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The Beekeeping Sector in Lebanon: A Sustainable Integrated Development Strategy

A Thesis Submitted in Partial Fulfillment of the Requirements for the Joint Degree of the Master of Business Administration (M.B.A.) and the Master of Science in International Business (M.I.B.)

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THE BEEKEEPING SECTOR IN LEBANON: A SUSTAINABLE INTEGRATED DEVELOPMENT STRATEGY

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ABSTRACT

The American Foulbrood (AFB) disease is one of the most serious bee diseases affecting the brood, and causing substantial damage to apiaries. The misuse of antibiotics by beekeepers in order to treat AFB has led to elevated antibiotic residues in Lebanese honey products, constituting one of the major trade barriers affecting export activities to the EU territories.

The occurrence of the AFB disease is common in Lebanon. In fact, 53% of the Lebanese beekeepers are suffering from AFB infection with an annual loss of 1.7% of their colonies. In an attempt to eradicate this disease, beekeepers are using excess amounts of antibiotics. The samples examined in this study have shown the elevated amounts of antibiotic residues, reaching the level of 705 ppb/kg.

This thesis studies the local beekeeping market and analyzes the performance of 30 of the biggest beekeepers in the country covering 9.34% of the beehives, with an annual honey production of 6.87%. It further depicts that only 43% of the beekeepers studied are eligible to export honey products to the European Union. This low percentage is not sufficient for an industry with as much potential as the honey production has, and thus upgrading the domestic market would increase the chances of opening new markets worldwide, especially the European market that constitutes of around 25% of the world's consumption.

Despite of that, the local market has been slowly, but unstably, developing with an obvious increase in the number of beehives. This increase is sensed with a drop in the production yield that has not been stable through the past years, dropping sometimes below regional average.

As for the country trade activities, the import has been shown to be very close to the exports but with a monetary value of 200%, meaning that the price of exported products is half the price of imported ones.

All this combined with the rising issue of antibiotic residues in honey products, and the tremendous drop in honey production in terms of quality and quantity, it has become obvious that action needs to be taken by authorities and concerned parties to avoid further deterioration in this sector.

Among agricultural activities, beekeeping enables supplementary revenue mostly for rural areas and poor population as an additional income for disadvantaged families. This puts the

support of beekeeping activities among the high priorities of the national authorities in an aim to promote sustainable agricultural solutions.

A national integrated development strategy for the sector appeared to be an essential step, aiming at providing solutions to trade barriers facing beekeepers and the major problems hindering the development of the beekeeping industry. This strategy combines a set of sustainable solutions to create a more developed market, with four major axes to create a momentum. These axes include marketing and awareness, technical support, financial support, and proper policy implementation.

Synchronized with collaborative efforts from different stakeholders and concerned parties, this action is considered as a milestone to achieve progressive results in this sector.

Keywords: *Beekeeping, apiculture, American Foulbrood disease, honey trade, sustainable integrated development strategy, bee diseases*

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Joelle S. Elias

May 2012

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1. CHAPTER 1: INTRODUCTION

1.1. Honey at a Glance

Defining Honey

As defined in the Lebanese Standards for Natural Honey published by Libnor, natural honey is "(...) a natural sweet substance which has distinguished taste and odor. It is produced by honeybees from the nectar of flowers, excretions of living parts of plants or secretions of plant sucking insects on the living parts of plants, which the bees collect, transform and combine with specific substances of their own, before storing them in honey combs to ripen." (Lebanese Standard for Natural Honey NL 209:1999).

Honey consists of glucose and fructose sugars, with color varying from nearly colorless to dark brown based on the food source, and consistency varying from fluid, viscous, to crystallized.

Honey and its importance

More than 3000 years back in history, in 1550 BC, the first written medical scriptures were published to be the Egyptian Papyrus Ebers named after the ancient Egyptians. The Ebers were rediscovered in 1873 to contain cures for more than 800 medical issues, amongst which a major ingredient, *honey*, was used that proved excellence in treating serious illnesses.

Throughout the years, this ingredient has been used as an alternative medication in many cases, mainly for eyes wellness, baldness, indigestion, smallpox, throat soreness, and many others.

Honey is still being widely used nowadays as a major component in medical treatments, and has grown to become among the staple food list. The increasing demand for honey has created a growing market with a need to boost production and increase beekeeping capacities without compromising quality and health safety.

Lebanon is blessed with rich natural resources ranging from numerous types of plants, trees, and blossoms across the different geographic landforms that provide honeybees with nectar to initiate the honey making process resulting in a distinguished Lebanese natural honey product. Lebanon is also known for its strategically geographic location and adequate temperate climate that contribute to the good honey production quality, which gives it a competitive advantage and makes it among the most desirable places for honey making.

In addition to it being an agricultural activity generating economical gains, this globally

growing market has been driven by some major factors led by the health benefits following older generations from Native Americans to Buddhist monks, or for its wide range of use and various applications as shown in Table 1:

Table 1: Potential uses of honey (FAO, 1996)

Application	Use
Food	Most commonly consumed in its unprocessed state (e.g. liquid, crystallized or in the comb).
Food ingredient	The traditional use of honey in food preparations has been substituted by sugar and various sugar syrups derived from starches. These exhibit similar characteristics to honey, but at a much reduced cost.
Natural, health and biological products	Honey can substitute for all or part of the sugar in most products. Limitations include costs, handling characteristics and the natural variations in honey which change the end product, make it more variable and require more frequent adjustments in the industrial formulation.
Baked products	Advantage: products containing honey tend to dry out more slowly, have a lesser tendency to crack, offer an improved aroma.
Confectionary production	Disadvantage: Honey used in confectionary products can only be used in small amounts. In caramels, for example, honey reduces preservation time and softens the caramels at the surface, causing them to stick together.
Breakfast cereal	Used in either its liquid form or dried and pulverized both for better flavor and increased consumer appeal.
Ice cream	Disadvantage: Honey in ice cream causes the ice creams to melt more easily and at lower temperatures than those made with sugar, causing issues in distribution and sales.
Non-alcoholic beverage industry (e.g. functional drinks/iced tea).	Need to use a special ultra filtration process to eliminate impurities. Ultra filtered honey loses some of its flavour and colour, but gains in consistency, which is highly appreciated by food processors for its lower production costs.
Ingredient in medicine-like products	Honey is used in moisturizing and nourishing cosmetic creams, and pharmaceutical applications.

Honey Grading

Honey grading in terms of quality indication is dependent on several factors, mainly its floral source, humidity and acidity value, electrical conductivity, diastase activity and hydroxymethyl furfural (HMF) content. Also, honey is sometimes graded according to its color and optical density (as shown in Table 2) relative to the Pfund scale set by U.S. Department of Agriculture (USDA) standards.

Table 2: Color designations of extracted honey (U.S. Department of Agriculture, 1985)

USDA Color Standards	Color Range USDA Color Standards	Color Range Pfund Scales Millimeters	Optical Density
Water White	Honey that is Water White or lighter in color.	8 or less	0.0945
Extra White	Honey that is darker than Water White, but not darker than Extra White in color.	Over 8 to 17 Over 17 to 34	0.189
White	Honey that is darker than Extra White, but not darker than White in color.	Over 34 to 50	0.378
Extra Light Amber	Honey that is darker than White, but not darker than Extra light Amber in color.	Over34 to 50	0.595
Light Amber	Honey that is darker than Extra light Amber, but not darker than Amber in color.	Over 50 to 85	1.389
Amber	Honey that is darker than light Amber, but not darker than Amber in color.	Over 85 to 114	3.008
Dark Amber	Honey that is darker than Amber, but not darker than Amber in color.	Over 114	.....

Dissimilarity in standards

Honey standards in different countries portray dissimilar value limits set for some honey quality criteria. This dissimilarity causes a mismatch between trading countries leading to adversely affect the export-import process. Below is a table showing the difference in the limits for Lebanon vs. the European Union countries for HMF. The HMF content is indicative of honey freshness (Feása, Piresa, Iglesiasb, & Estevinhoc, 2010).

Table 3: HMF Limits in the EU and Lebanon

Country	HMF limits (mg/kg)	Source
European Union	40	Codex European standard
Lebanon	20	Lebanese Standard (NL 209:1999)

Environmental Concern

Insect pollination is thought to benefit the yields of 75% of globally important crop species and is responsible for an estimated 35% of world crop production (Breezea, Baileyb, Balcombec, & Pottsa, 2011). Beekeeping has played an essential role in Lebanese agriculture and forestry due to the fact that the pollination through the cross-fertilization act of bees is fundamental for the growth and sustainable existence of agricultural crops as well as the survival of trees. Putting some effort into cultivating bees has constituted a mutual benefit to farmers as it increases their agricultural productivity and in return provides more sources of food for honeybees. Many species are known to provide pollination services, however honeybees (*Apis mellifera*) are often assumed to provide the majority of these services to agriculture. Economically, the value of insect pollination services to crop agriculture has been estimated at €153 billion per annum globally (Breezea, Baileyb, Balcombec, & Pottsa, 2011).

Cultural Behavior

Beekeeping is believed to be related to gender as it pertains to masculine activity (Kommerskollegium, 2012). The focus Lebanese beekeepers chosen to conduct the study were 100% males. All registered beekeepers at the CCIB were males because rarely do we find women running farms and men running families. Up till date, beekeeping in Lebanon has been principally dominated to be a male profession. Farmers explain the above mentioned phenomenon simply by stating that beekeeping requires some physical activity that is naturally

present in men and it is argued that chores required during the art of honey making suits men better as it requires one to leave residence for lengthy periods of time for completing the harvesting process and sometimes waking up early or very late at night which mostly is not much desirable for a woman to indulge in.

1.2. The American Foulbrood Disease

AFB disease lifecycle

AFB is the most serious disease among all bee diseases affecting the brood (Kilwinski, Peters, Ashiralieva, & Genersch, 2004). This disease is contagious and once a beehive gets infected with the disease, bee colonies slowly become weak and is threatened for extensive destruction (Carpinteri, 2011). This disease causes a substantial damage to the apiaries and may be destroying the beehive within two or three years from its onset. In some developed countries, if the AFB is detected, it must be reported to the official responsible authority to be regulated by the correspondent law and perform necessary procedures (vanEngelsdorp & Meixner, 2010).

The AFB disease is caused by the bacterium Paenibacillus larvae (James & Li, 2012). This bacterium has two forms known as the vegetative and spore cells. When the bacterium finds the conditions not suitable for growth, it takes the form of spores which is resistant and too small to be seen by the naked eye.

Inside a beehive, only larva (see Figure 1) gets infected after they swallow the contaminated honey with spores from adult bees. Spores that passed through the alimentary tract of adult bees remain viable and incite American foulbrood disease when fed to susceptible honeybee larvae (Wilson W. T., 2011).

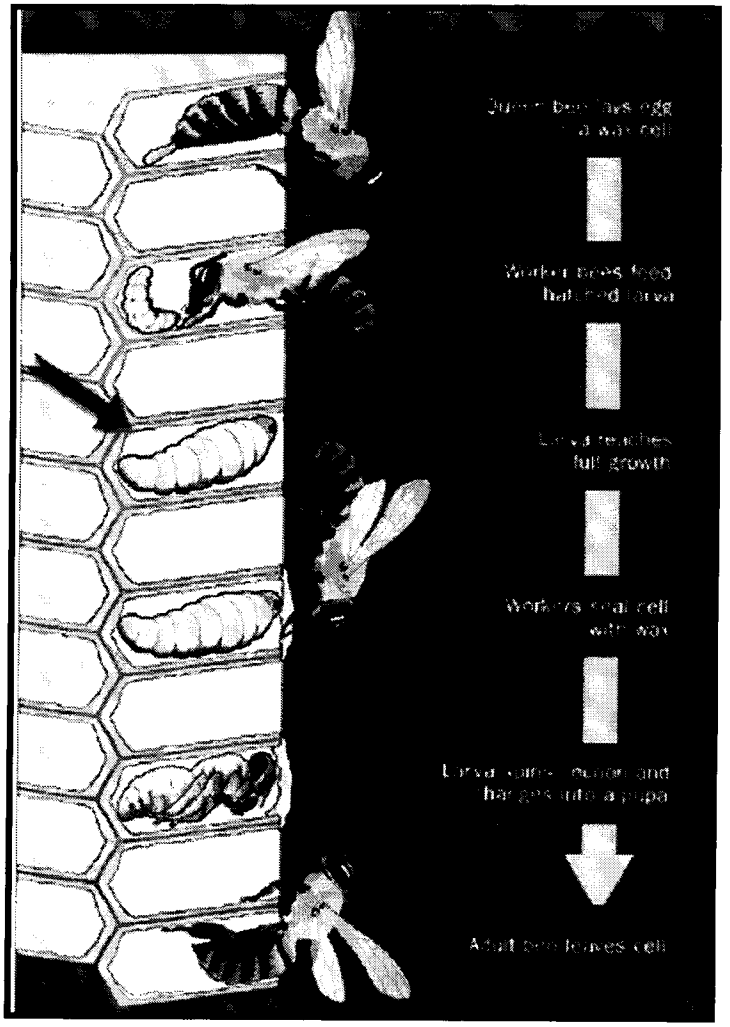

Figure 1: Honeybee lifecycle (Wilson, 2007)

Swallowed bacteria germinate in the larva gut

Within one to two days, the swallowed spores germinate in the gut of the larvae as the bacteria find the conditions favorable to awaken from its dormant state. It then develops into vegetative rods. The rods continue to grow and invade the haemolymph and larva body tissues (Department of Primary Industries, 2011). This invasion of the hopeless larva causes its death before it reaches the pupation phase. Generally invasion takes place following the capping of the brood cell by worker bees. Following the larva destruction, the bacterium goes back to the spore state.

1.3. Domestic practices against AFB disease

AFB is a known to be a fatal and contagious disease attacking young larvae that have not

completed their first early larval stages, i.e. 12-36h after egg hatching (Genersch, 2010). The causative agent is *Paenibacillus larvae*, a gram positive and spore-forming bacterium that is spread worldwide (Antunez, 2008). In Lebanon, traditional beekeeping techniques still exist especially with the lack of technical and practical experience among beekeepers, with the majority of beekeepers using antibiotics as a preventive measure, according to local beekeeping experts and researchers, "Oxytetracycline" (OTC) and "Tetracycline" (TC) is mainly used in fighting the AFB disease. This is carried out in early spring to stop four weeks before the main honey flow in an aim to avoid contamination of the honey crop and allow degradation of the antibiotic, and then to continue in fall after the honey crop is removed. But as a matter of fact, and in search for economical gain, it is the case that early harvesting takes place where still elevated concentrations of antibiotics are present.

Our emphasis in this study is the OTC antibiotic use that is being used in uncontrolled amounts and frequencies leading to high antibiotic residue in honey products. As antibiotics are proven to be (Genersch, 2010):

(1) Not effective against the infectious spores, hence, they only suppress clinical symptoms and mask the disease but cannot cure AFB

(2) Chemical residues that can persist in honey affecting its quality and safety for human consumption

1.4. Antibiotics: A Growing Problem

The growing problem nowadays is the existence of antibiotics in the final product, which is disqualifying our honey from being exported to European Nations. Antibiotic residues are mainly dominated by OTC and TC, but also include Aminoglycosides, Macrolides, and other underrated material.

The major cause of beekeepers using antibiotics is to treat bacterial infections (Barganska, Slebioda, & Namiesnik, Determination of antibiotic residues, 2011). In some countries, antibiotics are allowed for the treatment of infected colonies but in most European countries, the use of antibiotics in the treatment of bee disease is banned (Genersch, 2010).

In 2010, the U.S. Food and Drug Administration (FDA) has issued a draft guidance on the "judicious use" of antibiotics in food producing animals emphasizing that the routinely feeding of antibiotics to animals is good for the agricultural production but is almost surely bad for the public health (FDA, 2010). Recently, widespread resistance to OTC has been reported (Evans,

2003). Its presence endangers human health (Barganska, Slebioda, & Namiesnik, Determination of antibiotic residues, 2011) by inducing an increased resistance to antibiotics (Reynaldi, Albo, & Alippi, 2008). Symptoms of chronic exposure to OTC include (Johnson & Jadon, Antibiotic Residues in Honey, 2010):

(1) Blood changes (leucocytosis, atypical lymphocytes, lung congestion, toxic granulation of granulocytes and thrombocytopenia purpura)
(2) Liver injury and delayed blood coagulation may also occur
(3) Damaging calcium rich organs such as teeth and bones and sometimes causes nasal cavities to erode
(4) Children under 7 years of age may develop a brown discoloration of the teeth.

1.5. The National Honey Standard

The Lebanese honey standard (NL 209:1999) is based on the Syrian standard "Bee Honey" number 412-1987 , the French standard "Honeys-Specifications", NF V 35-001 Sept. 1990 and the Saudi standard "Bee Honey" number 01-1993. As for the rules related to residues of pesticides and veterinary drugs section, they are established based on those established by the Codex Alimentarius Commission (CAC). The Lebanese "Honey standard" states specific Hygiene requirements that follow the general principles of Food Hygiene recommended by the same CAC and further relevant Codex texts.

Unfortunately, the Lebanese standard lacks Maximum Residue Limits (MRLs) needed for beekeepers to refer to and use as a trustworthy scientific source to treat some honeybee diseases, especially the OTC. OTC is among the critical list that most of the times become decisive in either rejecting or importing the honey stock, especially that OTC is sometimes banned in some countries. As a matter of fact, this situation leads to a chaotic environment where beekeepers tend to use the MRL absence as an excuse to the uncontrolled amounts being used.

This study further stresses the need to improve and revise the Lebanese standard for honey to make it more aware of the need for OTC MRL to control the market.

1.6. Need for the Study

The American Foulbrood disease is expected to be observed by more than half of the beekeepers beehives in Lebanon, making it among the most deleterious bee diseases hitting the

Lebanese beehives recently. The wide use of antibiotics to fight diseases is adversely affecting the honey sector in Lebanon. Moreover, the incompatibility of the Lebanese Standards in this regard, represented by the absence of the antibiotic Maximum Residue Limit (MRL) for OTC content to be used as a reference by beekeepers, has created chaos for the uncontrolled use, especially with the wide range of difference among international norms and standards, which makes it complicated to have a reliable reference to be used. Table 4 shows the difference in the accepted levels for OTC between countries.

Table 4: Inconsistency in accepted OTC levels

Class	Antibiotic	Codex Alimentarius	EU	USA	EIC
Tetracycline	OTC	No MRL	Provisional: 25 ppb	No MRL	10 ppb

Antibiotics have been randomly used in any case of doubt that the beehive is infected, and hence, the prescription of OTC has appeared to be a suitable, preventive method, and stay on the safe side plan.

This study discusses the current methods performed by beekeepers to fight the AFB disease and sheds the light on how to better manage the apiary through setting up a Sustainable Integrated Development Strategy aiming at producing honey that is free of chemical contaminants and healthy for local as well as foreign consumer protection.

Health Issues From the Use of Antibiotics

The elevated levels of antibiotics in honey are favoring a resistance mechanism in the human body for bacteria, and leading to lower sensitivity to antibiotics with repetitive use due to the fact that human body gets used to these antibiotics necessitating higher doses afterwards to fight the disease.

Moreover, antibiotics-based honey leads to the destruction of "flora", a good bacterium that lives in human intestines which in turn facilitates the digestion process with a major role in determining the stool consistency. The absence of flora for whatever reason causes an adverse effect mainly leading to stomach pain, digestive problems, and watery diarrhea.

Incompatibility with EU and Canada Import Requirements

One of the largest markets for honey is the European Union, that constitutes of around 25% of

the world's consumption (CBI, 2009). The EU produces around half its consumption of honey, with the other half imported mainly from Latin America and lately China after breaking the ban imposed in 2002 (CBI, 2006).The EU has an annual consumption average of 0.7 kg per capita (Bianca, 2011; Kommerskollegium, 2012). Entrance to this market is subject to strict regulations that the Lebanese products fail to fulfill.

Until 1994, Lebanese honey was being imported to EU countries without violating any standards (Daher, 2011). But later that year more restrictions were set up by the EU authorities requiring higher standards local beekeepers could not meet, especially with the elevated detected concentrations of antibiotics in Lebanese honey that exceeded the permitted amounts by the EU norms.

Twenty tones of honey were exported to various countries during 2008, none of which reached the European Union. Every trial to enter the market was unsuccessful due to the inability to meet the EU standards set for honey, which requires meeting specific criteria on top of which being antibiotic-free. But technically, equipment and machines used for OTC detection are unable to detect a concentration less than 5ppb. Therefore, EU has set a provisional MRL of 25 parts per billion (ppb) for OTC in honey (Centre for Science and Environment, 2010).

Any country seeking honey export to the EU needs to fulfill a list of requirements. It has to apply as an importing party to the EU and seek approval in order to be listed among the shortlisted foreign suppliers of honey to the EU.

Failing to do so, Lebanon was unable to export honey to the EU since 1994, and in order to get back to exporting it needs to satisfy the conditions set and complete the application form to seek necessary approval and inspection for compliance and allow entry.

As for Canada and Australia, the MRL set is less strict allowing 300 ppb, which is twelve times more than that of the EU. In the Canadian case, the procedure is less complicated and less time consuming.

Beekeepers Suffering From a Glass Ceiling

The market is growing and the trend is tending towards free import-export activities with free market agreements, multilateral and bilateral trade. By not moving forward and moving with the trend to increase production and supply the growing world demand in the competitive market, beekeepers are indirectly bearing undesired losses.

Diseases hitting honeybee colonies

On the other hand, losses accounted for are also linked to the diseases hitting bee colonies. In Lebanon, the prominent diseases most frequently infecting beehives are either parasitic, such as the Nosema and the Varroa diseases, or bacterial such as the AFB. Failing to properly deal with these diseases at inception could lead to the death of the whole honeybee colony.

Figure 2 illustrates the major diseases affecting honeybees.

This study explains how to deal with the infected beehives with AFB disease to better serve beekeepers' produce.

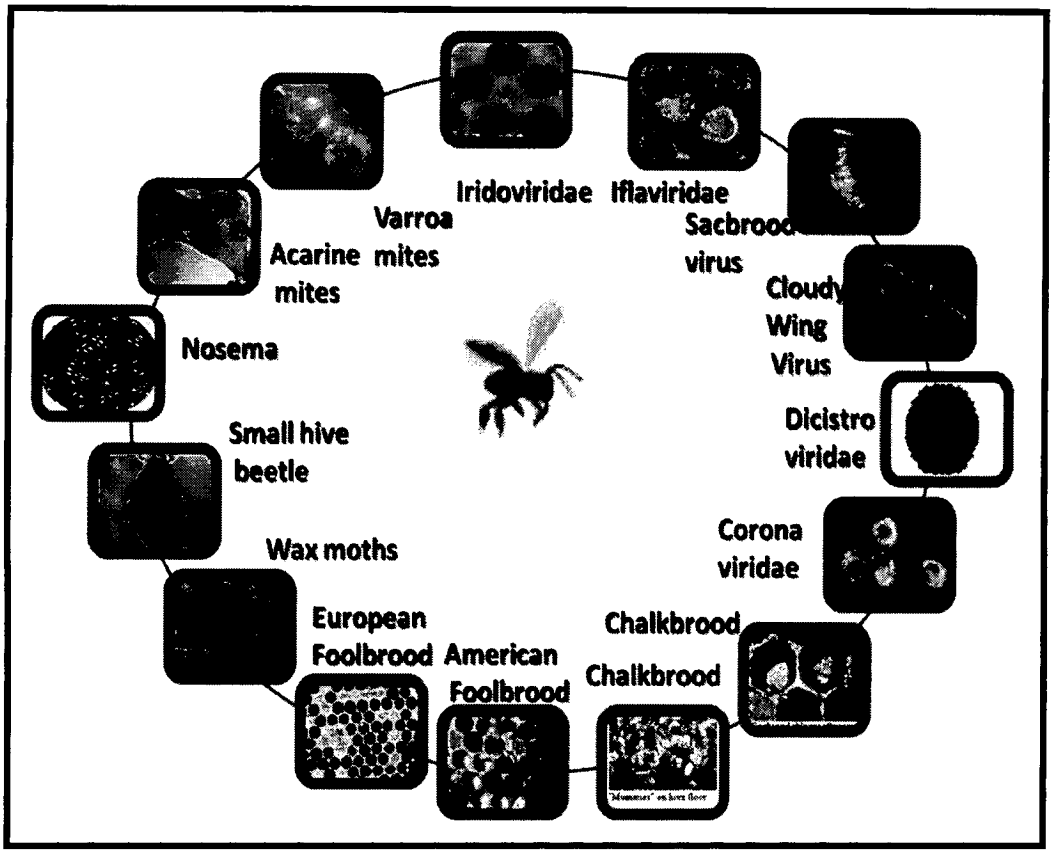

Figure 2: Major diseases affecting honeybees

1.7. Purpose of the Study

This study aims at studying the beekeeping industry in Lebanon and exploring the problems preventing the export of Lebanese honey to the EU. It also explores the local market and the domestic malpractices leading to an uncontrolled spread of AFB and antibiotic residues in honey.

The study gathers and presents vital data about the market and the beekeeping practices that would serve as a reference for future studies. It performs problem analysis and investigates the reasons behind the unsatisfactory results, trying to find a correlation between the presence of elevated OTC concentration in the honey end product following two major parameters selected to be the frequency and uncontrolled amounts used by beekeepers, in addition to other factors such as geographic location and type of honeybees raised.

Starting with a brief overview of the beekeeping sector in Lebanon, the study sheds the light on the American Foulbrood disease, its causes, consequences, and the prevention method. It also presents a well-rounded AFB management plan to enhance the Lebanese market and achieve good export potential for the EU as well as other large scale honey consuming countries.

The research performed intends to well understand the practices of beekeepers and show the reasons behind the AFB spread and the increase of 3-4% per year (Al-Moghrabi, 2011) of infected beehives in the last few years. Accordingly the setup of a compensation mechanism to be adopted by the authorities and key players in the field will be proposed as a solution through burning beehives to eradicate the presence of the Paenibacillus larvae bacteria which is the causative agent of the AFB disease.

With data collected from large scale beekeepers owning more than 50 beehives in different regions of the country combined with laboratory testing performed to detect antibiotic levels in samples taken within the past year, this study tries to compile the resulting data along with the scientific explanation to bring attention to the serious problem facing beekeepers in Lebanon as well as consumers.

The study concludes with a proposed national action plan ready to be adopted by the national authorities after reaching a feasibility plan and an adequate compensation scheme.

The need for an action plan

Upon the study completion, it should serve for raising the red flag for the governmental responsible authorities to intervene and take the necessary actions pushing for a large scale implementation of the national action plan.

The output of the research would provide beekeepers with the proper methods to cease the use of antibiotics, and would give essential data and information of the past market performance.

The study concludes with recommendations and propositions to move towards a healthier domestic honey product and increasing the potential of international export.

Complying with the international standards

International standards differ from a country to another, but they share some common characteristics related to safety, quality, and composition.

In an aim to improve productivity and have better reach to foreign markets, this study has an objective to improve the quality and better comply with international standards in order to have a better chance to access to EU and other developed countries.

The major international standards and regulations related to the specification of OTC in honey are presented in Table 5.

Table 5: Honey International Standards and Regulations

National and International references	OTC specification in Honey
Codex	No standards for antibiotics
EU Regulation (No 37/2010)	A provisional MRL of 25 ppb for OTC in honey
USA	No limits for antibiotics in honey
Australia/New Zealand	MRL for only OTC in honey at 300 ppb
Canada	AMRL for OTC is fixed at 300 ppb
India	No standards for antibiotics in honey
EIC standards	Level of Action (LOA) for OTC is 10 ppb
Lebanon	No standards for antibiotics in honey

Setting an AFB management plan

Intensive research and market analysis is to be delivered to all concerned parties to better understand the global situation. This would include but not be limited to awareness activities, technical support, and spreading the compensation strategy for beekeepers to reach consensus.

Reaching a final product in the best way possible requires going by the EU standards, as they represent the most stringent regulations for honey present till date. Therefore, the basis of the AFB management plan is to base our findings on the EU standard as to judge whether the product is an accepted or rejected honey product.

Prevention of the AFB is to be highly considered in avoiding cross contamination and destructing infected hives.

To do so, there should be a clear method used in getting rid of the infected hives and

compensating the beekeeper for the loss. How much should it be, and how would it be implemented are some questions the study answers scientifically with a consideration of what beekeepers would find acceptable.

1.8. Brief overview of all chapters

The study includes four additional chapters throughout which the topic will be discussed and the results of the research will be presented.

