

**Czech University of Life Sciences Prague**

**Faculty of Economics and Management**

**Department of Economics**



**Bachelor Thesis**

**Agricultural Production in Latin America**

**Ismael Cruz Ortega**

© 2021 CULS

## BACHELOR THESIS ASSIGNMENT

Ismael Cruz

Economics and Management  
Economics and Management

Thesis title

**Agricultural Production in Latin America**

---

### Objectives of thesis

The main objectives of this thesis is to evaluate the agriculture production in Latin America. Also the impact of the agriculture industry on the economy indicators of Latin America countries.

### Methodology

The methodologies to be the use in the thesis are:

Statistical Methods:

- Trend Analysis
- Index Analysis
- Time series Analysis

Economics Methods:

- GDP calculation in base of agriculture impact
- Export/Import by country

## The proposed extent of the thesis

40 – 60 pages

## Keywords

agricultural, production, GDP, Time series

---

## Recommended information sources

ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE. INSTITUT TROPICKÉHO A SUBTROPICKÉHO ZEMĚDĚLSTVÍ. *La agricultura latinoamericana*. V Praze: Česká zemědělská univerzita, 2001. ISBN 80-213-0833-8.

DALGAARD, P. *Introductory statistics with R*. New York: Springer, 2008. ISBN 978-0-387-79053-4.

FOOD AND AGRICULTURE ORGANIZATION OF THE UN. *FAO yearbook : production. Vol. 50. 1996 = FAO annuaire. Vol. 50. 1996*. Rome: Food and agriculture org. of UN, 1997. ISBN 92-5-003999-9.

HILL, B. – RAY, D. *Economics for agriculture : food, farming and the rural economy*. Basingstoke: Macmillan, 1987. ISBN 0-333-35225-4.

MCKILLUP, S. *Statistics explained : an Introductory guide for life scientists*. Cambridge ; New York: Cambridge University Press, 2011. ISBN 9781107005518.

MUJICA, E B. – RUEDA, J L. *El desarrollo sostenible de montañas en américa latina*. LIMA: CONDESAN, 1996.

---

## Expected date of thesis defence

2020/21 SS – FEM

## The Bachelor Thesis Supervisor

Ing. Jiří Mach, Ph.D.

## Supervising department

Department of Economics

Electronic approval: 30. 10. 2020

**prof. Ing. Miroslav Svatoš, CSc.**

Head of department

Electronic approval: 5. 11. 2020

**Ing. Martin Pelikán, Ph.D.**

Dean

Prague on 24. 01. 2021

## **Declaration**

**I declare that I have worked on my bachelor thesis titled Agricultural Production in Latin America by myself and I have used only the sources mentioned at the end of the thesis.**

**In Prague on date 15/03/2021**

**Ismael Cruz Ortega**

## **Acknowledgement**

**I would like to thank Ing. Jiri Mach, MSc, Ph.D. for his advice and support during my work on this Thesis.**

**Agricultural Production in Latin America**  
**Zemědělská výroba v Latinské Americe**

## **Shrnutí:**

Zemědělství je jednou z hlavních výrobních činností v Latinské Americe, která představuje 4,5% HDP regionu a do roku 2018 vzrostlo jeho zastoupení na celkovém vývozu na 22%. V této práci byla zemědělská výroba v Latinské Americe porovnána s proměnnými týkajícími se ekonomické výkonnosti této výroby a využití těchto zdrojů ve prospěch produkce potravin pro světový trh. Výzkum je založen na údajích o populaci, využívání půdy, hlavních zemědělských produktech, ekonomické hodnotě a dopadu na životní prostředí. Díky výzkumu bylo zjištěno, že Latinská Amerika je jedním z nejdůležitějších producentů potravin na světě, který v roce 2018 dosáhl exportní hodnoty kolem 219 miliard dolarů a má ambiciózní cíle rozšířit svou produkci do roku 2030. Analýza této práce je rozšířena tak, aby bylo vidět dopady, které má zemědělství na životní prostředí. V tomto segmentu nejsou výsledky příliš povzbudivé, protože dopad na životní prostředí vyvolaný zemědělskou výrobou je velmi negativní, např. se jedná o 6% snížení plochy lesních oblastí mezi roky 1990 a 2016 a nárůst produkce skleníkových plynů.

Ukázalo se, že zemědělská produkce v regionu je různorodá a složitá, vychází z tradic každé země, a je získávána za cenu ekologických dopadů a snižování populace venkovského obyvatelstva, která poklesla v období 1990–2020 o 10%. Navzdory dopadům na životní prostředí v Latinské Americe je důležité zmínit, že společným zájmem regionu je udržení jeho role jako jednoho z největších producentů potravin na planetě. Potřeba sladit výživu obyvatel Země a ochranu životního prostředí byla nastíněna jako nevyřešený úkol pro sociální subjekty spojené se zemědělskou výrobou

**Klíčová slova: Výroba, Obchod, HDP, Trh, Latinská Amerika, Export, Dovoz, Životní prostředí, Půda, Zemědělství, Plodiny, Hektar, Venkov, Hospodářská zvířata, Skleníky a Populace**

## **Summary:**

Agriculture is one of the main productive activity in Latin America, which accounts the 4.5% of the region's GDP and until 2018 with 22% of total exports. In this thesis, agricultural production in Latin America was contrasted with variables related to the economic value of its production and the use of resources in favor of world food. The research is based on population data, land use, main agricultural products, economic value and the impact on the environment. Because of the research, it was found that Latin America is one of the most important food producers in the world, reaching an export value in 2018 of around 219 billion dollars and with ambitious goals to expand their production by 2030. The analysis of this thesis is extended to see the impacts; agriculture has on the ecological system and the environment. In this segment, the results are not very encouraging, since the environmental impact generated by agricultural production obtained very negative results, such as the 6% reduction in forest areas from 1990 to 2016 and the increase of bulk of greenhouse gases.

It has demonstrated that agricultural production in the region is diverse and complex, resulting from the traditions of each country, and is obtained at the cost of a partial ecological destruction and reduction of the rural population, which was reduced 10% in the period 1990-2018. Despite the environmental impact in Latin America, it is important to mention that the common interest of the region is to maintain its role as one of the largest food producers on the planet. The need to reconcile the nutrition of the inhabitants of the Earth and preservation of the environment was discussed as a pending task for the social actors linked to agricultural production.

**Keywords: Production, Trade, GDP, Market, Latin America, Export, Imports, Environment, Land, Agriculture, Crops, Hectare, Rural, Livestock, Greenhouse and Population.**



## Table of content

<b>1. Introduction</b> .....	<b>5</b>
<b>2. Objective</b> .....	<b>7</b>
<b>3. Literature Review</b> .....	<b>8</b>
3.1 Latin American agriculture role in the global context.....	8
3.2 Agriculture and the external sectors .....	12
3.3 Regional agricultural production in 21th century.....	15
3.4 The development of the productive forces.....	19
3.5 Food security and Agricultural impacts on the environment .....	24
3.6 Economic impact of illegal crops in Latin America .....	28
<b>4. Methodology</b> .....	<b>32</b>
<b>5. Results</b> .....	<b>34</b>
5.1 <i>Analysis of the main macroeconomic indicators of agricultural productivity.</i> 34	
5.1.1 Latin American Agricultural GDP Performance .....	34
5.1.2 Development of agricultural production.....	36
5.1.3 Hectares of arable land.....	37
5.2 <i>Foreign trade</i> .....	37
5.2.1 Agricultural Exports .....	38
5.2.2 Agricultural Imports .....	40
5.2.3 Agricultural Trade Balance .....	42
5.3 <i>Important aspects with a significant impact on agricultural production</i> .....	44
5.3.1 Yields of Main Crops per Hectare .....	44
5.3.2 Livestock Indicators.....	47
5.3.3 Wage/ worker in Latin American Agriculture .....	49
5.4 <i>Agriculture Productions and its impact on rural populations</i> .....	50
5.4.1 Agricultural land.....	50
5.4.2 Rural population development .....	51
5.4.3 Percentage of employees by the agricultural sector .....	51
5.5 <i>Environmental influences</i> .....	52
5.5.1 Forest Area Reduction .....	53
5.5.2 Fertilizer consumption .....	55
5.5.3 Pollution levels and environmental impact.....	56
5.5.4 Organic Farms .....	58
5.6 <i>Analysis of illegal crops in Latin America</i> .....	59
5.6.1 Coca Leaf Production .....	59
5.6.2 Poppy Production.....	61
<b>6. Conclusions &amp; Discussions</b> .....	<b>63</b>
<b>7. References</b> .....	<b>66</b>

# 1. Introduction

This work examines the main aspects of the evolution and recent transformations of agriculture and food in Latin American countries.

The analysis carried out has taken into account some relevant aspects of the new world agricultural framework, which have influenced to varying degrees the behavior of national agriculture.

Regional agriculture presents a combination of progress resulting from the use (Partially) of its potential and unresolved problems, which could be worsening. Economic progress is evident; its dimensions have increased significantly in the last decades.

The technical progress is notorious and at the same time diverse according to the region where it takes place. The strong generation of capital in the Business productive units has made possible much of the productive expansion achieved until now. Similarly, international cooperation through foreign investment and development programs led by international organizations, have also made a great contribution to the growth of agricultural production in Latin America.

The coexistence of this material progress together with the persistence of rural poverty is the most striking negative feature of Latin American agriculture. Nevertheless, it is important to mention that agricultural growth has an impact on reducing poverty. This leads us to think, to define clearly and constantly that a sustained growth in agriculture is a necessary condition for reducing poverty, at least for the rural population.

Latin America has more than 175 million hectares of arable land, but a negligible entire land area of Latin America part is distributed in mountains, deserts, swamps, jungles and other landforms in which human life is very difficult. To meet the challenge of feeding a growing population, the United Nations Food and Agriculture Organization (FAO) considered that it should increase the agricultural area in Africa and Latin America over 120 million hectares, but according to its own estimates (FAO) possibly is expected a reduction of the agriculture are by 50 million hectares.

These estimates leave a question mark and uncertainty in world trade, since Latin America is called to lead food exports to the world in the next 20 years. This could encourage Latin

American governments to relax trade rules and to undertake safe, efficient and productive policies to motivate agricultural production, especially in places like Colombia where it is estimated that around 170 thousand hectares are used for illicit crops.

The private economic sector could play an important role in the agricultural development that the world expects to take place in Latin America. Since the private sector manages economic, human and manage knowledge resources in world trade. This change could make the agricultural sector in Latin America a more important economic sector, better creator of wealth and generating quality jobs so far.

This last mentioned is very important, since Latin America is the third region in the world with the worst wages in the agricultural sector in the world, only behind Africa and Asia.

Finally, I would like to make it clear that this document offers a technical analysis of the trends in agro-food trade in the Latin American and Caribbean region. However, the pandemic of the coronavirus disease (COVID-19) is not studied in depth, as the crisis continues its course and a general technical analysis of its repercussions would lack data beyond estimates.

## 2. Objective

The general objective of this thesis is to analyze and understand the new territorial, economic, environmental and political dynamics of the Latin American region, generated because of the consolidation of the dominant agricultural production model of the last decades.

Also to evaluate the economic impact of the agricultural industry and government strategies.

The following are specific objectives:

- Analyze the role of Latin America agriculture in terms of regional GDP.
- Analyze the influence of exports and imports in the productive models of Latin America.
- Analyze the trade balance and its impact on the Latin American economies.
- Describe and understand the impact of traditional agricultural practices on the environment.
- Analyze some relevant aspects of agricultural production such as main export crops, cereals, agricultural raw materials, fruits and livestock.
- Identify the future challenges of Latin American agriculture in reference to the increase in world population and reduction of rural population
- Identify the greatest production capacity based on the amount of arable land and agriculture land.
- Describe the role of the private economic sector within the agricultural economy.
- Evaluate the generation of jobs in the agricultural sector and the wages allocated to its workers
- Evaluate the social and economic impact of illicit crops in Latin America.

These objectives will help us understand the current situation of the Latin American agricultural sector and identify possible solutions to the problems and challenges that the region faces in terms of agricultural production.

### **3. Literature Review**

#### **3.1 Latin American agriculture role in the global context**

The great changes that are currently taking place in the Latin American agriculture make it difficult to calculate the scope that these changes had in the regional economy. Despite the difficulties derived from the growing heterogeneity that determines important differences in the relevance of agricultural activity within the global economy, their productive orientation, their link with internal and external markets, their dynamism and the economic segments that comprise it.

In the relations of these segments together and with the rest of the economic system, there are still enough common elements that allow Latin American countries to set an overall view in the region. This illustrates on the direction and intensity of economic and social transformation, which has been experiencing the Latin American Agro. (Haar, 2015)

In past decades, due to its size and its own resources, agriculture was a sector of relevant importance in most Latin American economies, while industry was in relatively incipient stages of its development. Therefore, and capital resources being scarce at the time (except in some countries with high mineral or oil exports) and external financial assistance reduced, agriculture should contribute to the growth of other economic activities. To this was added the widespread conviction that the expansion of agriculture could be achieved by making more efficient use of the resources already applied to the sector, as its own capital requirements were rather modest. (Pascual, 2003)

The industry of manufacturing has been, without a doubt, “the Sector” with the greatest dynamism in the development of the Latin American economic system during the decades. Agriculture, for its part, has played an important role: it has contributed significantly to this dynamism of the industrial sector. He continues to play the same role, the economic dimensions are quite higher than those had in previous decades, but despite those facts, no longer occupies the prominent place.

The growth in terms of the quantity of production in this sector in Latin America has generated better economic income that has an impact on the reduction of poverty and there has been a debate about it, generating "controversy" in this regard. However, despite the growth in production, in the economic area this sector has lost strength and relevance in the local and international economy. (Foster, 2010)

#### *Latin American agriculture in the world's GDP*

The agricultural sector in Latin America has a very short participation in the world's economy. Latin America and the Caribbean represents 8.0 of the global Gross Domestic Product (GDP), while this percentage only 0.36 percent belongs to the Latin American agricultural sector. This share has decreased by 1.4 percent compared to the 90's decade. This line of traditional economic development with a downward trend has impacted all the countries of the region except Argentina (FAO, 2019). This last country, unlike the other countries in the region, has kept the percentage of share of agricultural production in GDP at an average of 6 to 9 percent during the last 2 decades. (FAO, 2019)

Latin America's performance as a region has generated an average growth of 2.7 percent over the last 20 years. This speed for economic growth can be considered faster than the OECD countries (1.2% per year) but it is much slower than the average growth of other regions in the planet. To give an example, the average growth in regions such as Asia Pacific is about 3.4 percent and for sub-Saharan Africa the growth reached 4.6 percent. (World Bank, 2020)

#### *Latin America's position in world agriculture production*

Latin America is an important player of agricultural commodities to the world, accounting for an estimated 16% of global food and agriculture exports. Moreover, with an expectation of growth in the coming decades.

From now until 2050, global food production will have to increase by 60% to meet the nutritional demands of more than 9 billion people. This represents an opportunity for Latin America and the Caribbean to consolidate its position as one of the main food suppliers in the world. Nevertheless, the fast evolution of agricultural systems poses important

challenges that will require an intervention from the public and private sectors in front of them. (Pizarro, 2020)

In addition, it is important to take into account that this growth in agricultural production affects both the international markets and the domestic markets of Latin America.

For several Latin American & Caribbean countries, the expansion of the domestic market has been determining in a crucial way the agricultural productive behavior and its composition. For other countries, their agriculture has continued to internationalize. In both cases, national agriculture has been impacted not only by the repercussions of requirements for higher volumes produced, but also by the characteristics and composition of the markets on which it depends. (Pascual, 2003)

Due to its vast extension, varied topography and rich biodiversity, Latin America and the Caribbean presents the most diverse and complex range of agricultural systems in the world. Sixteen major systems have been identified and these are briefly mentioned below:

Irrigation, Based on the Use of Forest Resources, Mixed and Coastal Plantation, Intensive Mixed, Mixed Cereals-Livestock (Fields), Temperate Humid Mixed with Forest, Corn-Bean (Mesoamerican), Intensive Mixed Mountain (Northern Andes), Extensive Mixed (Closed and Plains), Mixed Temperate (Pampas), Dry Mixed, Dry Mixed Extensive (Gran Chaco), Mixed Highlands (Central Andes), Grazing, Scattered (Forest) and Based on Urban Areas. (FAO, 2019)

#### *Productive land in Latin America.*

Latin America and the Caribbean is a region that has more than 2 billion hectares divided into 34 countries. This region represents in global terms 15 percent of the earth's surface; it also receives 30 percent of the global rainfall and generates 33 percent of the world's water. These characteristics make Latin America a place with a giant reserve of arable land. Due to the enormous territorial extension and biodiversity, it becomes one of the best agricultural complexes in the world. (Bravo, 2015)

The countries with the largest amount of productive lands are Brazil with around 80 million hectares, Argentina with 39 million hectares and Mexico with 22.5 million hectares, but there are other countries such as Peru and Colombia with long extensions of

land. Colombia for its part could release in the future between 3-4 million hectares, used in the armed conflict. (World Bank, 2020) It is important to mention that other countries in the region have maintained a gradual growth of their arable lands, due to the implementation of good practices to preserve their arable lands. These countries are Paraguay, Bolivia and Cuba. (Bravo, 2015)

However, the region has also experienced land degradation issues such as the loss of natural soil nutrients, salinization, erosion and desertification. Close to 20 percent of Latin American, soils are at risk of erosion. (Nation, 2014)

In Argentina, erosion affects 25 million hectares, and humid plains farmers often incur huge economic losses because of soil salinization. Erosion also represents a major challenge for 19 percent of Mexico's territory, 43 percent of Cuba's, 30 percent of Uruguay's, 50 percent of Ecuador's, and 75 percent of El Salvador's. Because of its large share of agricultural land located on hillsides, Central America has been particularly vulnerable to erosion. (United Nations, 2020).

