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Production and exports of mexican honey

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Resumen

La apicultura es una actividad muy importante por su impacto económico, social y ecológico. En México, esta actividad genera ganancias, ingresos y empleo para gente que está relacionada con la agricultura. El siguiente trabajo es un estudio documental que busca explicar la situación actual de producción y exportaciones de miel en México. Se muestra una revisión de investigaciones actuales en la literatura acerca de producción de miel, con una distinción entre la abeja Apis Mellifera y la Melipona. Se muestra evidencia de que la cantidad de miel exportada no ha tenido un aumento significativo de 1961 al 2017, sin embargo, la producción de miel sí ha tenido un aumento significativo. Esto indica que, anteriormente, la mayor parte de la miel producida, servía para exportación; en la actualidad, el consumo de miel en México ha aumentado. La generación de ingresos por exportación de miel también ha aumentado significativamente, lo cual indica un incremento en los precios de la miel internacionalmente. Este estudio concluye que hay potencial para la expansión de esta actividad productiva y menciona una serie de propuestas sociales y gubernamentales para aumentar la producción y exportaciones de miel en México.

Abstract

Beekeeping is a very important activity because of its economic, social and ecologic impact. In Mexico, this activity generates revenue, income and employment to people and is closely related with agriculture. The following work is a documentary study that seeks to explain the situation of honey production and exports in Mexico. We show the state of the art on investigations on honey production, differentiating between Apis Mellifera and Melipona bee. We show evidence that the amount of exported honey hasn't significantly risen from 1961 to 2017, however, honey production has risen significantly. This indicates that previously most of the honey production used to be exported, and nowadays consumption has risen in the country. The generation of revenue brought by honey exports has also significantly risen, which indicates an increase in the prices of honey internationally. We conclude that there is potential for the activity and we mention a number of social and governmental proposals to rise honey production and exports in Mexico.

Key words: Apiculture, honey, production, exports

Códigos JEL: F15, Q17, Q21, Q02

Introduction

The following work aims to examine the past, present and future panorama of the production and exports of Mexican honey in the world. We also want to briefly examine the effect of the revenue generation on economic development, specifically in the rural area where the activity takes place.

Beekeeping in Mexico is an important economic activity for the agricultural sector, in fact, between 2000 and 2011 it ranked third worldwide in exports, being surpassed only by Argentina and China, with an average export volume of 26.9 thousand tons per year, the equivalent of 47.3% of the country's production (Magaña, Sanginés, Lara, Salazar and Leyva, 2017).

Carballido Meza et. al. (1980), defines beekeeping as the cultivation of bees, in order to obtain honey, wax, propolis, pollen and royal jelly. In summary, a primary economic activity, whose main byproduct is honey, however, its main importance lies in the work of bee pollination. In fact, honey export activities produce an annual profit of approximately 55 million dollars, while the value of crop pollination activities is estimated at approximately two billion dollars (Guzmán-Novoa, 2004). It could be for this reason, that in many cases beekeeping has been considered an activity that is complementary to agriculture (Chemas and Rico-Gray, 1991). In fact, according to Macías, Quezada, Parra and Reyes (2001), in many crops the action of the bee helps to considerably increases the yield of the crops, between 25 and 70 % depending on the crop. In Mexico there are approximately 44,000 people dedicated to beekeeping, most of them are located in the Yucatan Peninsula, Campeche, Quintana Roo, and Chiapas (Magaña, Sanginés, Lara, Salazar and Leyva, 2017).

Part of the success of this activity is due to the pre-colonial ancestral knowledge about beekeeping and the potential for production of honey and polleniferous from regional flora, which in Yucatan amounts to 370 species (Toledo, 2008). As a result of the diversified management of the activities of the Mayan of the Yucatan Peninsula, there is a heterogeneous landscape composed of patches of vegetation interspersed with mature forests and productive units (Toledo, 2008).