Chapter 2: Literature Review

This chapter reviews the local market and the international activities taking place. It presents the major research and surveys conducted, and provides the steps to be taken for a proper implementation of the research.

Within this chapter, the local market is analyzed and the major characteristics of this industry in Lebanon are presented.

Chapter 3: Procedure and Methodology

This chapter presents the methods used throughout this research including survey, interviews, laboratory testing, and results collected through literature review. It further states how the research questions have been obtained. The hypotheses are introduced and the steps to validate and prove them will be also presented in details in chapter 4.

Chapter 4: Findings and Results

The findings and results of the research including the survey and the empirical review are presented in this chapter. Supported by the meetings and interviews conducted, and backed up with a detailed scientific analysis the hypothesis is discussed based on the major output of the study.

Chapter 5: Conclusions and Recommendations

This chapter reiterates the main findings of the research after the scientific discussion are presented. With an official recommendation made to the officials in the Ministry of Agriculture as well as the Ministry of Economy and Trade.

This chapter also presents the limitations of the study and the managerial implications after concluding with a national action plan that is ready to be implemented starting 2013.

2. CHAPTER 2: LITERATURE REVIEW

Honey is being consumed all over the world and applied for different uses and applications; however there is still doubt that it has become an international product. The implementation of international regulations and the adoption of honey-related standards are playing a major role in the directions and intensities of honey trade activities.

Lebanese honey is known to be amongst the best qualities in the region, in terms of plants diversification and complementarities, yet the market has not been at its best due to various reasons and conditions discussed in every publication, article, and even interviews with major stakeholders in the field.

The production capacity, honey yield, exports and imports activities, and the different types of honey produced in Lebanon are important factors describing the market overview gathered through intensive literature review mainly relying on interviews and local statistics due to the lack of official publications in this regard.

2.1. Market Overview

Production capacity

The quantity of honey that a beehive produces on average in a year varies relative to several factors related to the state of weather, the number of bees present in a hive, their health, the availability of the nectar, and other factors. But, under normal conditions in Lebanon, one beehive produces around 8 kg of honey per year. Figure 3 demonstrates the average value calculated relative to statistics showing the production volumes per year for four consecutive years, and Figure 4 shows the average beehive production in Lebanon over the past years.

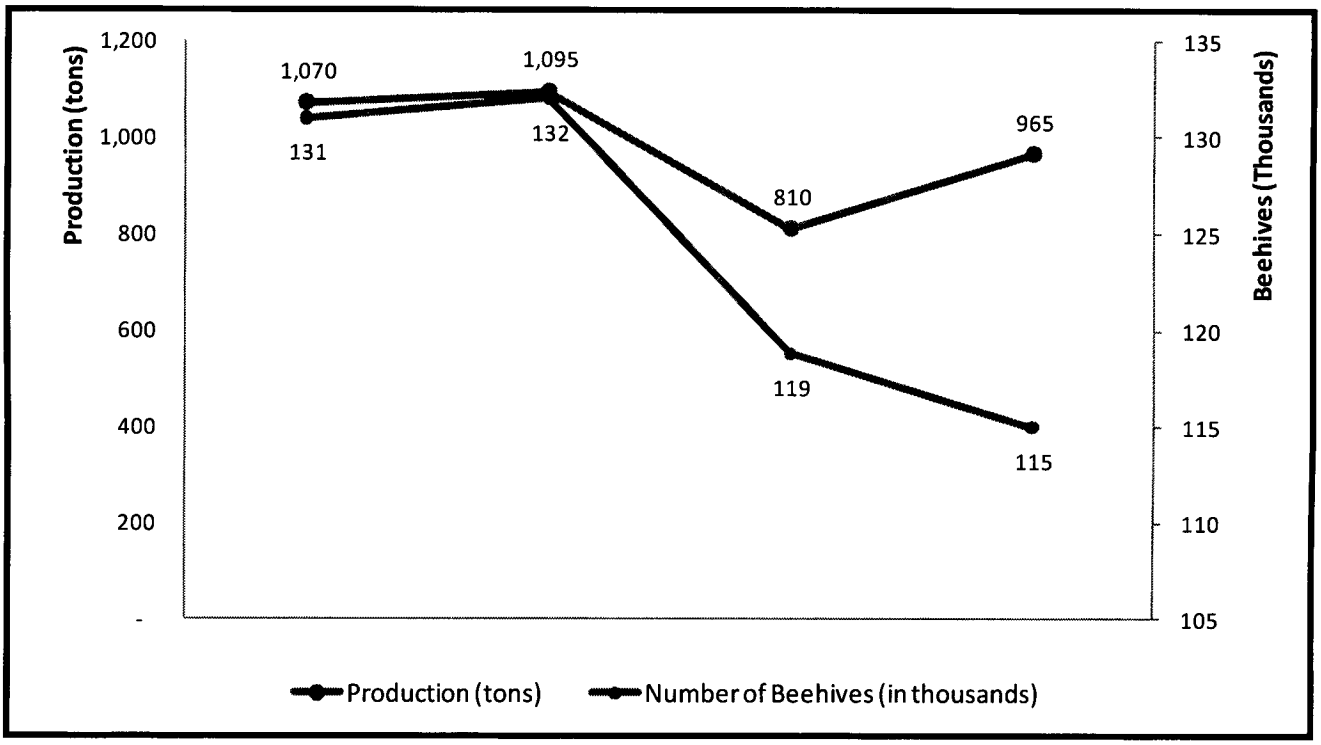

Figure 3: Average Production Capacity per year (FAO, 2008)

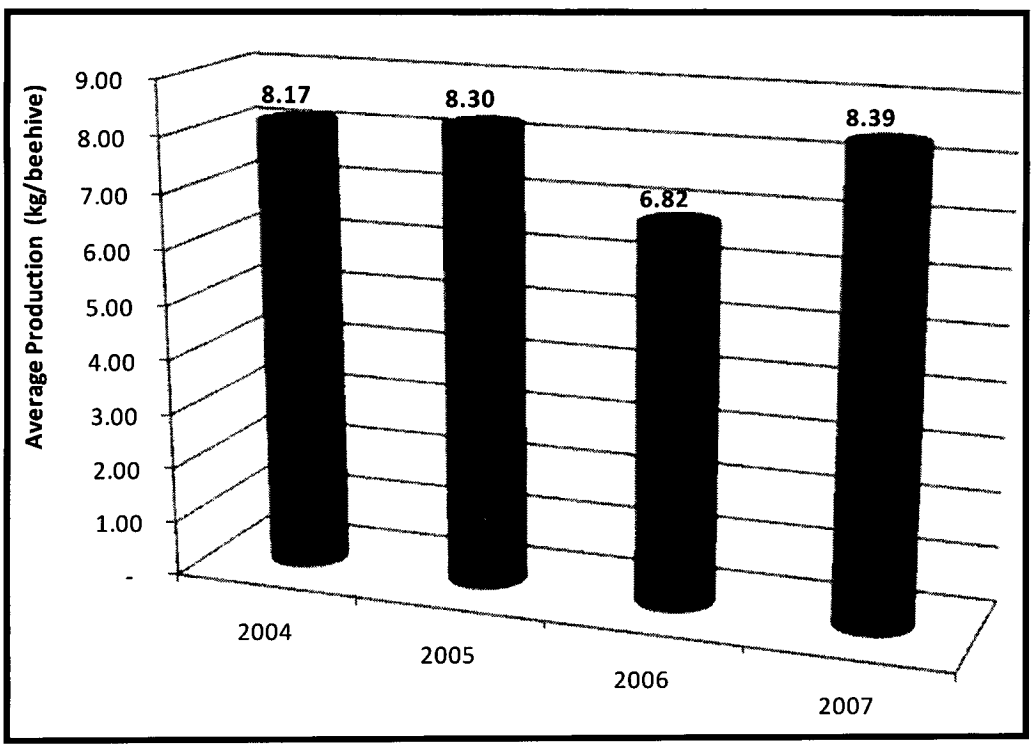

Figure 4: Average production of honey per beehive in Lebanon

The average annual yield of 8 kg in Lebanon is considered low when compared to countries of the region. With Egypt, Tunisia and Iran being 10 kg per beehives annually, while Israel being 20 to 30 for small scale beekeepers and 50 to 60 for large scale as shown in Figure 5.

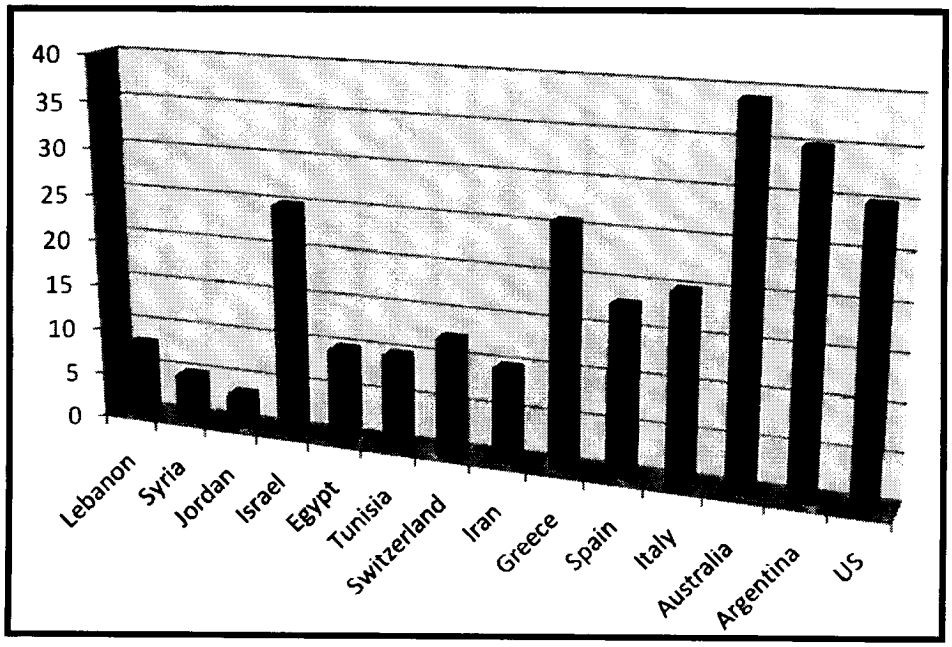

Figure 5: Honey production yield in selected countries in kg (ThinkQuest.org; Mashav, 2011)

No official honey production capacities are published yet, but local honey experts estimate the total production capacity in Lebanon to be 1,400 tons in year 2012. It is estimated with an average production of 8 kilograms per year for the available number of beehives in Lebanon. According to a study conducted by the MoA, the number of beehives is estimated to be 168, 614 in February 2011 but is estimated to have grown to be 175,000 beehives at current (Moghrabi, 2011).

The honeybee production annually is distributed in the five districts of Lebanon, excluding Beirut, with different shares. Mainly, South and Mount Lebanon have shown to be the highest contributors to the Lebanese honey production as shown in Figure 6.

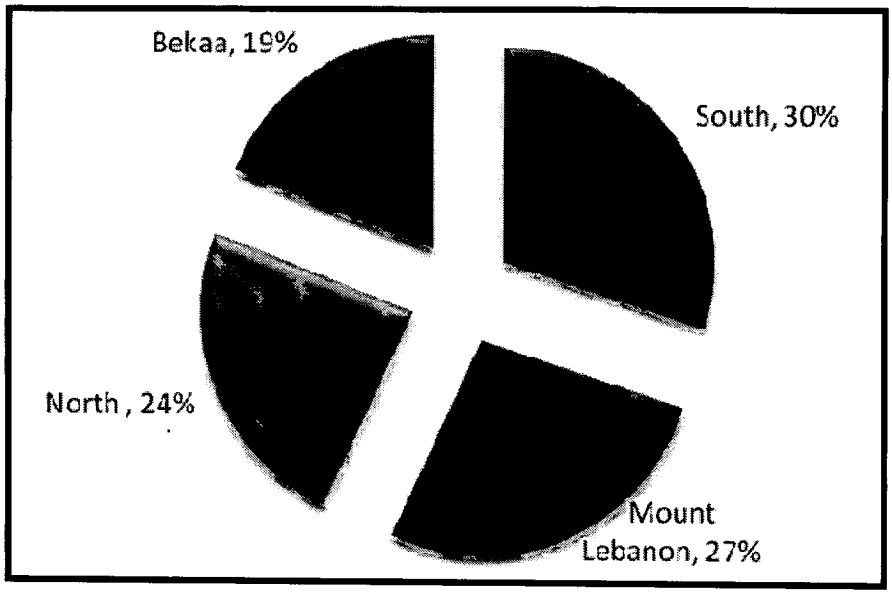

Figure 6: Honey production by district in Lebanon (FAO, 2008)

Beehives distribution

Around 175,000 beehives in Lebanon were distributed to around 5,250 beekeepers in year 2010. Table 6 shows the distribution by category groups according to the number of beehives each beekeeper holds and geographical location:

Table 6: Beehives' distribution in Lebanon (Moghrabi, 2011)

District	Beehives (from 1-50)	Beehives (from 51-75)	Beehives (from 76 and above)	Total Beehive number
Nabatiyeh	17,211	3,787	6,204	27,202
South	9,998	2,728	5,326	18,052
Bekaa	12,179	4,162	9,268	25,609
Mount Lebanon	16,732	4,556	20,402	41,690
North	19,207	7,160	29,694	56,061
Total	75,327	22,393	70,894	16,8614

In 2011, it is observed from the data collected that North Lebanon and Mount Lebanon rank among the highest contributors to the Lebanese honey production at current as they have amounted to a total of 58% out of the total number of beehives present in Lebanon. The number of beehives is distributed as shown in Figure 7

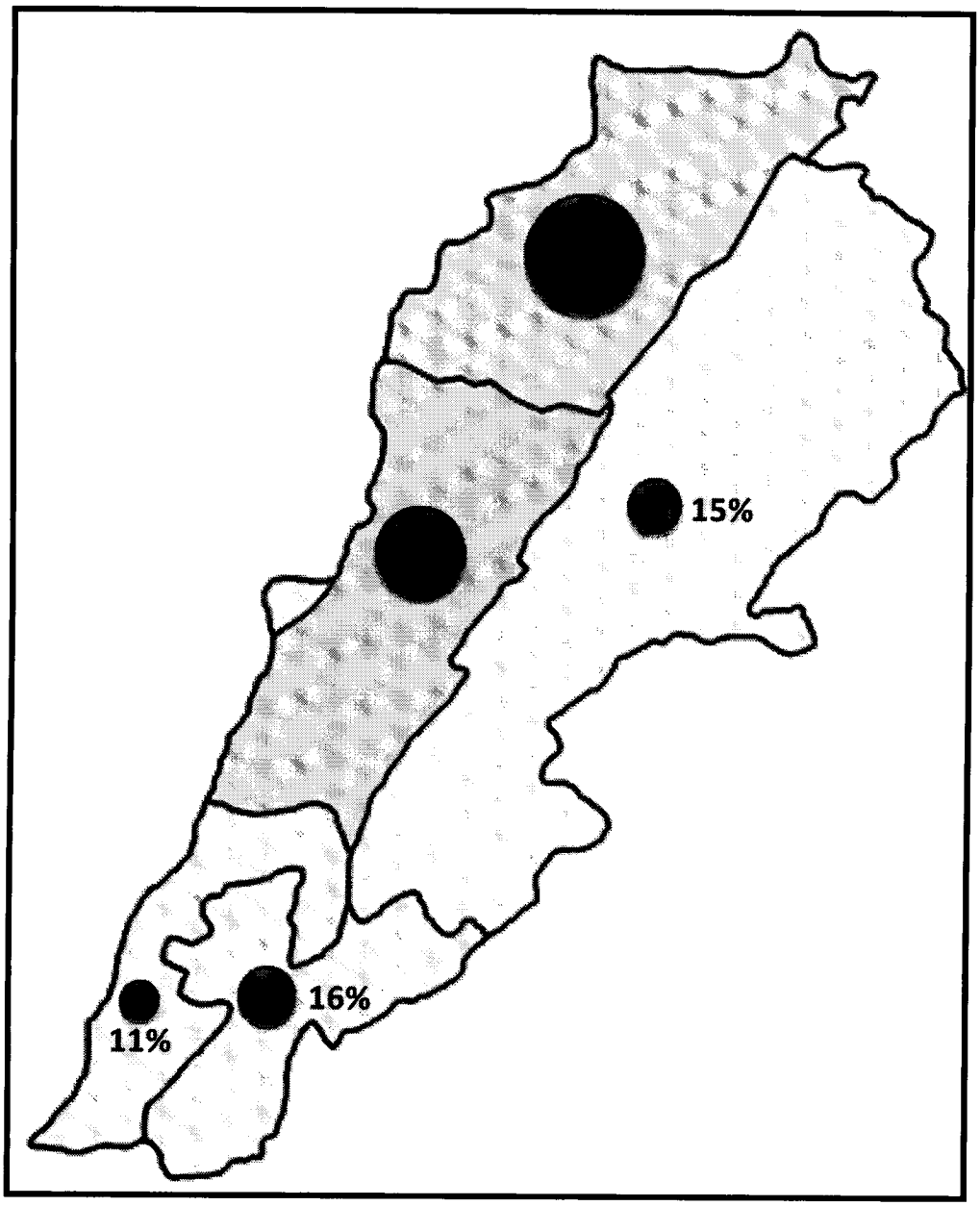

Figure 7: Beehives distribution by region in Lebanon

Export and Import figures

Honey is classified internationally under the Harmonized System (HS) code heading 0409.00 and is subject to a custom fee of 35% with a minimum 8,000 L.L. per kilogram to be collected on import. In addition, a 10% is collected as value added tax (V.A.T).

Another type of honey that is not naturally produced by honeybees but industrially and resembles the natural honey is namely called "artificial honey". It holds no specific common definition worldwide but it can be referred to as the honey produced industrially. Artificial

honey, whether or not mixed with natural honey, holds the sub-heading 1702.90.10 and is subject to 25% custom fee. Also, a 10% is collected as a V.A.T on the import.

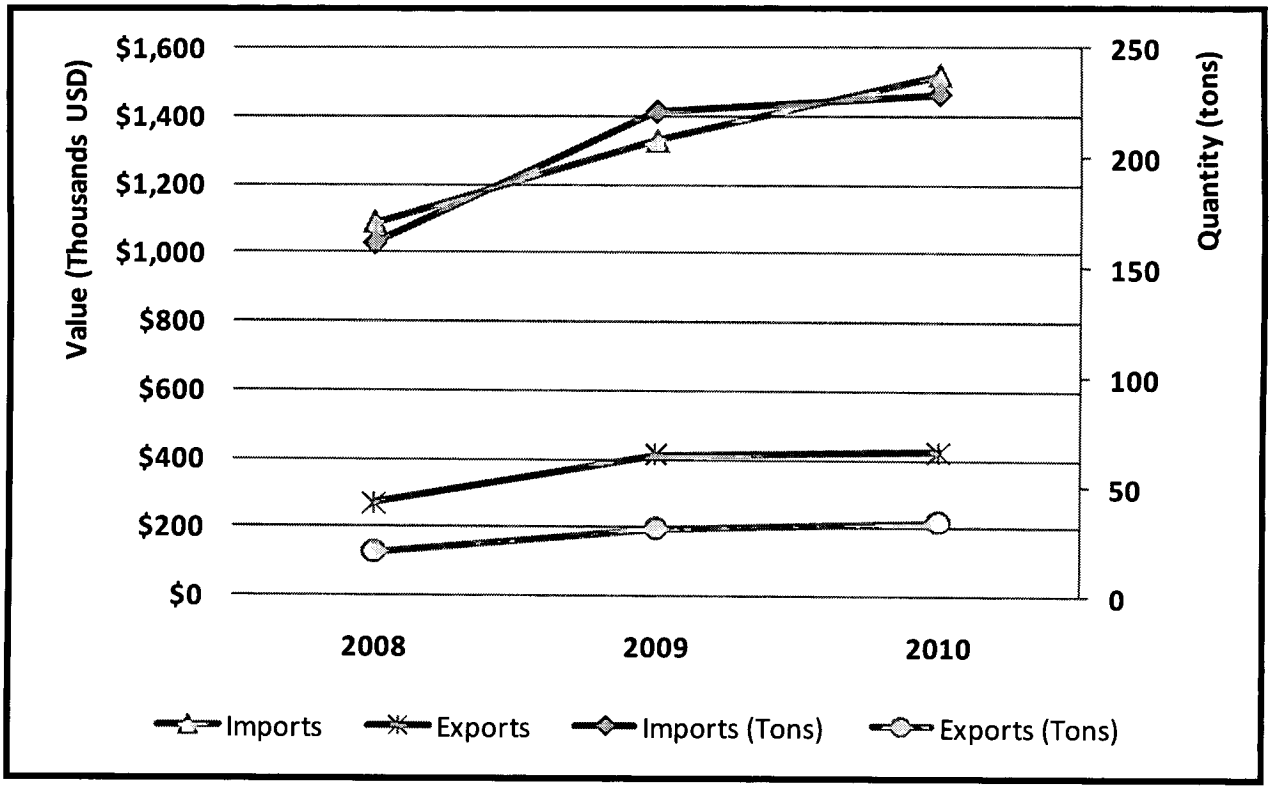

Figure 8: Imports and exports of Natural Honey from 2008 to 2010 (Lebanese Customs, 2012)

Import Figures Analysis

Import has increased by 42.2% from year 2008 till year 2010. It is also noticed that imports are increasing at a higher pace than exports across the years. The increase in imports is sometimes correlated to the government following a strategy signing free trade agreements allowing the opening of the market to foreign honey products entering the domestic market. Lebanon has signed the Arab convention for facilitating trade exchange with 17 Arab countries under the resolution No. 1317 d 59 dated 02.19.1997 issued by the Economic and Social Council of the Arab League. The Convention came into force in 1/1/1998 where an executive program and a timetable for the establishment of an Arab free trade zone were targeted. The percentage reductions reached 100% in year 2005, among which natural honey became tariff free for importers that are considered a party in the abovementioned agreement.

Export Figures Analysis

As for exports, it has also risen by 70% from year 2008 till year 2010. This significant percentage shows that producers are increasing their production to supply bigger local or foreign markets. The reason behind the increase in export is correlated to the distinguished taste and odor of Lebanese honey products pertaining to the multi-floral sources offering a mix of nectar and pollen types that honeybees use in the process of honey production and the nutritional value of its consumption.

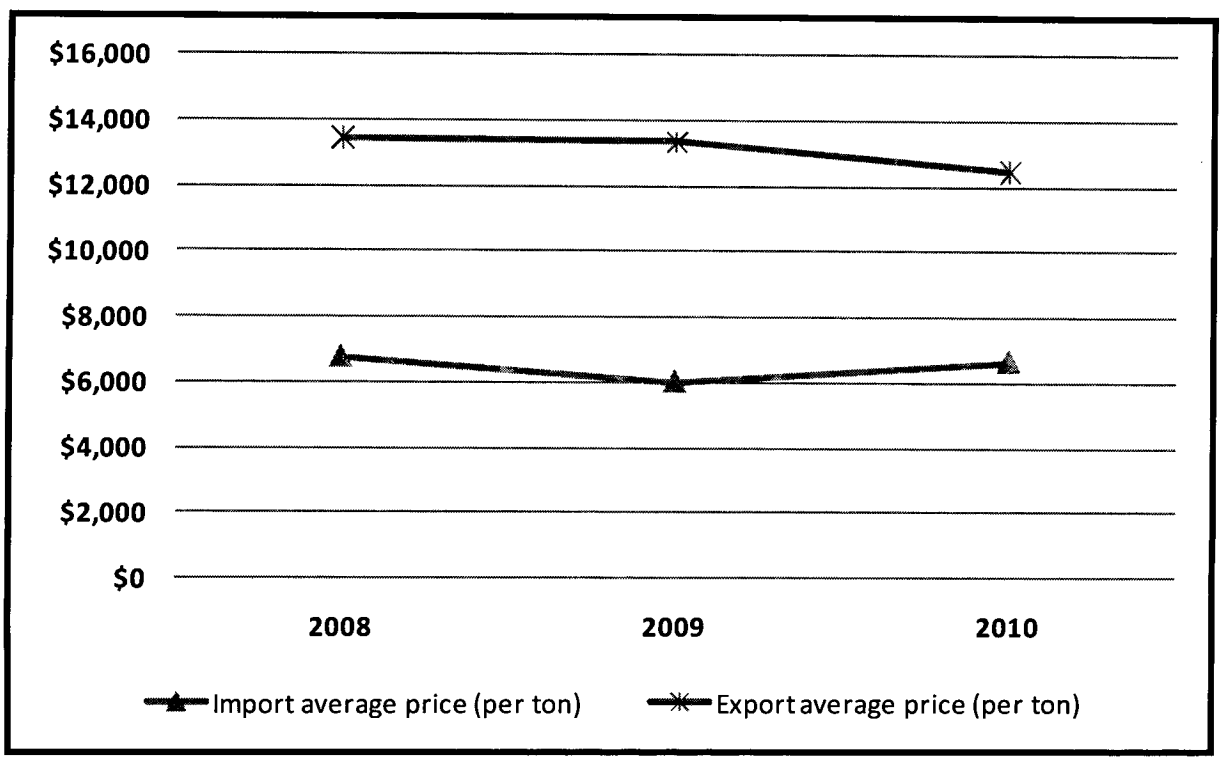

Figure 9: Import and export average price per ton (2008-2010) (Lebanese Customs, 2012)

Honey has become among the staple food list and the demand for this item by consumers is growing surpassing local honey production quantities to import in order to respond to the Lebanese market demand. More honey is being imported mainly due to the lower price that is around 50% the price of locally produced and exported honey.

Table 7: Import Figures by Country in years 2008-2010 (Lebanese Customs, 2012)

Country	Imports 2008			Imports 2009			Imports 2010		
	1000 $	Tons	%	1000 $	Tons	%	1000 $	Tons	%
Saudi Arabia	525	97	60.2%	776	132	59.7%	818	129	56.3%
Greece	167	13	8.1%	85	8	3.6%	156	12	5.2%
Germany	135	18	11.2%	210	25	11.3%	159	19	8.3%
New Zealand	105	5	3.1%	13	1	0.5%	4	0	0.0%
Spain	78	16	9.9%	77	17	7.7%	40	10	4.4%
Egypt	28	6	3.7%	102	29	13.1%	35	6	2.6%
France	34	3	1.9%	23	2	0.9%	44	4	1.7%
Canada	11	2	1.2%	12	2	0.9%	19	2	0.9%
India	3	1	0.6%	0	0	0.0%	41	16	7%
Italy	1	0	0.0%	1	0	0.0%	1	0	0%
United States	1	0	0.0%	1	0	0.0%	6	1	0%
Kuwait	0	0	0.0%	25	4	1.8%	11	1	0%
Hungary	0	0	0.0%	1	0	0.0%	1	0	0%
Argentina	0	0	0.0%	0	0	0.0%	1	0	0%
Belgium	0	0	0.0%	0	0	0.0%	1	0	0%
Tunisia	0	0	0.0%	0	0	0.0%	185	29	13%
Australia	0	0	0.0%	2	1	0.5%	0	0	0%
Total	**1,088**	**161**		**1,328**	**221**		**1,522**	**229**	

Lebanon imports honey from several countries (see Table 7). The list of importing countries to Lebanon is diversified to include European countries such as Greece, Germany, France, Italy, and Spain too. Unfortunately, the trade between Lebanon and the EU is only one way with the European honey products invading out market. No significant export of Lebanese honey products reach European countries in return.