Desertification affects 17 percent of Colombia's territory, 28 percent of Ecuador's, 62 percent of Chile's, and poses significant challenges to some vulnerable regions, such as Brazil's northeast. In order to deal with land degradation. Degradation is also associated with poverty: 40% of the world's most degraded lands are in areas with high poverty rates. Poor farmers have less access to land and water, working soils of poor quality and with a high vulnerability to degradation. (Nation, 2014) Several farmers have adopted Conservation Agriculture, an approach that follows three main principles: a) no or minimum tillage, b) soil cover and c) crop diversification / crop rotation. (United Nations, 2020).

In 2015, was celebrated the International Year of Soil, where some Latin American countries committed to some goals in the future that help preserve soils. (Nation, 2014).



### **3.2 Agriculture and the external sectors**

Latin America is responsible for 16 percent of exports and four percent of world agricultural trade imports. Latin America faces great challenges to take advantage of its great productive potential and achieve sustainable development. This percentage of exports has become Latin America the world's largest net food exporter, surpassing North America at the beginning of 2000, and since then it shows an upward trend, according to a new report from the United Nations Organization for Food and Agriculture (FAO). (Libre, 2016)

In addition, other studies by various international organizations, such as FAO, CELAC, and the WTO, show that Latin America will lead the increase in agricultural production until 2025, with an annual growth rate of 1.8 percent. (FAO, 2019)

The agro-food trade in Latin America and the Caribbean varies from one sub region to another. The countries of South America are net exporters of agro-food products, with the exception of the Bolivarian Republic of Venezuela and Suriname; the Caribbean countries are net importers, and the majority of Mesoamerican countries are net agricultural exporters, with the exception of El Salvador and Panama. This is the source of various vulnerabilities, dependencies and priorities in the field of international trade. (FAO, 2020)

Although the opening of trade offers opportunities to access markets located beyond national borders, the high degree of dependence on agricultural trade (within of total trade), a limited number of exported commodities or a limited number of trading partners can also increase the vulnerability of countries to shocks in international markets, for example by expanding their exposure to potentially large declines in income from exports or drastic increases in import costs. Trade shocks can arise as a result of abrupt changes in trade policies, sanitary problems (such as the repercussions of the COVID-19 pandemic or African swine fever), and phytosanitary products (such as the wilt of the tropical race 4 banana [TR4]) worldwide, fluctuations in the exchange rate or variations in climatic conditions. (FAO Media, 2020)

Taking advantage of new business opportunities within and outside the region can contribute to reducing these vulnerabilities. The current low degree of trade integration between some subregions of Latin America and the Caribbean and the high degree of complementarity between their trade structures, they are indications of the considerable potential for new regional trade agreements and flows. In this way, expanding regional trade

integration among certain groupings of countries can boost agri-food trade and diversify business partners. (FAO Media, 2020).

To expand this analysis, we will enter to study the most important aspects in the trade of any region; Exports, Imports and Trade Balance against regions.

### Latin American Agro Exports

In the 1970s, the agricultural volumes exported by Latin American countries increased approximately 2.8% per year, between 1950 and 1972 they did so at 2.9% per year, while the world rate was almost 5% per year in past decades.

Latin America's share of world agricultural exports, which had been declining in the 1980s and late 1970s, but remained relatively constant in the 1990s and 2000s at around 12-14%. Due to the slowdown in the growth rate of African exports, sales from the Near East stagnated, there were changes in the composition and diversification of Latin American exports and the achievement of greater efficiency in the production process that has placed the region in better conditions to compete in international markets. (Giordano, 2019)

The most exported products from Latin America are seven products; Bananas, beef, coffee, corn, poultry, soybeans and sugar, in order of importance - contributed more than 50% of agricultural exports during the last 2 decades. Despite the diversification of exports achieved, about 35% of the countries' export earnings came from three products: coffee, bananas and soybeans. Exports continue to go mainly to developed countries. In 2018 it was estimated that around 25% went to the United States, 14% to Europe, 8% to China and 15% to developing countries and those with centrally planned economies, and the remaining 38% constituted international trade with other world regions. (IICA, 2020)

Many countries in Latin America and the Caribbean are highly dependent on agriculture for export earnings, especially in South and Central America. When a large share of export earnings comes from agriculture and a very small number of agricultural commodities, economies are exposed to shocks that can arise from certain export destinations or world commodity markets. These longer-term shocks or depressions can directly translate into macroeconomic shocks that affect the performance of Latin American economies, their gross domestic product (GDP) growth, and inflation rates or even their exchange rates. (FAO, 2019)

### Latin American Agro Imports

The agricultural volumes imported by Latin American countries increased by 8% per year in the 1970s - they did so at 5.3% per year between 1965 and 1976 - and by 10% per year between 1975 and 1980. But in the last 20 years it has declined significantly by as much as reach 4% in 2016. The slowdown in the growth rate was due to the growth of agricultural production in Latin America and the improvements in its capacity to reach it.

Agricultural imports reach 8.9% of the regional supply. However, the part corresponding to different subregions is heterogeneous. In Mesoamerica it ranges from 6% in Mexico to 30% in Panama, and although most South American countries spend a very small part of their export earnings on agricultural and food imports, the average exceeds 32% in the Caribbean and 80% in the small Caribbean islands. (FAO, 2020)

A third of the agricultural products imported by Latin American countries comes from the same region and just over 60% originates from developed countries, such as the United States, the European Union and China. This dependency is aggravated by the fact that these supplies are handled by a small number of large export companies that concentrate the supply. Specifically in the Caribbean Regions, the share of export earnings spent on agro-food imports drops considerably when tourism is taken into account. These net importing countries depend on foreign exchange earnings from tourism to finance their food imports. The vulnerability derived from dependence on the commercial sphere has been revealed during the COVID-19 crisis to the extent that the decrease in income derived from the stoppage in tourism has endangered food security in these countries. (FAO, 2020)

### Economical trade balance of Latin American agriculture

The current dollar value of agricultural exports from Latin American countries would have gone from 6.8 to 23.1 billion between 1969/71 and 1977/79. Currently they are estimated to exceed 200 billion dollars. In 2016 it is estimated that the value in dollars of Latin American exports exceeded 270 billion dollars. The value of imports would have increased from 1.7 in the 1970s to less than 50 billion dollars in 2016. The balance in favor of the region would

have gone from still being favorable for the region to despite the increase in imports. (FAO, 2020)

Most of the countries in Latin America and the Caribbean also depend on a very small number of partners, a high concentration compared to international levels. Most receive more than 50% of their imports from just three suppliers, and a large part send more than 50% of their exports to just three destinations. Over the last 20 years, the subregional evolution has been heterogeneous. Practically half of the countries switched to depend more on their export destinations and import sources, while the other half became somewhat less dependent, which could represent a very big commercial challenge for the region. (Solution, 2021) The high level of dependence on agriculture, certain products and a number of markets outside the region provide challenges in the area of dependence that must be addressed. In principle, there are options to effectively maintain these high levels of dependency and options to modify them. For the former, measures such as greater access to risk management instruments could be adopted, while the latter entails diversifying production patterns and trade destinations. (Giordano, 2019)

### **3.3 Regional agricultural production in 21th century.**

The marked changes and uncertainties of global scope that occurred in the economic, social and political spheres during the last decade and more clearly in the second half of the decade had an intense impact on the international agricultural markets of technological and financial products. Through those changes, the markets had a diverse and profound impact on the agricultural production process of developed countries and in developing countries. Latin America did not escape these repercussions. When the exported fraction of a product exceeds a third of the regional total produced, the impact of external market conditions on the production process is notorious. Therefore, before entering into the examination of what happened with regional agricultural production, a brief account of world agriculture is presented. (Foster, 2010)

*Relevant aspects of the new world agricultural order.*

The period from the beginning of the 1950s to the 1970s was generally one of definite and stable growth in world agricultural production and in particular in food production, which was accompanied by an unprecedented growth in food consumption. In the last 10 years it was raised for world agriculture; the way to reconcile and the need to increase the income obtained from the exports of agricultural products, with that of improving the income of agricultural producers in both developed and developing countries, while maintaining greater stability and strongness in international markets and thus a better balance between supply and demand worldwide.

One of the most important and influential aspects of agricultural production is the growth of the world population. The world population will grow from the current six billion people to 8.3 billion in 2030. (FAO, 2016) The population will grow in annual average of 1.1 percent until 2030, a slower pace than the previous annual average of 1.7 percent during 80's or 90's. Consequently, the increase in world demand for agricultural products would have to decline further, the annual average of 2.2 percent in the last thirty years to 1.5 percent annually until 2030. This will represent a challenge in terms of production for Latin America, since the regions expects to maintain the growth of agricultural production despite, the recommendations. This growth, according to experts, should not represent a problem, due to the notorious decrease in the agricultural sectors in Europe and the United States. (FAO, 2016)

Another important aspect is the growth of productive land based on current demand. Expansion of arable land for food production must grow more slowly than in the past. In the next 30 years, developing countries will need another 120 million hectares for crops; this means less new land, comparatively, than in the past. The expansion will take place mainly in sub-Saharan Africa and Latin America.

It is also worth mentioning that among the group of important aspects that influence agricultural production in the 21st century. New practices that guarantee effectiveness, productivity and are friendly to the environment. Modern biotechnologies could serve to improve food security. If the potential dangers that biotechnologies can pose to the environment are addressed, and if the technology is made available to the poorest and most

undernourished, and if these technologies are geared towards meeting the needs of those with fewer resources, modified varieties Crops can help to strengthen agriculture in marginal areas and to restore production on degraded lands. FAO has called for effective testing and safety protocols for genetically modified organisms, in order to respond to consumer concerns. (Arias, 2020)

As the last important aspect in the new agricultural world, order is the use of water. Globally, there is still plenty of water available, but some regions will have to face severe restrictions. Between now and 2030, a 14 percent increase in water abstraction for irrigation is expected in developing countries. Irrigation is critical to food stocks around the world. The irrigated area in developing countries is likely to grow from 202 million hectares today to 242 million hectares in 2030. (FAO, 2016)

One in five developing countries will suffer issues with water scarcity. These regions will have to use water more efficiently. Agriculture takes 70 percent of all fresh water withdrawn for human consumption. Saving water in agriculture means that more water will be available in other sectors.

### Regional productive behavior

For several Latin American countries, the expansion of the domestic market has been crucially determining the agricultural productive performance and composition. For other countries, agriculture has continued to internationalize. In both cases, national agricultures was impacted not only by the impact of requirements for higher production volumes, but also by the characteristics and composition of markets that depend basically.

As we have already mentioned before, Latin American agricultural production represents only 0.36% of the world gross domestic product in 2019 and the participation of the agricultural sector in Latin American GDP was 4.8% in the same year. The analysis of the productive evolution through the growth of domestic product sector gross, according to national accounts, suffers from several limitations, including the inability to explain what happened with various production lines and the difficulty in identifying and weighing the causes that have given the dynamism or stagnation of these stands. Therefore, it is better to examine the productive behavior of agriculture based on the physical volume by products. (FAO, 2020)

If we examined in terms of the gross value of Latin American per capita production, it could be classified as relatively dynamic; reached 0.8% per year. However, it is insufficient compared to the potential demand for food in Latin American society, which includes around 45 million malnourished; has grown less than effective demand, which would have grown by 3.6% per year. (FAO, 2020)

The productive behavior can be different according to agricultural area. The crops grew will go slowly than the livestock. The evolution by production lines shows marked differences between product groups; some have been dynamic, others of slow growth and some have registered reductions. Four groups of vegetable products grew faster than the population: oilseeds, vegetables, fruits and saccharin. Within the livestock farms, poultry and pork, eggs and milk did well. Cereals, stimulant drinks, dried legumes and beef grew slightly less than the population. Finally, in roots and tubers and in vegetable fibers (excluding cotton) production has fallen. (Arias, 2020)

#### *Bases of the agriculture behavior (Latin America)*

The growth in production continues to sustain mainly by the increase in the harvested area. However, there has already been an upward trend in the contribution of productivity to the total produced. In the 1960s, the expansion of the area contributed two-thirds to the increase in harvest, with the remaining third coming from the increase in yields. In the 1970's that relationship has changed significantly. In the current times, Three-fifths now come from the expanded area and two-fifths from the improved yields. (FAO, 2019)

It is estimated for Latin America; a bit more than a third of the arable agricultural area is used. The largest land reserve in the world. About 75% is located in the humid tropics where the soil is known by its low natural fertility and its fragility, in the subtropics it is located 24% and the remaining 4% in the temperate sub region and in the temperate sectors of the mountain ranges Andean. Slightly more than half (54%) of the arable land reserves belong to Brazil; Argentina, Mexico and the countries of the Andean Group concentrate a large part of the rest. (Gómez, 2018)

However, most of the regional agricultures have raised their unit yields. A combination of factors has contributed to this, such as the maturation of an organic research work and the dissemination of their results, especially with regard to the genetic improvement of plants, the application of new fertilization and pest control techniques, and advanced cultivation

methods. (Gómez, 2018) We cannot forget the advances derived from the more efficient organization (both technical and economic) of business-type production units. However, there agricultures that during the ten years examined have not succeeded in raising an important measure performance; if they notice is effective progress in some crops, which fail, however, influence the average level of productivity of the whole land harvested.

The increase of physical capacity of production was possible by good technical progress applied. This has been diverse according to the characteristics of each production line, its requirements in technical inputs and the importance of each technological package adopted, measured by the number of its components and by the degree of interdependence between them. (Giordano, 2019)

### **3.4 The development of the productive forces**

Important changes have occurred in the agricultural productive forces over the last 20 years. Some have been more obvious, others have been obscured by the characteristics of the agricultural sector and, finally, others have gone unnoticed, confused within the behavior productive sector. Perception (sometimes incomplete) of those changes allows, on the one hand, appreciate how it has been accentuating the productive and social differentiation among economic agents directly involved in the production process.

To simplify the analysis, attention is focused on the two most important segments: private business and family farms. The processes of agrarian reform and other redistributive actions of land and water have influenced the evident process of deconcentrating of land ownership and the consequent expansion of the intermediate segment, which reflected in the increased number of small-sized economic units to medium. However, its relative importance is still secondary compared to that of the business community and family farms. (Chavarría, 2017)

The business segment groups together those forms of farming that commonly are identified as modern commercial agriculture, plantations, and farms. The family farm segment also groups very diverse productive realities, such as small affluent farmers, small family producers, and poor farmers in secular agricultural areas, settlers in areas of expansion of the agricultural frontier and others. (FAO Article, 2019)



### *The Business Segment*

Latin American agricultural entrepreneurship is a reality highlighted by clear differentiations throughout the history of each country. However, they can be distinguished from other economic sectors and from the family farmers by many characteristics that is mentioned below.

Proper changes in the passage of time add new features that have to do with their greater homogeneity as segment producer; the medium to large economic enterprises and their degree of control over productive resources, the size of its capital, the composition of their dives, complexity and even sophistication of technological systems adopted.

The degree of specialization respect to production lines that generate changes in their characteristics as; the labor modalities to which they take refuge to avoid social conflicts, the excessive amount of interrelations with non-agricultural spheres, in particular financial, industrial, commercial and with the media. (Chavarría, 2017)

Finally the strengthening of the ties that unite them to groups close to the centers of power and decision, with a view to maintaining a vigilant presence in the official spheres responsible for agricultural and rural development. They are selective regarding the location of their lands, regarding both natural fertility and favorable topography, as well as proximity to markets.