Literature Review

Beekeeping has been practiced in Mexico since pre-Hispanic times (Toledo, 2008), and besides being an ancient and noble activity, it is an option to obtain positive economic, social and environmental impacts (Pasin, Tereso and Barreto, 2012, Urquidi, 1996). Toledo (2008) mentions that the socio-environmental resilience of the Mayan culture is based on the sacred conceptualization of health, the balance that can be extrapolated from the human being to the entire universe, in addition to the strategy they have of multiple use of nature.

Prior to colonization, beekeeping was an activity developed by indigenous tribes, with highly cultural connotations, and honey production was carried out specifically for self-

consumption and ritual purposes, through a stingless bee, endemic to southern Mexico (melipona). Echazarreta, Arellano and Pech (2002) mention that, since pre-Hispanic times, the Mayan of the Yucatan Peninsula raised the melipona bee, without a sting, and that they used their honey as food, medicine and for religious rites. Melipona bee breeding continues to date, however, it is important to mention that its yield in terms of the amount of honey produced per hive is much lower than the much more commonly used Apis Mellifera.

The Apis Mellifera has a honey production up to 7 times higher than the native melipona, so much of the revenue generation comes from this medium, however, melipona honey has medicinal properties and can be offered at a higher price in the right market (Chuc and Russell, 2016).

The bee Apis Mellifera was brought to America by the colonizers in the year 1600. The genetic origin of this insect is European (Santamaría, 2009), with meek characteristics with the animals and people surrounding the apicultural production system.

The introduction of the bee Apis Mellifera and later with Africanization, profoundly transformed the beekeeping practices in Mexico. African bees are more territorial, hostile and less productive than European bees, so with the introduction of African bees worldwide (Mexico was no exception) the Africanization process took place. This process began in Mexico in 1986 (Uribe, Guzmán, Correa and Zozaya, 2003). Today, most of the world's beekeepers work with Africanized bees, which are defined as a cross between Apis Mellifera European and Apis Mellifera from Africa (Uribe, Guzmán, Correa and Zozaya, 2003).

In Mexico, Africanization has had a considerable impact on the displacement of the melipona bee, however, there is still a considerable market for honey produced by the melipona bee (Toledo, 2008).

Today, most beekeepers in the northern and central regions of Mexico raise Africanized bees, and most beekeepers in the southern part of the country, especially in the Yucatan Peninsula, continue to raise melipona bees.

Chemas and Rico-Gray (1991) described the way of apicultural management and knowledge of the honey flora of the Yucatecan community, before the Africanization of the Apis Mellifera. This activity has been strongly related to the Mayan culture and worldview. This activity is closely related to other productive activities, which usually focus on self-consumption and not expansionism, and practitioners of these activities believe that there is a balance in nature, treating it with respect and trying not to exploit it.

Magaña, Sanginés, Lara, Salazar and Leyva (2017) mention that Mexico has a considerable competitive advantage in the world honey market, however, this could be increased by increasing the productivity per hive of the producers. There are several proposals to increase the quantity and productivity of Africanized bee hives. One of them is the adoption of technologies and technical knowledge regarding the activity.

Reyes Sámano (2013) mentions that beekeeping as such was introduced to Mexico by the Spaniards, given that it occurs through the raising of Apis Mellifera, however, he also reiterates the importance of the melipona honey and mentions that it has been used for consumption, for the preparation of alcoholic beverages and for rituals (Ortega and Ochoa, 2004).

Abud Russell (2017) mentions in his theoretical framework some interesting statistics about beekeeping, in addition to cataloging it as an ecologically sustainable activity. According to CONABIO (2017) figures, Mexico is the world's third largest exporter of organic honey. The same report also mentions that 30% of the country's production is concentrated in the states of Yucatán, Campeche and Quintana Roo.

González Razo et al. (2014) conducted a study about the commercialization of honey and what part of the supply chain takes the highest profit margin. They concluded that there are three ways to bring the product to the final consumer: direct sale, sale to collectors and sale to retailers. According to the surveys they conducted, the average marketing margin was 30.53 pesos per liter of honey, of which the wholesale intermediaries took the largest margin with 16.90 pesos and the rest the retail intermediaries.

Matus de la Cruz (2003) has an extensive theoretical framework that encompasses from the details about beekeeping to its relationship with sustainable development. He mentions that bees are able to work within a range of 1500 to 2000 meters from where they are located, and that they play a decisive role for the human being from an economic, social and ecological point of view.