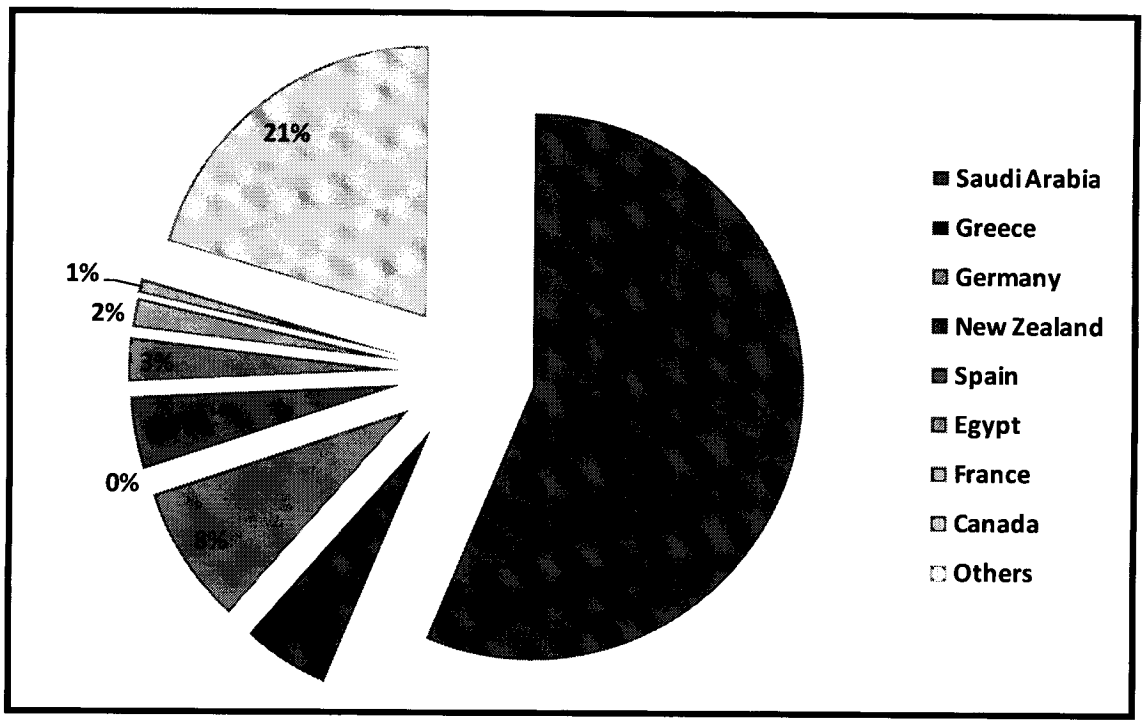

Figure 10: Natural Honey import by country in 2010 (Lebanese Customs, 2012)

Figure 10 shows the honey import by country in 2010 where it is highly dominated by Saudi Arabia with a share of 56% followed by Germany with 21%. Thus around 77% of the import total is limited to 2 countries.

This could be a result of Arab convention that Lebanon took part of and signed in 1998. The Arab Convention of 1998 removed the tariff over the trade of honey products among Arab countries, and thus honey became freely traded and exempted from tariffs when being imported to Lebanon.

This decrease in tariff created a competitive advantage in terms of cheaper prices to facilitate entrance to other markets, but also created more pressure on local producers who were not able to have lower production costs and thus was subject to huge imports of honey and failed to find sufficient market for their products.

Export activities over the years 2008 to 2010 are shown in Table 8.

Table 8: Export Figures by Country in years 2008-2010 (Lebanese Customs, 2012)

	Exports 2008			Exports2009			Exports2010		
Country	1000 $	Tons	%	1000 $	Tons	%	1000 $	Tons	%
Kuwait	156	12	58%	43	3	10%	37	2	9%
UAE	43	3	16%	63	5	15%	93	7	22%
Australia	21	1	8%	0	0	0%	0	0	0%
Qatar	18	1	7%	10	0	2%	17	1	4%
United States	8	0	3%	49	3	12%	41	2	10%
Congo	6	1	2%	2	0	1%	9	1	2%
Saudi Arabia	6	1	2%	183	14	44%	121	7	29%
Bahrain	1	1	1%	23	2	5%	21	1	5%
Ivory Coast	3	0	1%				4	1	1%
Oman	4	0	1%	7	0	2%	1	0	0%
Jordan	0	0	0%	20	2	5%	0	0	0%
Senegal	3	0	1%	1	0	0%	0	0	0%
Angola	0	0	0%	3	1	1%	2	0	0%
Nigeria	0	0	0%	3	1	1%	0	0	0%
Madagascar	0	0	0%	2	0	0%	0	0	0%
Niger	0	0	0%	1	0	0%	1	0	0%
Senegal	0	0	0%				0	0	0%
Sweden	0	0	0%	1	0	0%	0	0	0%
Syria	0	0	0%	2	0	0%	0	0	0%
Venezuela	0	0	0%	1	0	0%	0	0	0%
Egypt	0	0	0%	0	0	0%	60	10	14%
Nigeria	0	0	0%	0	0	0%	9	1	2%
Guinea	0	0	0%	0	0	0%	2	0	1%
Sweden	0	0	0%	0	0	0%	3	1	1%
France	0	0	0%	0	0	0%	1	0	0%
Gabon	0	0	0%	0	0	0%	1	0	0%
Ghana	0	0	0%	0	0	0%	1	0	0%
Total	**1,088**	**161**		**1,328**	**221**		**1,522**	**229**	

Lebanon has been exporting honey throughout the previous years to various countries as shown in Table 8, such as Sauid Arabia which ranks first among the countries where Lebanon exports most of its honey production with 29% out of the total honey export in 2010. UAE ranks second with a 22% honey export, followed by Egypt with 14%, and the United States, Kuwait, Bahrain, and with percentages ranging from 1% till 10% maximum.

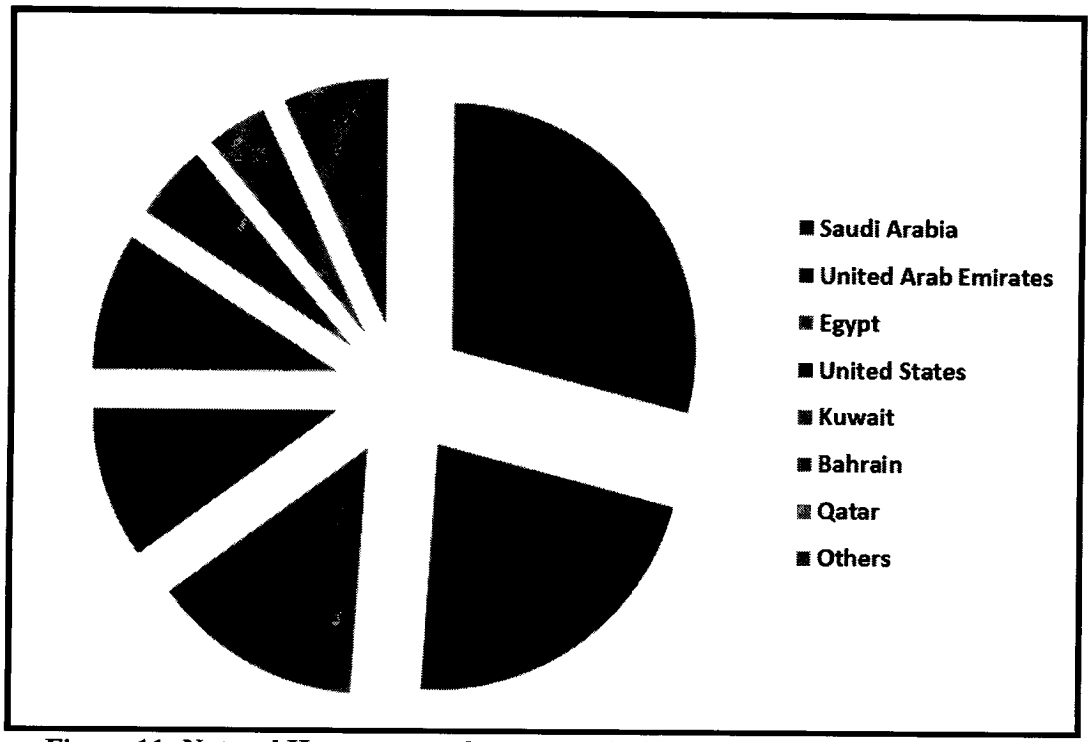

Figure 11: Natural Honey export by country in 2010 (Lebanese Customs, 2012)

Up to date, still export to EU countries is relatively low. A total percentage of 93% of beekeepers surveyed representing 1% of the beekeepers in Lebanon responded that they are willing to increase their production for export services.

Honey represents a small share of the Lebanese total Agri-food products, with a share of around 0.0021 percent in 2008 (from HS code 1 till 22). Still, it is a sector which is expected to grow significantly with a potential well-off prospective future.

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[1] The share of natural honey exports from the Agri-food products (from HS code 1-22) is calculated as follows: $(21\ tons \div 793{,}666\ tons) \times 100 = 0.002\%$

Honey products available in the market

Honey is classified into several categories; the following is a list of the possible honey products present in the Lebanese market:

Table 9: Types of Natural Honey (Lebanese Standard for Natural Honey NL 209:1999)

Type	Description
Blossom or Nectar Honey	Blossom or nectar honey is the honey that bees collect from nectars of flowers.
Honeydew Honey	Honeydew honey is the honey that bees collect from secretions of living parts of plants and/or from excretions of insects after they pierce the surface of some trees and suck their juice.
Extracted Honey	Extracted honey is the honey obtained by centrifuging combs after opening them, provided that they are free from damaged bee eggs and from any parts of any insect growth phases.
Liquid Honey	Liquid honey is the honey extracted from honey combs by sorting and draining.
Granulated Honey	Granulated honey is the honey that experienced a naturally occurring freezing phenomenon due to glucose crystallization.
Comb Honey	Comb honey is the honey stored by honeybees in the cavities of recently formed wax combs that are free from damaged bee eggs and from any stages of insect growth. Comb honey is sold in form of whole or divided naturally sealed combs.
Creamed Honey	Creamed honey is the honey that has a finely crystallized texture and that may be subject to a physical treatment that gives it this texture and renders it easily spreadable.

Cooperatives and Associations registered in Lebanon

Table 10shows the distribution of registered cooperatives and associations in the CCIB in Lebanon per district. The total of associations and cooperatives registered in Lebanon amount to 39 in year 2009.

Table 10: Association and Cooperative Distribution in the Lebanese Region (Moghrabi, 2011)

Region	Association/ Cooperation
Mount Lebanon	14
Bekaa	7
North	15
South	13

Through the regular meetings held each year, the cooperatives and associations help in the exchange of information and ideas between beekeepers in addition to sharing experience and offering solutions to common problems faced by the beekeeping sector.

Forums are often organized each year discussing structural and chronic problems. Problems vary from the use of pesticides, antibiotics, veterinary drugs to reduced planted acreage and the climate change implications.

Spread of AFB

Diagnosis of the AFB disease

A beekeeper can detect the AFB disease from some warning signals in his beehive indicating an unusual situation. The earlier the disease gets detected; the better off it is since the daily routine apiary management can easily spread the disease even to healthy bee colonies.

When looking for the symptoms of the disease, beekeepers would notice the irregular distribution of the brood. Cell caps of infected larva may be pinched taking the concaved form instead of the convex shape. The cells look darker in color and give the impression of a greasy appearance. Moreover, a few numbers of caps may be perforated while others entirely removed rendering the infected larva exposed.

In general, the internal structure of a beehive which is a densely-packed matrix of hexagonal cells made of beeswax, witnesses a decrease in the cells filled with brood.

Another characteristic of dead larvae recognition is the sticky and rubber-like profile that when a matchstick is used to pull the dead larvae, it extends around four to five centimeters forming a thread-like shape. In addition, an emission of a strong rotten smell is noticed.

AFB Transmission

The transmission of AFB is a major issue itself making the destructive consequences of the disease even more adverse and less likely to be controlled.

The disease can be transmitted all over the beehive through several channels all leading to the spread of this destructive disease all over the hive.

These means are as follows:

(1) Inside the hexagonal cells

This mean of transmission takes place inside the hexagonal cells as the feeding process of the larvae with contaminated honey occurs with the help of the nursing bees

Infected dead larvae

A second mean of disease transmission to honeybees is done by the infected dead larvae themselves during the process of the cleaning of the hexagonal cells performed by worker bees. The act of worker bees' contamination itself assists in the spread of the disease easily from one cell to another, especially to the healthy brood. This takes place through contaminating the honey that is located nearby in adjacent cells and using it to feed the hopeless larvae.

(2) Beehives invasions

The third transmission mean is done through the invasion of beehives by other nearby bee colonies to steal honey. This stealing process is identified by the majority of the beekeepers to play a big role in the transmission of the disease. More precisely, when the infected beehive weakens with time, a stronger colony beehive would strike to steal the weakened colony that is unable to defend the easy access to its honey infected with the AFB disease.

(3) Beekeepers practices

The beekeeper also contributes to supporting the disease spread. Mainly, the use of tools such as the beekeeper's contaminated gloves along with the transferring of frames by beekeepers from the infected cells to healthy cells and the unintentional use of contaminated boxes as honeybee shelters is unfortunately aiding in the disease spread.

2.2. Related Programs and Stakeholders

Previous Programs and initiatives

International NGOs such as the USAID, UNDP, and Oxfam have been active in rural development and the formation of models targeting income generation programs post the Lebanese-Israeli war in 2006.

USAID have been involved in a 6-year project ended in 2012, assisting and training farmers to establish a cooperative as a viable business. Among the major achievements of the project entitled, "Expanding Economic Opportunities for Survivors of Landmines and Victims of War", USAID has been able to include businesses related to beekeeping; honey and beeswax production.

Similarly, Oxfam has conducted a project to support the beekeeping sector growth in Lebanon through specific interventions aimed at enhancing technical assistance. More specifically, Oxfam has been contributing to strengthening the Lebanese beekeeping by increasing the level of technical knowledge and by the improvement of product quality, and supporting the Ministries of Agriculture and Economy in their role as supporters and promoters of beekeeping honey production.

On another note, the ministry of agriculture is getting more involved in this field especially with the new minister assigned in 2010. Several cross-divisional meetings and discussion groups have been formed in addition to various capacity building and awareness raising sessions.

Stakeholders

Ministry of Agriculture

The Ministry of agriculture comprises several units concerned in setting agricultural policies and regulations to enhance the overall performance of the agriculture sector in Lebanon, aiming at attaining sustainable food security, and improving the livelihoods of rural and farming communities. The Beekeeping department in the MoA has been working lately on specific objectives as to level up the honey profile in Lebanon through the reinforcement of honey related standards and international norms. Furthermore, a new decision pertaining to the pesticide and antibiotic MRLs is being formulated recently jointly with the MoET to be issued in the forthcoming months aiming at limiting the antibiotic and pesticide use for better international market access.

The MoA has been working on a national level to support beekeepers with their daily technical approach to raising bees and facing challenges. Collaboration with Italian experts has been carried out for sharing experience and improving beekeeping skills.

Ministry of Economy and Trade

The MoET is responsible for planning, managing, and implementing decisions in the field of trade and the economy. It is held accountable for economic matters and national stockpiling needs. Within the ministry, the consumer protection department is in charge of the "honey export initiative" folder aiming at increasing the potential of market access to European countries. Meeting with senior beekeepers and assessing their needs has constituted the drive behind initiating the required process for Lebanon applying to be on the list of importing to the EU. In 2009, an application has been sent to the European Commission but no approval has been attained for the major drawback of Lebanon not being able to conduct antibiotic testing in a domestic accredited laboratory. Recently, a revision of the application form and the Honey Residue Monitoring Plan for Lebanon has taken place and has been resubmitted to the EU by the end of January 2012. The MoET has been involved in the formulation of the honey related decision that the Minister of Agriculture will issue soon. Moreover, collaboration with the Italian Organization "Oxfam" and cooperation with the Italian laboratory "Floramo Corp." for technical assistance on beekeeping in Lebanon is taking place aiming at future potential cooperation in export related projects in the honey and beekeeping sector.

UNDP

UNDP's principal role is to assist governmental units in effective projects management in terms of consultation, cooperation, operation, control mechanisms, and other aspects.

Among its programmatic activities that entail several sectors, UNDP has been involved in year 2010, in organizing the Fourth Mediterranean Beekeeping Forum in collaboration with international organizations aiming at promoting biodiversity and environmental sustainability.

And further to its various development programs, in year 2008, UNDP has been involved in a support project in South Lebanon seeking assistance to the Al Shifa beekeeping Cooperative in Toul/Kfour, through helping in the establishment of a modern center that offered new methodologies in production and packaging.

In addition, UNDP has been running training in year 2008 focusing on sensorial analysis of the various types of Lebanese honey produced.

Lebanese Customs

The Lebanese Customs Administration is the government authority responsible for ensuring the conformity of products entering the country relevant to local laws and regulations. It

operates under the ministry of finance and is the major body responsible for collecting customs duties.

The Lebanese Customs Administration controls the flow of goods in and out of the country, through its locations at the national airport and other land and sea ports where goods enter and leave the country.

As part of the ministry of finance, this administration plays an important role in setting customs on imported honey and controlling the quality entering the country.

Previous Studies

Studying quality parameters

Reference to a study carried out in 2004 by the United Nations Development Programme (UNDP) covering three regions in Lebanon: Bekaa, South and North Lebanon aiming at having a preliminary idea about the honey produce in Lebanon. Five quality parameters were tested:

- Humidity (%)
- HMF (mg/kg)
- Diastase activity
- Conductivity
- Acidity

It has been shown that all results were compliant with international limits as well as the Lebanese norms and that the Lebanese honey produce is characterized to have low moisture content and low HMF level relative to foreign countries which highly gives a competitive advantage and encourages its export.

Studying safety parameters

In year 2010, a different criteria of sample testing was performed by UNDP, but with the objective of detecting the level of OTC and tetracycline present in natural honey. Contradicting with previous studies, results have shown that samples from Bekaa, South, Akkar-Dannieh regions are extremely contaminated with high levels of antibiotics, making honey ineligible for human consumption.

According to studies, Paenibacillus Larvae, a spore-forming bacterium causing AFB, becomes resistant against OTC with time, and has been proven to lack effectiveness in curing honeybees from the disease but delays its appearance. Therefore, another method may be used to get rid of

the persisting bacteria and face the AFB disease problem facing beekeepers resulting in drug residues in honey. In order to study the real size of the problem in Lebanon, a series of 33, 25, and 30 samples selected from the Bekaa, South, and Akkar-Dannieh regions respectively. Samples were analyzed in 2010 for OTC and Tetracycline residue using the liquid chromatography–mass spectrometry (LC-MS/MS) to verify the positive result in the selected samples. In the Bekaa region, only 7 out of 33 (21%) were found to contain less than 25 ppb, i.e. only 7 samples were considered safe for human consumption according to the European standards which accepts a maximum level of 25ppb of OTC in honey. As for the South and Akkar-Dannieh region 72% and 53% of the samples respectively were found to be safe for consumption.

On the other hand, Tetracycline residue has also been found in the honey samples, while it should be 0 ppb since it has been banned internationally.

Residue analysis signifies that the two antibiotics are present and in very high levels that is dangerous for human health.

At the international level

Internationally, several countries have undertaken similar studies to grow their beekeeping sector and achieve higher quality if honey products. Most are European and first world countries, with only some developing countries aiming at opening new markets for their products in the European Union. A plan was initiated in Uruguay in 1999 when the first AFB event was reported, and then a nation-wide survey carried out during 2011 when a prevalence of 2 % was found and discuss national strategies for prevention of the disease. Other initiatives were done in Switzerland, Australia, and other European Countries. A small scale study was conducted in Jordan to investigate the beekeeping sector in general, and analyze the problems hindering its development in 2004.

2.3. **Conclusion**

Apparently the apiculture sector in Lebanon is passing through difficult times. The production yield is not stable through the past years, and sometimes dropping below regional average. The country imports volume is very close to its exports but with a monetary value of 200%, meaning that the price of exported products is half the price of imported ones.

All this combined with the rising issue of antibiotic residues in honey products, and the tremendous drop in honey production in terms of quality and quantity, it has become obvious

that action needs to be taken by authorities and concerned parties to avoid further deterioration in this sector.

Several initiatives have been taken by national as well as international bodies and organizations to strengthen the sector and improve the honey production industry. Stakeholders were partially involved, but the efforts were unfortunately not aligned enough to complement each other.

Action needs to be taken. More specifically, the action requires several activities and initiatives to be performed, on top of which is directly related to beekeepers and the quality of honey being produced. This involves a participatory approach that gathers the 5,250 beekeepers, collects their concerns, and discusses the possible solutions with them.

To proceed with that, a baseline needs to be defined. That is done through a survey conducted in parallel with laboratory testing to investigate the antibiotic residues in honey products as explained in the next chapter.

This would provide a clear background and would pave the way for an integrated management plan to further enhance the honey production status in Lebanon.

3. CHAPTER 3: PROCEDURE AND METHODOLOGY

Knowing that the apiculture industry in Lebanon is not at its best and that the integration of a management plan that unites efforts to perform in perfect harmony is critical, the formulation of a national strategy requires intensive analysis and a proper research methodology.
This study aims at design a sustainable integrated development plan of the beekeeping industry in Lebanon, including an AFB management plan for the control of the American Foulbrood disease infecting honeybees at the apiary and national level.

3.1. Introduction

The research performs a detailed study of the market characteristics, beekeepers behavior, correlation between antibiotic use and undesired residues. It formulates a compensation plan as a supporting scheme to AFB management actions. The research is conducted in an aim to answering the following research questions to have a well-rounded strategy:
What are the drivers and means for the use of antibiotics in Lebanon?
How is the uncontrolled use of antibiotics affecting local market and international trade?
What is the correlation between the use of antibiotics and the formation of undesired antibiotic residues in the produced honey?
What would be an effective national AFB management plan? How can the Government compensate for burning beehives?

Hypotheses

With the status quo and following an extensive research pertaining to the AFB disease and its spread, the limited knowledge of the research questions tend to lead to the formulation of the following two hypotheses:

(1) The indiscriminate use of antibiotics is leading to elevated residue concentration in honey produced in amounts proportional to the amount of antibiotics applied while treating AFB

(2) The formulation and adoption of a national action plan seems to be not such a feasible option with obstacles arising in the legal, technical, social, and financial aspects.

Selected variables

The quantitative research involves several variables to investigate the different aspects involved in the use of antibiotics in AFB prevention. With the results concluded by laboratory testing, and the face-to-face survey conducted with the beekeepers, a relation between different factors is to be examined. For this purpose a selection of independent variables is done to study their impact on the final product and the doses of antibiotics present in the honey produced.

The independent variable(s)

Among several potential factors, the research is limited to the following independent variables for what they could be of effect on the contents of the honey produced:

(1) The level of antibiotics used

This factor varies by season and by beekeeper as there is no official standard followed defining the amount of OTC to be applied as a treatment of the AFB disease. It is advised by the MoA to use 0.5 grams of OTC in a sweet solution of 1 liter for every infected beehive.

(2) The frequency of antibiotics

Similarly to the level of OTC, the frequency and the delay time between uses is an important factor to be considered, and which obviously affects the amount of antibiotic residues in the final product. It is also advised to use the OTC to infected beehives three times with a delay of one week between every use.

(3) The type of honeybees raised

Honeybee species vary by region and beekeeper. Every species possesses different biological and physical characteristics. This makes some species more prone to AFB or more responsive to the use of OTC than others. Whether it is an Italian, Australian, Egyptian or Syrian colony, they all lie under the genus Apis, but the level of responsiveness and sensitivity differs.

The dependent variable

The concentration of the antibiotic is measured to represent the dependent variable. Results are compared relative to international standards in order to evaluate their compliance, and analyzed to see their dependence on the independent variables.

Methodology used

This study is based on two major research activities. The first aims at studying the market characteristics and the relationship between various factors present during the honey making

process and the level of antibiotic residues appearing in the final product. The second aims at proposing a national strategy pushing towards the development of the sector and the reduction of antibiotics use to enhance international trade and export activities.
The first requiring an empirical research and the second being more conceptual, the study combines two models in an aim to present a comprehensive national strategy for Lebanon.

3.2. Research 1: Market Characteristics and Antibiotic Residues

Research Type

Researching the factors affecting the level of antibiotic residues is done in an empirical approach, with a major focus on observation and experimentation, especially with the conduction of laboratory tests.
In this empirical research model, the research type followed is the causal conclusive research used to analyze the cause-and-effect of the use of OTC in beekeeping.
Multiple thoughts and several reasons lie behind the cause of OTC usage by beekeepers that fear the spread of the disease and the death of the brood. Hence, the presence of the AFB disease initiates the probability of the existence of antibiotic in the honey samples tested. And as an effect, the final product of honey with elevated levels is facing rejection when exported while on the other hand, the high concentrations are going unnoticed nationally.

The need for better market surveillance

The unnoticed national high levels of OTC in honey are not being treated fairly in Lebanon due to several reasons, among which is the lack of accredited Lebanese laboratories capable of conducting the testing for safety parameters in honey. Hence, the indiscriminate and random use of antibiotics goes unnoticed and uncontrolled.
In addition to the lack of proper funding for governmental inspection entities responsible for market surveillance to control the market, regular testing of samples taken at the different phases of the honey supply chain identifies the possible hazards encountered leading to an end product with low quality.

Research Method

Laboratory testing for the 30 chosen samples representing the Lebanese market were conducted for the level of OTC in each. Sample testing took place in an accredited Italian

laboratory, *Floramo Corp.* s.r.l, funded by the Italian cooperation in order to receive the results 2 month later. Two samples, each weighing 250 grams in a sterilized glass container were taken from each of the 30 beekeepers chosen to conduct the study. The samples were taken in the month of November 2011 for analysis in Italy. The results were distributed to all concerned beekeepers in the month of February, 2011.

Testing hypothesis 1: "OTC is the only viable and most practical solution beekeepers can currently adopt to treat AFB disease", hypothesis 2: "The indiscriminate use of OTC is leading to elevated concentrations in honey that only affect the international trade of honey without affecting the local market situation" and hypothesis 3: "Antibiotic residues in honey are produced in amounts proportional to the amount of OTC applied while treating AFB" have all been tackled for testing through the survey results' and laboratory testing analysis.

Whereas hypothesis 4: "The formulation and adoption of a national action plan seems to be not such a feasible option with obstacles arising in the legal, technical, social, and financial aspects" was tested through measuring the extent to which beekeepers are willing to accept the implementation of the new method of burning infected beehives to get rid of the AFB disease through the survey results' analysis and interviewing governmental authorities to weigh the capabilities present from one side and following the rules and regulations of all actions that could be taken on a later stage under the law.

Pilot Test

The formulation of the questionnaire was done in coordination with experts in the field to serve as a good source of information for the survey. The first drafted version was pilot tested with two beekeepers, to be then upgraded to the final version that is available in Appendix A, containing 45 questions tackling several aspects that are related to the research topic and the beekeeping industry as a whole. The feedback given from experts highlighted some criteria to be added to collect more information aiming at further studying the market and better serving the objectives of the study.

Much emphasis was given to the diseases hitting honeybees annually leading to drastic economic losses. Statistics have shown that Lebanon suffers from three prominent diseases encountered by the majority of beekeepers: the Varroa, Nozema, and the AFB diseases. The Varroa is being controlled as well as the Nozema by the use of pesticides. Further to that, the MoA is assisting beekeepers by distributing the pesticides to beekeepers on a regular basis.

Whereas the AFB disease is not being well managed and controlled and is believed to be incurable. Hence, more attention has been given to the AFB disease in specific to help honey producers resolve their major impediment.

Moreover, the existence of this antibiotic is not only harmful, but also constitutes a major barrier for the honey export as consignments are being rejected once antibiotics are being detected in the product.

Also, a pre-testing was conducted by the Ministry of Economy and Trade in year 2010 at the level of the market, the final place where the act of selling honey to end consumers is conducted. A total of 40 samples were taken from the market representing various types of honey products from several sources and produced at different altitudes.

The samples were tested for antibiotics presence in a Lebanese laboratory. Testing results have shown very high concentrations of antibiotics in samples exceeding norms and standards by concentrations reaching 200%. The results are viewed to be reliable with good level of confidence. However, the concentrations portray the existence of the antibiotic is an indication for endangering human health. The survey has based its essential questions on the reasons behind the high concentrations detected and the analysis of the survey results draw out some linkages between variables.

Data Collection

Primary data were collected through answering survey questions in addition to interviews with stakeholders ranging from local and foreign experts, non-governmental organizations to Lebanese governmental representatives. The essential information was based on the results of the survey and sample testing results of the 30selected beekeepers from different geographical locations. Based on the criteria of choosing 30 beekeepers owning 50 beehives and above out of a total of 5,250 Lebanese beekeepers to participate in this study, the data was collected and organized using the excel Microsoft to reach links and conclusions serving the thesis.

Two samples of 250 grams each were collected from beekeepers in a sterilized glass container. The samples were taken from 30 beekeepers distributed in different casa covering all 6 districts of Lebanon. The samples were all taken in the month of November and December 2011 for testing in the Italian accredited laboratory for the antibiotic OTC.

The purpose behind the followed strategy in the selection process of beekeepers is to target medium to large Lebanese honey producers owning 50 beehives and more and located in a

geographical location suitable to be part of representing the whole Lebanese market. Lebanon is divided into 6 districts and each district is divided into several casa. Figure 12 below shows the distribution of the samples selected from beekeepers owing 50 beehives and more to study the market.