An indirect way to evaluate the development of the enterprise segment is analyzing the distribution of arable land in Latin America. Large, export-oriented capital-intensive farms coexist with small, labor-intensive, subsistence-oriented farms. Out of the estimated 20.4 million farms in the region, 81.3% are smallholder family farms, occupying only 23.4% of agricultural land. Conversely, 18.7% of all farms own 76.6% of total agricultural land. (Salcedo, 2018)

This expansion of the agricultural business segment has led above farm size averages to do not consider land renting, a common practice in some countries such as Argentina, whose “seeding pools” may manage farms of several thousand hectares, or Mexico, with its long established transnational agribusinesses that, through contract farming, implicitly control the whole production process of several thousand hectares. (Salcedo, 2018)

Another example, Peru reported land fragmentation in the past couple of decades; one single economic group manages farms that range from 1.240 to 8.858 ha in the fruit and

vegetable export sector. In Brazil, where land fragmentation was also reported, a single farmer was able to plant 223 000 ha of soybeans. (Salcedo, 2018)

In addition to land concentration, a relatively recent phenomenon appears to be increased foreign investment in agricultural land. Foreign investors have not only come from outside the region but also from within the region. Brazilians and Argentinians are producing soybeans, livestock and forest products in Bolivia, for example. Brazilian investors have acquired land not only in Bolivia, but also in Paraguay, Colombia, and Uruguay. Mexican, Costa Rican and Guatemalan investors are engaged in forest, cattle, rice, sugarcane, citrus and oil palm fruit production in Nicaragua, to name a few examples. (Chavarría, 2017)

In both cases, land rent and increased land acquisition by foreign companies make agriculture reach thousands of hectares in production. These expansions produce changes in the structure and dynamics of the region, as well as an increase in land concentration. On the one hand, could be positive in economic and productive terms because it positions the private sector with over 75% of farm income in the region. On the other hand, it could become a social challenge for Latin America. (AGENCIAS, 2020)

### *The family farms Segment*

Rural agriculture, as an agricultural productive force, has a significance and undisputed importance. Various investigations, some completed on specific cases and others still under way, explain the dynamics of its operation and demonstrate its articulation within the accumulation model of the global economic system.

Family farm agriculture is characterized because the fundamental motivation of its economic activity is to ensure a level of family income that allows its workforce to reproduce and to replace its tools and farm implements. Family work constitutes the basis on which the organization of productive work is based, with which the production, simple or extended, of the family unit is sought.

Progress around the physical integration and development of related infrastructure, which have facilitated the exchange, displacement, have allowed family farm agriculture open spaces wider, and have a new perspective on their own possibilities and difficulties. The expansion and organization of markets has affected traditional lines of production, has stimulated new ones and has altered, sometimes drastically, productive linkages and, finally, government interventions aimed at modifying agrarian structures through agrarian

reform processes, as well as the actions of government's agricultural support services, which in one way or another have generated changes in the family farm agriculture. (Varangis, 2015) The importance of family farm agriculture in Latin America and the Caribbean is indisputable. The results of various studies confirm this. Most of these studies shows that family farm agriculture groups about 81% of the farms registered in Latin America, provides at the country level, between 27% and 67% of the total food production; it occupies between 12% and 67% of the agricultural area, and generates between 57% and 77% of agricultural employment in the Region. (Chavarría, 2017) Even though family farm agriculture has been the subject of numerous studies that seek to deepen knowledge of the sector, the truth is that in most Latin American countries there are no quantitative data that allow it to be specified and dimensioned with certainty. Most of the agricultural censuses in Latin America do not consider in their designs variables typical of family farm agriculture that allow setting an exact profile of the sector in the countries of the region. (Salcedo, 2018)

The path of the family farms over the last 20 years has shown its capacity for change in the face of the isolated or combined incidence of phenomena and processes of diverse nature and intensity. These include population dynamics and migratory movements; the greater interaction of the urban with the rural, whose repercussions have modified the aspirations and economic activity of the farmers as well as their relations social.

The Latin American agricultural boom has not stopped migration from rural areas to cities nor to countries outside the region. During the late 1980s, the rural population in the region stopped growing and a few years later started to decline slightly. The number of people living in rural areas in 2017 (126 million) equaled that recorded in the mid-1970s. Latin America has thus become increasingly urban, with 80.4% of its 644 million inhabitants living in urban areas. Much of the population's migration to the cities has come from the male population, in different studies estimate that rural farms headed by women have grown around 40% between the years 2002 and 2014. (Chavarría, 2017)

Among the positive things we have seen in the last 25 years, Latin America witnessed continuous improvement in rural poverty reduction (20% points from 1990 to 2014). Some countries were able to reduce rural poverty significantly such as Brazil (42% points from 1990 to 2014), Ecuador (39% points from 2000 to 2014), Chile (32% points from 1990 to 2013) and Peru (27% points from 1997 to 2014). (Salcedo, 2018) Economic growth, public investment in infrastructure and public services, and the implementation of social

protection programs, mainly conditional cash-transfer programs which, by 2015, covered about a fifth of the Latin American population, largely explain these achievements. This positive poverty alleviation trend, including the narrowing of the rural/urban poverty gap, stagnated in 2014-2016 and reversed in some countries.

Paradoxically, being an agricultural and food surplus region, Latin America witnessed the number of food insecure population increase between the years 2015 – 2018. Rather than the physical availability of food, the affordability of food to poor consumers has become the swing in food security trends in the region. (Salcedo, 2018)

### *The role of the state segment*

Without entering into the discussion related to the degree of efficiency of the Governments as the organizer of agricultural development, it can be affirmed that Governments had a relevant participation in the expansion of agricultural production. In recent decades, their responsibility and participation in the economic and social fields of agriculture has been increasing in most countries of the region. On the other hand, government's intervention in agricultural markets was strongly criticized. Among other considerations, the arbitrariness of such interventions, their high costs and the resulting distortions have highlighted, many of the social problems affecting the life and productivity of the agricultural sector.

Latin American governments have pursued a number of agricultural policy objectives according to their own visions and changing socioeconomic and political contexts. Objectives have included improved productivity and competitiveness, food security, environmental protection, access of smallholder farmers to markets and increased foreign exchange earnings. Governments have used an array of policy instruments to address their policy objectives. One of the instruments is financial aid and subsidies for small, medium and large agricultural producers. These measures aim to alleviate the production costs of farmers and obtain more benefits from the harvest of their production. (Chavarría, 2017)

Producers' dependence on government aid and subsidies varies widely in different parts of Latin America. For most countries, the estimate of producer support (PSE) as a percentage of gross farm income is lower than the average recorded by the Organization for Economic Cooperation and Development (18%). Support is less than 5% in several countries, including Brazil, Chile, Guatemala, Paraguay and Uruguay. Argentina has a negative

percentage, which is an indication that government policies tax the country's producers, this list has some exceptions like Panama, Peru, Dominican Republic and El Salvador where the support reach more than 18%.

In Latin America, assistance comes mainly from measures to support market prices and input subsidies. Mexico is an exception by providing half of its aid through direct payments to farmers. Use of direct payments is also made in Brazil, Chile and Paraguay. However, the overall rate of support provided to producers is low in these countries, which is a symptom of the competitiveness of agriculture. (Varangis, 2015)

Another category of support for agricultural producers is the investment in technological development, education, infrastructure and promotion of regional agricultural products. These investments can be estimated by using the GSSE (General Services Support Estimate) metrics. (Glossary, 2021) Spending in this latter category is just 15% in Mexico, but 85% in Costa Rica. In general, Latin America region would appear to be under-spending on public goods with the potential to accelerate agricultural development. (FAO, 2019)

Finally, would be very nice to mention that the allocation of investments to agriculture requires proper diagnostics and evaluation. Evaluation is probably the link in the policy cycle that suffers the most. Sometimes multimillion-dollar programs are inadequately evaluated or not evaluated at all. (FAO Article, 2019)

### **3.5 Food security and Agricultural impacts on the environment**

#### *Food security*

Food security is a measure of the availability of food and individuals ability to access it. According the United Nations Committee on World Food Security. In this case, the region in analysis is Latin America.

Having adequate levels of food production is one of the most important factors in ensuring the achievement of security food and nutrition. Latin America has been characterized over the last decades for having more than enough food to meet the needs of its population.

However, this situation differs between countries and sub regions, showing different thresholds of domestic production, so that trade plays an important role in food and nutrition security. Food trade is also an opportunity to exploit synergies between the countries of the region and other regions, and ensuring the availability of food. (Rapallo, 2017)

The variety of food availability differs between countries and not necessarily respond to their productive capacity. Thus, factors such as trade and the food environment are key to establishing a supply of healthy foods.

Evaluating food production by sub region, it is observed that in the per capita production rates (Production growth vs. population growth), there is clearly an upward trend in Latin America of almost 100%, beyond some falls in some specific periods. The Caribbean region, after a significant decline during the 1990s, has seen a significant increase since the mid-2000s.

The outlook for the growth of agricultural production for the coming years is favorable. The region has natural resources to continue growing. In terms of productivity when comparing the yields of Latin America with other producing regions, important gaps are observed. These indicate that the region still has a wide margin to grow in this area. (Rapallo, 2017)

### Food access

Latin American food productions continue to be, the main component of the food supply in Latin America and one of the largest in the world. Latin American agriculture has been progressively articulated and integrated into domestic markets, which has diversified food production in the region.

The region produces enough food to meet the needs of all its population. The central problem of hunger in the region is not the lack of food, but the difficulties that the poorest face in gaining access to it.

Among the social groups most prone to these effects, are rural populations. Indigenous peoples for example, have contributed as no one else to the domestication of Agrobiodiversity that today feeds humanity; however, their indices of food insecurity are several times higher than that non-indigenous population. This problem is caused mainly by the market prices applied to local products. Many of these prices are very expensive compared to the income of these populations. Another important sector of the population that has been affected by access to food are rural women. (FAO Articale, 2020)

The Latin American women are responsible for almost half of food production. They play an important role in preserving biodiversity and ensure food sovereignty and security from the production of healthy food. However, living in social, political and economic inequality with only 30% of ownership of the land, 10% of loans and 5% of technical assistance. (FAO Articale, 2020)

The most vulnerable sectors assign a greater proportion of their income to the purchase of food, and in turn have a lower capacity to save. Unemployment could increases the prices of food and other basic items, or a decrease in their income, can significantly worsen their living conditions. This can mean an impoverishment in the quality of the diet, leaning towards less expensive but also less nutritious foods with a higher caloric concentration, putting the food and nutritional security of the whole household at risk. (FAO, 2010)

Despite this fact, there are significant improvements in hunger reduction. According to the latest FAO estimates, 805 million people suffer from hunger in the world (2012-2016). This is a decrease of more than 100 million in the last decade, and 209 million less than in 1990-1992. (FAO, 2020) In Latin America and the Caribbean, this phenomenon affects 42 million people (6.1% of the population), a significant advance compared to the 68.5 million people (15.3%) who suffered from hunger during 1990 -1992 . (Rapallo, 2017)

### *Agriculture and the environmental impacts in Latin America*

Agriculture plays a fundamental role in the economy and society of Latin America. In this context, it is expected that climate changes anticipated for this century exert additional pressure on the environmental conditions under which agricultural activity takes place. This means that if these impacts are not addressed adequately, it could lead to considerable economic and social consequences in the region.

Among the climatic changes relevant to agricultural activity that are visualized under the most common scenarios are; increase in atmospheric/soil temperatures, alterations in CO<sub>2</sub> concentrations on the atmosphere, rise on sea level, changes in the hydrological cycle as well as in the quality of the water and its availability, intensification/increase of extreme climatic events (among them droughts and floods), and modifications in the altitude level of the dew points, among others. (Moreno-Moreno, 2018)

Some of these changes are gradual and unidirectional, which means that they will manifest themselves over time at a rate that is still uncertain but whose direction is known.

These environmental changes generally affect three areas of the ecosystems: Land, Water and Air.

Latin America is one of the regions in the world with the greatest agricultural land resources, especially South America where countries like Brazil and Argentina have first-rate land extensions. However, the region has experienced in recent years a problem of land degradation such as the loss of natural nutrients from the soil, salinization, erosion and desertification.

About 20% of arable land is under risk of erosion, it is also estimated that land desertification is affecting countries such as Colombia, Ecuador and Chile mainly for around 35% of arable land. (FAO, 2020)

In order to deal with land degradation, several farmers have adopted Conservation Agriculture (CA),

Conservation Agriculture practices, however, has posed additional challenges to farmers and governments. For farmers, this approach, being capital intensive, demands having access to sufficient financial resources. In addition, Conservation Agriculture practices is heavily dependent on herbicides, especially on the use of glyphosate, and some governments are now considering the possibility of banning the use of this herbicide. (Vergara, 2015)

Latin America is a region with abundant water resources. Agriculture in the region uses around 68% of fresh water and more than 90% of agriculture uses the irrigation method known as rain fed. However, population growth has put considerable pressure on the water available for agricultural irrigation systems. The rains are expected to decrease because of the climatic changes. (Vergara, 2015)

Irrigated land accounts for 8% of total cultivated land in South America and 7% in Central America, compared to 17% in the world. Subsidies from different Latin American governments on irrigation systems have drastically reduced in recent years, resulting in bad practices regarding the use of water resources. The region is expected to change these positions and can help conserve such an important resource as water. (Varangis, 2015)

For agriculture in Latin America, the effects of climate change could mean a reduction in yields and livestock, putting the world's food security at risk. However, agriculture also contributes to climate change, notably with greenhouse gas emissions. The World Bank estimates that 24% of greenhouse gases in Latin America for 2015 were derived from



agriculture. Even in some countries, cases such as Uruguay where greenhouse gas emissions can reach 75% of the total. (World Bank, 2020)

Within agriculture, livestock production plays the major role in greenhouse gas emissions. Across regions, Latin America report the highest levels of greenhouse gas emissions, owing to a large extent to the region's specialization in the production of beef. (World Bank, 2020)

Regardless of their level of contribution to total greenhouse gas emissions, actions are urgently required in order to reduce greenhouse gas emissions from agriculture.

There are many examples of how agricultural production can grow in a sustainable way, following practices such as CSA (Climate smart Agriculture) that have a positive impact on the environment. In addition, the participation of governments is very important for the development of sustainable agricultural practices. Government support in terms of clear laws for environmental protection and economic contributions to farmers who use sustainable practices on their farms could be key to halting the effects of climate change. (O'NEILL, 2016)

### **3.6 Economic impact of illegal crops in Latin America**

The problems related to the production, trafficking and consumption of drugs in Latin America affect the quality of life of the population. These problems are linked to forms of social exclusion and institutional weakness, generate greater insecurity (violence) and influence governance in some countries.

These factors lead to social problems in some of the rural and agricultural areas of Latin America, creating an illegal economy that generates many inconveniences for real agricultural production.

#### **Root cause**

Illegal rural economies develop more deeply in the territorial peripheries. These territorial peripheries are characterized by their institutional failure, lack of political representation, poverty and violence. The state monopoly of security is disputed and there is a territorial control, led by some irregular armed group, which is a perfect condition for these illegal economies develop. In these territories, criminals represent the only source of external

private investment on a significant scale, which generates trust and commercial exchange and, together with the ability to exercise violence, create a perfect kind of monopoly of the any rural production. (Aranda, 2012)

In the case of coca, from the planting, cultivation and harvest of the leaf, the extraction of the paste, the transformation into coca base, and finally the conversion of the base into cocaine hydrochloride, a cycle in which it is they generate new working relationships with competitive payments to employees, in seasonal collection and processing schemes. As for the poppy, it is planted and once it has matured, the bulb is scratched and the latex is extracted. These value-adding processes generate informal seasonal employment, which hardly happens with legal agriculture in these places. (Aranda, 2012)

The incomes derived from illegal rural economies alleviates, in some way, monetary poverty; Compared to farmers engaged in legal subsistence agriculture in rural areas with similar characteristics, these communities continue to living in conditions of poverty and extreme poverty in terms of health, education, access to water, energy and housing, among others. In addition, to the extent, those conditions prevail of insecurity and lack of government presence, in these areas investment in public goods and services is very difficult. Moreover, private investment and its possibilities of generating employment are far away. (School, 2019)

### Yield of illicit crops

Latin America and the Caribbean together represent a critical zone for the production and trafficking of illicit drugs. The South American region, including Bolivia, Colombia and Peru, is the world's foremost producer of coca leaf and cocaine. Mexico is the main producer of heroin in the Americas; Colombia, Mexico and Paraguay are all significant producers of cannabis. There are an estimated of approximately 246 000 hectares of coca fields, according to the measurement reports of the Office of the United Nations Office on Drugs and Crime (UNODC) for the year 2017. However, this activity represent a structural problem in producing territories of these countries, especially if Latin American considers that coca production in the last 12 years has remained at an average of 150 000 ha per year (except peaks falling between 2012 and 2014) with a potential transformation of cocaine hydrochloride from 150,000 and 250,000 tons per year. (Grisaffi, 2018)

According to UNODC (2018), coca cultivation in Peru increased from 43,900 ha in 2016 to 49,900 ha in 2017, an increase of 14%. In Bolivia, the coca growing area has increased

by 6% (from 23,100 to 24,500 ha), while in Colombia, the variation indicates an increase in area of 17% (from 146,000 to 171,000 ha). Thus, in 2017, the area cultivated with coca in production in the South American region was 245,400 ha, 15% higher than that reported in 2016. That planted coca were produced 1,410 tons of cocaine consumed by approximately 18 million people worldwide, a record since statistics are available, and in any case, based on a conservative estimate made by official sources. (Grisaffi, 2018)

It's important to mentioned that part of the yields of coca leaf, is used in the local market as recreational plant which plays a role in many traditional Andean cultures as well as the Sierra Nevada de Santa Marta. Nevertheless, this part of the production cover only 5% from the total usage.

