportation.
- There are no costs for an extraction room. Beekeepers utilize a small room in their own homes as an extraction room.
- There are no additional costs for labour. A beekeeper can manage 10 hives by himself.

Yield (litres/hive/year)	NPV (TT \$) Discount Rate 8%	NPV (TT \$) Discount Rate 10%	NPV (TT \$) Discount Rate 15%	IRR (%)	Payback Period (years)
6 (low)	(\$1,698.96)	(\$2,665.45)	(\$4,661.22)	5%	5
16 (present scenario)	\$69,930.26	\$65,341.26	\$55,476.44	270%	2
32 (high)	\$184,537.01	\$174,152.01	\$151,696.70	>270%	1

Table 2: NPV, IRR and the payback period for varying discount rates for a small size apiary

With reference to table 2, the small size apiary is viable at yields of 16 litres/hive/year and 32 litres/hive /year as indicated by the positive NPV's and high IRR's. The viability of a small-scale beekeeping operation at the current average yield of 16 litres/hive/year is consistent with the fact that the majority of beekeepers in Trinidad and Tobago are hobbyist beekeepers, owning between 10-30 hives. At the medium and high yields, the low investment costs, relatively short payback periods, and the ability to obtain profits in a relatively short amount of time, make this small scale operation attractive. On the other hand, negative NPV's and an IRR which is less than the discount rates show that an investment into small scale beekeeping at the low yield of 6 litres/hive/year is not a financially viable investment. It is worthwhile to note that due to the small size of such an operation, this type of

venture should be undertaken for the purpose of bringing in supplemental income rather than be used as the main source of income and only at medium and high yields should this investment be considered.

MODEL 2: MEDIUM SIZE APIARY

This model was based upon a 5 year analysis. The following are additional assumptions specific to model 2.

- Cost of a vehicle – TT \$250,000
- Cost of an extraction room (12ft x 12 ft.) – TT\$100,000
- For this model, the apiary is expanded from 10 hives in year 1 to 20 hives in year 2 and 40 hives in year 3. From year 3 onwards, the apiary remains at 40 hives.
- Additional labour needed throughout the year on a part-time basis.

Yield (litres/hive/year)	NPV (TT \$) Discount Rate 8%	NPV (TT \$) Discount Rate 10%	NPV (TT \$) Discount Rate 15%	IRR (%)	Payback Period (years)
6 (low)	(\$429,999.19)	(\$413,343.80)	(\$376,604.53)	< -56%	>5
16 (present scenario)	(\$224,076.97)	(\$219,897.10)	(\$209,984.31)	-56%	>5
32 (high)	\$105,398.59	\$89,617.61	\$56,608.03	28%	4

Table 3: NPV, IRR and the payback period for varying discount rates for a medium size apiary

With reference to table 3, the establishment of a medium size apiary of 40 hives is only commercially viable at the high yield of 32 litres/hive/year. This is due to high investment costs of a vehicle and an extraction room which is required for the extraction of honey.

MODEL 3: LARGE SIZE APIARY (COMMERCIAL APIARY)

This analysis was done over a 6 year period. The following are additional assumptions specific to this model:

- A vehicle (pick-up truck) is to be purchased – TT \$250,000
- An extraction room (20ft. x 20ft.) is to be constructed – TT \$400,000
- Apiary is expanded from 10 hives in year 1 to 20 hives in year 2, 40 hives in year 3, 80 hives in year 4, 160 hives in year 5 and 320 hives in year 6.

Yield (litres/hive/year)	NPV (TT \$) Discount Rate 8%	NPV (TT \$) Discount Rate 10%	NPV (TT \$) Discount Rate 15%	IRR (%)	Payback Period (Years)
6 (low)	(\$829,521.36)	(\$782,709.92)	(\$683,285.14)	-	>6
16 (present scenario)	(\$62,569.67)	(\$82,525.05)	(\$120,413.08)	3%	6
19	\$167,515.84	\$127,530.41	\$48,448.54	19%	6
32 (high)	\$1,164,553.04	\$1,037,770.75	\$780,182.22	67%	4

Table 4: NPV, IRR and the payback period for varying discount rates for a large size apiary

Compared with model 2, high investment costs associated with the purchase of a vehicle and an even bigger extraction room is needed as the apiary further expands. From table 4, there are negative NPV's and a low IRR associated with yields under 16 litres/hive/year, which is considered to be the current average yield. However, it should be noted that if yields were to increase to 19 litres/hive/year, the investment would now be financially viable with an IRR of 19%, positive NPV's and a payback period of 6 years. A yield of 19 litres/hive/year is very possible to attain with improved management techniques and training and increased foraging areas. Thus for a large scale apiary, any yield above 19 litres/hive/year would make this investment a financially viable investment.