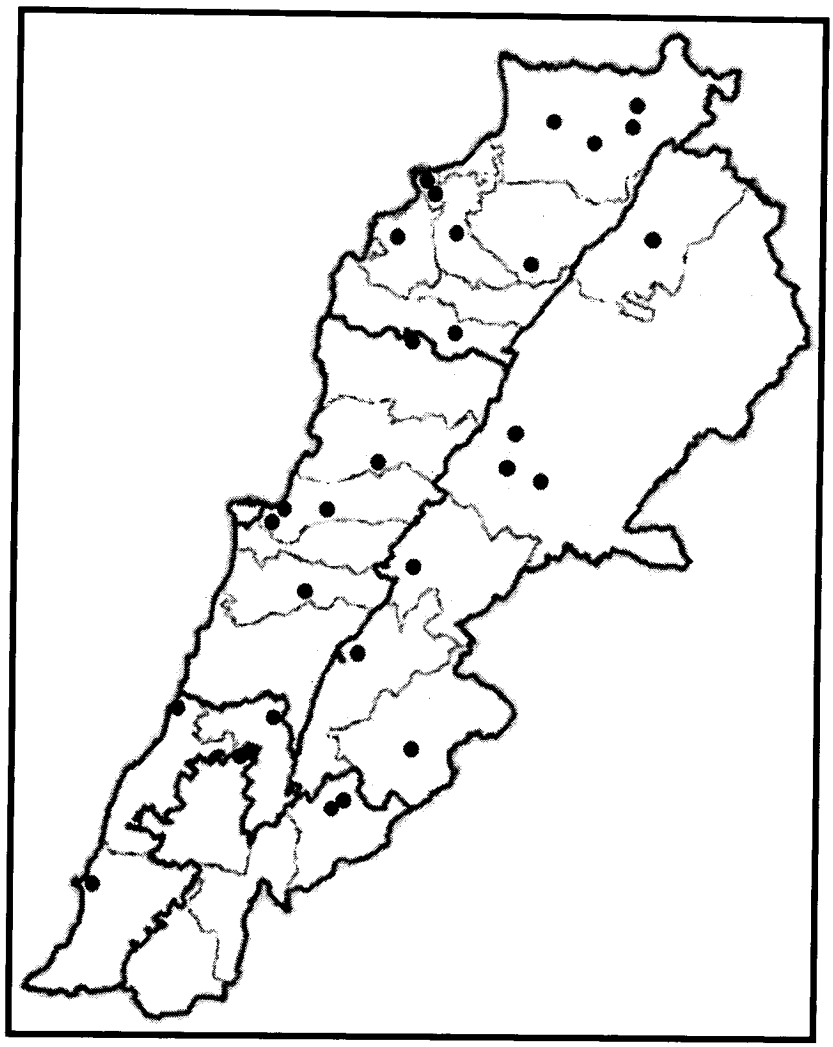

Figure 12: Geographic distribution of samples taken

Survey preparation

The first method used throughout this research is a survey compiling 45 questions (see Appendix A). It presents some major questions addressed to the Lebanese honey producers, mainly beekeepers owning 50 beehives and above; in order to collect the needed information concerning the American Foulbrood disease spread in the Lebanese regions and potential export possibilities. Questions selected to be inserted in the survey allows to have an overview of all the aspects related to the beekeepers to further understand his status starting from his age,

gender, years of beekeeping to his expected estimation of the subsidy value projected if he is to burn his infected beehive with the AFB disease. Data were collected from beekeepers using the single-visit-multiple-subject formal survey.

Following a conference organized by the Lebanese MoA that involved 106 attendees, mainly beekeepers that own large apiaries, the survey was distributed for completion. All beekeepers filled the survey which constituted an abundance of information to better serve the market study. However, more attention was given to the 30 beekeepers that contributed to the study by giving a sample for analysis. For survey completion purposes, 30 minutes to fill the survey was given and time was further extended for beekeepers to identify their needs and requirements.

The survey stresses the benefit that will be given to the public sector with more accurate information gathered in order to offer suitable assistance and customize a national action plan that suits them well.

Additionally, the survey preparation serves to reach the highest number of beekeepers with the aspiration of collaboration between the public and private sectors for future mutual cooperation in the field of honeybees and beekeeping in Lebanon.

Some guidelines were provided at the top of the survey to familiarize the holder with the needed information and facilitate the act of paper filling. The guidelines are presented below:

- The purpose behind the survey is to take note of the beekeepers' perspective and gather information in order to evaluate the natural honey market in Lebanon and the problems facing beekeepers to develop this sector and to help in opening the export horizon.
- The survey filling will take no more than 10 minutes
- It is pleased to answer the survey clearly and honestly
- In case of unclear questions, please consult the survey holder
- It is pleased to answer with the adequate number inside the set cases or insert the sign (X) in the proper place
- All beekeepers attending the conference were requested to fill the questionnaire. Beekeepers were asked to identify themselves. Forms were collected upon completion.

The questionnaire was completed by all beekeepers at the same time and date, Friday 3rd of February, 2012. The 30 questionnaires were distributed to all concerned beekeepers and instructions were given in parallel to assure the fully understanding of each question.

Sample Description

The focus group selected to be 30 beekeepers out of the 5,250 beekeepers present in Lebanon reflecting coverage of 5.7‰. The sample was limited to 30 due to the high cost of laboratory testing and the unavailability of funds.

This coverage of as much as 0.5% of beekeepers in fact represents 9.34% of the number of beehives in Lebanon and around 6.87% of the honey produced annually.

Samples were taken from Lebanese professional beekeepers. Upon sample collection, information of each sample was recorded specifing the type oh honey, date, area,etc. Laboratory testing comprised a total of 30 samples, which all have a Lebanese origin. The samples taken covered three regions:

(1) Coastal area

(2) Middle area

(3) Mountain area

The types of honey analyzed were both forest Honey and multifloral honey.

The conference held was attended by 106 beekeepers, all of whom have been surveyed and with a response rate of 99%, which is considered a good sign of high interest in exchanging information and shows the good will and intention of collaboration.

The focus group

A focus group was selected to match the 30 samples taken and tested as previously explained. This group included 30 beekeepers, representing different regions of the country and following different beekeeping techniques.

More attention was paid to this group through face-to-face interviews and then followed up with phone calls to proof-read and ensure the answers provided.

Data Analysis

The Microsoft Excel package was used to organize the data received from the survey conduction. The software helped in generating the correlation between the variables to measure more accurately the level of dependency of each independent variable on the final dependent variable.

Validity and Reliability

Validity

The fact that the survey was individually filled by each beekeeper with no close surveillance resulted in some unclear answers or false understanding of the questions set. Therefore, several telephone calls were given to the 30 beekeepers to double check the numbers and better understand the data provided. Post the re-filling of some of the missed questions through the phone conversation, the best way to secure the validity of the information taken is to interview the beekeeper and let the interviewee confirm the compliance of the answers with his.

Reliability

Some questions showed contradictory answers and is believed to be the result of fear beekeepers exhibited as the conference emphasized on the importance of seizing the use of antibiotics for its adverse impact on export and human health. Beekeepers had the tendency to shift from the questions addressing their frequent use of antibiotics and random frequency and dosage used.

The level of confidence differs between beekeepers but was relatively high due to the factor that each beekeeper was condemned to be truthful because of the results present showing clearly the side where the beekeeper was not very well managing.

Large beekeepers with high honey production capacity and owning 140 beehives and more usually delegate the work to his employees to take care of the beehives. And since the taking care of the beehives is not self-done, it is sometimes viewed that the answers given to some questions are approximate serving to represent the situation taking place.

3.3. Research 2: The Introduction of an Integrated National Strategy

Research Type

As for the feasibility study for a national strategy to control the use of OTC and the monitoring of antibiotic residues levels in honey, conceptual research is applied.

In this conceptual research model, the research type followed is a combination of two especially with the little knowledge and information available on this topic, explorative research is needed to better understand the study area and deeply investigate the various possible options that could contribute to the execution of the study. For this purpose

explorative research is used combined with performance monitoring research to forecast future aspects and investigate the impact of adopting a national strategy by the government officials.

Research Method

The research was initiated through critically questioning beekeepers individually targeting in-depth specific information examining their situation and the various barriers faced trying to find an explanation to the growing problem of the AFB disease spreading in apiaries.

Furthermore, in search for the needed information, several ways were adopted. A review to all relative studies undertaken locally and internationally was exhibited and access to various published materials through online databases was performed. Additionally, statistical data were also received from the Lebanese customs, magazines and newspapers forming the basics to build upon.

The research method was also a combination of the output of several meetings with governmental decision makers in the beekeeping field that have been supportive for developing this study due to its beneficial expected return and being the first of its kind in the field. Their shouldering in several phases constituted a cornerstone for the whole project as their cooperation helped in better outreach.

Moreover, organized trade conferences, beekeeping seminars and trainings were attended to better be up to date of the status quo and laws and regulations governing. Nevertheless, information collected from speakers at conferences, seminars and workshops tends to be rather subjective and may not be representing the beekeepers views and concerns accurately.

Academic experts in the field were also cooperative as they provided the scientific part to reach more accuracy and efficiency throughout the decision making.

Associations and cooperatives were all enthusiastic to start exporting their exquisite honey to the rest of the world and were interested in the study due to the compilation of information it entails which makes it a good reference for getting more acquainted with the current situation and the problems faced in addition to the possible solutions proposed.

Data Collection

The data collected focused mainly on primary data gathered through survey completion, phone conversation and personal meetings. As well as secondary data was collected through literature review and studies conducted earlier in Lebanon.

Key persons representing the private as well as the public sectors have contributed through their invaluable input to the completion of this research. The strategy behind the key persons' selection was based on the concept of diversifying the sources of information so as to cover all the sides of the topic from a scientific point of view to issues related to trade and governmental procedure requirements. Selection criteria were also dependent on the position, experience, publications, and background of each person. Interviews tackled several aspects pertaining to the thesis topic in addition to the possible cooperation strategies to reach better results and develop the beekeeping sector.

Namely, several interviews were conducted with the below listed contacts:

Table 11: Main experts in the beekeeping and honey sector in Lebanon

	Party	Contact	Position
Public Sector	MoET	Ms. Lama Oueijan	UNDP Project Manager
		Ms. Rita Feghali	Trade Expert
		Ms. SihamDaher	Agriculture Expert
	MoA	Mr. Ramzi Al- Moghrabi	Head of Beekeeping
	Lebanese Customs	Mr. Nasrallah	Head of HS coding
Private Sector	AUB	Mr. Rami Olleik	Professor
	Miele Association	Mr. MassimoCarpinteri	President

3.4. Conclusion

The methodology used has two major perspectives; the first analyzes the market characteristics through the results of a survey conducted among 30 senior beekeepers producing 6.87% of the national honey production. This provides a better presentation of the beekeeping market and highlights the trends and orientations the market is taking.

The second perspective is more strategy oriented, as it is focused on proposing a national strategy for the development of the industry. This is based on the major results of the survey and the laboratory testing, combined with detailed analysis and experts' opinions.

Based on the proposed methodology, the findings of the research are discussed to draw necessary conclusions and recommendations in the following chapters.

4. CHAPTER 4: FINDINGS

The two perspectives the methodology followed provide sufficient information about the market characteristics and the industry obstacles and barriers, from which a comprehensive action plan is extracted in an aim to present an effective strategy.
This strategy is build based on the results of the survey that provides beekeepers' perspectives, and the laboratory testing that presents the antibiotic residues for each beekeeper.

4.1. Survey Results

Market Description

Beekeepers' characteristics
The profession of beekeeping is a man's job, especially in Lebanon as well as in other countries, dominated by men especially when performed in rural areas. The study conducted has shown that 100% of the beekeepers were males, with an average age of 48 years, which is enough of an indicator for the lack of young individuals practicing the profession.
The youngest beekeeper interviewed was 32 years old, while the oldest was 67 with two beekeepers in retirement ages. The average number of years while in business is 26.3 years with a range going from 10 years to 79 years, and the average number of beehives per beekeeper was 202 in 2011 with the least being 50 and the most being 600.

Beekeeping capacity
Despite the challenges facing beekeepers in Lebanon and leading to tremendous losses, the average number of beehives is increasing throughout the previous years. The beekeepers selected represent 9% of the market share as they constitute 6,068 beehives out of the total of 175,000 beehives in Lebanon in 2011, with their potential growing from an average of 169 beehives per beekeeper in 2009 to 202 beehives in 2011, as shown in Figure 13.

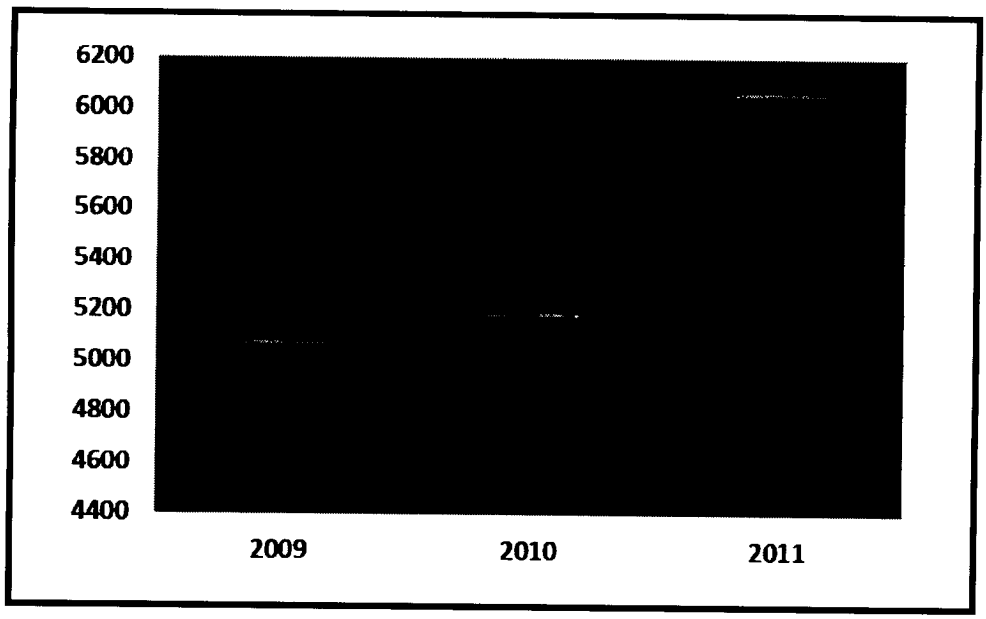

Figure 13: Number of beehives evolution for focus group

As for queen rearing activities, the number of beehives dedicated for that increased from 489 in 2009 to 660 in 2011 as shown in Figure 14, with an average queen rearing beehive per beekeeper increasing from 16.3 in 2009 to 22 in 2011.

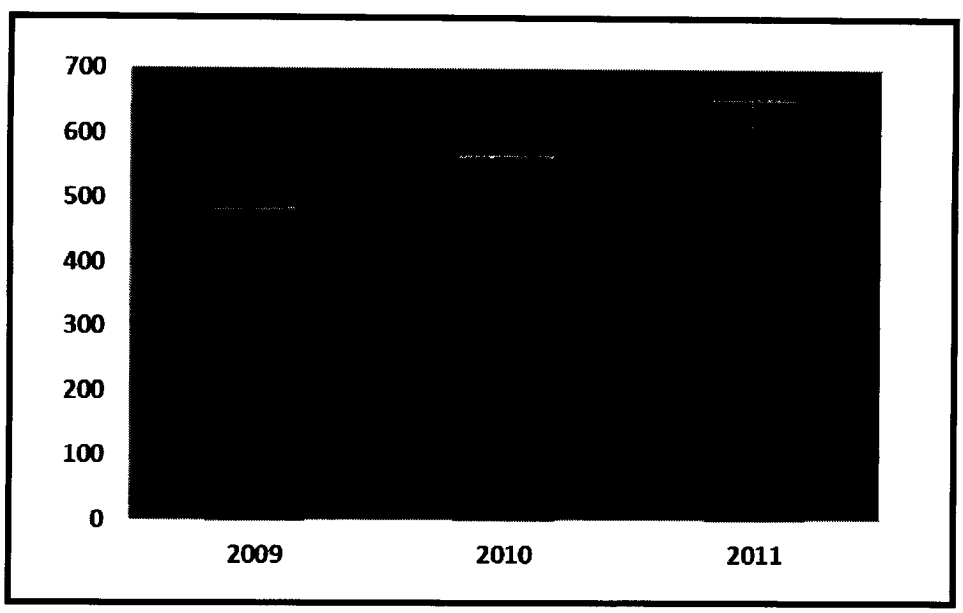

Figure 14: Number of beehives dedication for queen rearing evolution in 2009 to 2011

Types of bees

Two types of the Apismellifera, the Italian and Syrian, are dominating the Lebanese market since old times with 73% of the beekeepers of the focus group raising this type of bees. Having

both types for several years have resulted in an average of 28% hybrid honeybees. Each type posses some different characteristics and beekeepers tend to choose the needed type according to their needs. If the beekeepers aim at increasing their beehives, then they would go for honeybee types with a higher potential of swarming behavior and laying eggs.

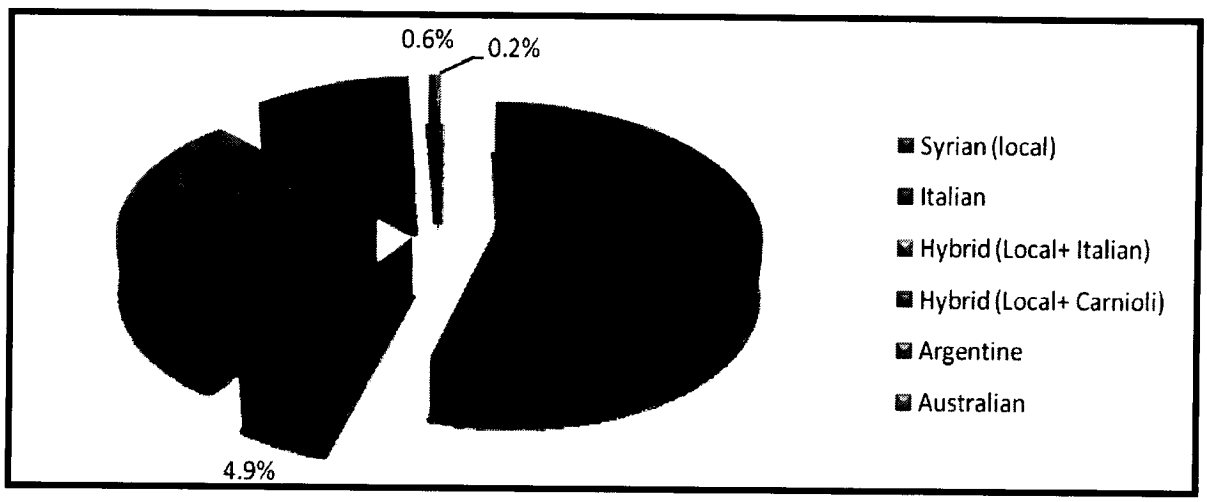

Figure 15: Types of bees at the Lebanese market and their share related to focus group

Survey results showed that 73% of beekeepers in this focus group raise the Syrian type with 27% of them raising only this type. Italian type is being raised by 33% while hybrid local and Italian 60% compared to 33% for hybrid local and Carnioli, as shown in Table 12.

Table 12: Types of honeybees being raised by the focus group

	Raising this type	Raising only this type
Syrian (Local)	73%	27%
Italian	33%	0%
Hybrid (Local+ Italian)	60%	3%
Hybrid (Local+ Carnioli)	33%	0%
Argentine	3%	0%
Australian	3%	0%

Honey types

Beekeepers were found to have several types of honey as they follow the strategy of moving their beehives from one geographical location to another to serve the honeybees with better agricultural lands to store food and produce more quantities of honey with various sources. Middle area honey is normally produced in big amounts until 2011 which was the year of upper area honey with 43,510 kg of honey produced by the selected beekeepers compared to 30,060 of middle area as shown in Figure 16.

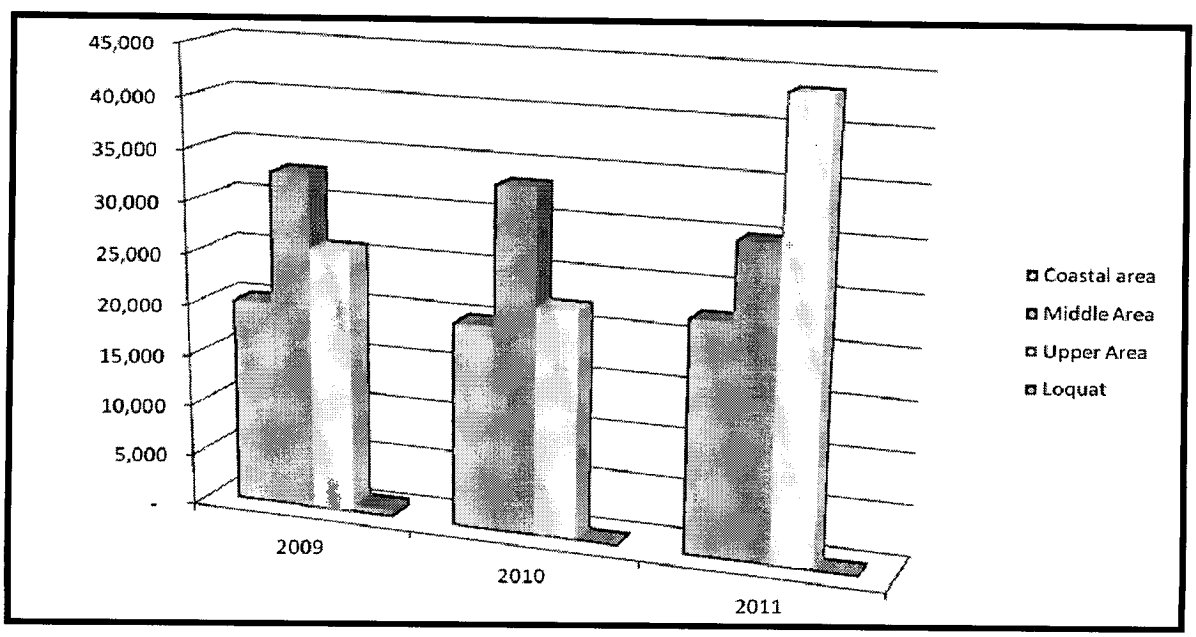

Figure 16: Honey production by focus group by type from 2009 to 2011

Honey Price

It is known that honey coming from the upper areas is mainly the most expensive due to its superior quality and health benefits. The price per 900 grams of honey from upper areas could reach as much as 75,000 LBP with an average of 37,826 LBP and a lowest limit of 25,000 according to the survey. Second on the list is the middle area honey with an average price of around 30,000 LBP, then the coastal honey with 22,647 LBP, and the loquat of an average price of 17,500 LBP per 900 grams of honey as shown in Figure 17.

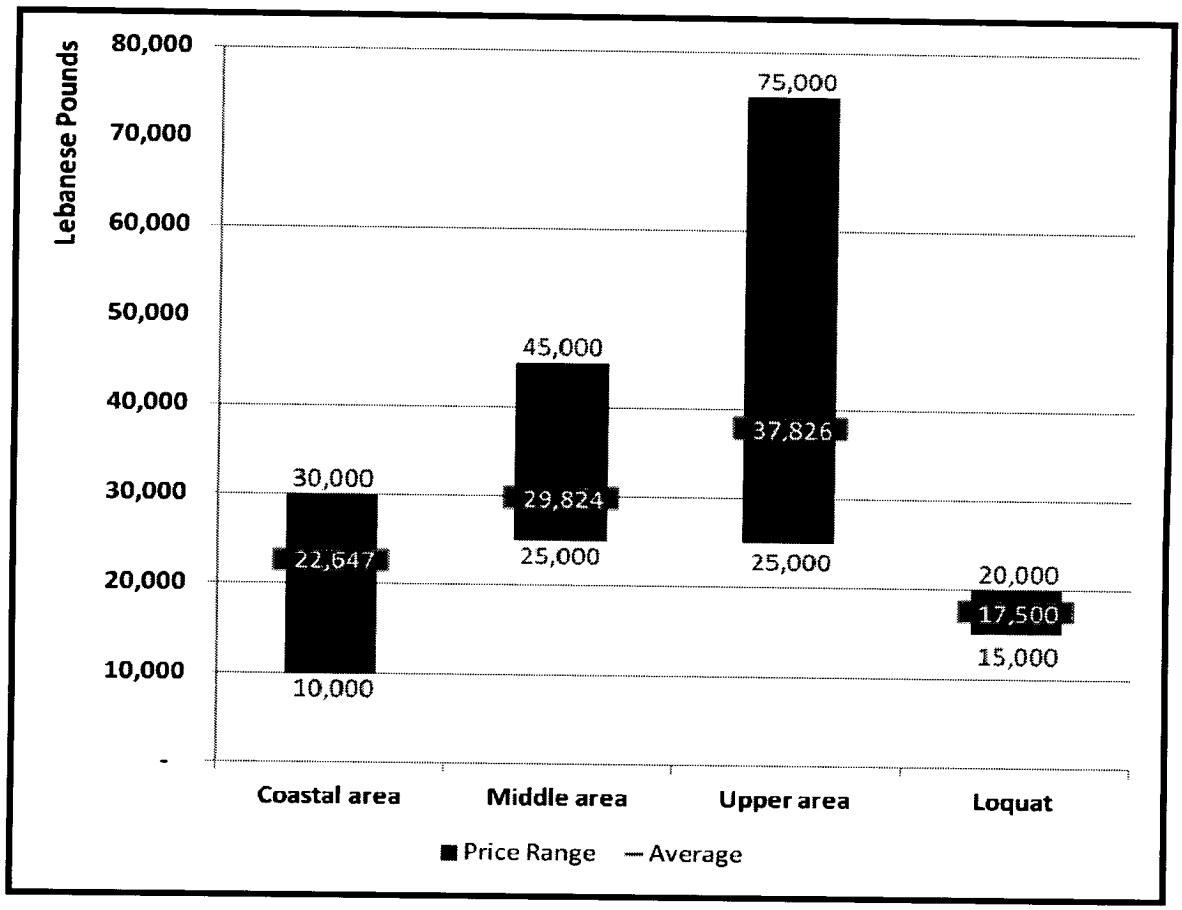

Figure 17: Price per 900 grams of honey by type

Honey consumption

Around 89% of the honey produced is sold for money; the rest is either consumed by the beekeepers or given away as gifts.

For one of the beekeepers, the personal use was as much as 80%, meaning that beekeeping was not perceived as a money generating activity.

Survey results have shown that personal consumption of honey amounted to an average of 5%, while gifts and giveaways make around 6%. The highest share is sold through intermediaries followed by home selling, both making 83% as shown in Figure 18.

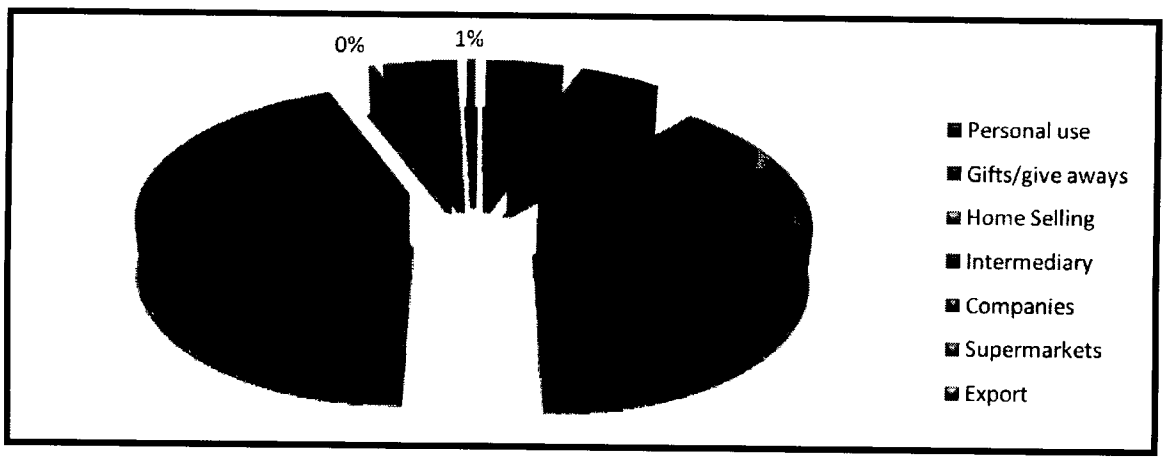

Figure 18: Honey consumption behavior for the focus group

Swarming behavior

The major drive behind the increase in beehives number is the swarming behavior that takes place with the birth of new queens. Mainly the stronger queen remains in the beehive while the new queen leaves to find a new place for shelter as there is no room anymore. As the new queen leaves the beehive, a small number of the worker bees leave to serve their new queen and start a new beginning of beehive building. The survey returns showed an average of 41% swarming relative to the total number of beehives owned by the 30 beekeepers.