In the case of heroin, UNODC notes that Mexico, and to a lesser extent Colombia and Guatemala, supply most demanded heroin in the United States and South America. In Colombia, it is estimated that 6,500 ha of poppies were cultivated in 2003, production that declined steadily and in 2016 595 ha were reported. UNODC data for 2014-15 in Mexico show a minimum estimate of 21,500 ha. Regarding marijuana, according to the same report, Central and South America produced 23% of the world's cannabis production. (Grisaffi, 2018)

In this agricultural chain linked to drug trafficking, the provision of technical assistance and access to technology is confirmed. In some coca-growing regions of Colombia, UNODC identified in 2017, a trend towards an increase in the capacity to obtain both the coca leaf and the alkaloid. Producers with a higher degree of certainty in prices and profitability reinvest their profits largely in research of better agricultural practices (irrigation system, production staging, better cultivation areas, advice from qualified agronomists, etc.). So that they can ensure a higher production density, the introduction of high-productivity hybrid varieties and provision of technical assistance, delegating to other operators in the chain, the production stages of coca base and paste that were previously carried out on a small scale and now done in integrated processes increased volume and efficiency. Another factor to note is the increase in some regions not only of the number of lots cultivated but also the size of them. With this, the traditional coca-growing economy smallholdings, family production of less than two hectares, is decreasing and giving way to the industrialization of the leaf production in large scales where the peasantry is no longer master but a day laborer in the production process. (Aranda, 2012)

### *Economic Impact*

The economic value of the drug trafficking business is truly uncertain; there is no real and clear data, which verifies the total profits of these illicit activities. In 2008 Antonio Maria Costa, at that time the head of UNODC estimated that drug trafficking could generate a total of 352 billion dollars and that this money could be inserted into the different financial systems of the world. (Guardian, 2009) Another estimation came out but in 2011 by the same UNODC where it was reported that worldwide proceeds from drug trafficking and other transnational organized crime were equivalent to 1.5 percent of global GDP, or \$870 billion in 2009. From that amount, there are almost \$430 million that belong only to drug trafficking with the United States, which places the North American nation in the most profitable country for the drug trafficking business. (Bake, 2011)

In Latin American countries, the economic impact can reach figures that equal the share of any business / economic sector in GDP. An example of this syndrome is Colombia, where drug trafficking income converted into Colombian pesos corresponds to an average between 3% and 4% of GDP. Other economic impacts of drug trafficking is the misuse and conservation of foreign and national currencies, which has reduced the progress of other commercial activities, limiting exchange rate management and generating inflationary effects that prevent the development of other exports, implying more drug exports and fewer exports of other items. This has generated a dramatic blow in regional trade and in the collection of taxes from different governments.

Finally, the strongest economic impact is received by farmers displaced from their lands by armed groups that require the use of the land for drug trafficking. This has caused an alarming number of displaced people in Colombia and Mexico, which has generated an overpopulation in the different capitals of Colombia and Mexico. It is estimated that between 2000 and 2017 drug trafficking gangs in Mexico and Colombia displaced more than eight million people. (Meyer, 2016)

## 4. Methodology

To acknowledge the geographical concept of the thesis, it would be very important to identify Latin America as a region. This region belongs to the American continent and includes all countries with languages of Latin origin such as French, Portuguese and Spanish. However, for the purpose of creating indicators, institutions such as the FAO, the World Bank and other organizations take into consideration all the countries within the American continent from Mexico to Argentina, including the Caribbean islands that are independent countries. In this thesis, we will take the definition of the FAO, the World Bank and other organizations in order to obtain reliable and concrete data on the agricultural productivity of Latin America.

The thesis is divided into two main parts: theoretical and practical. In theoretical part, it's created in based of research on a bibliographic review carried out for the period between the last 50 years. The topics are related to rural development, agricultural trade indicators, productivity and Agricultural GDP.

From this exploratory study, the scope and trends of research on these issues were specified. The information available in databases analyzed in order to be able to characterize the trends of the different indicators for different Latin American countries.

The methodology implemented is based on the data used by different government institutions and international organizations (World Bank, FAO, and WTO) where the activities corresponding to forestry and fishing are considered as agriculture, in addition to the cultivation of crops and livestock practices.

The practical consists of statistical analysis on the data obtained. The following statistical methods are the following:

- Trend analysis: A statistical technique attempts to predict the future of the variables under study. Trend analysis is based on the idea that what has happened in the past gives traders an idea of what will happen in the future. The formulas integrated for trend analysis are the followings:

$$\text{Change in Amount} = \text{Current Year Amount} - \text{Base year Amount}$$

$$\text{Percentage Change} = \frac{(\text{Current Year Amount} - \text{Base Year Amount})}{\text{Base Year Amount}}$$

It is very important since we can predict the behavior of agricultural markets and the behavior of some economic indicators in Latin America

- Index: it is a statistical measure that allows us to study the fluctuations or variations of one or more indicators
- Time series: It is a succession of data measured at certain times and arranged chronologically. However, Time series data means that data is in a series of particular times or intervals. This method will be used to reflect the results of different metrics that affected Latin American agriculture.
- Regressive analysis: It is a set of statistical processes to estimate the relationships between two variables (dependent and independent). It can be utilized to assess the strength of the relationship between variables and for modeling the future relationship between them. For this thesis, was selected the most common models that is simple linear.

The formula for the regression model is the following:

$$Y_i = f(X_i, \beta) + e_i$$

Y = dependent variable

X = dependent variable

e = error terms

f = function

B = unknow parameters

The regression model as statistical process could help to find the relationship among the challenges on the development of agricultural processes in Latin America

The methods mentioned above will improve the study framed within the characteristics of an analytical-comparative documentary research.

As economic methods were employed analysis on the impact of agricultural GDP in the world economy, also export / imports performance and their influence on macroeconomic indicators of each country and the economic contributions of illicit crops in Latin America.

## 5. Results

### 5.1 Analysis of the main macroeconomic indicators of agricultural productivity

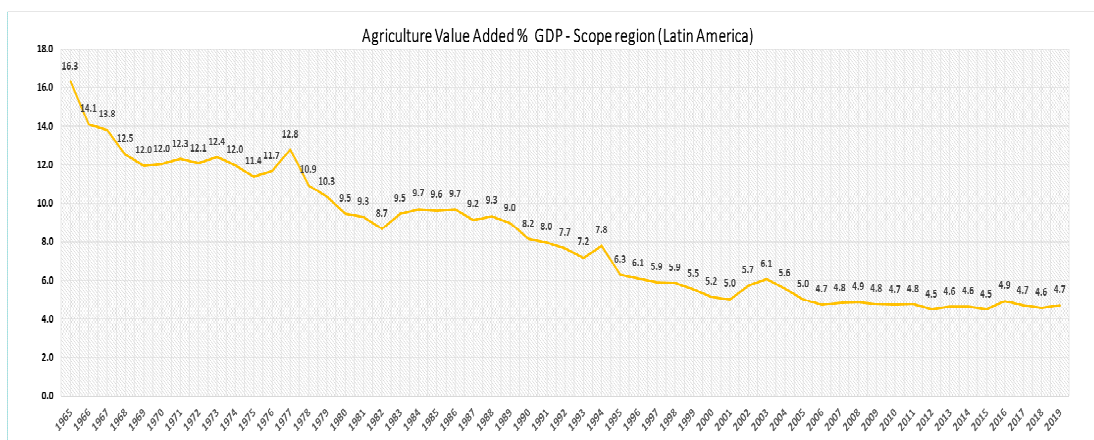
To obtain a better analysis on the economic role of the agricultural sector in Latin America. In this Chapter will be analyzed the distribution of the agricultural GDP at the regional level (LATAM) and at the global level, also an evaluation about the position in productive terms of Latin America in the world trade and will be compared the hectares of productive land in Latin America vs other regions of the world.

#### 5.1.1 Latin American Agricultural GDP Performance

To visualize the indicators mentioned above, a Trend Analysis was prepared from the available data on the percentage of agricultural GDP in Latin America from 1965 to 2019. In this analysis it can be observed that the participation of the agricultural sector in the GDP of Latin America decreased significantly in the last 50 years, as can be seen in graph number 1 that in 1965 the participation of the agricultural sector was 16.3 percent and in 2019 low to 4.7 percent.

In the table can be observed, the decrease over the years of the participation of agricultural production in the Latin American economies.

Graph 1. Percentage of agriculture in Latin American GDP from 1965 to 2019.



Source: self-processing based on World Bank Data

Some countries have seen agriculture's share in total GDP reduced drastically in the last 2 decades such as Ecuador (6.4%), Guatemala (13.6%) and Guyana (13.2%). Nevertheless,

agriculture still accounts for around 10% or more of total GDP in these countries, as well as in Belize, Bolivia, Dominica, Ecuador, Haiti, and Paraguay.

The economic development has been different in various parts of the region. In general, agricultural production and fishing in the South American countries had a better development than the Central American countries. Similarly, the agricultural sector had a better economic impact in some of the Caribbean countries such as the Dominican Republic where the growth of agricultural production has been 4.3 percent compared to past decades. As mentioned before, the increase in agricultural production as its share in local GDP and the size of the agricultural population with respect to the total population, vary considerably from one country to another. For reference of the mentioned above see the index table below with the overall of the agriculture gdp development from the period 2000 to 2019.

Table 1. Growth of Latin American GDP from 2000 to 2019

Country Name	Latin American Agro GDP % per Year				
	2000	2005	2010	2015	2019
Aruba	0.4	0.4	N/A	N/A	N/A
Argentina	4.7	7.9	7.1	5.2	6.1
Belize	14.6	13.5	11.7	12.9	9.6
Bolivia	13.0	11.8	10.4	10.2	12.2
Brazil	4.8	4.7	4.1	4.3	4.4
Barbados	2.0	1.6	N/A	N/A	N/A
Chile	5.4	4.1	3.6	3.6	3.5
Colombia	8.3	7.5	6.3	6.0	6.7
Costa Rica	9.3	8.7	6.6	5.0	4.2
Cuba	6.6	4.4	3.6	3.8	N/A
Curacao	0.5	0.6	0.4	0.4	N/A
Dominica	11.9	11.5	11.5	14.1	13.0
Dominican Republic	6.7	7.2	6.1	5.5	5.2
Ecuador	15.4	9.5	9.7	9.5	9.0
Guatemala	22.8	12.4	11.1	10.0	9.4
Guyana	30.0	28.9	28.5	25.4	17.6
Honduras	14.4	12.5	11.6	12.2	10.7
Haiti	17.2	18.1	20.2	17.2	19.4
Jamaica	6.2	5.2	5.3	6.3	6.6
St. Kitts and Nevis	1.5	1.7	1.3	1.0	1.4
St. Lucia	N/A	N/A	2.7	2.2	2.0
St. Martin (French part)	0.0	0.0	0.0	0.0	0.0
Mexico	3.3	3.1	3.2	3.2	3.4
Nicaragua	17.8	16.1	17.0	16.1	15.4
Panama	6.3	6.0	3.6	2.8	2.1
Peru	8.1	6.9	6.8	7.0	7.0
Puerto Rico	0.7	0.6	0.8	0.8	0.7
Paraguay	12.9	12.7	13.0	9.5	10.1
El Salvador	7.2	6.2	7.0	5.5	5.1
Suriname	9.5	4.9	9.5	9.3	9.7
Trinidad and Tobago	1.4	0.5	0.5	1.0	1.1
Uruguay	6.0	8.7	7.2	6.1	5.9
St. Vincent and the Grenadines	7.4	5.5	6.1	6.2	7.2
Venezuela, RB	3.9	3.7	5.4	N/A	N/A

Source: self-processing based on World Bank Data

This decreased of the agriculture sector is due to the growth of other sectors on the local economy, such as the manufacturing industry, the service economy, Tourism, etc. which have generated much more wealth to the countries in the region. (United Nations, 2020)

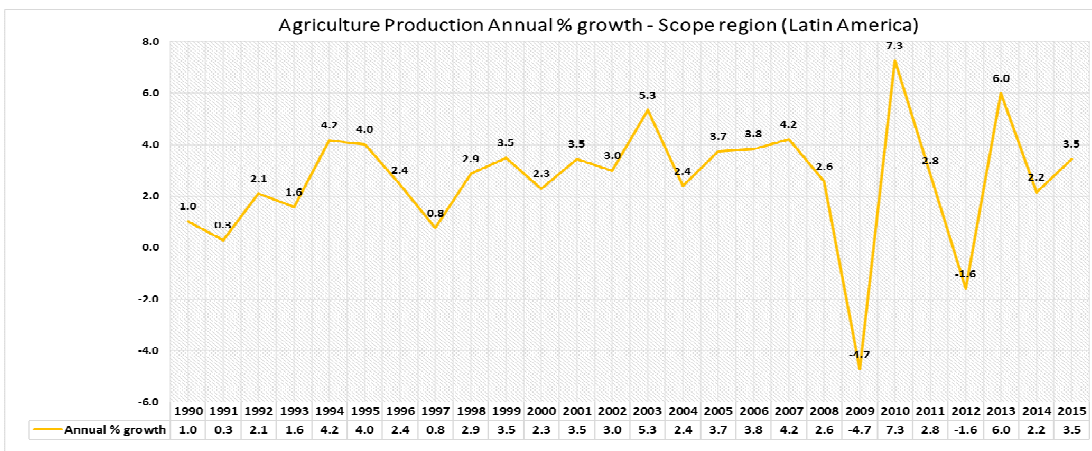


Many of the statistics on the contribution of agriculture to the economy are available for many countries, in many places. However, statistics on the contribution of agribusiness to the economy are not widely available for analysis, since this part of agriculture tends to be integrated into the industrial consumer sector.

### 5.1.2 Development of agricultural production

As we have mentioned previously, Latin America and the Caribbean had a transcendent growth in terms of production in the last 20 years. Brazil has been the most productive country in the region and one of the most productive in the world. With a productive growth of 4.1 percent between 1990 and 2015. In other regions of the continent, productivity has not been so great, in the rest of South America, the growth was 2.6 percent and in the Caribbean, the growth reached only 1 percent. According to the agricultural productivity factor (TFP) from the World Bank in Latin America and the Caribbean, growth was about 2.6 percent, within the period from 1990 to 2015, which means 0.5 percent above the average. Although this growth shows great progress in terms of production, it is still not enough to surpass North Asia, as it continues to lead the world agricultural production. The growth of agricultural productivity in the region has been driven by research and development that has brought investment from various economic sectors, in support of the agricultural productive sector of the Latin American region. Although the public investment is still key to maintaining growth in agricultural production. To refer the comments above, you can see below the graph number 2 with a Trend Analysis of 25 year (1990 – 2015) with percentage of production’s growth.