Astorga de Ita (2014) citing Toledo (2008) mentions that as a result of the diversified management of the activities of the Mayan at the Yucatan Peninsula, there is a heterogeneous landscape composed of patches of vegetation interspersed with mature forests and production units, he also cites several authors that classify the landscapes in this area. López López Manjarrez (2015) also completed his thesis based on information from the Yucatan Peninsula, so he mentions statistics on this.

Reyes Sámano (2013) mentions the global economy, as well as international business as important factors in the welfare of society, debating between the freedom of the market and the regulations that arise, sometimes internationally and sometimes more local. He mentions neoliberalism and its fundamental basis of free market and free trade, as well as the mobility of capital between sectors, focusing on the theory of Marshall, Javons and Walras. It also criticizes neoliberalism, mentioning, for example, monopolies and their need to maintain poverty in a large number of people.

Olguín Lacunza (2007) mentions Mexico as the fifth largest producer and fourth largest exporter in the world (SAGARPA-IICA, 1991). In addition, he mentions that honey export activities produce an annual profit of approximately 55 million dollars, while the value of the activities of pollination of crops is estimated at approximately two billion dollars (Guzmán-Novoa, 2004).

Matus de la Cruz (2003) also talks about the economic advantages and disadvantages of beekeeping as a productive activity. Some of the disadvantages mentioned by Benedetti

is the great influence of the s urban areas that destroy natural areas of good flowering, deforestation and the use of chemicals to combat pests that end up being harmful to bees.

It is important to remember that, being a primary activity, a large part of the producers are low-income farmers. Satizabal et al. (1986) determined the "apicultural production unit" (UPA) for a Colombian study with 88 producers. They determined that the minimum amount of hives needed to cover expenses and have profits ranges between 45 and 67 productive hives, based on optimistic and conservative scenarios with respect to honey production of a given year.

Methodology

Apart from the literary review, we performed a linear regression using the least squares method on official statistics about the production and exports of honey in Mexico. The information presented was obtained from the Official data of the Food and Agriculture Organization of the United Nations (FAO) and analyzed using the statistical analysis software SPSS. We used the year for independent variable, given that we were interested in the behavior of the honey production, exports and revenue over time. We performed the three regression analyses using the least squares method, which showed not only the relationship between the dependent variables and the year, but also the linear equation for predictions. The equation is only presented for the analysis that showed a statistically significant result.

The adjustment for inflation was made using the Consumer Price Index (CPI), in order to determine if there is a statistically significant rise in revenue from the exports of honey.

Results

Table 1 shows descriptive statistics for honey exports, honey production and honey revenue from exports from 1961 to 2017. Tables 2 and 3 show the regression analysis for the year against honey exports, showing there is not a correlation between them. The results of the p value in the ANOVA are not statistically significant.

Table 1: Descriptive statistics for honey exports, revenue and production in Mexico from 1961 to 2017

Descriptives

			Statistic	Std. Error
HoneyExp	Mean		32614.91	1330.958
	95% Confidence Interval for Mean	Lower Bound	29948.68	
		Upper Bound	35281.14	
	5% Trimmed Mean		32188.14	
	Median		30393.00	

	Variance		100972616.724	
	Std. Deviation		10048.513	
	Minimum		17316	
	Maximum		57992	
	Range		40676	
	Interquartile Range		14709	
	Skewness		.651	.316
	Kurtosis		-.380	.623
Revenue	Mean		42009.88	4642.297
	95% Confidence Interval for Mean	Lower Bound	32710.24	
		Upper Bound	51309.52	
	5% Trimmed Mean		38723.31	
	Median		32882.00	
	Variance		1228402442.824	
	Std. Deviation		35048.573	
	Minimum		2762	
	Maximum		155986	
	Range		153224	
	Interquartile Range		33117	
	Skewness		1.407	.316
	Kurtosis		1.953	.623
HoneyProd	Mean		52895.51	1586.475
	95% Confidence Interval for Mean	Lower Bound	49717.42	
		Upper Bound	56073.60	
	5% Trimmed Mean		53346.00	
	Median		55970.00	
	Variance		143463422.076	
	Std. Deviation		11977.622	
	Minimum		24000	
	Maximum		74613	
	Range		50613	
	Interquartile Range		11109	
	Skewness		-.870	.316
	Kurtosis		.051	.623

Source: Own elaboration with data from FAO (2017).