Use of protein and nectar alternatives

The major and only source of protein for honeybees is the pollen that honeybees gather through their journey tapping thousands of flowers. Sometimes it is not possible for honeybees to leave their beehives due to severe weather conditions, transportation moves, or the loss of agricultural acreages due to several reasons. It is when beekeepers have to interfere by supplying their bees with protein alternatives. In order to prevent honeybees from starving at winter times or during their change of location from one area to another, beekeepers use the other sources of protein for honeybees. The supply of candy is one of a protein alternative type that helps the honeybees continue producing honey to feed their brood and drones. Almost half the beekeepers (47%) appeared to be using candy as an alternative, with 43% preparing the candy by themselves, and 23% were buying it from a local supplier.

Another type of protein substitute is the pollen bought by beekeepers to compensate the lack of its presence in critical times (see Figure 19).

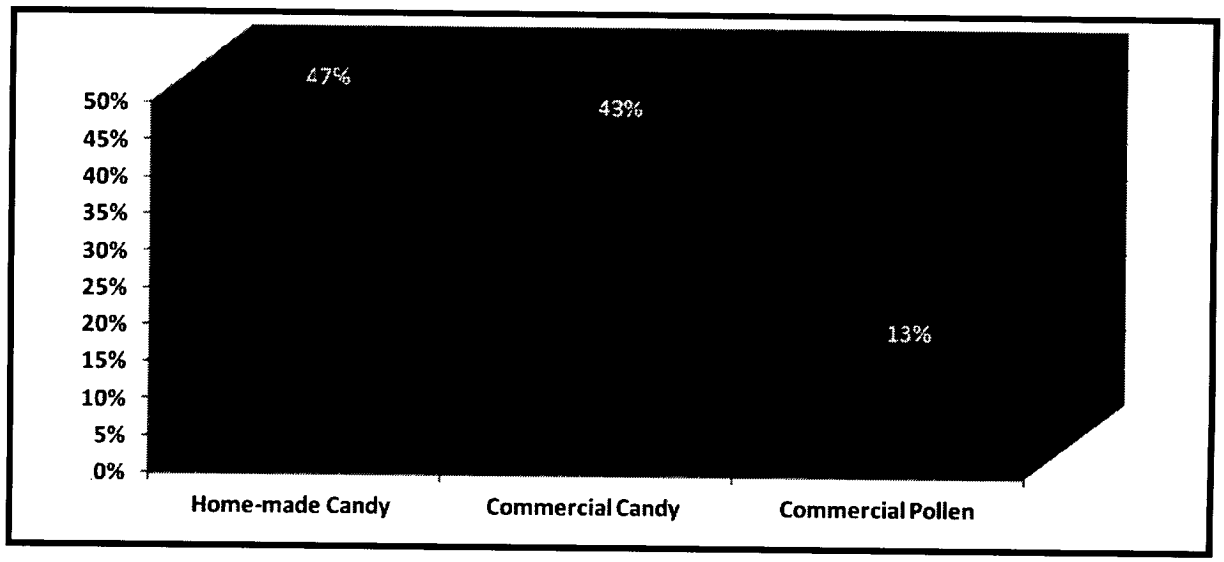

Figure 19: Different types of protein alternatives used by focus group

On another note, nectar alternatives are used with a domination of sugar nectar alternative used by 67% of the beekeepers and corn syrup used by only 3% as shown in Figure 20.

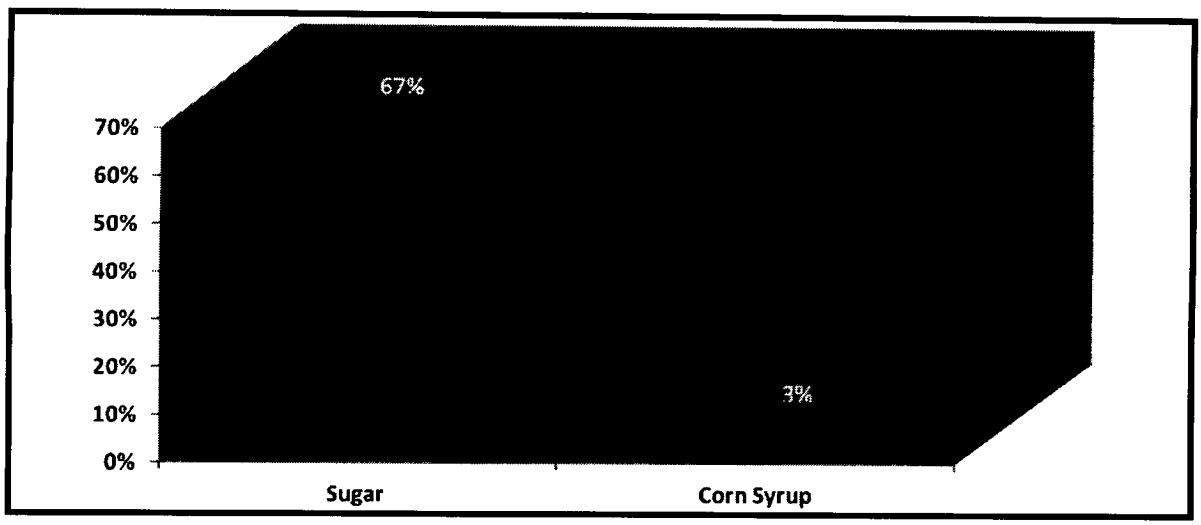

Figure 20: Different types of nectar alternatives used by focus group

Honey extraction

Having addressed mainly senior beekeepers in Lebanon, it was viewed that 97% of the beekeepers throughout the previous three years have their own honey extractors and they perform the final step of honey production on their own. This high percentage is considered to be a good step towards reducing the percentage of cross-contamination from one beekeeper to another at the final stage.

Market Issues and concerns

Loss of beehives

On average, beekeepers lose around14.8% of their honeybees annually for several reasons led by diseases and pesticides with 35.9% and 17.9% respectively as shown in Figure 21.

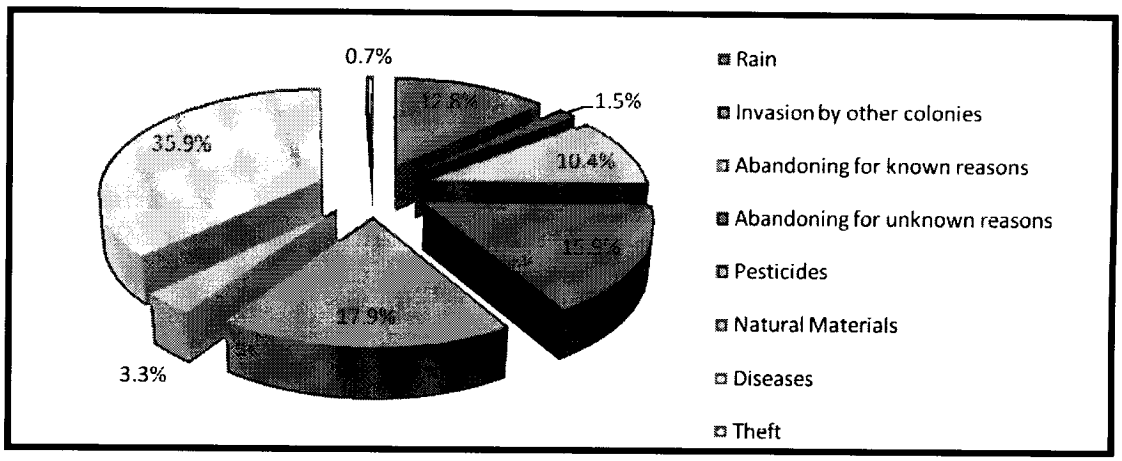

Figure 21: Major reasons of honeybees losses

The reasons behind the beehive losses have been correlated with disease infection, queen abandoning beehive for no reason, pesticides, rain, and other reasons like theft and invasions, which was reported by the beekeepers from the selected focus group shown in Figure 22.

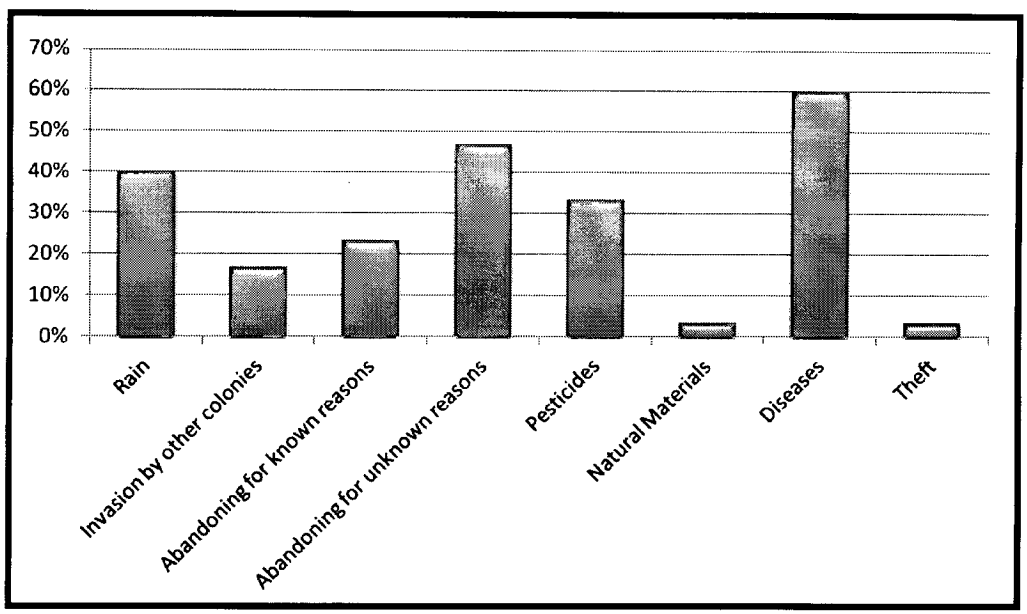

Figure 22: Major causes of honeybees' losses as reported by the focus group

AFB disease

The American foulbrood disease is one of the major diseases attacking the Lebanese beekeeping sector, with 53% of the beekeepers claiming that their bee colonies have suffered from AFB in the last 3 years.

It has been noticed the number of colonies affected by AFB has decreased by 41% in 2011 to reach 102 beehives, and thus dropping from 3.3% to 1.7% as shown in Figure 23.

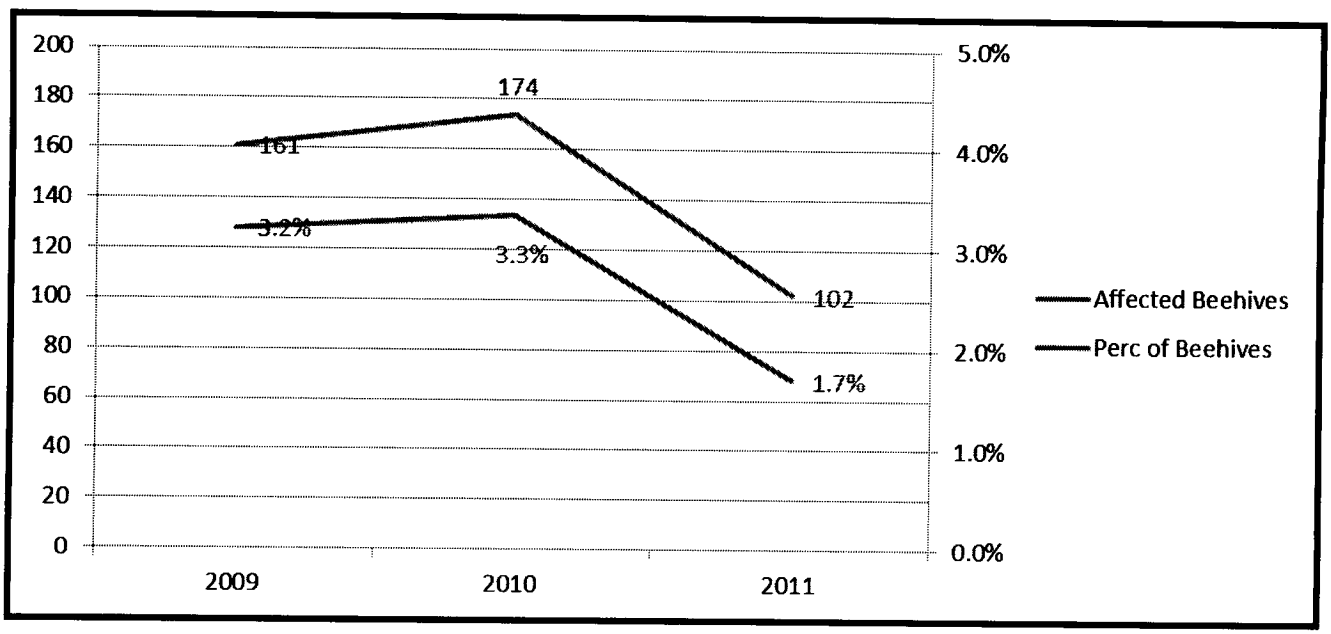

Figure 23: AFB affected beehives in numbers and percentages

Use of antibiotics

As commonly known, most beekeepers tend to use antibiotics to face the spread of AFB with the two mostly common used being Oxytetracycline and Tetracycline. The survey revealed that beekeepers pay an average of 135 LBP (8.9 USC) per gram of antibiotics, ranging from 50 LBP to 500 LBP per gram.

Less dependency on antibiotics with claimed awareness on the importance of the issue and getting rid of the beehive in 47% of the beekeepers for strong colonies, and 30% for weak colonies have been shown. While only 27% used Oxytetracycline, 10% used tetracycline, and 13% used both Oxytetracycline and tetracycline for strong colonies as shown in Figure 24.

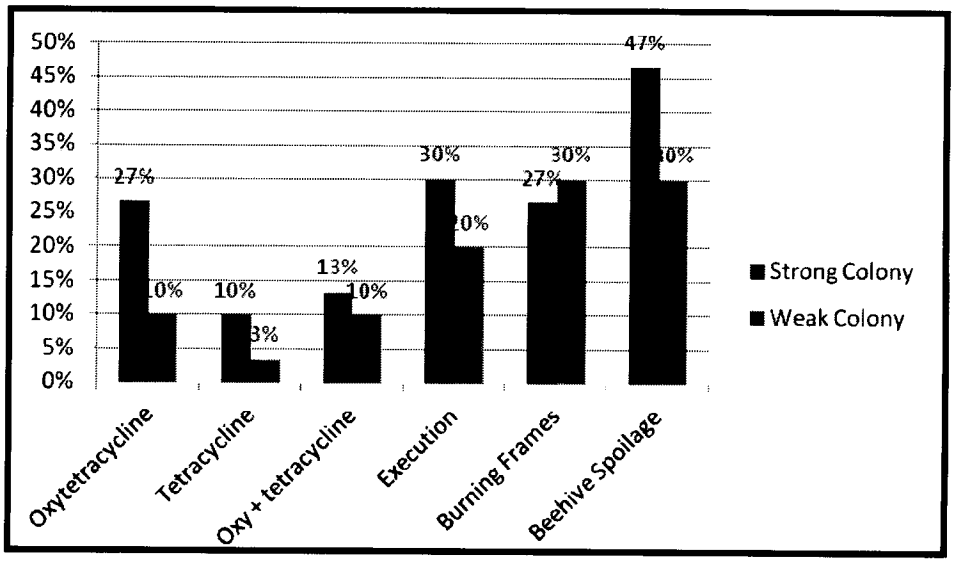

Figure 24: Action taken for colonies affected with AFB

In terms of application, 43% of beekeepers applied the treatment to all frames they have, while 33% applied it to the affected frames only. As for the dosage, it was revealed that only 37% of the beekeepers had an idea about the limits set by MoA, which is not to exceed one gram of antibiotics, which lead to an average of 1.68 grams of antibiotics applied by the beekeepers.

As for the source of antibiotics, 33 of the beekeepers in the focus group get the antibiotics from an agricultural pharmacy, while only 13% get it through the ministry of agriculture. Other sources are co-op, super markets, friends, and pharmacies as shown in Figure 25

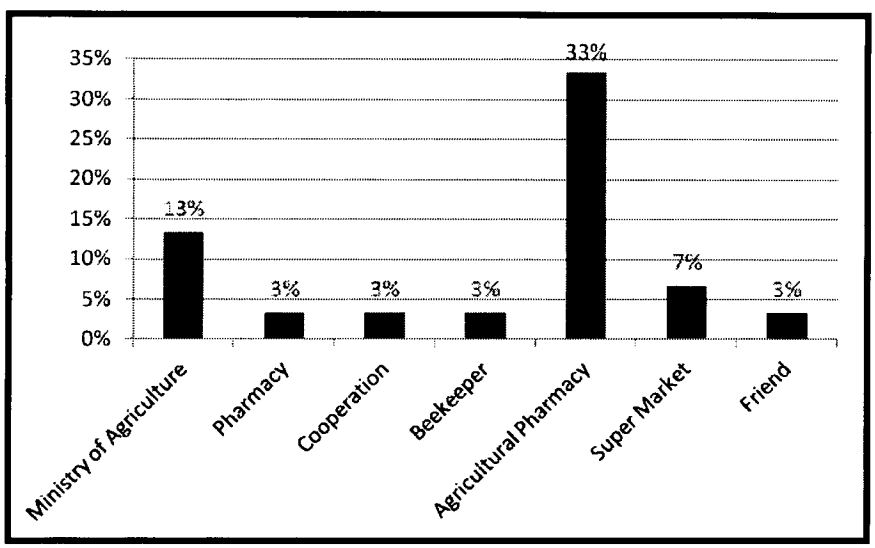

Figure 25: Source of antibiotics used by beekeepers

Beekeepers Perspective

Business Growth

When asked about their willingness to increase their capacity and boost their honey production, 87% of the population were willing to increase their capacity while 10% were not willing at all, making 4.31 on a scale of 1 to 5. But with the support of the official bodies all the answers came positive scoring 4.73 as shown in Figure 26.

The scale method gives score of 1 to certainly not and moves up to 5 for surely yes, passing through No, don't know, and Yes. The score is summed based on the share provided by the results, and the final score represents a result of a similar scale from 1 to 5.

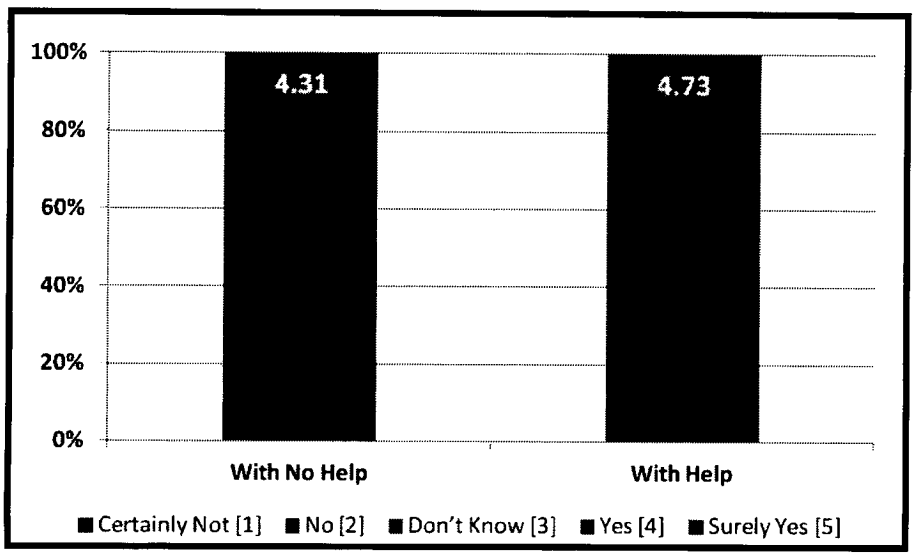

Figure 26: Beekeepers' willingness to increase their beehives capacity

Beehive valuation

The value of the beehive is different from a beekeeper to another and varies based on the strength of the bee colony. The average value of the beehive with a strong colony was estimated by the focus group beekeepers to be 283,684 LBP with a range from 150,000 to 450,000 LBP, while for the weak colony, the average value was 149,605 LBP ranging from 37,500 to 500,000 LBP as shown in Figure 27. While for the frame the average value was 14,625 LBP ranging from 2,000 to 30,000 LBP.

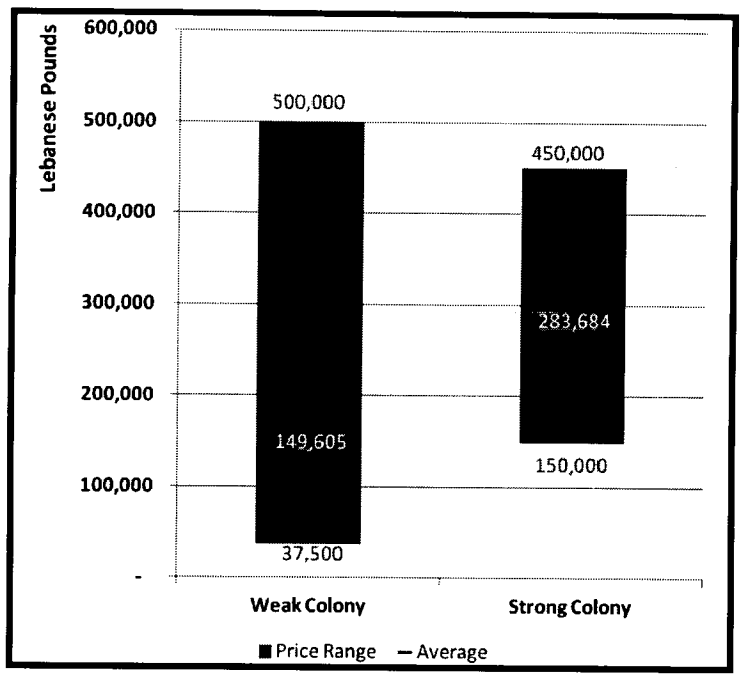

Figure 27: Value of strong and weak beehives according to the focus group

Dealing with AFB

All the beekeepers in the focus group expressed willingness to notify the concerned bodies as they witness symptoms of AFB. With the explanation of the threats of AFB, 80% of the beekeepers were willing to destroy the beehives to avoid contamination of the disease with 57% saying surely yes. On the scale from 1 to 5, the score was 4.3 as shown in Figure 28.

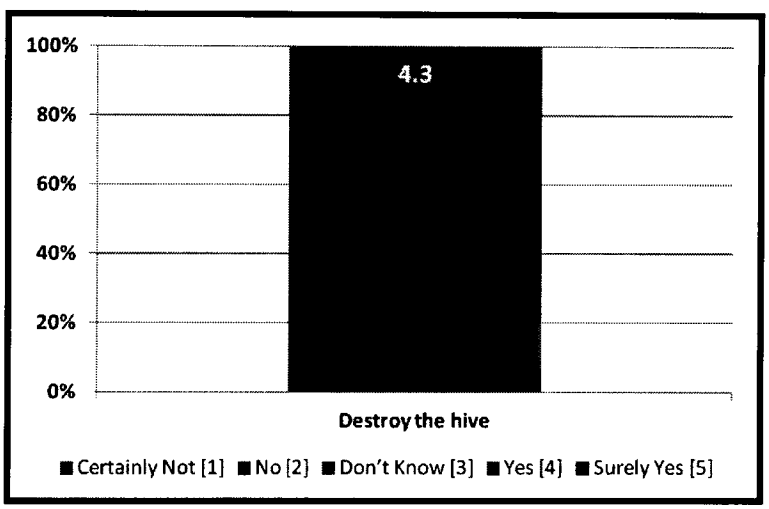

Figure 28: Willingness to destroy affected beehive

On another note, 97% of the beekeepers required compensation from the ministry of agriculture to help them destroy the beehive. The average compensation ratio was 53%.

Willingness to Lab-test

The study revealed that 93% of the beekeepers within the focus group expressed their interest in exporting their products and has trade activities with neighboring and European countries. For this to be achieved, honey produced needs to be tested in accredited laboratories to prove conformity with the international standards.

The majority of beekeepers in the focus group are willing to send samples to testing with a score of 4.73 dropping to 4.56 when having to pay for testing as shown in Figure 29.

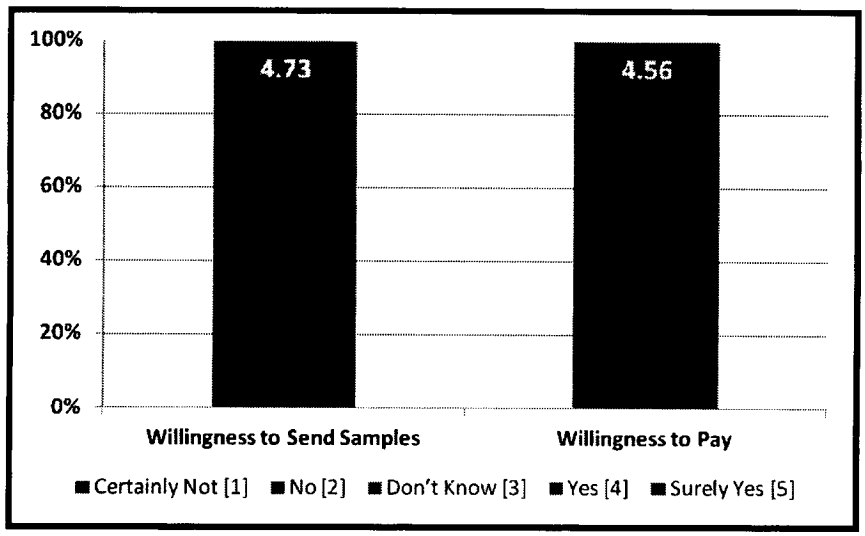

Figure 29: Willingness to send samples and pay for them for testing

The beekeepers were apparently not aware of any testing facility with only 17% of them knowing where they can test their products, but had a willingness to pay an average of 158,000 LBP per beekeeper, but when divided by the samples to test by each beekeeper the average amount the beekeepers intend to pay for testing a sample had an average of 57,311 LBP ranging from 10,000 LBP to 300,000 LBP.

Major problems and barriers

It was obvious that the major problem reported by the beekeepers was the use of pesticides and the lack of fields for beekeeping, followed by the problem of Varroa and the inability to find a proper solution for that, theft, and the irresponsible cutting down of trees and flowers.

The major problems reported are shown in Figure 30.

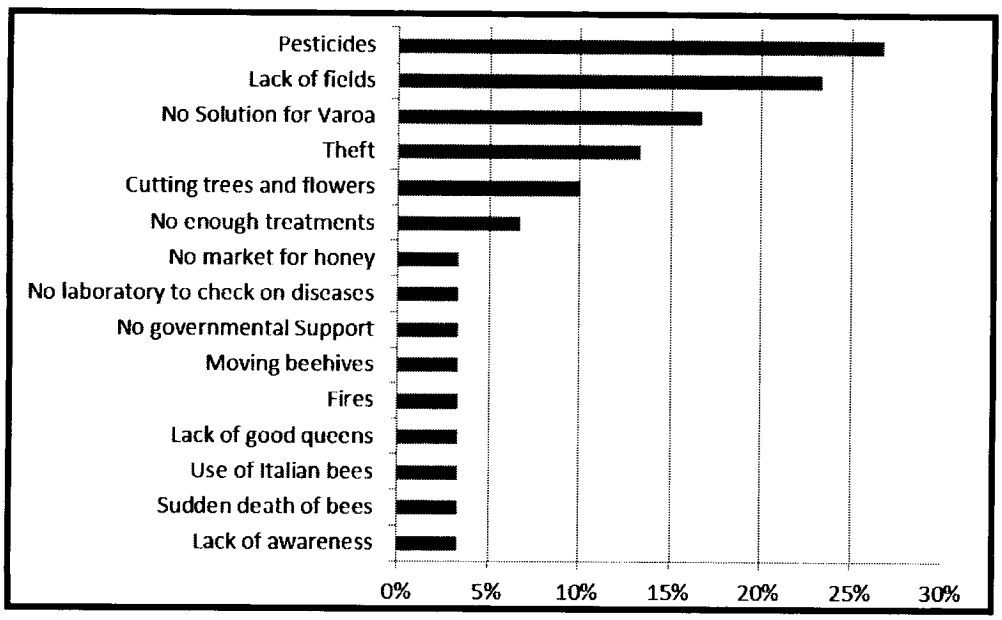

Figure 30: Major problems reported by the focus group

Recommendations

Being major stakeholders and key players in the development of the beekeeping industry in Lebanon, beekeepers were asked to provide their recommendations and advice to improve the sector and provide them with better working conditions.