Graph 2. Growth percentage of agriculture production in Latin American 1990 to 2015



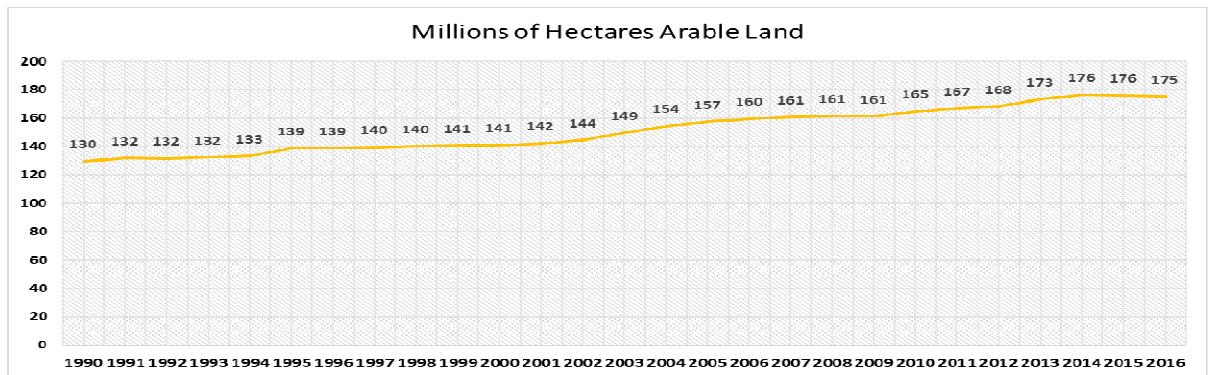
Source: self-processing based on World Bank Data

Moreover, most of this production growth has come from productivity improvements, rather than bringing more land into production. (FAO, 2019) This growth also has a contrast with the environmental effects in the region but despite this, according to the World Bank, Latin America will maintain the productive growth of agriculture for at least the next 10 years. (World Bank, 2020)

### 5.1.3 Hectares of arable land

Latin America until 2016 has a total of 175 million hectares of arable land, this shows a growth in comparison with the 90's. In 1990 Latin America had 130 million hectares of productive land, which results in a growth of 45 million hectares gained in the last 25 years. In the graph number 4 below, Its available the trend analysis on the growth of arable land in a perios of 25 years (1990 – 2016):

Graph 3. Growth of arable land in Latin American 1990 to 201



Source: self-processing based on World Bank Data

In addition, Latin America has available a huge resource of in terms of types of arable land. More than 90 percent of this arable land is considered prime land, highly recommended for agriculture, this compare with the rest of the world where the average is 80 percent. (Carr, 2009)

### 5.2 Foreign trade

Agricultural-food trade in Latin America and the Caribbean varies from one sub region to another. The countries of South America are net exporters of agricultural-food products, with the exception of the Bolivarian Republic of Venezuela and Suriname; the Caribbean

countries are net importers, and most Mesoamerican countries are net agricultural exporters, with the exception of El Salvador and Panama. This is the source of various vulnerabilities, dependencies and priorities in the field of international trade.

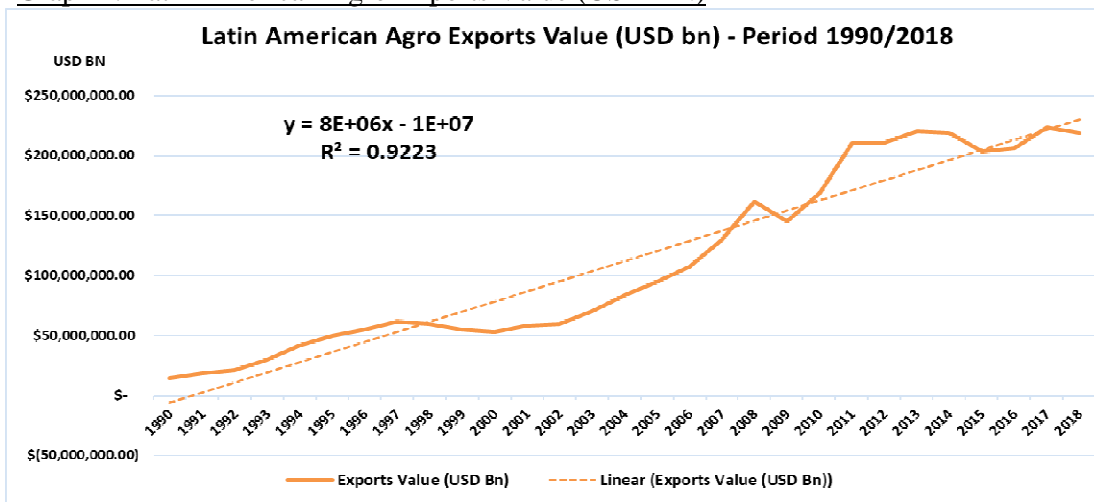
In the last 20 years, the agricultural trade surplus of Latin America and the Caribbean has grown steadily, as the growth of agricultural exports was much greater than the growth of agricultural imports. In the following sub-chapters, more details and statistics on the trade balance between Latin America and the world will be given.

### 5.2.1 Agricultural Exports

In trade terms, agricultural exports in Latin America had increases in reference to their economic value and in the total percentage of exports. In monetary terms, total exports increased from USD 14 billion in 1990 to USD 219 billion until 2018.

To detail these numbers better in the graph number 4 below, it is showing the time series development in terms of economic value growth, since 1990 until 2018.

Graph 4. Latin American Agro Exports Value (USD BN)



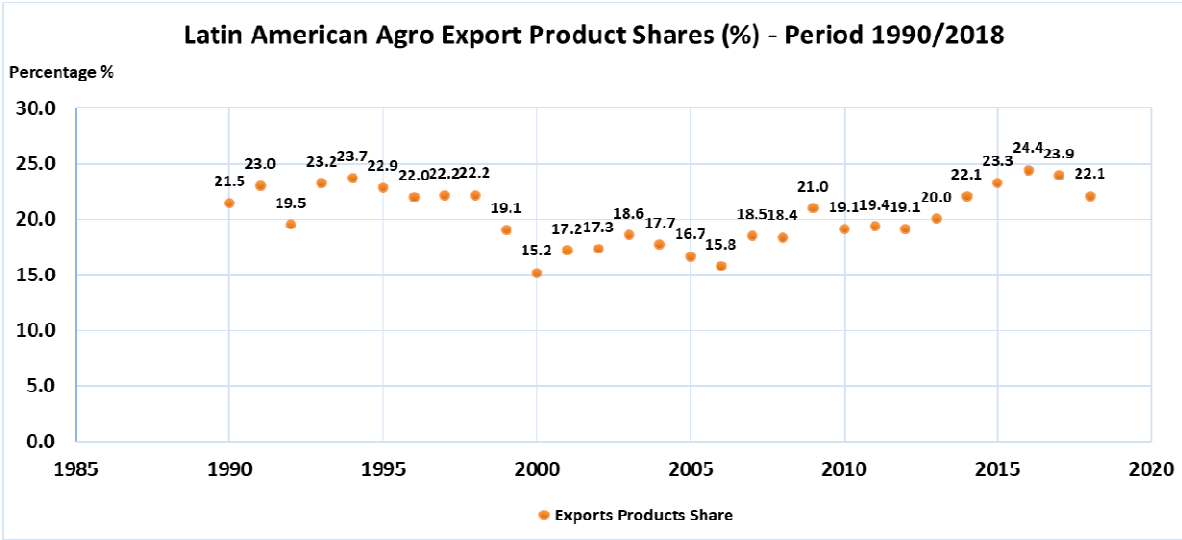
Source: self-processing based on World Bank Data

Another important aspect in Latin American agricultural exports is maintained its share in total exports. Despite the growth of mining and hydrocarbons, agriculture had a balanced growth, which has allowed the agricultural sector to have an important share in agricultural exports.

From the 90s to 2018, the share of agricultural exports has remained an average of 20%. In 2016, the agriculture sector reach the maximum point with 24% of the total share exports.

The following time series graph number 5 shows the development over the years on the share of agricultural exports.

Graph 5. Latin American Agro Exports Shares (percentage)

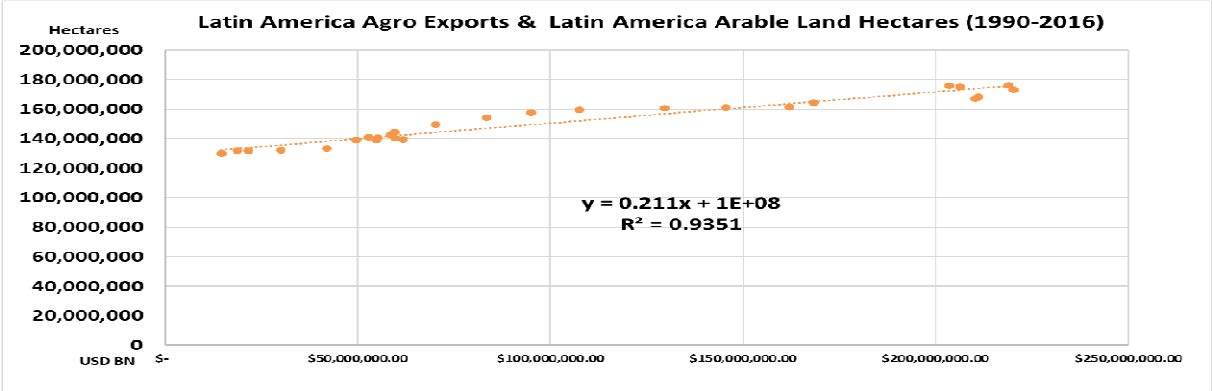


Source: self-processing based on World Bank Data

To understand better the correlation between agricultural exports growth and its productivity in order to have better economic results.

The regressive analysis has found the relationship between the economic growth of exports and the growth of arable lands in Latin America (Period 1990-2016); these are two very important variables within the production processes. The results show that more exports grow, the greater the arable land in Latin America. This model is explained by 93% as R<sup>2</sup> results. (See Graph number 6 below).

Graph 6. Regression Analysis Latin America Agro Exports & LAC Arable Land Hectares.



Source: self-processing based on World Bank Data

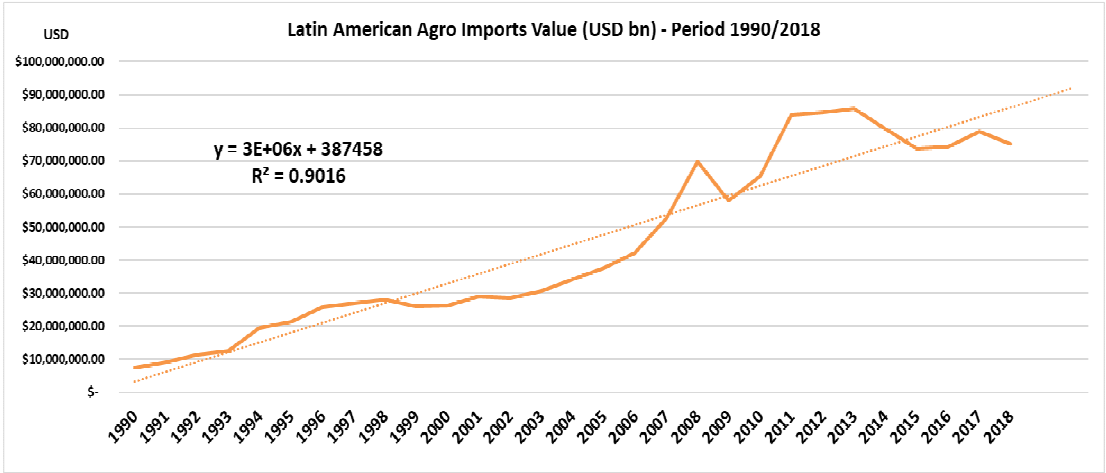
Many countries in Latin America and the Caribbean are highly dependent on agriculture for export earnings, especially in South and Central America. This dependence varies according to the country, the highest dependence registered is that of Paraguay, where 64% of its total export earnings came from agriculture. When a large share of export earnings comes from agriculture and a very small number of agricultural commodities, the economies are exposed to shocks that can arise from particular export destinations or world commodity markets. (FAO, 2020)

**5.2.2 Agricultural Imports**

The share of export earnings that Latin American and Caribbean countries spend on agricultural imports is relatively small and although the region's agricultural exports continue to exceed agricultural imports in value, the imports have a relative weight in the trade balance over the last 20 years. In the time series analysis below, it is observed that in 1990, imports in Latin America were around 7 billion dollars, while for 2018 they reached 75 billion dollars with expectations of growing the in the next years.

To visualize this better, look at the growth of the economic value of agricultural imports in Latin America in the period 1990 to 2018. (See Graph number 7 below)

Graph 7. Latin American Agro Imports Value (USD BN)

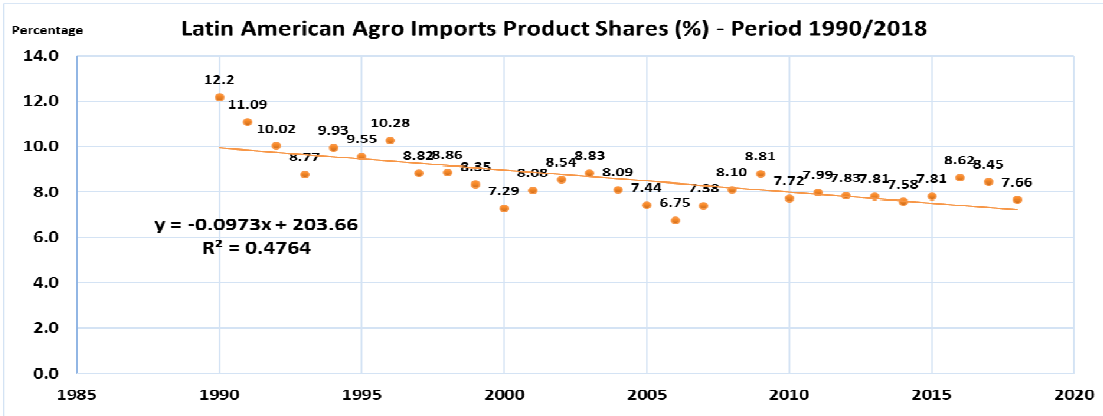


Source: self-processing based on World Bank Data

This growth is due more than all to the increase in the prices of imports and not much to the quantity of imported products, since in graph number 8 the percentage of agricultural imports has decreased due to increased productivity. Unlike exports, the shares of

agricultural imports over total imports has decreased in the last 20 years. In 1990 agricultural imports represented 12% of total imports, while in 2018 they reached 7.7%, reaching the lowest percentage in 2006 with 6.7%. The following time series graph number 8 shows the development over the years on the share of agricultural imports (Period 1990 – 2018).

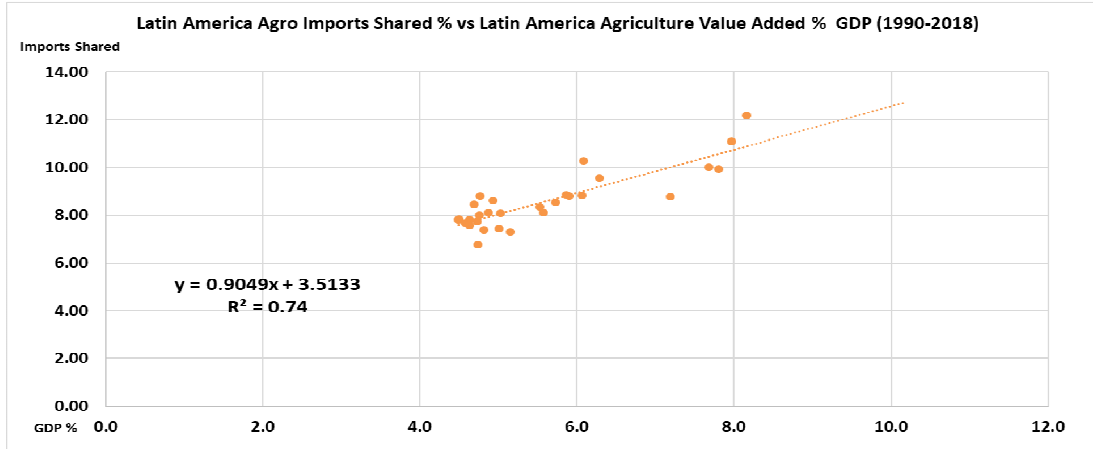
**Graph 8. Latin American Agro Imports Product Shares (%)**



Source: self-processing based on World Bank Data

This decrease in imports is due to the increase in agricultural productivity in Latin America; as the regional production growth, less needs to import is required. To understand better the correlation between agricultural imports shares and its performance in order to have better economic results, The regressive analysis has found the relationship between the decrease of agricultural imports shares and decrease of shares percentage on agriculture value added on total GDP Latin America (Period 1990-2018); these are two very important variables within the production processes. The results show that as agriculture GDP decrease, the bigger are agricultural imports in Latin America. This model is explained by 74% as R2 square results. (See graph number 9 below).