Table 2: Regression Coefficient the least square method comparing year and honey exports from 1961 to 2017

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.043[a]	.002	-.016	10129.963

a. Predictors: (Constant), Year

Source: Own elaboration with data from FAO (2017).

Table 3: ANOVA for year and honey exports from 1961 to 2017

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10578682.921	1	10578682.921	.103	.749[b]
	Residual	5643887853.641	55	102616142.793		
	Total	5654466536.561	56			

a. Dependent Variable: HoneyExp

b. Predictors: (Constant), Year

Source: Own elaboration with data from FAO (2017).

Figure 1 shows the number of tons of Mexican export honey per year, from 1961 to 2017. The information shows an average of 32614.91 tons of honey exported per year. The regression coefficient was calculated, which gave a value p = 0.7493, with an R = 0.04325, which indicates that there is no significant trend.

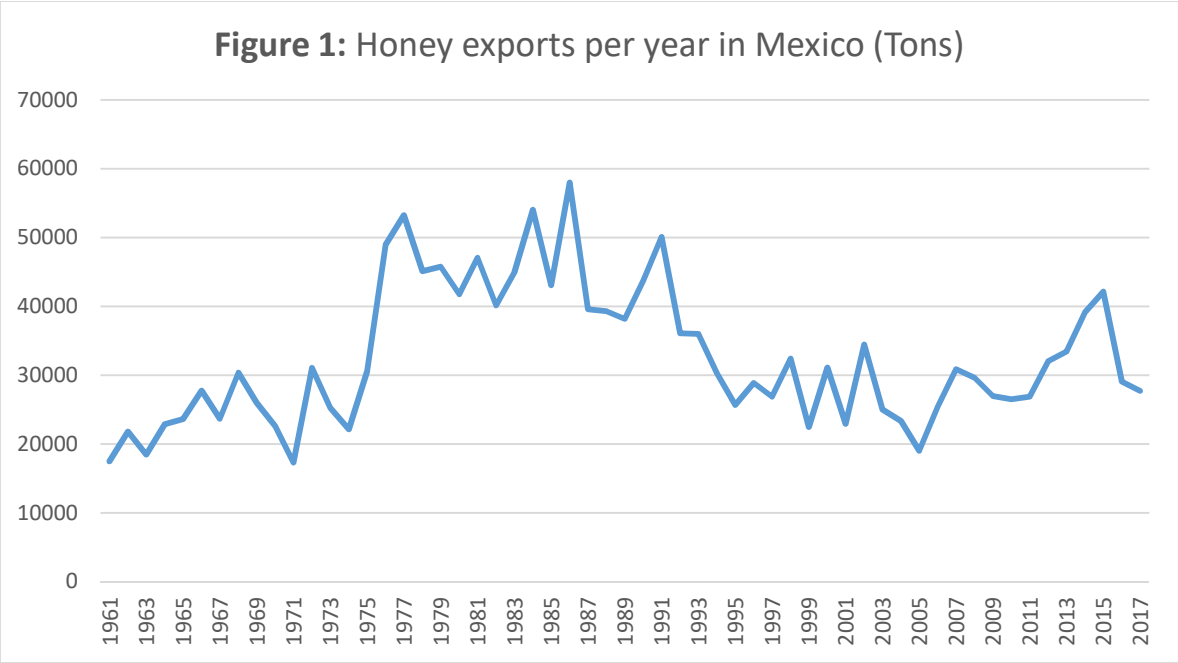


Figure 1: Honey exports per year in Mexico

Source: Own elaboration with data from FAO (2017).