Conclusions and Recommendations

Commercial Viability of an Apiary

From the financial analysis, small scale apiaries are considered to be a sound financial investment at the current present yield of 16 litres/hive/year or higher and large scale apiaries are considered to be a financially viable at yields of more than 19 litres/hive/year. Medium size apiaries are only viable at the high yields of 32 litres/hive/year. Current average yield of 16 litres/hive/year is considered to be a sustainable yield as it takes into account both 'bad' and 'good' years.

Small scale apiaries are appropriate for persons interested in beekeeping as a hobby or as a secondary income stream. Large scale apiaries are appropriate as a commercial venture.

Based upon the financial analysis, the following are recommended:

- ✓ The establishment of sufficient large scale apiaries to meet the domestic demand for honey. These large scale apiaries should be encouraged to increase their yields for it to be a financially viable investment.
- ✓ Beekeepers with medium size apiaries should be encourage to either: expand their apiaries, increase their yields per hive or form co-operatives/companies.
- ✓ Hobbyist beekeepers who do not wish to expand but are interested in attaining larger profits should be encouraged to form co-operatives/companies

Beekeeping Targeted for Rural Development Projects

Beekeeping takes place mainly in rural forested areas of the North Coast, North East and South West Trinidad due to the availability of nectar sources. Formal education is not required to become a beekeeper, so this industry is potentially relevant for development projects in the regions mentioned above, two of which are Growth Pole areas. Depending on the success of the local industry, consideration should be given to exports to the regional markets.

Government Involvement

The main role of the government should be to facilitate the development of the industry in the areas identified above to satisfy domestic demand, create jobs and thereby eliminate the importation of honey. The following actions are recommended:

- **Facilitate the formation of beekeepers into co-operatives.** Government should actively encourage beekeepers in forming themselves into co-operatives/companies.

- **Designate forage areas to beekeepers for rent.** Many beekeepers lack forage areas for their apiaries. The amount of forage areas are vital to the yields which are attained per hive because the large the amount of nectar sources available the higher the increased in yields and thus honey production. There should be properly designated forested areas accessible to beekeepers for which a price must be paid. These designated forage areas should be utilized for serious beekeeping and should be given out according to defined criteria, which must be met (e.g registered beekeeper, apiary consisting of a minimum number of hives etc.).
- **Provide proper infrastructure.** As with all other agricultural sectors, proper access roads and availability of water, electricity and other basic infrastructure is needed. Without these basic necessities, production will not increase.
- **Education and Continued Support: Provide proper training courses to beekeepers.**
 - I. **Technical training courses:** Proper management of bees and beekeeping techniques are crucial to obtaining higher yields per hive and therefore, properly structured and relevant training courses should be provided. Many beekeepers lack proper beekeeping knowledge and this is a vital aspect in developing the honey sector to a more efficient state. Included in these training courses should be the use of chemical/fertilizers and how they affect the quality of honey.
 - II. **Business/finance/accounting training courses:** Training courses should not only aim at the technical aspects of beekeeping but the business aspect of it. As such, there should be specific training courses aimed at teaching beekeepers on expanding and treating their operations as businesses. In summary, the training should aim to develop business skills within beekeepers.
 - III. **Marketing/branding:** Beekeepers should be made aware of the value in branding/marketing their honey; how attractiveness can increase sales, how branded high quality honey can increase prices etc.
 - IV. **Connecting Beekeepers to the Government:** The decentralization of the Apiaries Unit within the Ministry of Food Production has led to a disconnect between beekeepers and the government. The following is recommended:
 - Full time beekeeping extension officers in the county offices of each major honey producing region.
 - The beekeeping associations to liaise with the Inspector of Apiaries a few times a year to discuss the developments and issues of the local beekeeping sector.
- **Requirements to attend training courses.** Many beekeepers have expressed concern about the fact that persons who currently attend training courses, attend to specifically learn how to extract honey for pre-

dial larceny purposes. In light of this, there should be some form of requirement in order to attend beekeeping courses. (E.g. must be registered as a beekeeper, proof of ownership of an apiary etc.).

- **Promote beekeeping as a viable source of income in the rural development areas.** Government should actively promote how beekeeping can add additional income as well as be a source of main income for persons in rural communities.