The most common proposed solutions are as shown in Figure 31.

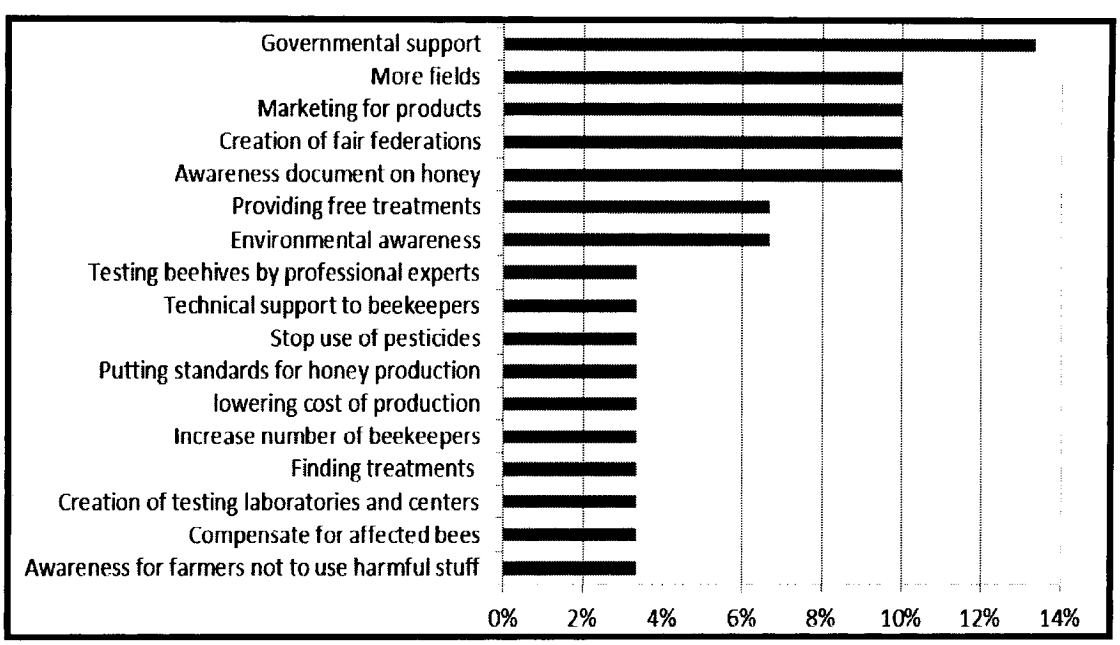

Figure 31: Recommendations given by the focus group

4.2. Honey Samples Laboratory Testing

Background

Studying the market also recommends a deeper insight into the microbiological state of the honey produced in the Lebanese market, which is claimed to hinder the export of Lebanese honey into international market and mainly the EU market.

For this purpose, Oxfam launched a national project to promote the production of organic honey in Lebanon through awareness, technical assistance, and support to the MoA.

One of the activities undertaken by Oxfam was the cooperation with the accredited Italian laboratory, Floramo Corp. s.r.l to test the residues in Lebanese honey, and specifically pesticides, antibiotics and the HMF levels.

The activity included collecting 30 samples of locally produced honey from senior beekeepers in Lebanon and testing them at the Floramo laboratory. The results were produced in February 2012 and shared with the beekeepers.

Antibiotic Residues

For analysis purposes, the level of antibiotic residue was measured relative to EU standards, as EU standards are relatively the strictest internationally in terms of quality and safety parameters. Among the fundamental regulations to be followed in order to conform to the EU laws are Reg. UE 37-2010 related to antibiotics, and Reg.149-2008 related to pesticides.

Going by the EU official control requirements, the samples were analyzed with the LC-MS/MS accredited method. The antibiotics classes analyzed were as follows:

- Cyclines: Tetracycline, Oxytetracycline, Doxycycline, and Chlortetracycline.
- Sulfamides: Sulfachloropyridazine, Sulfadiazine, Sulfadimethoxine, Sulfadoxine, Sulfaguanidine, Sulfamerazine, Sulfameter, Sulfamethazine, Sulfamethoxazol, Sulfamethoxypyridazine, Sulfapyridine, Sulfaquinoxaline, Sulfathiazole, and Trimethoprim.
- Macrolides: Tylosin.
- Aminoglycosid: Streptomycin

Test results have shown acceptable residue levels for 12 antibiotics, but unacceptable results for 6 major antibiotics mainly the most serious and unwanted antibiotics Tetracycline and Oxytetracycline appearing in 12 and 5 samples respectively as shown in Figure 32.

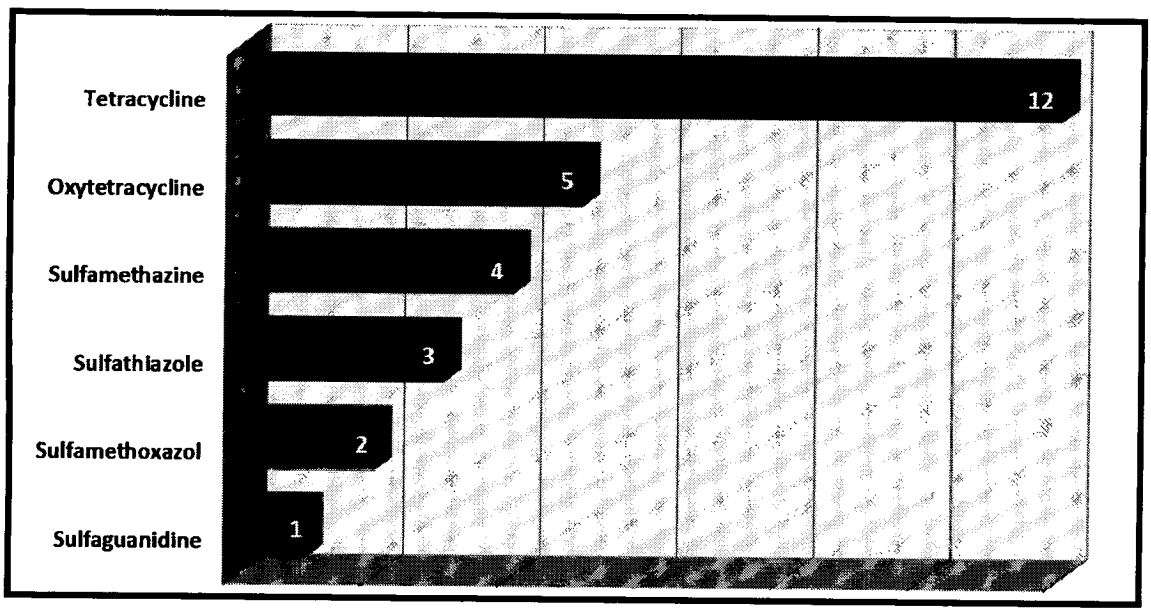

Figure 32: Positive results by antibiotic type

When analyzing the amount of antibiotic residue levels of the samples submitted by beekeepers, 13 samples showed to be in acceptable levels for all antibiotics, while the majority of the rest (11 samples) of the samples had only one antibiotic residue level above the MRL required by the EU control. On the other hand, only one showed unacceptable levels for 4 antibiotics namely Tetracycline, Oxytetracycline, Sulfamethoxazol, and Trimethoprim as shown in Figure 33.

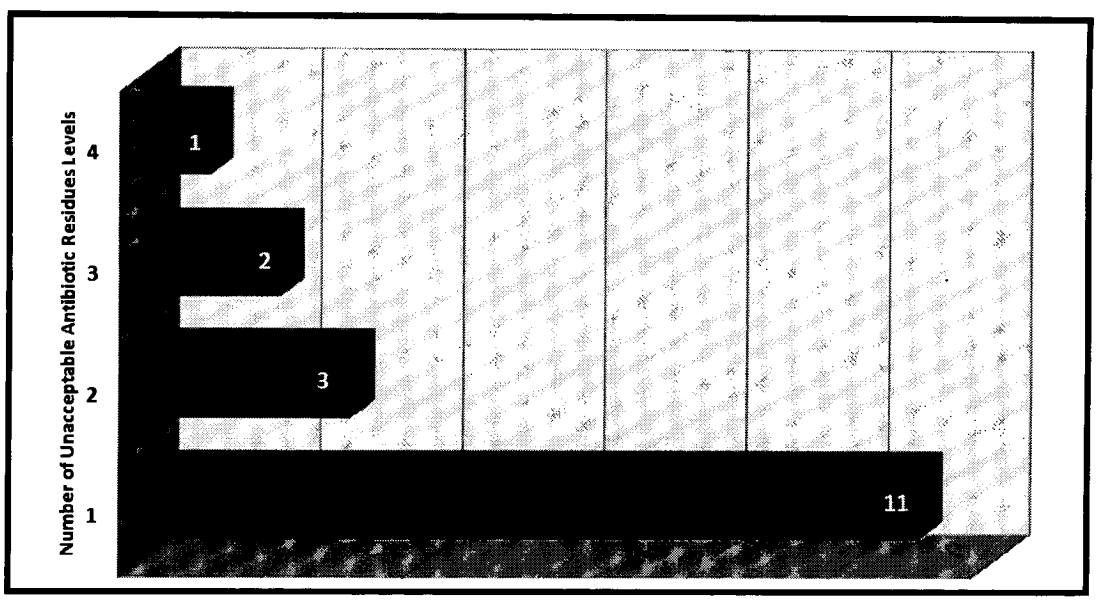

Figure 33: Number of samples showing multiple unacceptable antibiotic levels

The two major antibiotics were present in high level in 15 laboratory samples with ranges from 6.8 to 705 ppb for tetracycline and 5.5 to 27.7 for Oxytetracyclineas shown in Figure 34.

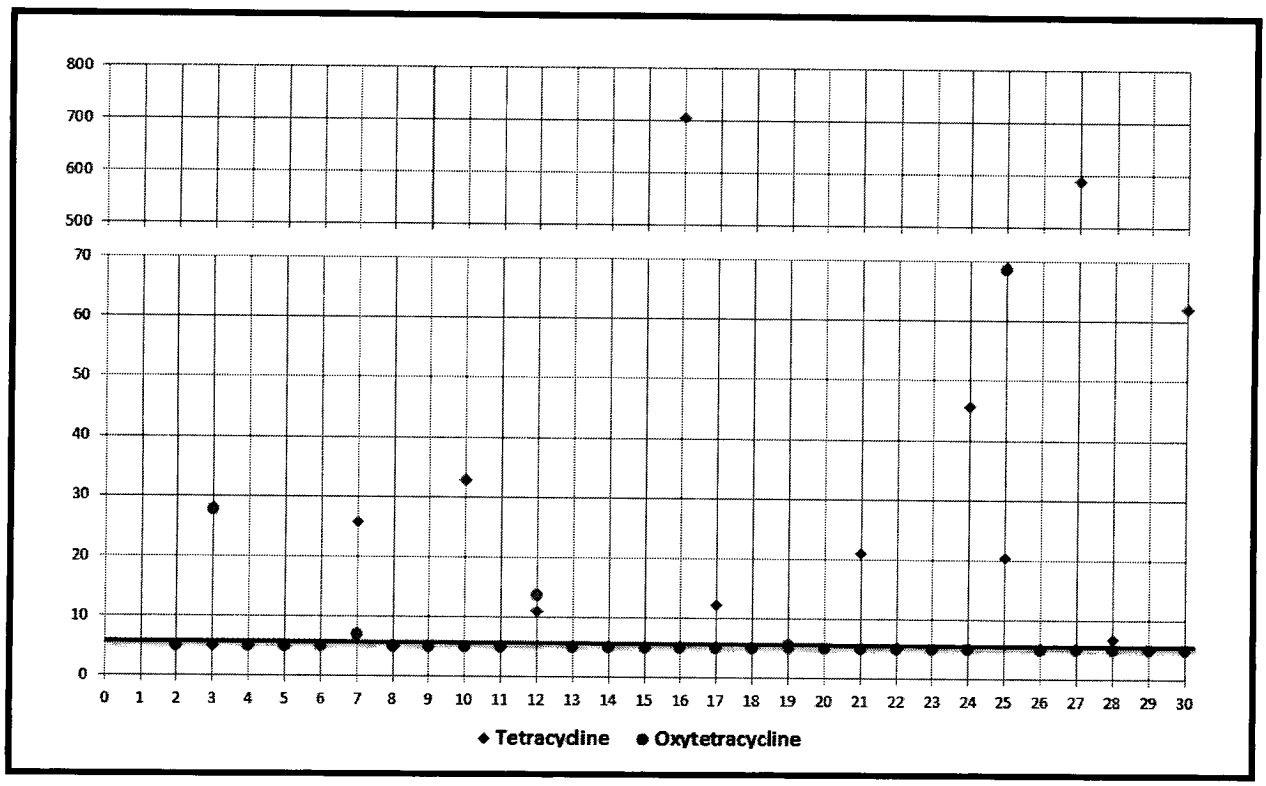

Figure 34: Levels of Tetracycline and Oxytetracycline residues in 30 samples

Pesticide Residues

For pesticide residue detection purposes, the laboratory used the LC-MS/MS accredited method also. Detection for the most important pesticides used by beekeepers for bee treatment was conducted. The pesticides residue list tested included Amitraz, Coumafs, Chorfenvinfos, Rotenone, and t-fluvalinate.

Test results have shown acceptable residue levels of pesticides for 22 samples, but unacceptable results for 2 major pesticides namely t-fluvalinate and Coumafs, appearing in 6 and 2 samples respectively.

The test results showed that none of the samples had high level of both pesticides, but with t-fluvalinate reaching as much as 950 ppb in some sample, and Coumafs reaching as much as 29 ppb as shown in Figure 35.

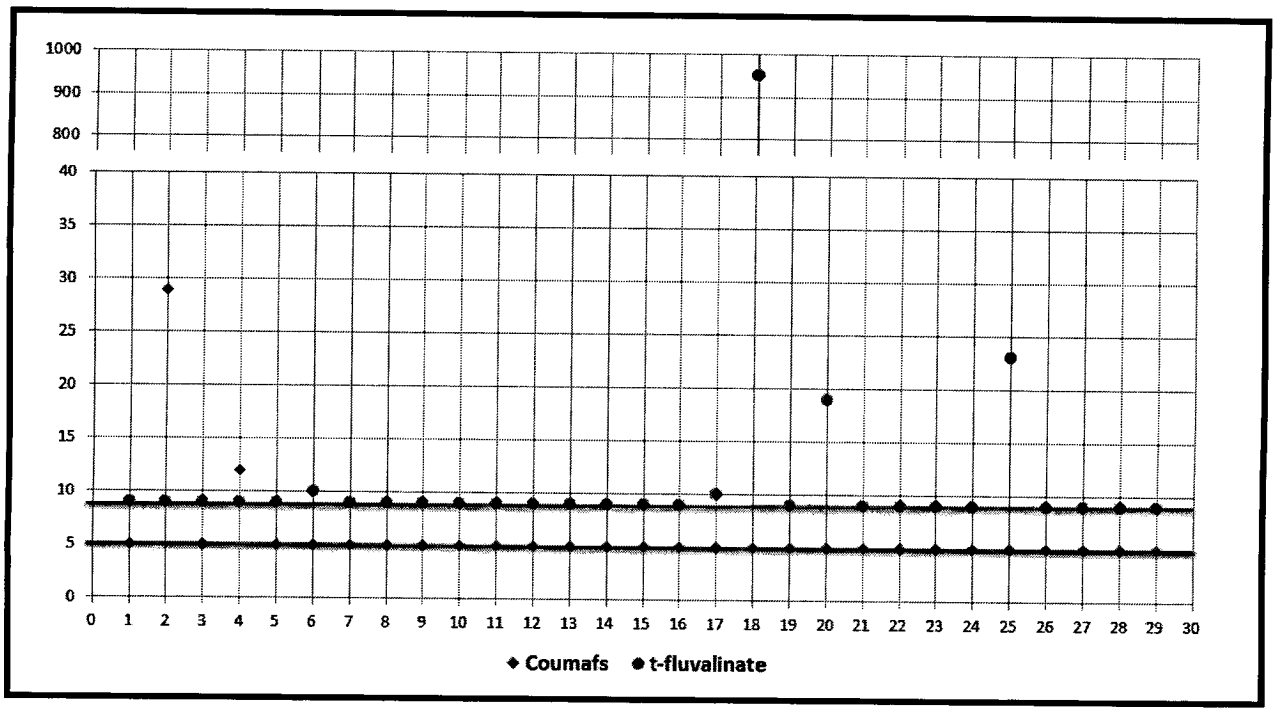

Figure 35: Levels of t-fluvalinate and coumafsresidues in 30 samples

HMF and Color Levels

Hydroxymethylfurfural (HMF) is a product formed slowly during storage and more rapidly when honey is heated. It is normally not present in fresh honey, its content increases during conditioning and storage (Zappal, Fallico, Arena, & Verzera, 2005).

It is used to measure the quality of honey, as it determines the storage period and heating that took place. The lower this value is the better the quality of the honey is.

The honey samples sent to Italy showed results ranging from 1 to 294 mg/kg. Normally, honey that is traded in a bulk form is usually required to be below 10- 15mg/kg to stay on the safe side for if further processing is to take place in an aim to retain a good margin for a suitable period of shelf life without exceeding 40 mg/kg.

The lab test results showed that most of samples had HMF levels not exceeding 10 mg per kg of honey in 87%, with an overall average level of 15.6 mg/kg.

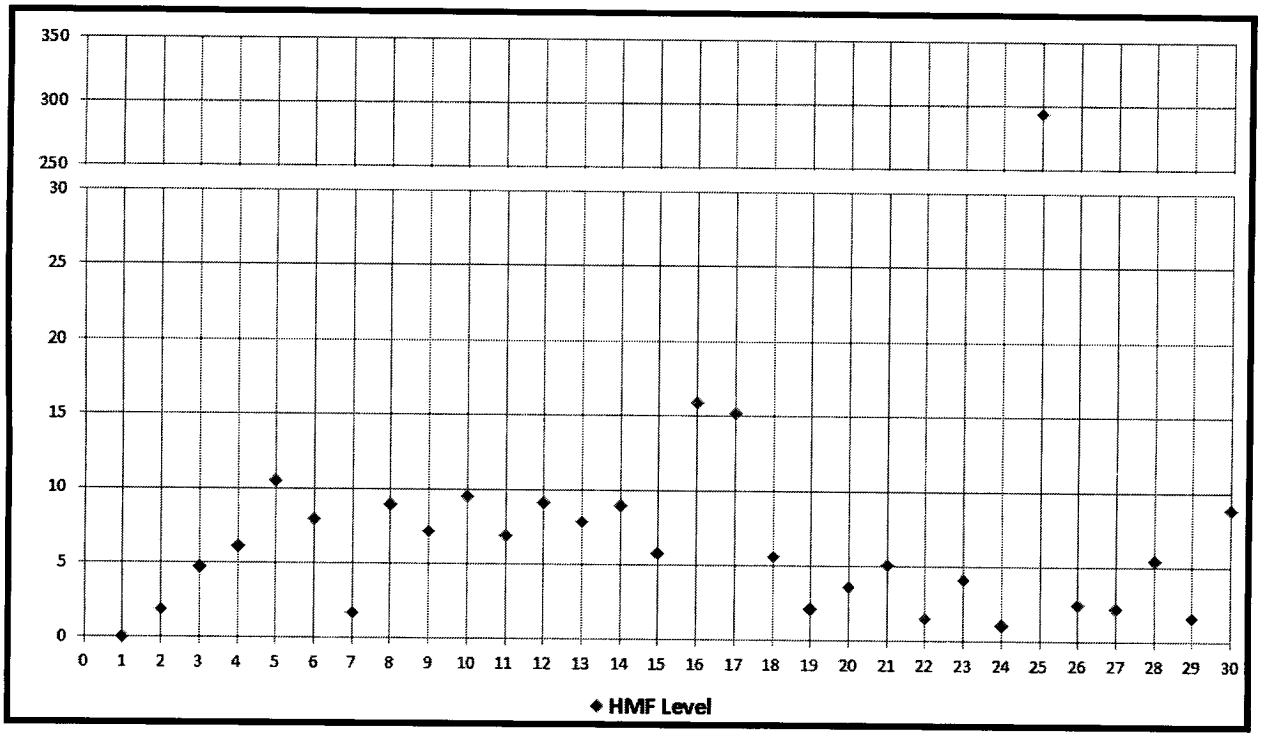

Figure 36: Levels HMF in 30 samples

The results also showed rich colors of honey gradient from white to amber dark, indicating a difference and the diversity of sources of pollen and nectar and different taste.

83% of the samples showed levels exceeding 51 mm measured on the pfund Scale, which shows the excellence levels flavored with honey and richness in minerals magnesium, iron, and sodium.

Conclusion

Results show that 43% of samples are currently eligible to enter the EU market as they are relatively free of antibiotics and pesticides and hence conform to the chemical and contaminant requirements.

Quality control of honey is a fundamental step for the internal market and export purposes. The Consumer has the right for a healthy product. This requires an intensive efforts from governmental bodies to ensure consumer rights and work on maintain a health standard of quality and safety.

EU RASSF for Food Safety

Analysis of residue antibiotics and pesticides is very important for the EU. The EU uses its Rapid Alert System for Food and Feed (RASSF) which is a mean of alerting all interested

countries of the consignments failing to enter the EU, specifying the reason of consignment rejection. The RASSF mainly displays an alert signal for food safety issues. In year 2011, the RASSF system has shown 10 notifications (nearly 1 notification per month) for the product category honey and royal jelly because of contaminants present in the honey, mainly antibiotics and pesticides.

4.3. Analysis of the Results

The major reason of antibiotic residues in honey is the use of antibiotic to face the AFB disease. This is further investigated to analyze the effect of other factors in the concentration of antibiotics in honey.

Tetracycline and Oxytetracycline Residues

To perform deep analysis the beekeepers are classified into three classes based on their behavior in dealing with AFB.

- Group A: Beekeepers not using any Antibiotics
- Group B: Beekeepers using Antibiotics in low levels (1 gr)
- Group C: Beekeepers using Antibiotics in high levels (>1 gr)

Group A: Nonusers of Antibiotics

Ten beekeepers were not using antibiotics although four of them were facing the AFB disease. Among the nonusers, only three samples showed high levels of antibiotic residues, one showing 11.1 ppb of tetracycline and 13.6 of Oxytetracycline, another showing 47.5 ppb of tetracycline, and the third showing 27.7 ppb of Oxytetracycline, while not using any for treating the beehives from AFB.

One of the three samples reported not having problems with AFB at the first place, but still witnessing 47.5 ppb of tetracycline.

Group B: Conservative users of Antibiotics

Among the 30 beekeepers, 13 used antibiotics in limited levels not exceeding 1 gram, 4 of whom did not suffer from AFB disease hitting their beehives, but they were using it for protection.

Among these 4 beekeepers two of them used antibiotics in limited times with only once a year and didn't get any residues in their products, while the other two used antibiotics for more than once a year and thus having residues of 12.3 and 32.8 ppb.

For the other 9 beekeepers that used 1 gram of antibiotics and faced the AFB, 5 only showed residues in the honey produced, ranging from 6.8 to 589 ppb of tetracycline and 5.5 to 68.6 ppb of Oxytetracycline. For this subgroup, the increased values of antibiotics residues are directly related to the frequency of use as shown in samples applying antibiotics for more than 4 times a year.

Group C: Overusers of Antibiotics

Seven beekeepers overused antibiotics in high levels ranging from 1.5 grams to 8 grams at frequencies from once a year to 10 times a year.

Among the seven beekeepers, only three faced AFB disease, meaning that 4 beekeepers used antibiotics without a need for that, and thus leading to unwanted residues for no good reason. Two of these beekeepers did not have antibiotic residues in their honey, while the other two had increased levels of 21.1 ppb of tetracycline after using 4 grams of antibiotic for the first user, and 25.7of tetracycline and 7 Oxytetracycline for the second user after using 8 grams of antibiotics.

Among those who suffered from AFB, three were users of antibiotics in increased levels two of whom had elevated levels of antibiotics reaching 6.4 and 705 ppb of tetracycline for the use of 1.5 and 4 grams of antibiotics respectively. The other beekeeper used 4 grams of antibiotics but had no relative residues in the product.

Pesticides Residues

Pesticide residues mainly come from the use of pesticides in nearby fields which could lead to the death of bees in case applied in very high levels. The two pesticides appearing in the results are coumafs and t-fluvalinate. The study did not find any correlation between the type of bees or the type of honey harvested, and the pesticide residues, which eliminated the possibility of have a link between the pesticide use and the geographic location. It also showed no obvious difference in resistance to pesticides from a type of honey bees to another. But when plotted on the map, it is noticeable that coumafs is mainly found in Mount Lebanon while t-fluvalinate is mainly spread in the northern half of the country spreading in Byblos, Baalbeck, Hirmel, Dannieh, and Tripoli.

The map in Figure 37 below shows the details.

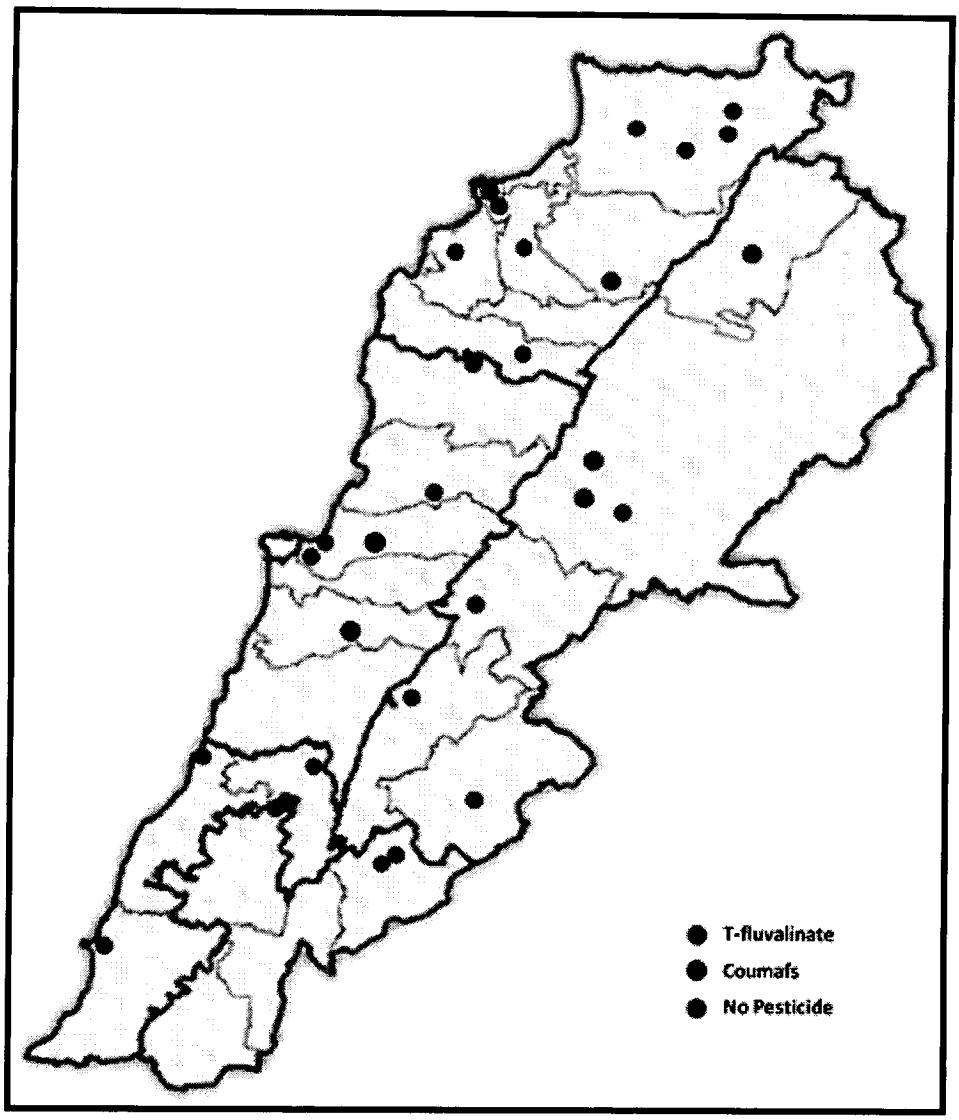

Figure 37: Pesticides residues in samples distribution map

4.4. Removing Barriers

Major Obstacles

The results of the survey and the interviews conducted with the major stakeholders and experts in the field highlighted several issues hindering the development of the beekeeping industry in Lebanon. The issue turned out to be not just limited to the spread of the AFB, but to several other issues and factors including spread of diseases, lack of technical experience, and disharmony of efforts undertaken.