**Graph 9. Regression Analysis Latin America Agro Imports Shared % vs Agro % GDP**



Source: self-processing based on World Bank Data

In imports, concentration rates are lower, as the big production profile of the region makes it necessary to supply a great variety of products. However, regional patterns are heterogeneous, as some large countries also have high rates of import concentration. Venezuela is one of these cases, where it is estimated that more than 80% of agricultural products are imported, this problem is not only caused by the country's political crisis, but by the total abandonment of productive agricultural sectors in the last 30 years. Another example is Panama where agricultural production is precarious and the close relationship with the United States leads Panama to import more than 50% of its agricultural products. (FAO, 2020)

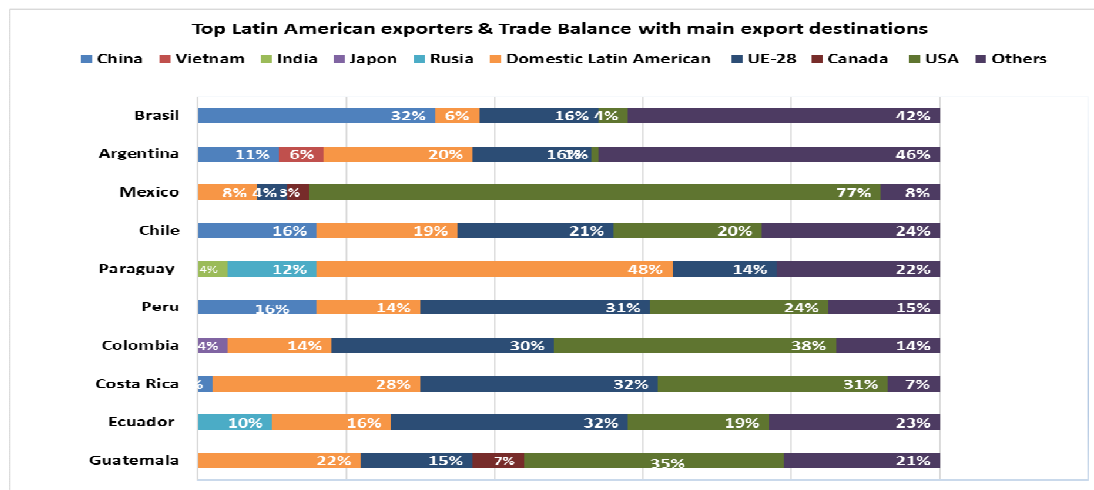
### 5.2.3 Agricultural Trade Balance

Exports to China, the European Union and the United States are an important part of the overall regional trade surplus of Latin America and the Caribbean. The importance of these three export destinations for the region's agricultural exports has been reinforced by numerous preferential trade agreements concluded by specific countries or regional groupings in Latin America and the Caribbean.

Among the main destinations for Latin American exports, we have the following countries and regions: China, Vietnam, India, Japan, Russia, EU-28, Canada & USA. Among the countries that receive, more agricultural exports from Latin America are the European Union (including UK), China and the United States. China, for example, in recent years has accounted for 32% of Brazilian exports and 16% of Chilean agricultural exports; this makes it the second most important beneficiary in the region.

In the graph number 10 below, we can see the top 10 countries with the highest agricultural exports and the percentage of exports to the main destinations.

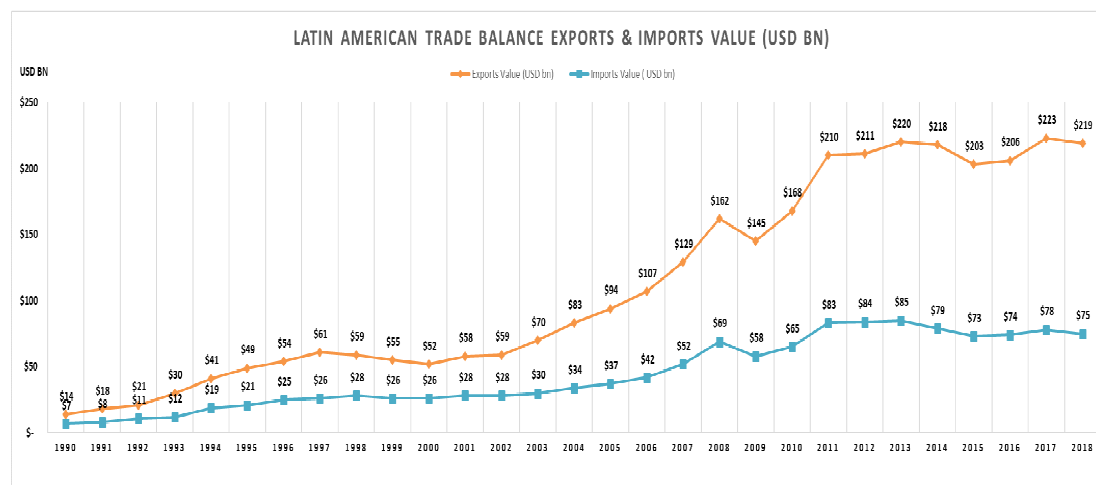
**Graph 10. Top Latin American exporters & Trade Balance with main export destinations**



Source: self-processing based on FAOSTAT

The high degree of dependence on agriculture, specific products and a number of markets outside the region poses challenges in the area of dependence that must be addressed. In principle, there are options to effectively maintain these high levels of dependency and options to modify them. But despite this, the balance between exports and imports has remained in favor of Latin America and is expected to continue in the coming years. To visualize this inputs see the graph number 11 with time series below, which shows the development of both trade metrics over the last 28 years and the last data from 2018. Where trade balance remains in superhabit with 209 billion dollars on exports and 75 billion dollars on imports.

**Graph 11. Latin America Exports vs Imports value (USD BN)**



Source: self-processing based on World Bank Data



### **5.3 Important aspects with a significant impact on agricultural production**

Agriculture in Latin America is heterogeneous from almost every angle. The region covers a wide variety of different agro-ecological zones, varied topography, and very different farm sizes and structures, operating with different levels of technology and sophistication. This makes agriculture in the region immensely diverse in terms of production systems, economic importance, and its contribution to income, employment, and trade. In terms of trade, although the region as a whole is an important supplier of cereals and oilseeds to world markets, as well as of bananas, coffee and sugar, there are large differences between the sub regions. For example, the Southern Cone countries, particularly Argentina and Brazil, are among the world's largest exporters of wheat, corn, soybeans, and sugar, while the Caribbean countries depend on world markets to meet their food needs. To visualize the yields of the mentioned products, a time series analysis and trend analysis will be carried out on some of the main products.

#### **5.3.1 Yields of Main Crops per Hectare**

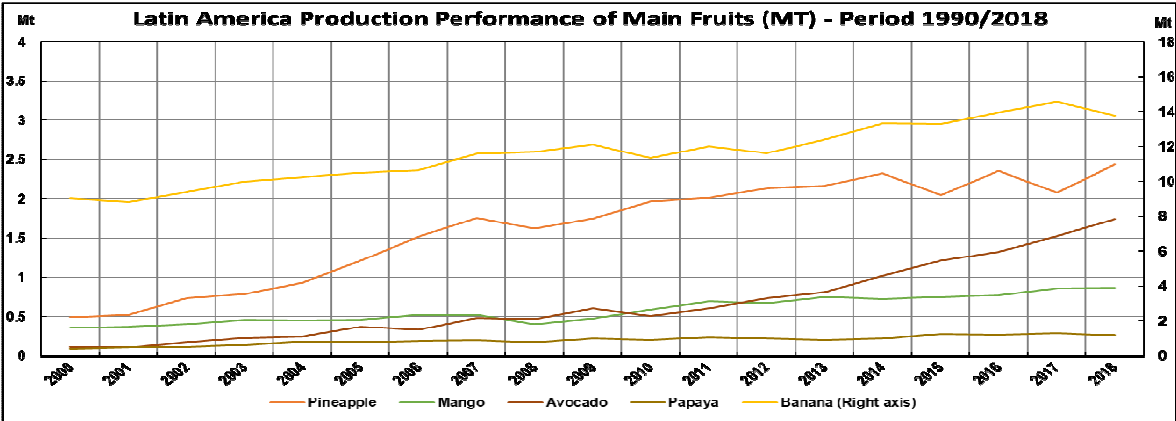
To understand better, crop yields in Latin America, the time series analysis will be done separately between the main fruits, cereals, raw materials and the main crop soybeans.

#### **Fruits Production**

The first agricultural rubles are the main fruits produced in Latin America, among which are pineapple, mango, avocado, papaya and banana. Each one has had quite a remarkable growth in recent years, mainly avocado and pineapple, where their growth has been almost exponential.

The graph number 12 below shows the growth in million tons of the mentioned fruits from the year 2000 to the year 2018 in a time series format. In the graph, we can highlight the growth of avocado production between years 2000 and 2018. In 2000, the production was 119 million tons and in 2018, it reached 1,742 million tons.

Graph 12 Latin America Production Performance of Main Fruits (MT)



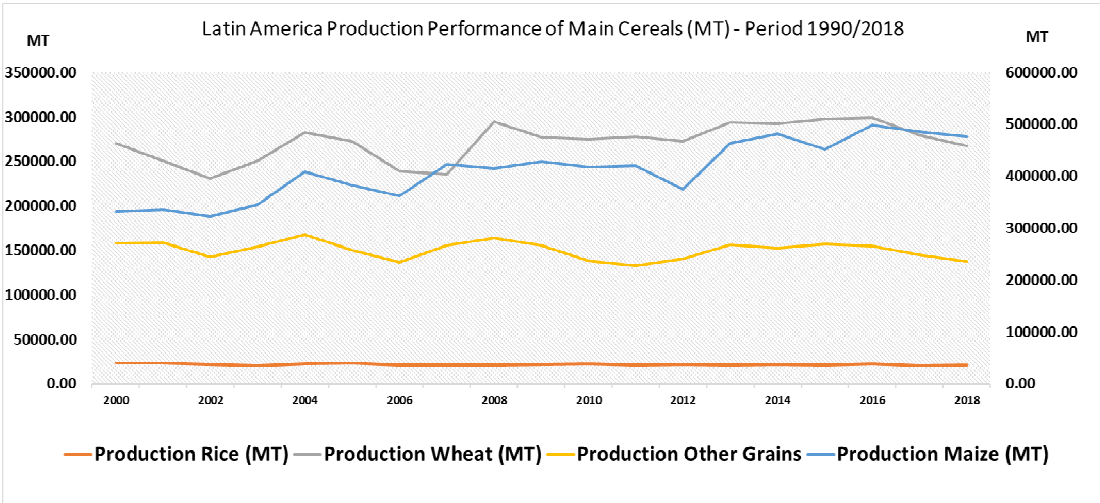
Source: self-processing based on FAOSTAT

**Cereals Production**

As for Cereals Argentina and Brazil are the main cereal producers in the region. Among 2000-2018, these two countries accounted for about half of Latin America's total coarse grains and rice production. Among the main cereals produced in Latin America, we can find corn, rice and wheat. The cereal with the highest growth in million tons was corn, from 337 million tons in 2000 to 477 million tons in 2018, while rice decreased its production from 23 million tons in 2000 to 21 million tons in 2018.

The graph number 13 below shows a time series with the development of cereal production in million tons from 2000 to 2018. (Including a column grouping the other cereals)

Graph 13. Latin America Production Performance of Main Cereals (MT)



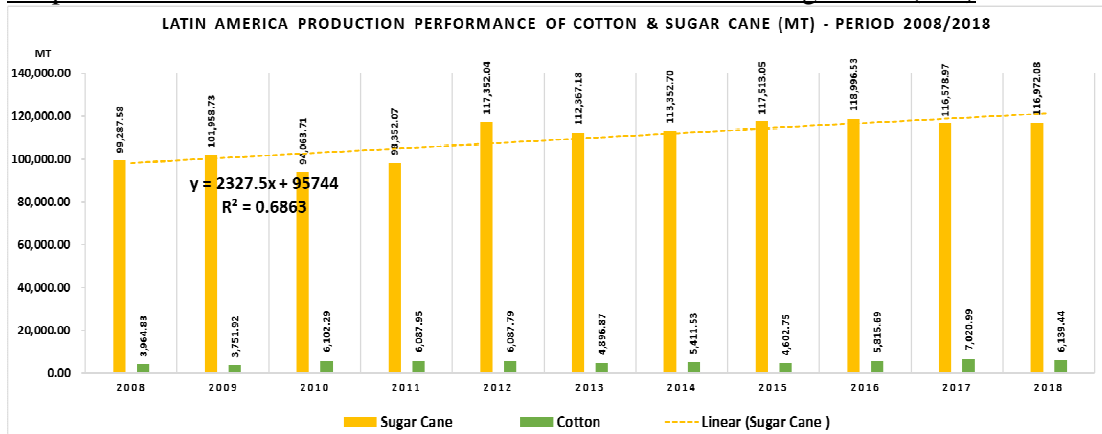
Source: self-processing based on FAOSTAT

**Main Crops Production for Raw Material**

Other important crops are cotton and sugar cane, these two used as raw materials in many of the world's industries. Sugar cane was always a very traditional crop in Latin America, but its productivity in the last 10 years has not been very significant, since it went from producing 99 million tons in 2008 to producing 116 million tons in 2018. On the other hand, cotton had a growth of almost 100 percent, going from producing around 3,964 million tons in 2008 to producing 6,139 million tons in 2018.

The following graph number 14 shows the development of the production of sugar cane and cotton in a period of 28 years (2008 - 2018) the graph is based on a time series analysis and the trend line.

**Graph 14. Latin America Production Performance of Cotton & Sugar cane (MT)**



Source: self-processing based on FAOSTAT

### **Soybean Production**

Soybean production is the main agricultural engine of the southern cone and this makes soybeans the main crop in Latin America. The production of soybean in Latin America has grown since the 1990s by almost 150 %. This is due to the high demand of this grain in countries such as China, Vietnam and the United States.

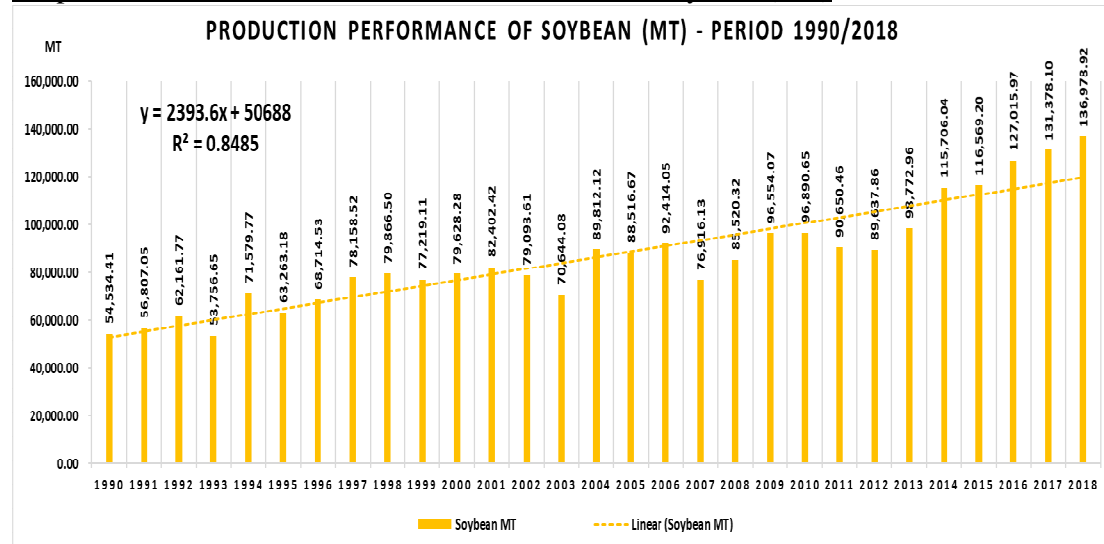
According to the data collected for graph number 15 (FAOSTAT) Soybean production went from 54 million tons in 1990 to the maximum point with 136 million tons in 2018.

Despite of the decreased production on 2003 (70 million tons) and 2012 (89 million tons), Soybean production has grown significantly and this growth has generated great economic benefits for the region.

This growth is basically concentrated in Brazil, Argentina, Paraguay and Uruguay. Among the countries mentioned, we can easily find around 50% of world production.

To understand better the performance of soybean crops in Latin America, it is observed below in the time series (Graph number 15) how was the growth trend of this crop in the last 28 years. Taking the period from 1990 until 2018 and calculated in million tons.