- **Continued Restrictions on Foreign Imports**

Currently, it is illegal to import bee products and bee-keeping equipment into the country without approvals. This is because contaminated bee products or unclean used bee-keeping equipment can affect the apiculture industry by introducing diseases and contaminated honey can seriously affect the health of individuals.

- ❖ Diseases – Currently, Trinidad and Tobago is practically free from any bee diseases which could be due to the restrictions on imports of beekeeping products. However, opening up the industry could severely impact the industry, particularly in Tobago. European bees in Tobago are susceptible to diseases. According to Solomon (2010)²⁹, the **Varroa mite** which was identified in Tobago in 2000, caused severe economic impact on the beekeeping industry on that island. Furthermore, in 2003 a **Parasitic Mite Syndrome (PMS)** associated with the Varroa mite caused a 52% reduction in the number of colonies on the island. In addition to these diseases, there are other diseases such as the **American Foul Brood Disease (AFB)** and the **Colony Collapse Disorder (CCD)** which is a serious threat facing the beekeeping industry around the world.³⁰ Fortunately, to date, Trinidad and Tobago’s beekeeping industry has never been infected with these diseases.
- ❖ Honey Contamination: Antibiotics which are used to prevent bee diseases are largely found in many honeys worldwide. Some of the residues found in these antibiotics can be very harmful to human health when consumed. According to Centre for Science and Environment (CSE)³¹, some drugs have the potential to produce toxic reactions in consumers directly while others are able to produce allergic or hypersensitivity reactions. Additionally, the CSE states that ‘There is a need to regulate and monitor the level of antibiotics in honey as continuous long term exposure to low levels of antibiotics could in due course of time lead to antibiotic resistance in pathogenic bacteria making their treatment difficult.’ The EU has imposed ban on countries such as China,

²⁹ S. Gladstone, “Beekeeping in Trinidad and Tobago:1901 to 2010”, (2010)

³⁰ <http://www.ars.usda.gov/>

³¹ Dr J. Sapna, Dr J. Nimisha, Prof. H. B. Mathur, Prof. H. C. Agarwal “CSE Study: Antibiotics Residues in Honey (2010)”

in 2000, when Chinese honey was found to contain **chloramphenicol**, a drug which has fatal side effects such as **aplastic anemia** on some individuals. A ban was imposed in Brazil when no agreement could be made in testing procedure and standards.

- ❖ Support for the sector to be competitive: Our local honey industry is considered to be a small scale, developing industry. Support within this sector is crucial for it to become competitive against foreign imports. Support should be focused on helping beekeepers improve supply, yields and maintain the quality of honey. The quality of our honey is an important factor in maintaining a comparative advantage over foreign honey imports.

Given that the importation of foreign beekeeping products can affect bees, beekeepers and consumers, careful consideration must be taken into account before the honey industry is allowed to be open for imports. In light of new information that the industry is at risk of being open for trade the following recommendations should be considered:

- I. Standards for bee products entering the country should be developed.
 - II. Enforcement of regularized testing of foreign honey and any other bee products entering the country. Any foreign beekeeping products should be certified to be clean and safe before it is allowed to enter the country.
 - III. There should be a restriction on the import of used beekeeping equipment.
 - IV. The GoRTT should be allowed to impose bans on those countries not in compliance with the rules and regulations of importing bee products in Trinidad and Tobago.
 - V. Support to be given to local beekeepers in order for them to be competitive with foreign honey imports.
- **Access to incentives.** Although incentives are provided, many beekeepers do not use government incentives as they have to wait a lengthy amount of time to obtain these incentives. As such, the government should provide a more efficient and effective way for beekeepers to access incentives, especially for starter colonies.
 - **Beekeeping equipment.** An opportunity to develop another industry lies within the creation of beekeeping equipment. Almost all beekeeping equipment is purchased from private sellers are obtained from the US or Canada. Many beekeepers have stated that foreign equipment cannot withstand our tropical climate, deteriorating at a fast rate. Equipment made from local trees can last much longer than imported equipment. Thus, the government should consider incentives in this area to support the local manufacture of beekeeping equipment, which in turn should offer a more competitive price to the beekeepers and result in higher profits.

- **Establishment of Honey Testing Facilities**

Honey testing facilities should be established in Trinidad and Tobago to continue to ensure the high quality of our honey as well as provide the opportunity for those beekeepers wishing to export honey. As previously mentioned, NAMEDEVCO is currently in the process of establishing a honey testing lab in Trinidad and Tobago. This lab should aim to ensure quality testing of both local and foreign honey and other bee products. Consideration for the development of testing facilities should also be given to CARIRI or other research centres that have the potential to conduct such analysis.