The barriers are classified into three phases based on their occurrence and major effect on the overall process:

(1) Pre-Production

This phase has a major effect on the production capacity and quality of honey produced. It is the base for having a fruitful operation and high standard product that could be exported to high-requirement countries.

In this phase several major problems and obstacles were highlighted, mainly led by the lack of sufficient policy to protect the beekeepers and ensuring the availability of pesticide-free fields where they can grow their capabilities without risking losing their bees or having unflavored residues in their honey.

At this level, there is also an issue with farmers and shepherds for their ignorance about the importance of beekeeping to the environment and the plants growth. This link between honeybees' growth and increased production of plants seems to be missing.

Moreover, a major obstacle facing beekeepers is the high risk that holds back investments in this field especially with the high dependence of the industry on environmental factors in the absence of governmental support and guarantees. Add to that the increased cost of production and the tough competition with the lack of regulating standards and directives.

(2) Production

At the production level, beekeepers seem to have the most critical obstacles and barriers especially at the technical level, where the beekeeping techniques are still at many places based on traditional beekeeping, meaning manners and methodologies gained by inheritance.

With the spread of new and serious diseases, and with the frequent evolution of honeybee kinds, using old-school beekeeping becomes less efficient for a market competitive product. This is becoming a serious issue that needs to be dealt with through providing technical support and building capacity for new and old beekeepers.

Still with diseases, beekeepers have highlighted the fact that they most of the time fail to find a reliable solution for the spread of diseases like the AFB, Varroa, Colony Collapse Disorders (CCD), and other diseases like the EFB. Even when solutions are available, they are inaccessible or beyond the abilities of beekeepers. Varroa treatments have never succeeded with them, CCD is something they do not understand, AFB is a disease they insist on using antibiotics to treat and refuse burning the beehive without a compensation for that.

On the other hand, beekeepers sometimes lose their colonies without diseases, in an action

of theft. This is something spreading in fields that are not subject to proper supervision from the owners, which thus leads to destruction of field, and loss of colonies.

Last but not least is the presence of insufficiently active cooperatives and federations in the field, sometimes developed for personal interests and lack fair and reasonable treatments.

(3) Post-Production

The phase following the production of honey mainly suffers from various obstacles especially in the marketing and competitiveness of the product. The lack of awareness among consumers is a major issue that beekeepers mentioned as one of the biggest obstacles they face when trying to market their products.

Consumer awareness lacks in two levels, the first on the importance of honey and the benefits it has on users' physical and mental health, and the second is the differences between artificial and natural honey, and why it is important to distinguish between these two types and appreciate the value of naturally produced honey.

This is a major concern for beekeepers, who also complained about the poor market causing an inability to sell their products, which has led to a noncommercial use of 12% as shown in the survey. With a secure market, beekeepers are believed to increase their production capacity and further develop their business.

Moreover, 93% of the beekeepers involved in the survey indicated their interest in exporting their products, but apparently fail to do so with the restrictions put in terms of quality and antibiotic residues. Forty three percent of the beekeepers in the focus group had their honey completely conforming to the EU standards, but never exported their products to any European territory. The reasons behind that are first the lack of guidance and support to export local honey, and the unavailability of local laboratories that can perform the obligatory tests, which requires sending the samples abroad for testing and thus involves additional expenses for the beekeeper.

The barriers negatively affecting the development of the market are summarized in the fish-bone diagram in Figure 38.

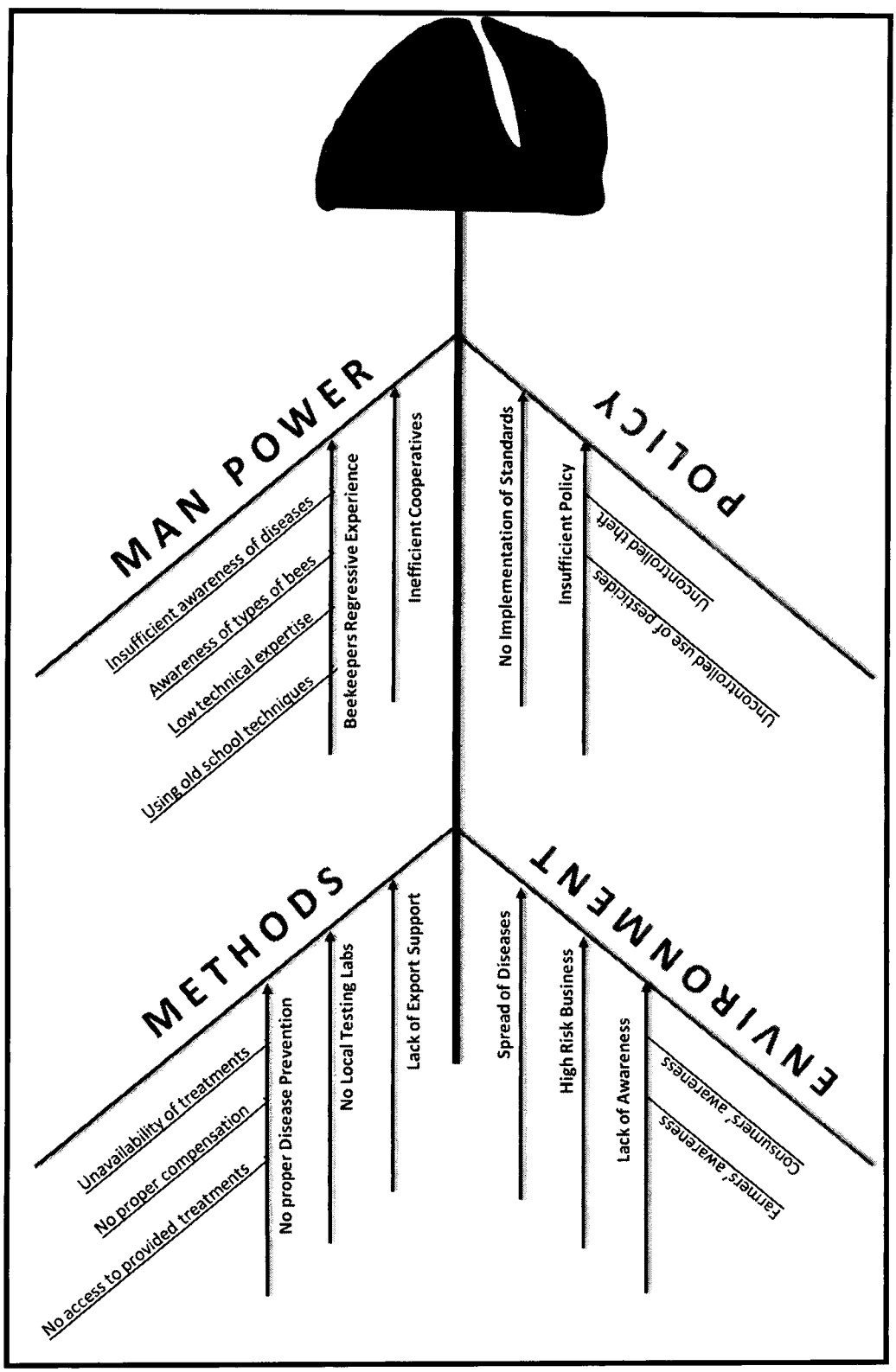

Figure 38: Fish-bone diagram of the market stagnation and barriers for development

Possible Supporting Actions

Being clear about the barriers and obstacles facing the beekeeping industry in Lebanon, several supporting actions can be undertaken to help remove barriers and provide the beekeepers with enough support to develop their business.

The major causes extracted from the cause-effect (fishbone) diagram are further investigated and discussed as major problems hindering the development of the market. Problem analysis is performed to the four major problems appearing to be of biggest effect on the market and having several appearances in the cause-effect diagram. These problems cover the four major levels of the diagram including man power, policy, environment, and methods. The selected problems are:

(1) The spread of diseases
(2) High risk business
(3) Lack of regulations and guarantees
(4) Antibiotic residues in honey.

For each problem a goal is identified, and then supporting actions are investigated to reduce the effects of the problem and achieve the targeted goals. These supporting actions will be considered major steps in the implementation of a national strategy.

The importance of problem analysis lies in narrowing down the problems to the major issues occurring and applying more focus and attention to the solutions that could be applied to reduce the influence of these problems. Some solutions would be able to totally eliminate the problem, while others would be powerful enough to minimize the influence of these problems on the overall objective of the project.

With the problems identified, deep analysis is then done to come up with the best and most applicable solutions to later complement each other and be integrated in a national and sustainable action plan.

Spread of diseases

Diseases are spreading and beekeepers are not perfectly dealing with them. This has been reported as a major issue applying a lot of pressure on the market of beekeeping and the beekeeping themselves.

This is sometimes due to the lack of experience and knowledge, and sometimes due to the

unavailability of treatments. This requires extensive efforts from the concerned authorities combined with an empowerment strategy enhancing bilateral cooperation and exchange of knowledge among beekeepers.

Problem-solution analysis for this issue is shown in Figure 39.

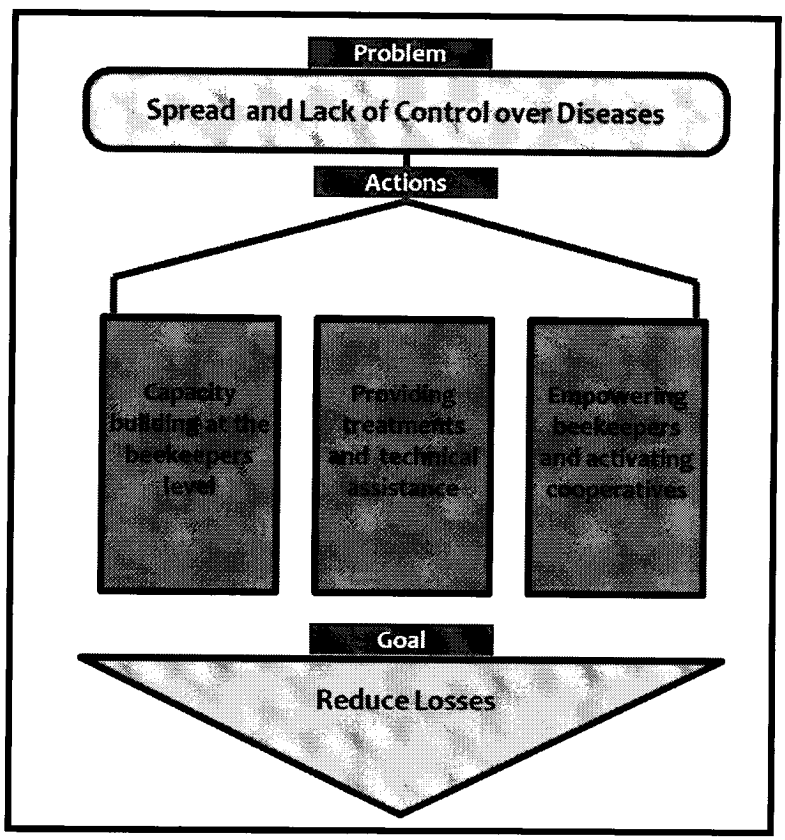

Figure 39: Problem-solution diagram for spread of diseases issue

High risk business

With no guarantees ensuring to that they will have a sufficient and sustainable market for their products, beekeepers have become less to rely on beekeeping and honey production as an economic activity bringing them profit, and tended to take beekeeping as a hobby or on-the-side activity they consider when they just have time for.

This makes it risky to further invest and increase production capacity, and sometimes suffer from financial constraints due to the lack of facilitations they get when asking for development loans and credits.

Problem-solution analysis for this issue is shown in Figure 40.

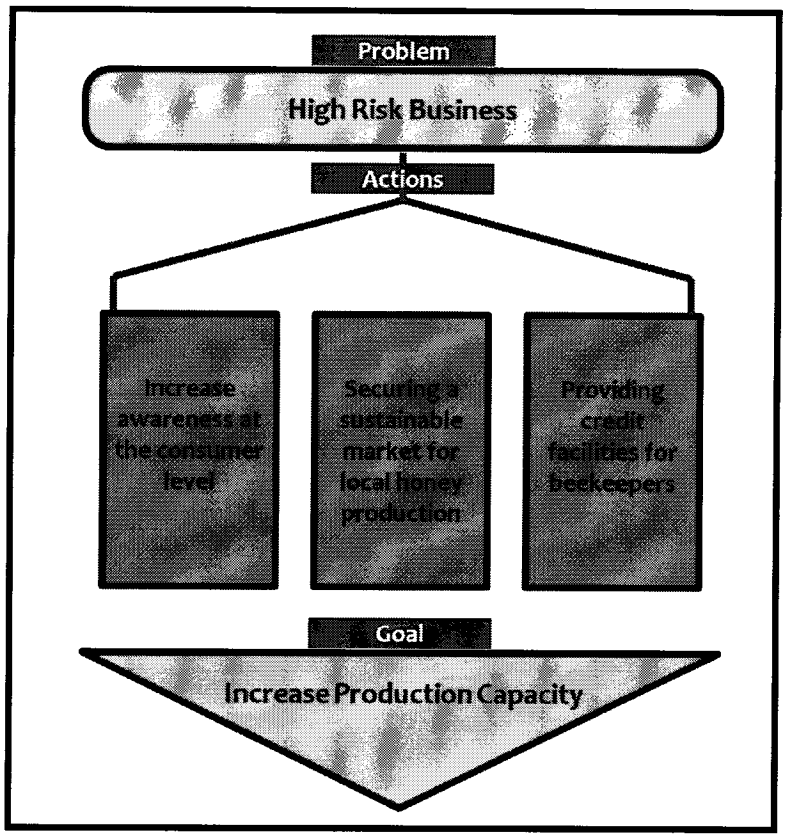

Figure 40: Problem-solution diagram for the high risk issue

Lack of regulations and guarantees

The Ministry of Agriculture has put some regulations and rules to protect beekeepers and local honey production, but apparently a proper implementation requires more effort combined with an introduction of laws and decrees protecting the local products and reducing the dependence on imported honey.

This has been creating market insecurity and providing no cover for the local beekeepers to protect them from competitive products imported and sold to the market in lower prices.

Problem-solution analysis for this issue is shown in Figure 41.

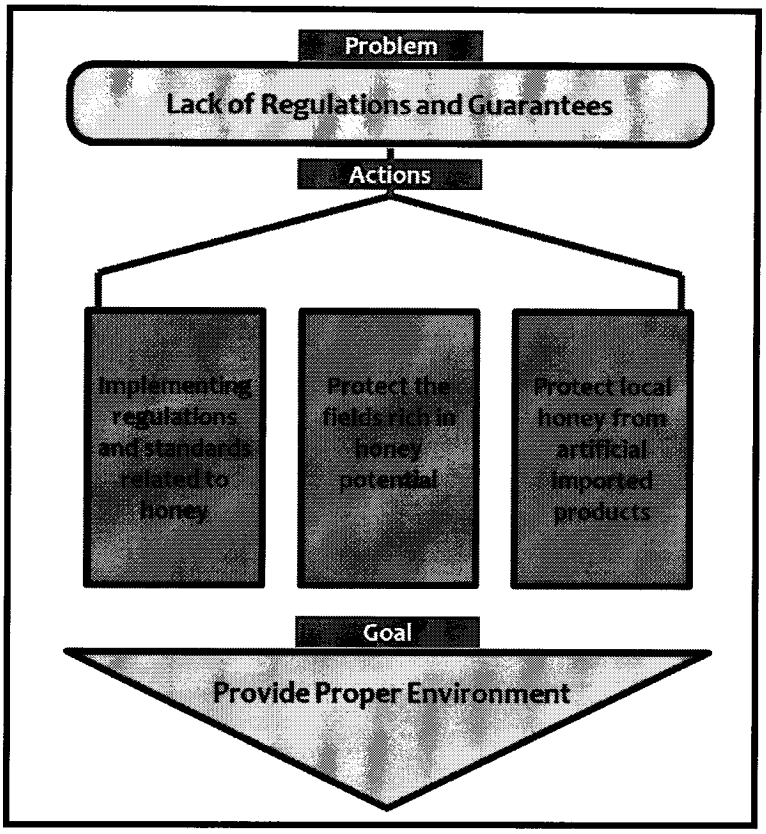

Figure 41: Problem-solution diagram for the lack of regulation an gurantees issue

Antibiotic residues in honey

As for the problem of increase antibiotic residues in honey products, this is linked directly to the use of antibiotics to treat beehives from AFB. Resolving this problem requires awareness, technical help, and governmental support especially in the financial aspect. Problem-solution analysis for this issue is shown in Figure 42.

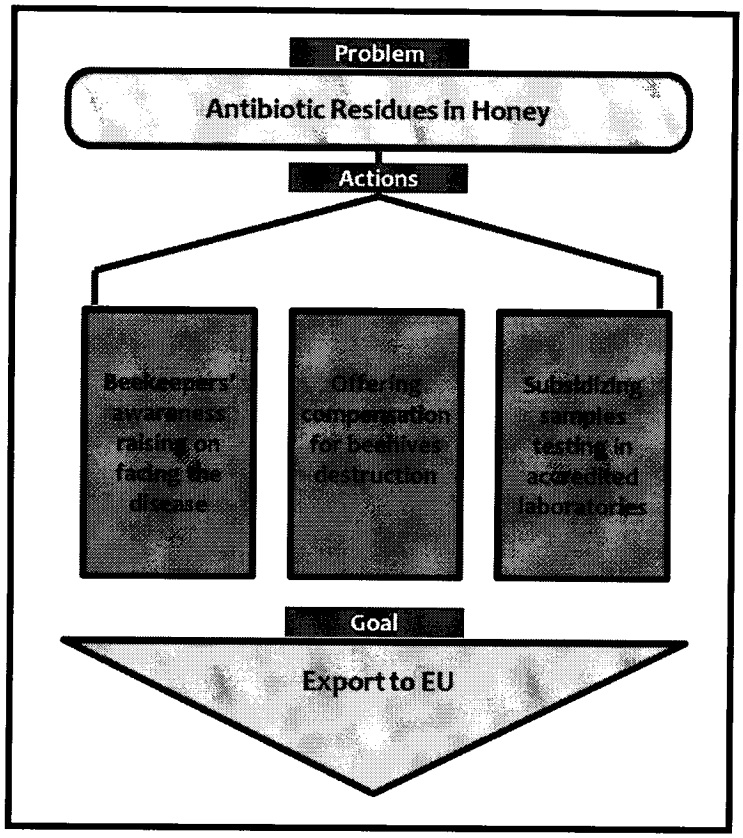

Figure 42: Problem-solution diagram for Antibiotic residues issue

Important Considerations

Export to the EU

According to the trade statistics department, the exports of natural honey are relatively low in comparison to the imported volume.

This pushed concerned authorities at the Ministry of Economy and Trade and Ministry of Agriculture to seek for export possibilities. Thus several studies have been carried out to identify the obstacles hindering reaching the biggest markets of the European countries, the United States, and Australia. The problems have been identified and narrowed down to reach possible steps to move forward to develop the current local situation and meet international standards pursuing higher export and better honey production quality.

Several meetings have been held between the Lebanese Ministry of Economy and Trade, the Ministry of Agriculture, Lebanese beekeepers, honey production related-companies, and the Chamber of Commerce and Industry of Beirut and Mount Lebanon in order work together towards the facilitation of natural honey export to the EU and other less strict countries posing

rules for export. It is being suggested to limit the export of natural honey in the market to specific exporters, mainly large companies. Several companies attending the meetings expressed their belief that more effort should be done to meet the EU requirements for the urge to increase their production and meet the huge demand of the EU. This opening to such a huge market is viewed as an economical gain and leads to a profit increase for beekeepers.

Till date, all required documents have been completed and submitted. However, approval for honey import to the EU has not been granted for Lebanon because of the absence of accredited laboratories present in Lebanon capable of performing the list of necessary tests required to fulfill for every consignment of honey exported to the EU.

Currently, an application has to be submitted by the Lebanese working party asking the permission for its local honey products to enter the EU territories. Bur as mentioned before, the barrier was the lack of having an accredited Lebanese laboratory capable of issuing a health certificate issued to accompany shipments of honey intended for export.

Lebanon has proposed a solution of sending the honey samples to European accredited laboratories for the testing process. Hence, the application has been resent with the modified information pertaining to the adoption of the European accreditation laboratory. The response was positive as the responsible committee in the European commission has approved the application but is awaiting the member states approval.

Samples Testing

Several Lebanese private and public accredited laboratories are present locally but unfortunately, the list of tests required to be done (Appendix B) by the EU to enter their market cannot be totally done nationally as the accreditation for testing for some specific fumigants, antibiotics, pesticides and other specific criteria necessitate the presence of specific advanced equipment that detect very low levels. Lebanon still lacks these advanced equipment as well as the know how to use and training necessitates very skilled employees to perform the needed tests. The absence of this equipment in addition to the long process of accreditation for the required testing poses the problem of inability of issuing accredited local certificates from laboratories showing the chemical levels in the exported honey product.

Failing to do so puts Lebanon in the pending state awaiting further progress in getting its laboratories equipped with the necessary equipment, staff, and accreditation for the specific highly desirable and essential tests needed to be performed.

The cost of a sample to be tested for conformity to the EU directive would exceed what a beekeeper makes in several months, and estimated to be around 1,500 USD. This would require some support from the government to get proper tests and have sufficient results to introduce local products to the European Union territories.

In this case different scenarios could be applied varying by the amount of subsidy the government could provide, but all based on the fact that these samples can be tested locally after getting the necessary tools and equipment and acquiring the required accreditation.

Compensation mechanism for burning beehives

In order for beekeepers to report the presence of the AFB requiring its burning, there is a need to compensate in terms of financial assistance for the losses facing beekeepers as a result of burning their infected beehives. This incentive will help in decreasing residues in the honey product from very high concentrations of OTC and TC to lower percentages across the years since beekeepers need not to eventually stop the use of antibiotics completely. The disease is being taken over by complete beehive burning.

Subsidies given to the beekeeping sector rely on the selective process of identifying the areas where assistance would help in creating a competitive advantage to the product and reach a better competitive status to when entering foreign markets.

As for the amount of compensation to be paid per unit, the survey revealed a demand of an average of 53% of the value of the burnt units, while the value is yet to be investigated but was reported by the beekeepers to be 149,605 LBP for a weak colony (5-6 full frames), and 283,684 LBP for a strong colony (9-10 full frames). This makes an average of 28,531 per full frame, which produces around 950 grams of honey per annum.

Table 13: Estimated revenue per annum per frame by type of honey

Type of Honey	Price (LBP)		Revenue per annum	
	Per 900 gr	Per gr	Net	With Uncertainty
Coastal	22,647	25.16	23,905	16,734
Middle	29,823	33.14	31,480	22,036
Upper	37,826	42.03	39,927	27,949
Loquat	17,500	19.44	18,472	12,931
Average	26,949	29.94	28,446	19,912

With an average price of 26,949 LBP per 900 grams of honey as extracted from the survey, the estimated value of one gram of honey turned out to be 29.94 LBP. Thus the revenue generated by a single full frame is 28,446 LBP per annum. Accounting for uncertainty, the expected revenue would be around 19,912 LBP on average. But this value varies based on the type of honey produced due to the difference in market prices as has been shown in Table 13.

As for the other costs, the beehive has an average market price of 40,000 LBP, and a colony with 10 full frames has a price of around 150,000 LBP making a total price of 190,000 LBP. While for a competitive price, it is estimated that the cost would drop by at least 35% making a final price of 123,500 LBP, equivalent to 82 USD.

Then the value of each full frame is determined for each type of honey to result in an average of 29,982 LBP per frame as shown in Table 14, which is close to the value set by the beekeepers of the focus group, who estimated the value to be 28,531 LBP.

Table 14: Valuation of full frames by type of honey

Type of Honey	Net Value (LBP)
Coastal	26,804
Middle	32,106
Upper	38,019
Loquat	23,001
Average	29,982

For the compensation scheme, three scenarios are considered starting with 25% compensation, to 50%, and then 75%. The compensation value for each type is shown in Table 15.

Table 15: Valuation of full frames by type of honey in 3 compensation rates scenarios

Type of Honey	25%	50%	75%
Coastal	6,701	13,402	20,103
Middle	8,026	16,053	24,079
Upper	9,505	19,010	28,514
Loquat	5,750	11,500	17,250
Average	7,496	14,991	22,487

To calculate the number of beehives and frames affected with AFB annually, the average rate of 1.7% that is concluded form the survey is used, and a market share of 44% for upper, 31% for middle, 23% for coastal, and 1% for Loquat as the survey concluded. The total number of frames infected is 20,770 full frames annually, using an average of 7 frames per beehive as shown in Table 17.

Table 16: Number of infected full frames for each type of honey

Type of Honey	Share	Infected Beehives	Frames Infected
Coastal	23%	698	4,885
Middle	31%	930	6,512
Upper	44%	1,309	9,163
Loquat	1%	30	208
Total	100%	2,967	20,770

The total budget for this activity would be around 173 million LBP for a compensation rate of 25%, and 346 Million LBP for a 50% compensation rate, and almost 520 Million LBP as shown in Table 17.

Table 17: Number of infected full frames for each type of honey

Type of Honey	25%	50%	75%
Coastal	32,737,929	65,475,858	98,213,787
Middle	52,273,894	104,547,789	156,821,683
Upper	87,092,508	174,185,016	261,277,524
Loquat	1,197,466	2,394,933	3,592,399
Total	173,301,798	346,603,595	519,905,393

SWOT Analysis of a General Action Plan

Strenghts

- Interest among beekeepers
- Governmetnal interest in supporting the beekeeping sector
- Adoption of the standard relative to natural honey
- Progress in the EU export file is already done
- Flexibility of action items and activities required
- Availability of local experts in the field
- Beekeepers' ability to increase their capacity and export
- Beekeepers' willingness to test products and cooperate in preventing AFB

Weaknesses

- Inavilability of accredited testing laboratory in Lebanon
- Spread of different kinds of diseases every year
- Lack of infomration
- High budget requirments
- Non-responsiveness from beekeepers due to unfamiliarity with the plan

Opportunities

- Potential cooperation with the EU which is one of the biggest markets
- Growing demand on honey worldwide and especially in EU countries

Threats

- Increasing restrictions from European countries
- Inavailability of budget
- Risk of not getting accreditation for local labs
- Enviroenmental effects
- Non-responsiveness from beekeepers due to unfamiliarity with the plan

4.5. Conclusion

As much as the beekeeping sector is simple, as much as it turns out to be sophisticated in Lebanon. This sector stays unique and difficult to deal with, especially when aiming at increasing production and reaching foreign markets, with an industry that highly relies on the use of antibiotics as a cure for the spread of AFB.

Antibiotic residues in honey have been shown to be a critical issue hindering the export to the EU, but was not at the entire one and only. Problem and cause-effect analysis have shown several other factors to be overcome in order to reduce losses, increase production capacity, provide the proper environment, and facilitate exports to the EU.

This economic development caused by the progressive development of the sector and the increased exports of honey requires some financial support in return, mainly dedicated to subsidies and compensation for beekeepers to achieve and maintain an elevated quality of honey products.

The first component includes the subsidy of laboratory testing for local beekeepers, while the second involves a compensation for beekeepers when treating the AFB with burning the beehives in order to avoid cross contamination. The budget of the first cannot be quantified and highly depends on the availability of an accredited laboratory in Lebanon, while the second requires a budget of 173 million Lebanese pounds for a compensation rate of 25%, and increases to around 520 million Lebanese pounds for a compensation of 75%.

A national action includes different components and activities ranging from technical to financial and awareness support. The first component includes the subsidy of laboratory testing for local beekeepers, while the second involves a compensation for beekeepers when treating the AFB with burning the beehives in order to avoid cross contamination. The budget of the first cannot be quantified and highly depends on the availability of an accredited laboratory in Lebanon, while the second requires a budget of 173 million Lebanese pounds for a compensation rate of 25%, and increases to around 520 million Lebanese pounds for a compensation of 75%.

The findings revealed that only 43% of the samples tested are eligible to enter the EU, with a major cause being the use of antibiotics to fight the spread of diseases like the AFB. Most beekeepers have reported using antibiotics in a haphazard manner to on their beehives without referring to the values set by the ministry.

All this together again highlight the importance of setting an integrated national plan, which is concretely discussed in this thesis. This would act as a guideline for the governmental bodies working to improve the beekeeping sector in Lebanon. Such a study has never been conducted in the country, and is believed to be a valuable asset to the agricultural industry and the country as a whole.

5. CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The findings of the research highlighted the importance of taking necessary action to improve the sector and avoid further deterioration. The conclusions and recommendations of this thesis were drawn from the findings and the analysis of the results.