Tables 4 and 5 show the regression analysis for honey production in Mexico from 1961 to 2017 and figure 2 shows the total amount of honey produced in Mexico, this has undergone several important changes, and although it is normally a fruitful activity, for several years the production of honey has stagnated. In the linear regression for honey production, the value of R = 0.58856 and the value p = 0.000, which suggests a statistically significant relationship between the year and honey production. Given the results, we also show the coefficients for the regression analysis in table 6.

Table 4: Regression Coefficient the least square method comparing year and honey production from 1961 to 2017

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.589[a]	.346	.335	9770.902

a. Predictors: (Constant), Year

Source: Own elaboration with data from FAO (2017).

Table 5: ANOVA for year and honey production from 1961 to 2017

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2783072869.659	1	2783072869.659	29.151	.000[b]
	Residual	5250878766.586	55	95470523.029		
	Total	8033951636.246	56			

a. Dependent Variable: HoneyProd

b. Predictors: (Constant), Year

Source: Own elaboration with data from FAO (2017).

Table 6: Coefficients for the linear regression, with year as an independent variable and honey production as a dependent variable.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-791881.833	156469.421		-5.061	.000
	Year	424.725	78.665	.589	5.399	.000

a. Dependent Variable: HoneyProd

Source: Own elaboration with data from FAO (2017).

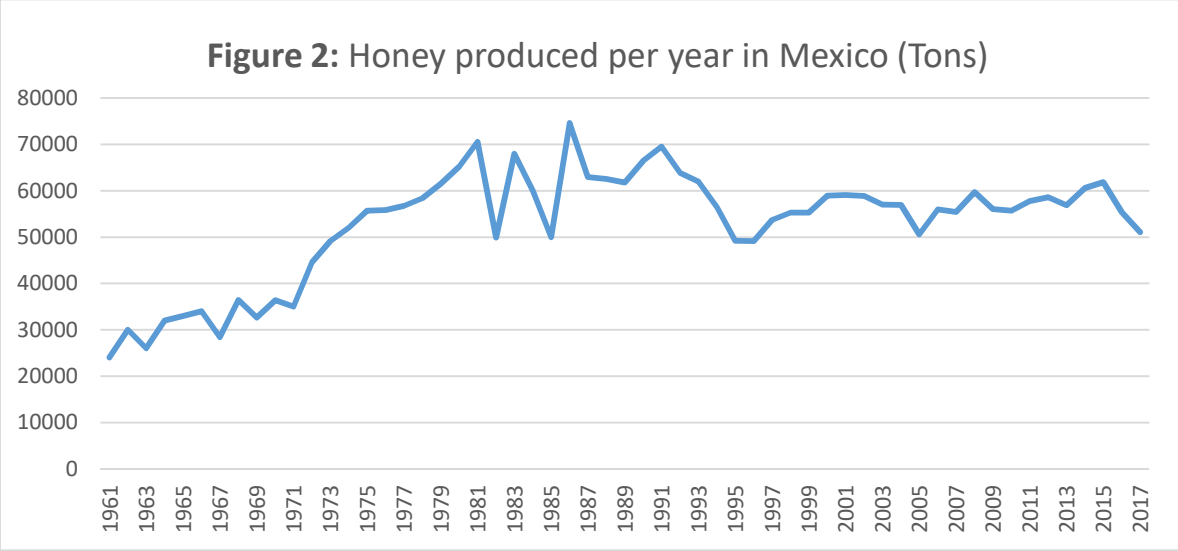


Figure 2: Tons of produced honey per year in Mexico

Source: Own elaboration with data from FAO (2017).

Figure 3 shows the generation of foreign exchange by exporting honey each year during the period from 1961 to 2017.