Glossary

- ❖ **Adulteration of Honey:** A process in which pure honey has been mixed with cheap syrups.
- ❖ **Aplastic Anemia:** This is a disease in which the bone marrow, and the blood stem cells that reside there, are damaged.
- ❖ **American Foul Brood:** This is the most widespread and destructive of bee brood disease. This disease is caused by a spore-forming bacterium which mainly affects bee larvae. Disease spreads rapidly throughout the hive contaminating brood food, honey and affecting other bees. American Foul Brood spores are extremely resistant to desiccation and can remain viable for more than 40 years in honey and beekeeping equipment.³²
- ❖ **Beeswax:** This is a natural wax produced by bees to build honeycomb cells.
- ❖ **Blended Honey:** Honey that is a mixture of polyfloral types, monofloral types or a mix of both polyfloral and monofloral honey varieties.
- ❖ **Colony Collapse Disorder (CCD):** This is an ongoing phenomenon in which worker bees abruptly disappear from the hive. The cause of this phenomenon remains unclear but many possible causes have been proposed: pesticide use, various pathogens, malnutrition etc.
- ❖ **Chloramphenicol:** Chloramphenicol is an antibiotic drug which is banned in many countries, for use in food-producing animals, including honey bees.
- ❖ **Grafting:** Grafting is the most common method of queen rearing. Worker larvae are transferred from cells in comb into queen cell cups, and then placed in a colony that is in the right condition to convert them into queen cells.
- ❖ **Honey Laundering:** Deliberate mislabeling of honey in order to disguise its origin. This is considered to be an illegal activity.
- ❖ **Honey Flow:** This is a term used by beekeepers which describes the period or periods of the year in which nectar sources are in bloom.

³² www.agriculture.state.pa.us/.../Bee%20Diseases%20-%20American%20F...

- ❖ **Monofloral Honey:** Honey obtained from one specific floral source.
- ❖ **Parasitic Mite Syndrome:** Parasitic Mite Syndrome is a condition that causes a honey bee colony to deteriorate and eventually dwindle away and die. There has not yet been a pathogen detected which causes the brood symptoms that appear with this syndrome. However there are always varroa mites present with this syndrome³³.
- ❖ **Pfund Honey Grader:** Device which provides continuous readings over the entire colour range of honey.
- ❖ **Polyfloral Honey:** Honey obtained from a variety of floral sources.
- ❖ **Pollen Index:** This is used to determine the nectar composition of the honey
- ❖ **Organic Honey:** Organic is not just an adjective, nor is it synonymous with “natural.” The USDA has implemented a set of national standards that foods labeled “organic” must meet, whether produced in the United States or imported from other countries. Before a product can be labeled “organic,” a USDA-approved certifier inspects the farm where the food is grown to make sure the farmer is following all the rules necessary to meet USDA organic standards.³⁴
- ❖ **Queen rearing:** A method to raise and mate queen bees. Queen rearing may also be carried out by beekeepers who wish to replace an old queen with a younger one to reduce the swarming impulse or to exchange a failing queen with a more vigorous one.
- ❖ **Stingless Melipona:** The *Melipona* is a genus of stingless bees. These are widespread in warm areas of the Neotropics, from Sinaloa and Tamaulipas (México) to Tucumán and Misiones (Argentina). At least 40 species are known
- ❖ **Swarming:** A new honey bee colony is formed when the queen bee leaves the colony with a large group of worker bees.
- ❖ **Third Countries:** This is a term used by the European Commission to define any country that is not one of the 28 EU member states.

³³ <http://beeinformed.org/>

³⁴ National Honey Board, “Organic Labelling Requirements”

Available: <http://www.honey.com/honey-industry/honey-testing-and-regulations/honey-labeling/organic-labeling-requirements/>

- ❖ **Varroa Mite:** Varroa is a parasite that feeds on the bee and acts as a vector for viruses. Untreated, colonies will die in just a few years. Varroa is thought to be at the core of unexplained bee losses (Colony Collapse Disorder) across the world.

APPENDIX 1

CONVERSIONS

- 1000ml = 1 litre
- 1 kg of honey = 0.70 litres
- 1 metric tonne = 1000kg
- 1 metric tonne = 700 litres
- 1 gallon = 3.785 litres

APPENDIX 2
EXCEL SPREADSHEET