The recommendations of this thesis are well built to match the market needs, but subject to several delimitations discussed at the end of this chapter.

5.1. Conclusion

The Lebanese Ministry of Agriculture (MoA) in coordination with the Ministry of Economy and Trade (MoET), associations, cooperatives and syndicates, is cooperatively working on improving the standard through including MRLs for essential chemicals used for honey.

In addition, more efforts are being employed to enhance the control mechanism and improve the quality of honey produced. Trainings and conferences related to essential beekeeping theoretical concepts and practical practices are being conducted, with a special focus on agricultural guiding personnel working with the MoA in various districts and empowering them with strong knowledge about the AFB and its consequences.

An evaluation of the value chain analysis is already established. The Lebanese honey is a distinctive product relative to other honey products abroad as it has a distinguished taste and faces no major problems to when it comes to HMF and moisture as the numbers obtained are relatively low and suitable for export. The Lebanese packaging industry is well organized and suffers no restraints, glass jars are already being dealt with and export with high volumes to GCC countries is a successful trial of that. Transportation time spent for honey being moved from apiaries to the port poses no risk before shipping to the EU.

But the obstacle mainly remains in the antibiotics that beekeepers indiscriminately use. This does not smooth the progress of access to the EU market.

Regulations and responsibilities for the Lebanese honey sector are divided between the MoA and MoET ministries. Access to education and equipment could greatly increase the production of Lebanese honey especially that senior beekeepers find it worthwhile to enter the EU and have a new market in the European Union.

This requires the setup of an integrated national action plan and development strategy to support the sector and enter new markets.

The hypotheses have both been partially voided as the findings of the research have shown a valid but not very direct relationship between the use of antibiotics and the level of residues with some results showing antibiotic residues for beekeepers who never used antibiotics and relatively increased level of antibiotic residues for users with relatively low amounts used.
On the other hand, the formulation and adoption of a national plan is definitely a feasible solution, but was not properly validated due to the limitation of resources and reliable information.

5.2. Recommendation: Setting an Integrated Development Strategy

The Importance of an Integrated Development Strategy

Among agricultural activities, beekeeping enables supplementary revenue mostly for rural areas and poor population as an additional income for disadvantaged families. This is not done only by the production of honey, but also by contributing to agricultural development through crop pollination.
With its nutritional contributions, honey and its byproducts such as royal jelly, are widely used in medications and traditional medicine for many serious diseases.
Setting up a national integrated development strategy aims at providing solutions to the obstacles and barriers facing beekeepers as was identified during the assessment of the beekeeping practices and the major problems hindering the development of the beekeeping industry.
The integrated development strategy looks at the problems from different perspectives and combines a set of sustainable solutions that together create a more developed market with bigger potential for exports and less destruction from AFB and other diseases.

Background on the AFB

AFB disease is treated worldwide with the use of antibiotics in a controlled manner; otherwise the procedure taken is burning the infected beehives with the whole colony and the contaminated honey as well.
The antibiotics cease the growth of bacteria or sometimes it even destroys it completely, with a possibility that the antibiotic is used during the lifecycle of the bacteria when it is growing and in its vegetative state. However, the antibiotic used, mainly OTC, has no effect on the spores which is characterized by the resistance power.

The bacteria causing the American Foulbrood disease takes the form of spores in the periods when the natural factors are not suitable for its growth, mainly in periods of brood absence that generally in the last days of autumn and the beginning of winter. Therefore, it is not allowed to give OTC when there is no brood because the latter only contains the live bacteria. The antibiotic has no effect on the spore state of the bacteria found on dead larvae or in the remains of the dead larvae that are stuck on the hexagonal cells.

Treatment

In practice, the infected beehives can be divided into four classes as shown in Table 18

Table 18: Classes of AFB infections

Class	Level	Infected Brood
Class A	Colonies slightly infected	less 10%
Class B	Colonies moderately infected	10-30%
Class C	Weak colonies highly infected	More than 30%
Class D	Strong colonies highly infected	More than 30%

For Class A, the treatment is with the antibiotic which is mixed in a sugary solution at the end of autumn or winter, with the condition of the existence of multiple frames containing brood).

For Class B, the treatment is by burning all the brood frames along with the sugary solution treatment.

For Class C and Class D, the treatment is by burning all the brood frames.

Execution of the honeybee colony

At night when the entire honeybee colony is back to the beehive, the hive is tightly closed and a glass of gasoline is emptied inside for the bees to suffocate. Then dead bees get burned along with the bees wax, the honey, and the waste in a hole with a depth of half a meter and then the hole is filled again.

If the used beehive is an old box that is no more useful, it is burned with all the frames it contains But if the beehive box is still new and valid, it is recommended to clean it well and then dip it in a barrel containing a sterilizer for about two hours and then wash thoroughly with water and dry it by passing it on the flame.

In the case of Class D, the method of transferring bees is usually done in two batches by isolating the infected brood. Another method is the transferring of the bees from the infected frames to new clean ones by the act of shaking the tires. Subsequently, the beehive is closed at night and placed in a relatively cool place for 48 hours without being fed. Afterwards, the contaminated frames are taken out for burning and then buried in the dirt.

Components of the Integrated Development Strategy

A sustainable integrated strategy is based on several components and action items all synchronized to produce an aggregative effect.

All initiatives implemented in parallel and in an integrated manner ensure a sustainable execution of the plan, aiming at supporting the beekeeping market and helping beekeepers improve their performance and increase their potential through 3 major blocs:

(1) Prevention the spread of AFB

(2) Providing business support to beekeepers

(3) Creating a sustainably driven market

The strategy has four major axes including awareness and marketing, technical support, financial support, and policy activities.

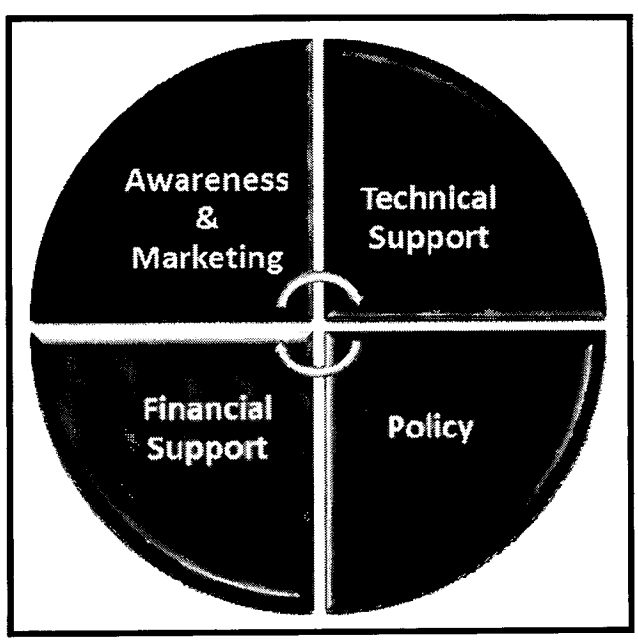

Figure 43: The four axes of the proposed integrated strategy

Axis 1: Awareness and Marketing

This axis includes two major components mainly targeting the public in general with an aim to support the beekeepers at the awareness as well as the marketing levels.

The components are shown in Table 19.

Table 19: Components and activities of axis 1: Awareness and Marketing

Component	Activity	Details
(1) Awareness Raising for the Public	Seminars and workshops	Targeting the public in social events and activities organized in coordination with municipalities
	Launching a national awareness campaign	Including media activities (TV, radio, newspapers, etc…)
	Including honey learning material in schools	Introducing a chapter in the science book about honey, bees ,and the importance of beekeeping
(2) Marketing	Securing market for produced honey	Conducting a market study, and setting up a national market strategy for local honey in Lebanon as well as outside Lebanon.
	Publishing a booklet on honey products	A booklet that acts as a guide for consumers as well as beekeepers on the importance of honey and the types of honey available in the market

Axis 2: Technical Support

With the spread of diseases and the appearance of more challenges and obstacles facing beekeepers, and with the implementation of old-school beekeeping techniques, a national capacity building strategy, combined with technical support activities are proposed to remove technical and practical barriers. This axis includes three major components, including capacity building at the beekeepers level, offering free technical support, and empowering beekeepers.

The components are shown in Table 20.

Table 20: Components and activities of axis 2: Technical Support

Component	Activity	Details
(1) Capacity Building at Beekeepers level	Practical Trainings and in-field activities	Conducting workshops and trainings for beekeepers in the field at different levels starting with beginners to reach senior professionals
	Workshops and seminars	Workshops on latest beekeeping advancements under the supervision of beekeeping experts in collaboration with international programs
	Introducing the practical beekeeping handbook	Publishing a cookbook recipe handbook for beekeepers about the basics of beekeeping, diseases, methods, and techniques needed.
(2) Offering Free Technical Support	Experts and inspectors	Offering experts to inspect beehives when facing a disease or an unknown problem to give the beekeeper a better understanding of the issue
	Dedicating a Hot Line for beekeeping	Launching a hotline dedicated to beekeeping, through which beekeepers can report problems or ask for advice
(3) Empowering Beekeepers	Creating efficient cooperatives	Starting and supervising regional cooperatives, aiming at transformation from self-sufficiency farming to full market production

Axis 3: Policy

Proper policy existence and implementation is a major step towards a stronger sector. This requires the involvement of different parties in addition to the involved ministries and stakeholders. This axis includes two major components, including quality control, and protecting beekeeping resources. The components are shown in Table 21.

Table 21: Components and activities of axis 3: Policy

Component	Activity	Details
(1) Quality Control	Implementing standards and regulations	Proper implementation of the standards set related to honey products especially in terms of quality.
	Protecting local products for foreign unfair completion	Applying increased custom tax on foreign products and performing detailed inspection of imported products
(2) Offering Beekeeping Resources	Protecting fields and preventing plants losses	Setting up a policy that prohibits the damage or cultivation of nectar and pollen plants, and sets a seasonal calendar
	Controlling the use of pesticides	Through prohibiting the use of pesticides in honeybee fields, and providing pest control alternatives

Axis 4: Financial Support

At the financial level, there is a lot to be done to help beekeepers especially in rural areas. This axis includes two major components, business development, subsidies and compensation. The components are shown in Table 22Table 20.

Table 22: Components and activities of axis 4: Financial Support

Component	Activity	Details
(1) Business Development	Providing credit facilities	Offering beekeepers credit facilities and providing them with bankable products to improve their business
(2) Subsidies and Compensation	Lab testing subsidy	Offering beekeepers subsidies for sending samples for testing in an accredited local laboratory
	Beehives burning compensation	Setting up a compensation mechanism to compensate for losses to AFB disease treatment actions

Subsidy and Compensation Scheme

Samples Testing Subsidy

The proposed subsidy scheme for laboratory testing varies by year as it starts with 80% at the first year available for all beekeepers without any requisites, and then drops to 30% at a later stage.

The proposed scheme offers two types of subsidies during the second year, an unconditional subsidy of 30% for all beekeepers without any requisites, with additional subsidies to beekeepers willing to export more than 1 ton of honey per annum. This subsidy is subject to various conditions, offering 45% reimbursements to beekeepers whose samples showed 100% conformity with the EU MRLs, and 20% for samples achieving at least 80% of the requirements.

The subsidy is dismissed if the beekeeper fails to export the required capacity.

Compensation Scheme

The compensation scenario favored is the subsidy of 50% which meets the beekeepers requirements who requested an average of 53% according to the survey conducted. This requires an overall budget of 346,603,595 LBP annually at an infection rate of 1.7% for AFB. This rate is expected to be dropping after the implementation of the integrated strategy but would be compensated with the increase in beehives due to the increase in capacity, leaving an overall annual budget of around 222,995 USD.

5.3. Study Limitations and Further Research

This research is the first of its kind in the country with a sample of 30 beekeepers covering 11% of the beehives ownership in Lebanon with primary data collected. The limitation of 30 beekeepers was due to the lack of sufficient funds to finance more laboratory sample testing, which will be highly expensive to be properly tested in an accredited laboratory.

As for the results of the survey, inconsistency appeared in some answers especially when related to the use of antibiotics for treating AFB, with some lab test results showing antibiotic residues in very high amounts for a beekeeper who claimed not to have used antibiotics during the past 3 years. Inconsistency is believed to be a result of fearing to share that they are using antibiotics and pesticides to cure diseases they are facing.

Moreover, literature review and data collected from publications and official statistics

departments are not as up to date as required, with official production data dating back to year 2007 due to the lack of officially announced numbers.

It has been also a limitation that the sample taken for testing was not randomly chosen, which gave the beekeeper the chance to choose a sample from any location he sees best, and with senior beekeepers who have hundreds of beehives, they would have them distributed in several regions and thus being subject to various factors.

Furthermore, the associations and syndicates in Lebanon have to start following a new strategy of fighting diseases with no adverse impact on the honey produced as this action negatively affects the domestic consumers' health as well as hinders export activities to reach consumers abroad. A suggested formula to upgrade the honey production and reach a sustainable good honey quality is done through the implementation of the ISO 22000.

In a nutshell, the results of this research serve as a general guide to better understand the market and take necessary action to improve the potential and capabilities of the key players. But further research is required to form a well-rounded strategy that provides a step-by-step action plan with detailed budget of each activity, and accurate revenues of the coming years. This would require an elaboration on the action items, and a study of the direct and indirect effects of each item at the micro as well as macro levels.

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APPENDICES

APPENDIX A: FINAL SURVEY QUESTIONNAIRE

في البداية يسعدنا التواصل معكم وكلنا أمل أن تتوطد علاقتنا لما فيه مصلحة قطاع النحل والنحالين في لبنان آملين منكم تعبئة الإستمارة أدناه لمساعدتنا على تحديد الحاجات والمتطلبات والمعلومات الدقيقة لنتمكّن من مساعدتكم.

إرشادات:

- يهدف هذا الإستبيان لإستطلاع أرائكموجمع المعلومات لتقييم سوق العسل في لبنان والمشاكل التي تواجه النحالين للنهوض بالقطاع والمحاولة على مساعدة فتح مجالات التصدير للخارج.
- تعبئة هذا الإستبيانسوف يستغرق ما لا يزيد عن 15 دقيقة
- يرجى إجابة الأسئلة بوضوح وصراحة
- في حال عدم فهم أي سؤال يرجى الإستيضاح من حامل الإستمارة
- يرجىالإجابة بالرقم المناسب داخل الخانات المخصصة أو وضع علامة (X) في المكان المناسب

التاريخ _____

أ.معلومات عامة

الإسم: _____	العمر: _____	الهاتف: _____
المحافظة: _____	القضاء: _____	المدينة \ القرية: _____

ب. معلومات عن النحل

1. منذ كم سنة وأنتم تعملون بتربية النحل؟

   [ ][ ] سنة

2. كم هي عدد طوائف النحل المخصصة لإنتاج العسل؟

   2009: [ ][ ][ ][ ] طائفة

   2010: [ ][ ][ ][ ] طائفة

   2011: [ ][ ][ ][ ] طائفة

3. كم هي عدد طوائف النحل المخصصة لإنتاج الملكات؟

   2009: [ ][ ][ ][ ] طائفة

   2010: [ ][ ][ ][ ] طائفة

   2011: [ ][ ][ ][ ] طائفة

4. **كم هو معدّل عدد الطرود سنوياً؟**

2009: [__][__][__][__] طرد

2010: [__][__][__][__] طرد

2011: [__][__][__][__] طرد

5. **كم برواز يغطي النحل كمتوسط أثناء مواسم الفيض؟**

[__][__][__][__] برواز

6. **هل نحلكم ثابت أم مترحّل؟**

[__] **ثابت** *(إذهب إلى السؤال 8)*

[__] **مترحّل**

7. **إن كان مترحّلاً، ما هي المواسم التي تحاولون جنيها لكل موسم؟**

[__] موسم الساحل (ربيعي) 5-350 م

[__] موسم الوسط الحرشي (صيفي) 350-750 م

[__] موسم الجرد (صيفي) 900-2200 م

[__] موسم الأكيدنيا (خريفي)

8. **ما نوع النحل الذي تملكون (مع نسبة مئوية)؟**

بلدي: [__][__][__] %

إيطالي: [__][__][__] %

هجين بلدي مع إيطالي: [__][__][__] %

هجين بلدي مع كارنيولي: [__][__][__] %

_____:[__][__][__] %

9. **كم قفير تخسرون بالسنة كمتوسط؟**

[__][__][__][__] قفير

10. **ما هو سبب خسارة القفير (مع نسبة مئوية)؟**

مطر: [__][__][__] %

غزو: [__][__][__] %

هجران النحل لقفيره لأسباب معروفة: [__][__][__] %

هجران النحل لقفيره لأسباب مجهولة: [__][__][__] %

إستعمال مبيدات: [__][__][__] %

إستعمال مواد طبيعية: [__][__][__] %

مرض: ☐☐☐ %

_____: ☐☐☐ %

11. هل تستعملون بدائل رحيقية لإطعام النحل؟

☐ محاليل سكرية

☐ شراب الذرة عالي الفركتوز (High Fructose Corn syrup)

☐ _____

12. هل تستعملون بدائل بروتينية لإطعام النحل؟

☐ نعم

☐ كلا *(إذهب إلى السؤال 14)*

13. ماذا تستعملون كبدائل بروتينية لإطعام النحل؟

☐ كاندي محضّر عند النحال

☐ كاندي من السوق اللبناني

☐ حبوب طلع مستوردة

☐ _____

ج. معلومات عن العسل

14. كم تنتجون من العسل سنوياً (كغ)؟

	2009	2010	2011
موسم الساحل	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
موسم الوسط الحرشي	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
موسم الجرد	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
موسم الأكيدنيا	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐

15. ما نوع العسل الذي تنتجون؟

☐ عسل حمضيات

☐ عسل أزهار متنوّعة

☐ عسل الليمون

☐ عسل ندوة عسلية
☐ عسل أشواك وأزهار جردية
☐ عسل كينا
☐ _____

16. أين تفرزون العسل؟

	2009	2010	2011
فرازة خاصة بكم	☐	☐	☐
لدى قريب / صديق	☐	☐	☐
لدى شركة مختصة	☐	☐	☐
_____	☐	☐	☐

17. كيف يتم إستهلاك العسل المنتج (نسبة مئوية)؟

إستهلاك خاص: [_][_][_] %
هدايا: [_][_][_] %
بيع بالمفرق: [_][_][_] %
بيع وسيط بالجملة: [_][_][_] %
بيع لشركات خاصة: [_][_][_] %
المحال الإستهلاكية: [_][_][_] %
تصدير: [_][_][_] %
_____: [_][_][_][_] %

18. في حال التصدير، ما هي الدول التي تصدرون اليها (نسبة مئوية)؟

[_____]: [_][_][_] %
[_____]: [_][_][_] %
[_____]: [_][_][_] %
[_____]: [_][_][_] %

د. صحة وسلامة النحل

19. هل تصادفون مرض تعفن الحضنة الأمريكي؟

☐ نعم
☐ كلا

20. كم قفير يتضرر من مرض تعفن الحضنة الأمريكي؟

2011: [ ] [ ] [ ] [ ] [ ] قفير

2010: [ ] [ ] [ ] [ ] [ ] قفير

2009: [ ] [ ] [ ] [ ] [ ] قفير

21. كيف تواجهون هذا المرض في الطوائف ذات الجيش القوي؟

- ☐ المضاد الحيوي: الأوكسيتتراسيكلين
- ☐ المضاد الحيوي: تتراسيكلين
- ☐ الأوكسيتتراسيكلين والتتراسيكلين سويا
- ☐ إعدام الطائفة بحرق القفير مع الطوائف
- ☐ حرق الإطارات
- ☐ إتلاف القفير
- ☐ لا شيء
- ☐ _____

22. كيف تواجهون هذا المرض في الطوائف ذات الجيش الضعيف؟

- ☐ المضاد الحيوي: الأوكسيتتراسيكلين
- ☐ المضاد الحيوي: تتراسيكلين
- ☐ الأوكسيتتراسيكلين والتتراسيكلين سوياً
- ☐ إعدام الطائفة بحرق القفير مع الطوائف
- ☐ حرق الإطارات
- ☐ إتلاف القفير
- ☐ لا شيء
- ☐ _____

23. في حال استعمال المضاد الحيوي الأوكسيتتراسيكلين، ما هي الكمية التي تستعملونها لمحاربة هذا المرض؟

- ☐ _____ ملعقة صغيرة على لتر محلول سكري
- ☐ _____غرام لكل طائفة
- ☐ _____

24. من أين تحصلون على هذا العلاج؟

- ☐ وزارة الزراعة
- ☐ الصيدليات [الإسم والعنوان: _____]
- ☐ جمعية النحالين [الإسم والعنوان: _____]
- ☐ نحال صديق [الإسم والعنوان: _____]
- ☐ صيدلية زراعية [الإسم والعنوان: _____]
- ☐ إستهلاكية محلية [الإسم والعنوان: _____]
- ☐ _____ [الإسم والعنوان: _____]

25. ما هو سعر الغرام من العلاج؟

الغرام: 0 0 0 [__] [__] [__] ليرة لبنانية

26. لأي من القفران تستعملون الأوكسيتتراسيكلين؟

- ☐ جميعها (المصابة بمرض الحضنة الأمريكي والخالية منه)
- ☐ المصابة بالمرض فقط
- ☐ _____

27. عدد مرات استعمال الأوكسيتتراسيكلين خلال السنة وبفاصل زمني:

	عدد المرات	بفاصل
2009	_____	_____
2010	_____	_____
2011	_____	_____

28. الطريقة الأسرع والأفعل للتخلص من هذا المرض هو إتلاف القفير. هل أنتم مستعدون لفعل ذلك؟

- ☐ بكل سرور
- ☐ نعم
- ☐ نعم بتحفظ
- ☐ كلا
- ☐ قطعاً كلا

29. بكم تثمّنون البضاعة التالية لديكم؟

الخلية الخشبية نفسها: 0 0 0 [__] [__] [__] ليرة لبنانية

البرواز المشمع الفارغ من النحل: 0 0 0 [__] [__] [__] ليرة لبنانية

البرواز المغطى بالنحل والعسل وحبوب الطلع: 0 0 0 [__] [__] [__] ليرة لبنانية

30. في حال أقامت وزارة الزراعة برنامجا لإتلاف الطوائف المصابة هل أنتم مستعدون لإبلاغ الوزارة بما عندكم من طوائف مصابة والتعاون مع مرشيدي وزارة الزراعة لإتلافها تحت إشراف الوزارة؟

- ☐ نعم
- ☐ كلا

31. بكم يثمّن القفير لديكم؟

الطائفة الضعيفة: 0 0 0 [__] [__] [__] ليرة لبنانية

الطائفة القوية: 0 0 0 [__] [__] [__] ليرة لبنانية

القفير نفسه: 0 0 0 [__] [__] [__] ليرة لبنانية

البرواز الواحد: 0 0 0 [__] [__] [__] ليرة لبنانية

32. في حال ساهمت الدولة بالتعويض بجزء من ثمن القفير المراد تلفه، هل ترغبون بذلك وما هي النسبة المرجوة؟

☐ نعم _____%

☐ نعم بتحفظ _____% لماذا؟_____

☐ كلا

33. في حال إستعمالكم للعلاج، متى تقومون بإيقافه (قبل القطف بكم يوم)؟

☐ قبل _____ أشهر

☐ قبل _____ أيام

☐ _____

34. هل تعلمون ما الكمية الأوكسي تتراسيكلين التي كانت وزارة الزراعة تنصح بها النحالين باستعمالها لمرض التعفن؟

☐ نعم الكمية:_____

☐ كلا السبب:

☐ عدم وجود لمركز إرشادي قريب

☐ لا وجود لمعايير محددة في مواصفة العسل

☐ _____

ه. معلومات تجارية

35. كم سعر الكيلوغرام الواحد من العسل؟

موسم الساحل 0 0 0 [__] [__] [__] [__] ليرة لبنانية

موسم الوسط الحرشي 0 0 0 [__] [__] [__] [__] ليرة لبنانية

موسم الجرد 0 0 0 [__] [__] [__] [__] ليرة لبنانية

موسم الأكيدنيا 0 0 0 [__] [__] [__] [__] ليرة لبنانية

36. هل يهمكم التصدير للخارج؟

☐ نعم

☐ كلا

37. هل بإستطاعتكم زيادة إنتاجكم بالوقت الحالي؟

☐ بالتأكيد

☐ نعم

☐ لا أعلم

☐ كلا

☐ قطعاً كلا

38. هل أنتم مستعدون لزيادة إنتاجكم بحال قامت الدولة بمساعدتكم على التصدير أو على تسويق العسل محلياً؟

- ☐ بالتأكيد
- ☐ نعم
- ☐ لا أعلم
- ☐ كلا
- ☐ قطعاً كلا

39. هل أنتم مستعدون لإرسال عينات من عسلكم لمختبرات مختصة للكشف عليها مما قد يخولها لتكون صالحة للتصدير؟

- ☐ بكل سرور
- ☐ نعم
- ☐ نعم بتحفظ
- ☐ كلا *(إذهب إلى السؤال44)*
- ☐ قطعاً كلا *(إذهب إلى السؤال44)*

40. ما هو عدد العينات المتوقع إرسالها الى المختبرات اللبنانية للفحص سنوياً؟

[ ][ ][ ] عينة

41. هل لديكم مختبر خاص للقيام بالفحوصات اللازمة للتصدير الى أوروبا؟

- ☐ كلا
- ☐ نعم إسم المختبر_____ عنوانه_____

42. هل أنتم مستعدون دفع قيمة الفحوصات اللازمة لإجراء التحاليل بهدف التصدير؟

- ☐ بكل سرور
- ☐ نعم
- ☐ نعم بتحفظ
- ☐ كلا
- ☐ قطعاً كلا

43. كم أنتم مستعدون أن تدفعوا لفحص العينة ؟

0 0 0 [ ][ ][ ][ ] ليرة لبنانية

أو

[ ][ ][ ][ ] دولار أميركي

و. نصائح و إرشادات

44. ما هي المشاكل التي تواجهك في تربية النحل؟

- [_____]
- [_____]
- [_____]

45. ما هي توصياتكم للنهوض بالقطاع؟

- [_____]
- [_____]
- [_____]

APPENDIX B: LIST OF TESTS REQUIRED BY THE EU

Item	Designation of analysis	Method	Quantification Limit [µg/kg]
1	Pesticides 1:		
	Amitraze	LC-MS/MS	2
	Coumaphos	LC-MS/MS	2
	Clorfenvinfos	LC-MS/MS	2
	t-Fluvalinate	LC-MS/MS	2
	Rotenone	LC-MS/MS	2
2	Tylosin (A)	LC-MS/MS	1
3	Sulfonamides (A)+Trimethoprin	LC-MS/MS	1
4	Tetracyclines (A)	LC-MS/MS	1
5	Streptomycin	LC-MS/MS	5
6	Chloramphenicol CAP (A)	LC-MS/MS	0,05
7	Nitrofuran metabolites	LC-MS/MS	0,3
8	Nitroimidazole	LC-MS/MS	1
9	Fumigant:		
	Naftalene	GC-MS	1
	1,4-Diclorobenzene	GC-MS	1
	1,3-Diclorobenzene	GC-MS	1
	1,2-Diclorobenzene	GC-MS	1
	1,2-Dibromoetano	GC-MS	1
10	Dapsone		1
11	H.M.F. (A)	DM 25/07/03	1 mg/kg
12	Attività Diastatica	DM 25/07/03	0,5 mg/kg
13	Metilantralinato	LC-DAD	0,2 mg/kg
14	Timolo	LC-DAD	0,1 mg/kg
15	F/G Ratio	HPLC	
16	Humidity	RI	
17	Trade Analysis Humidity+HMF+pH +free acidity+Diastase		
18	GMO	PCR	-

APPENDIX C: ACRONYMS AND ABBREVIATIONS

AFB	American Foulbrood
CAC	Codex Alimentarius Commission
CBI	Centre for the Promotion of Imports from developing countries
CCD	Colony Collapse Disorder
CCIB	Chamber of Commerce and Industry in Beirut and Mount Lebanon
EFB	European Foulbrood
FAO	Food and Agriculture Organization
HMF	Hydroxymethylfurfural
HS	Harmonized System
Libnor	Lebanese Norms
MBF	Mediterranean Beekeeping Forum
MoA	Ministry of Agriculture
MoET	Ministry of Economy and Trade
MRL	Maximum Residue Limit
NF	Norms Francais
NL	Norms Libanais
OTC	Oxytetracycline
ppb	Parts per Billion
TC	Tetracycline
UNDP	United Nation Development Programme
UNISA	University of South Africa
USDA	United States Department of Agriculture