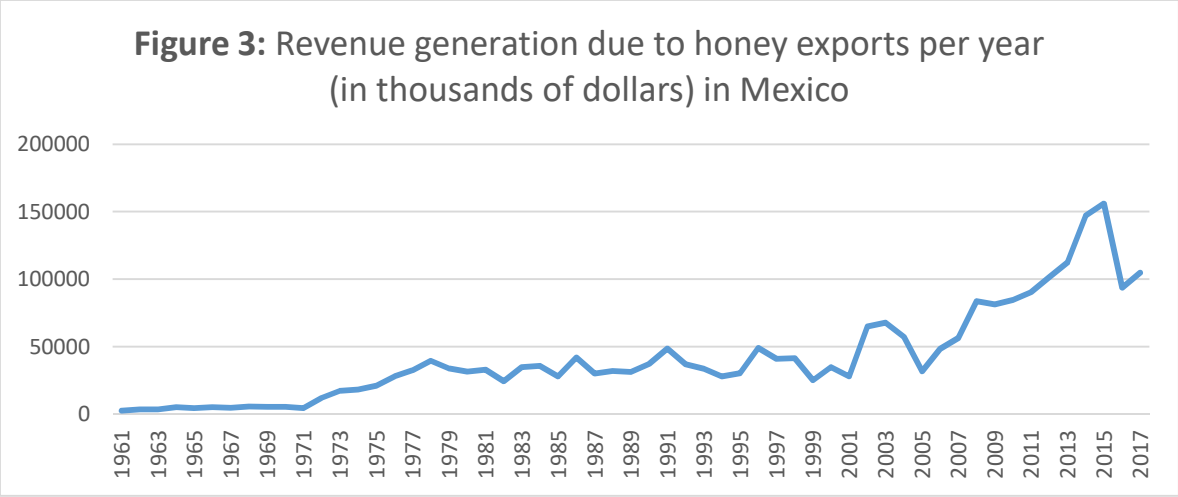


Figure 3: revenue generation due to honey exports per year

Source: Own elaboration with data from FAO (2017).

Tables 7, 8, 9 and figure 4 show the regression analysis for the revenue obtained from honey exports in Mexico during the period from 1961 to 2017. The R was 0.427, which shows a slight correlation and the ANOVA shows a p value of 0.001, which indicates a statistically significant result.

Table 7: Regression Coefficient the least square method comparing year and revenue from honey adjusted for inflation from 1961 to 2017

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.427[a]	.182	.167	3413.14277

a. Predictors: (Constant), Year

Source: Own elaboration with data from FAO (2017).

Table 8: ANOVA for year and revenue from honey adjusted for inflation from 1961 to 2017

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	142542852.234	1	142542852.234	12.236	.001[b]
	Residual	640724896.806	55	11649543.578		
	Total	783267749.040	56			

a. Dependent Variable: revajus

b. Predictors: (Constant), Year

Source: Own elaboration with data from FAO (2017).

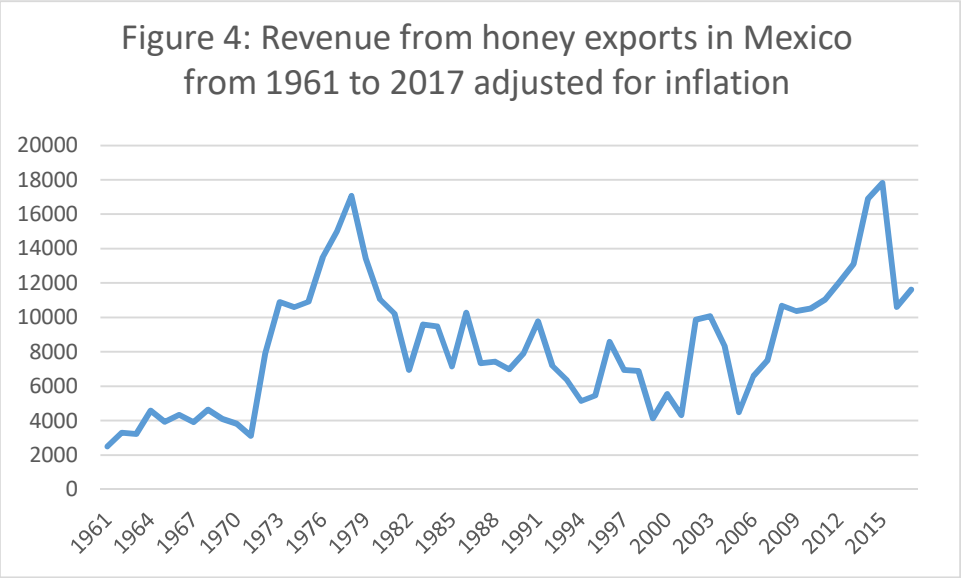
Table 9: Coefficients for the linear regression, with year as an independent variable and revenue from honey as a dependent variable.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-182817.952	54657.439		-3.345	.001
	Year	96.121	27.479	.427	3.498	.001

a. Dependent Variable: revajus

Source: Own elaboration with data from FAO (2017).