**Graph 15. Latin America Production Performance of Soybean (MT)**



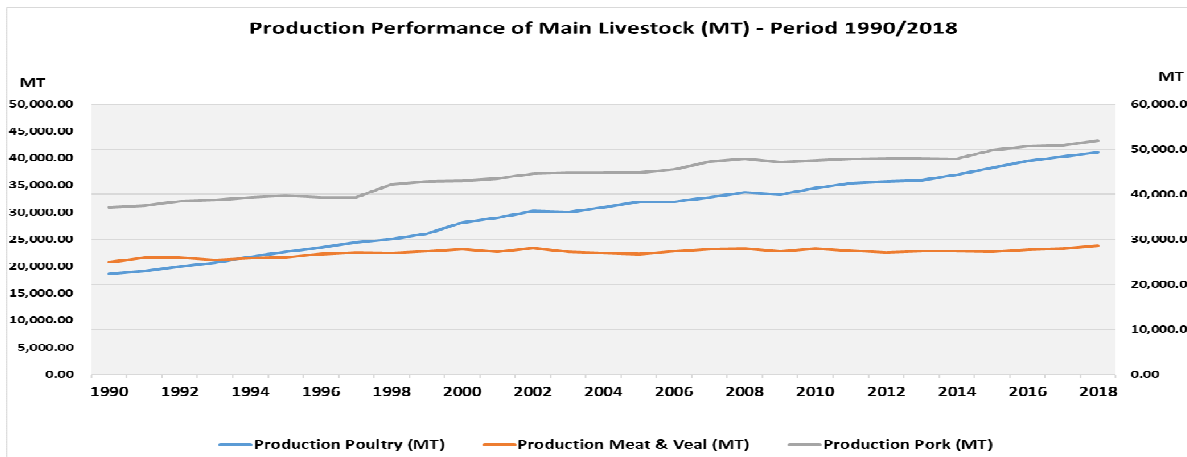
Source: self-processing based on FAOSTAT

### 5.3.2 Livestock Indicators

Livestock production has also grown substantially in Latin America: during the last 28 years, beef production increased by 11%, pork by 30% and poultry by 150%. This growth was driven by an expansion of the aviculture, swine and cattle ranching sectors and by technological innovation in all livestock sectors.

To observe this increase in production, it is possible to see in graph 16 below, show the time series with the annual production of poultry, beef and pork from 1990 to 2018 in million tons. In the time series chart, poultry production was 22 million tons in 1990 and grew to 49 million tons in 2018, beef production was 24 million tons in 1990 and reached up to 28 million tons in 2018 and pork production was 30 million tons up to 43 million tons in 2018.

**Graph 16. Latin America Production Performance of Main Livestock (MT) (1990 – 2018)**



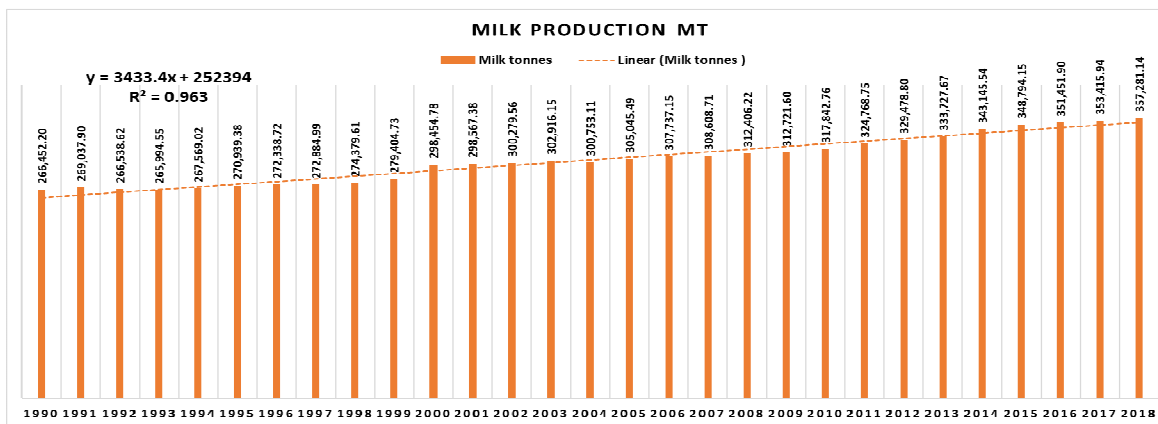
Source: self-processing based on FAOSTAT

Despite the growth of meat production in Latin America, this growth does not show a high level of productivity. The reason for this stagnation in productivity is due to the low demand for meat in Latin America since not all the Latin American population can buy meat as frequently as in Europe or the United States. This forces to allocate the great part of the meat production to foreign markets. (FAO, 2020)

### Milk Production

Another important item in agricultural animal production is dairy. Milk production (all types) in Latin America also had a notable growth, going from 266 million tons in 1990 to 357 million tons in 2018. The graph number 17 below shows a time series analysis with the growth trend of the 28-year period (1990 - 2018).

Graph 17. Milk Production MT (1990 – 2018)



Source: self-processing based on FAOSTAT

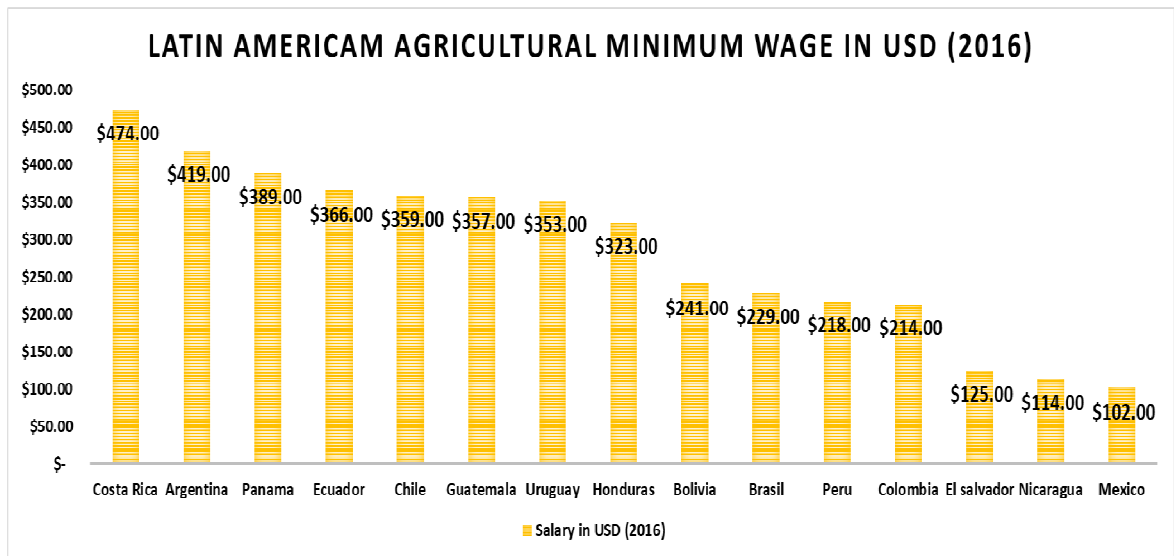
### 5.3.3 Wage/ worker in Latin American Agriculture

Another important aspect in agricultural production is the human capital that makes up the production system. This segment in recent years did not show remarkable changes, the migration of rural populations to the urban places has left the productive sectors of agriculture in the hands of large companies and land lieutenants, the latter well known for paying low wages and lack of respect for the working rights of employees.

It is estimated that more than 60% of agricultural employees work informally, making it difficult to monitor income per person in the agricultural sector. Even so, the group of people who work formally still shows a great difference in income over workers in cities.

The graph number 18 below shows the minimum wages of the agricultural sector for the year 2016 in Latin America (Latest Data available). Best salaries is led by Costa Rica and Argentina with more than 400 dollars a month and the last one would be Mexico with only 102 dollars a month. This last mentioned salary would be an approximate of 4.3 dollars a day, which would already be very close to the extreme poverty threshold established by the United Nations.

Graph 18. LATIN AMERICAM AGRICULTURAL Minimum Wage in USD (2016)



Source: self-processing based on Camara Agricola Costa Rica

## 5.4 Agriculture Productions and its impact on rural populations

Agriculture represents a social, economic, ecological and health challenge. Good management and prosperity make it possible to fight against food and nutritional insecurity, which was accentuated by climate change and political instability.

In addition, it constitutes the main employer worldwide since 40 percent of the population works in the agricultural sector. For these reasons, it is very important to take into account the consequences that agricultural production can have on rural populations.

Among many indicators that exist to measure the impacts of agricultural production in Latin America, it was chosen to analyze the growth of agricultural lands, rural populations and the percentage of employees in the agricultural sector. Taking into account the impact that agricultural land, rural population and employment have on the daily lives of rural communities

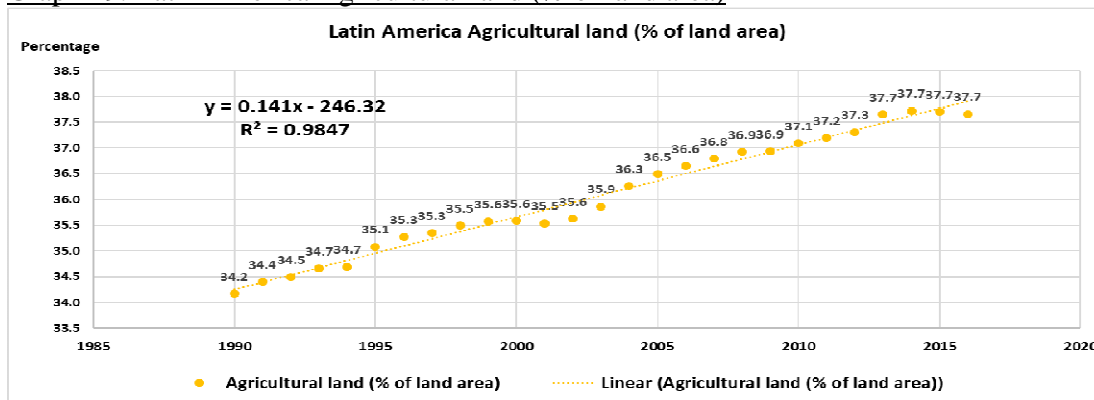
### 5.4.1 Agricultural land

Agricultural land refers to the areas of land they use as arable land, pasture land, and abandoned agriculture land. The difference between agricultural land and arable land is that arable land includes only areas defined for seasonal crops according to FAO.

Latin America had a meager growth in terms of agricultural land, going from having 34% of the total area of the sub-region of the continent in 1990 to reaching 37% of the total area of the sub-region in 2016.

The graph number 19 with the time series analysis and trend analysis below shows the growth over time, from 1990 to 2016, in terms of Latin America Agricultural land.

Graph 19. Latin America Agricultural land (% of land area)



Source: self-processing based on World Bank Data

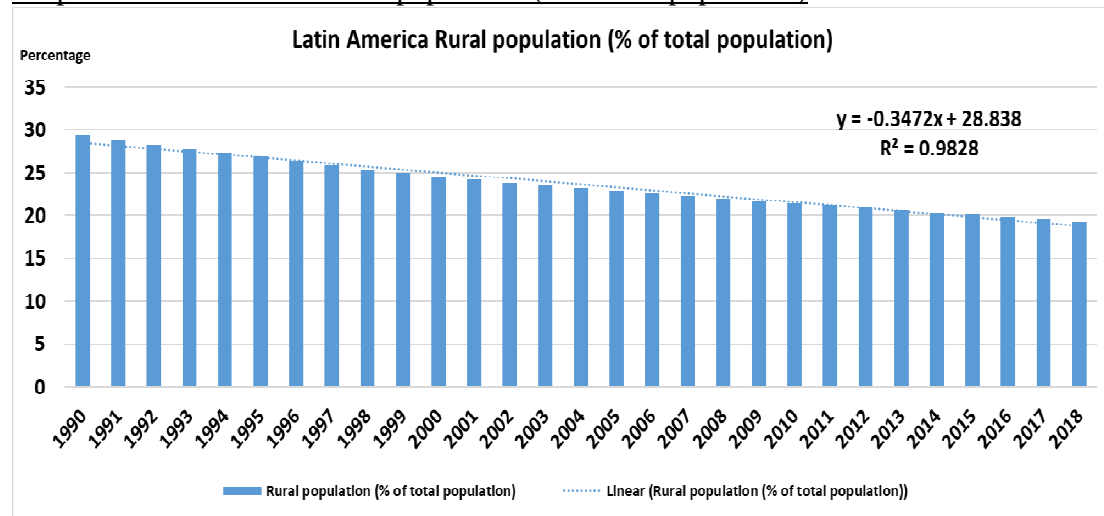
### 5.4.2 Rural population development

A rural population refers to those sectors of a country or region who live outside the cities, in geographic sectors with low population density and whose usual economic activities tend to be agricultural. In addition, according to INEGI, a population is considered rural when it has less than 2,500 inhabitants.

This type of population until 2018 represented almost 20% of the general population of Latin America. However, it has suffered a decline in the last 28 years due to the lack of opportunities and terrible public policies of different governments in Latin America.

In 1990, the rural population in Latin America represented almost 29% of the population, but over the years it decreased by around 19%. In the graph, number 20 below a time series analysis is observed that shows the percentage of the agricultural population over the rest of the population (period 1990 - 2018). This time series includes a trend analysis, which reflect the decrease of this segment over the time.

Graph 20. Latin America Rural population (% of total population)



Source: self-processing based on World Bank Data

### 5.4.3 Percentage of employees by the agricultural sector

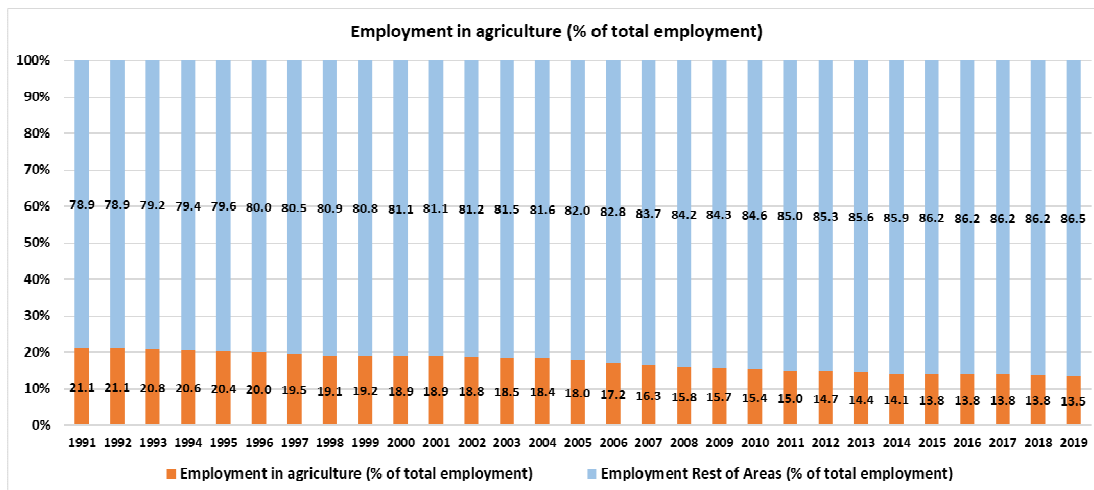
In the previous chapter, the minimum wages in the agricultural sector was analyzed, in this chapter the analysis will be carry on the percentage of jobs generated by the agricultural sector compared to the total percentage of jobs among others sectors of the economy. Taking the period 1991 to 2019.



The percentage of the population employed by the agricultural sector went from being 21% in the early 1990s to only 13.5% in 2019 (See graph number 21); this means, the decrease was almost 45%. This represent a big impact over the income among the rural populations. This indicator clearly shows that new agricultural practices and the industrialization of the agricultural sector have generated fewer jobs for rural populations in Latin America. This is also one of the main reason to force those populations to find other jobs in the nearest cities.

In the graph number 21with time series below, this shows the development between the years 1991 to 2019 in terms of agricultural employment.

Graph 21. Employment in agriculture (% of total employment) 1991 – 2019.



Source: self-processing based on World Bank Data

The results shown by the indicators explained. Send a message of abandonment and lack of social policies of Latin American governments in terms of quality of life for these citizens. These displacements from rural communities to cities can be dangerous for the future of agricultural production, since according to FAO Latin America must lead agricultural production until 2030, without rural population it will be almost impossible to meet the responsibilities of food production .(FAO, 2016)

### 5.5 Environmental influences

Agricultural production has profound effects on the environment. They are the main source of water pollution by nitrates, phosphates and pesticides. They are also the largest anthropogenic source of greenhouse gases, methane and nitrous oxide, and contribute greatly to other types of air and water pollution. Agricultural, forestry and fishing methods

and their scope are the main causes of the loss of biodiversity in the world. The overall external costs of all three sectors can be considerable.