Source: Own elaboration with data from FAO (2017).

Proposals for increasing productivity and exports

Here are some general proposals for the increase in productivity and the generation of foreign revenue that greater exports may bring to Mexico:

a) Promote beekeeping through mass advertising campaigns, inside and outside universities.
b) Expand the activity to appropriate geographical locations, with abundant farmland and water.
c) Facilitate the creation of projects and the request for governmental and non-governmental support for the expansion of the activity.
d) Create and operate accredited and certified quality control laboratories, where a series of product tests are carried out in order to comply with international export standards.
e) Create and operate Mexican honey collection and packaging companies, which will be able to open international marketing channels, increasing exports and generating foreign exchange.

Conclusions

Beekeeping is an economically, socially and ecologically viable activity whose impacts, in many ways, are incalculable, however, there are still a lot of challenges that must be faced in order to maximize the benefits of this activity.
This article gets information from official sources (FAO, 2017) about the production, exports and revenue obtained from Mexican honey worldwide, in addition to reflecting on the state of the art in scientific literature, specifically through a series of theses published in the UNAM and the sources of information used by them, as well as current scientific articles on the subject.

The analysis shows a statistically significant increase in production and revenue from exports of Mexican honey from 1961 to 2017, even when adjusting for inflation. This finding is interesting, given that there was no increase found in the amount of honey exported. This could be due to the increase in quality and acknowledgement of Mexican honey around the world. The main contributions of this work were the unification of theoretical framework gathered on the topic of apiculture as a productive activity and the increase in revenue from honey exports that was found, despite the fact that honey exports have remained relatively constant. This also means that the consumption of Mexican honey in the country is increasing with time. Apiculture, as a primary productive activity, should be studied and understood better, in order to improve the economic situation of Mexico and the world.

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Annex 1: Information on honey produced, exported and revenue generation in Mexico from 1961 to 2017 (FAO, 2017).

Year	Tons of honey exported	Thousands of dollars in revenue	Tons of honey produced
1961	17491	2762	24000
1962	21844	3693	30000
1963	18486	3634	26000
1964	22901	5273	32000
1965	23623	4562	33000
1966	27786	5153	34000
1967	23679	4798	28416
1968	30393	5832	36473
1969	25989	5413	32620
1970	22622	5389	36400
1971	17316	4628	35024
1972	31096	12114	44616
1973	25259	17319	49120
1974	22169	18216	52065
1975	30564	21147	55733
1976	48962	27957	55813
1977	53243	32538	56750
1978	45142	39603	58378
1979	45774	33946	61472
1980	41790	31558	65245
1981	47088	32882	70557
1982	40127	24367	49928
1983	44930	34870	68000
1984	54030	35780	60000
1985	43059	28094	50,000
1986	57992	41944	74613
1987	39568	30250	62931
1988	39297	32026	62573
1989	38210	31448	61757
1990	43767	37217	66493
1991	50089	48750	69495
1992	36093	36974	63886
1993	35998	33648	61973
1994	30279	27908	56432
1995	25706	30475	49228
1996	28910	49143	49178
1997	26900	41090	53681
1998	32441	41511	55297
1999	22477	25277	55323
2000	31115	34805	58935
2001	22923	28086	59069

2002	34457	65013	58890
2003	25018	67947	57045
2004	23374	57408	56917
2005	19026	31836	50631
2006	25473	48381	55970
2007	30912	56454	55459
2008	29646	83789	59682
2009	26984	81239	56071
2010	26512	84743	55684
2011	26888	90359	57783
2012	32040	101497	58602
2013	33458	112352	56907
2014	39152	147037	60624
2015	42161	155986	61881
2016	29098	93725	55358
2017	27723	104717	51066