Agriculture also affects the basis of its own future through land degradation, salinization, excess water extraction and the reduction of agricultural genetic diversity. However, the long-term consequences of these processes are difficult to quantify. Latin America, as an important part of the world's agricultural productive body, also has very alarming pollution numbers because of traditional agricultural practices.

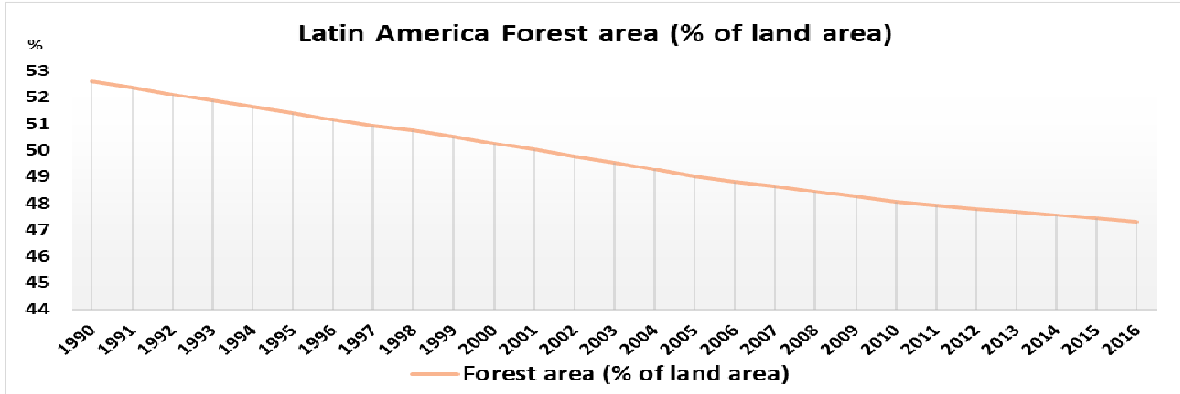
In this thesis, it is not possible to cover all the environmental details for a super broad analysis, but some important indicators about contamination will be observed. Among the indicators that will be analyzed are; percentage forest areas, fertilizer consumption (Kilograms per hectare of arable land), CH<sub>4</sub>, CO<sub>2</sub> & N<sub>2</sub>O emissions.

Also included is a brief analysis of the number of organic farms in Latin America as an alternative method to traditional farms with the aim of counteracting the polluting effects of traditional farms.

### **5.5.1 Forest Area Reduction**

Forest area is land under natural or planted stands of trees of at least five meters in situ, whether productive or not, and excludes tree belonging to the agricultural production systems. In Latin America, the percentage of forest area until 2001 exceeds half of the entire surface of the American sub region. Since 2002, a deterioration of forest areas has been observed to build infrastructure for agricultural, urban, social and logistical purposes. To be more specific, in 1990 the percentage of forest area in Latin America was 52% of the total surface, while in 2016 it reached only 47%, this deterioration represented a loss of almost 6% of the forest area between the years 1990 and 2016. In the graph number 22 below, an analysis of time series is observed where the trend line is clearly seen going down over the years.

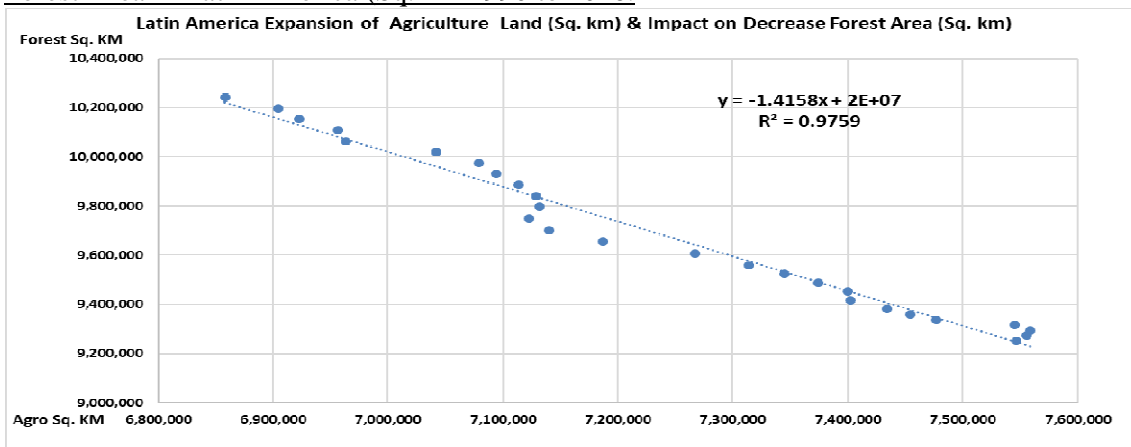
Graph 22. Latin America Forest area (% of land area) 1990 to 2016.



Source: self-processing based on World Bank Data

This growth of forest areas may have irreversible impacts on Latin American ecosystems and may be a cause of the effects of climate change. To understand better the correlation of deforestation and agricultural production. Regressive analysis has found the relationship between the decrease in forest areas and the growth of arable land; These 2 factors are important for the sustainability of life in Latin America. The results show that the more arable land grows the forestlands decreases. This model is explained by 97% as R2 squared. For reference, see graph number 23 below.

Graph 23. Regression Analysis Latin America Agriculture Land (Sq. km) & Impact on Forest Area in Latin America (Sq. km 1990 to 2016.



Source: self-processing based on World Bank Data

In the data shown above on deforestation, the impact of the fires in the Amazon was not included, where 2.5 million hectares were burned in August 2019. (Green Peace, 2019) With this event, Latin America becomes one of the three regions of the world where

deforestation is most advanced. Which endangers human life and especially the future of agriculture.

### 5.5.2 Fertilizer consumption

Fertilizers are substances rich in nutrients that are used to improve the characteristics of the soil for further development of agricultural crops. There are three types of fertilizers:

**Chemicals:** These are nutrients made by man that are generally of mineral, animal, plant or synthetic origin. **Organic:** They are those that are formed naturally with little or no participation from man for their formation. **Inorganic:** They are substances derived from rocks and minerals that applied to the soil or substrate to increase the fertility of crops.

Despite the benefits of fertilizers, there are negative effects on fertilizers; the pollution of the water that it has produced mainly by leaching into groundwater and surface waters. The latter is one of the most dangerous forms of pollution for agriculture and ecosystems. In addition, the use of fertilizers generates large emissions of greenhouse gases such as N<sub>2</sub>O. Nevertheless, inside the agriculture process in Latin America the use of fertilizer has growth in the period 2002-2016. In 2002 the fertilizer consumption covered 89.5 kilograms per hectare of arable land and in 2016 140.1 kilograms per hectare of arable land, this represent an increase of about 80% in 14 years. The index table number two, below shows a time series with the development on kilograms of fertilizer use per hectare (Arable land).

Table 2. Fertilizer consumption (kilograms per hectare of arable land) 2002 to 2016.

Year	Fertilizer consumption (kilograms per hectare of arable land)
2002	89.49067233
2003	107.3637232
2004	111.9989229
2005	96.61565048
2006	99.39279496
2007	120.0130716
2008	103.7253551
2009	88.7627686
2010	112.5464481
2011	128.6084954
2012	126.8148747
2013	126.3286282
2014	129.2413919
2015	122.5666555
2016	140.1913795

Source: self-processing based on World Bank Data

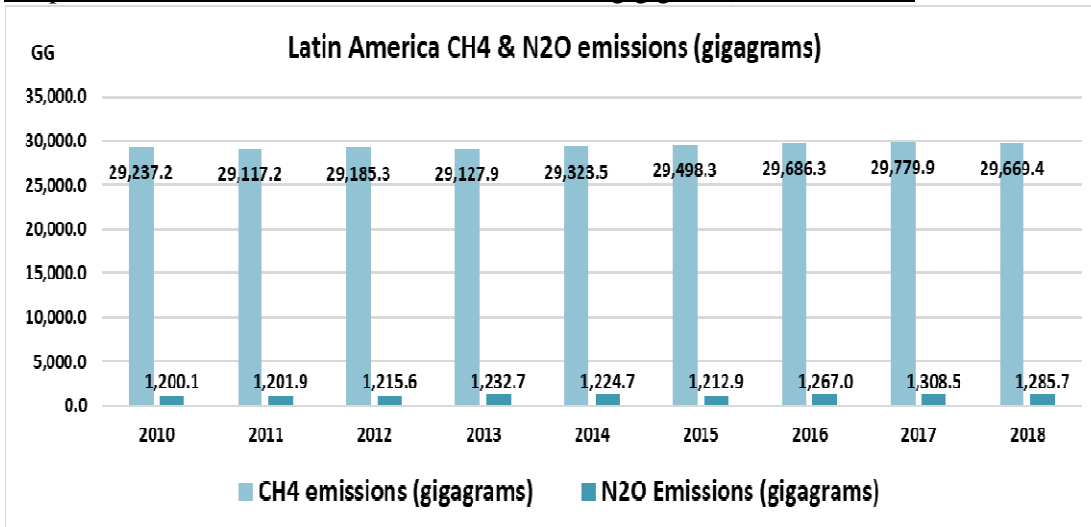
### 5.5.3 Pollution levels and environmental impact

Agriculture in particular releases significant amounts of methane and nitrous oxide, two powerful greenhouse gases. Methane is produced by livestock during digestion due to enteric fermentation and is released by belching. It can also be released by manure and organic waste stored in landfills. Nitrous oxide emissions are an indirect product of organic and mineral nitrogen fertilizers. The burning of fossil fuels on factory farms (in heating, machinery, etc.) also represents a relatively important source of carbon dioxide emissions. However, this source of emissions is small next to the carbon dioxide emissions from livestock derived from changes in land use.

Greenhouse gas emissions in Latin America represent 14% of total emissions and according to FAO data, this number has not increased significantly in the period from 2010 to 2018. Below there is the graph number 24 and 25 to shows the growth of the three main greenhouse gases generated in agriculture CH<sub>4</sub>, N<sub>2</sub>O & CO<sub>2</sub>. As for the CH<sub>4</sub>, emissions went from 29,237 GG in 2010 to 29,669 GG in 2018. For N<sub>2</sub>O emissions went from 1,200 GG in 2010 to 1,285 GG in 2018.

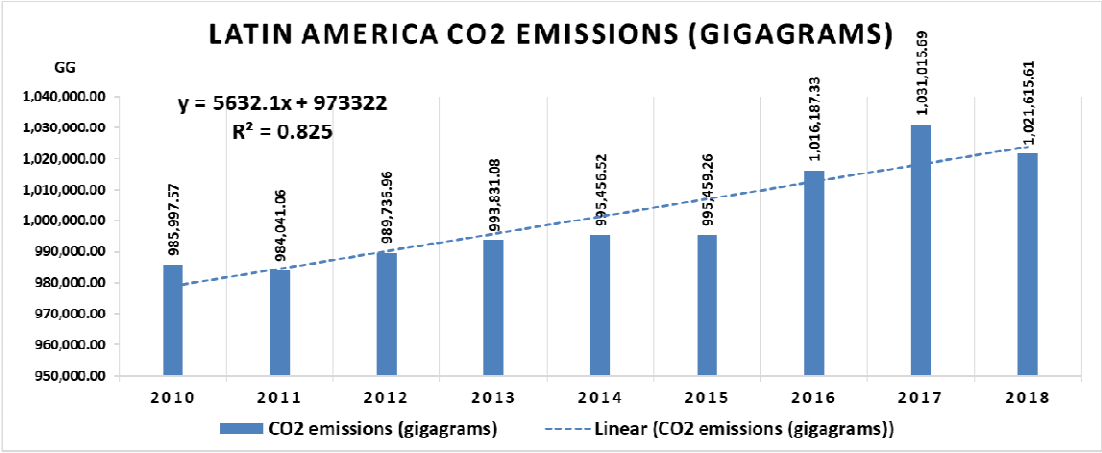
The analysis of time series below covers the period 2010 to 2018 and measures the gas emissions in gig grams.

Graph 24. Latin America CH<sub>4</sub> & N<sub>2</sub>O emissions (gig grams) 2010 to 2018.



Source: self-processing based on FAOSTAT

Graph 25. CO2 emissions (gig grams) 2010 to 2018.

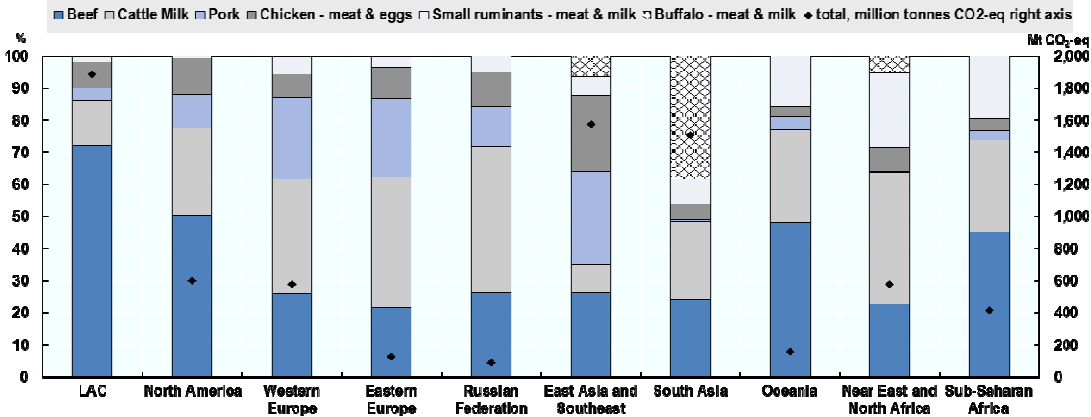


Source: self-processing based on FAOSTAT

In graph number 25 it can be identified that the growth trend of CO2 emissions in Latin America increased from 985,997 GG in 2010 to reaching 1,021,615 GG in 2018.

According to FAO data until 2017, Latin America leads the CO2 emissions related to livestock. This means that Latin America was the region of the world that emitted the most CO2 in world livestock with a total of 1021 million tons. This occurs since beef livestock emit 70% of the emission. (See Graph 26) For effect of a comparative analysis on the levels of CO2 emissions generated by the agricultural (Livestock), sector between Latin America and other regions of the world. The graph number 26 below shows the percentage of emissions according to the type of agricultural practice and the amount of tons emitted by each agricultural practice, all subject to emissions by regions of the world.

Graph 26. Latin America & Rest of the world CO2 Emissions per Area in 2017.



Source: FAOSTAT

As mentioned before, the increase in emissions has not been significant but it still does not meet the requirements agreed in the Paris agreement of 2016. Even in some countries, the impact of gas emissions may be worse than in other countries, especially in the southern cone where agricultural production has more relevance. (FAO, 2020)

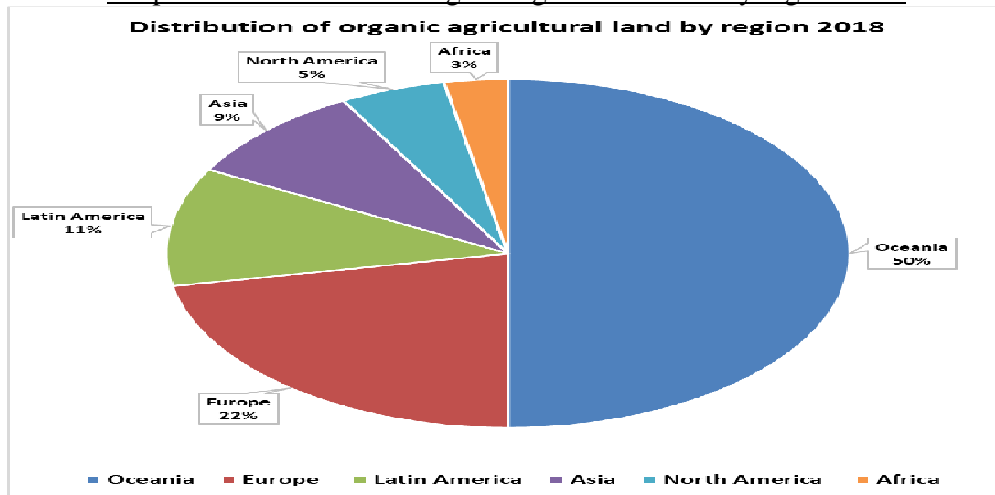
#### 5.5.4 Organic Farms

Organic agriculture is a cultivation system of an autonomous agricultural exploitation based on the optimal use of natural resources, without using synthetic chemicals, or genetically modified organisms, neither for compost, nor to combat pests, nor for crops, achieving this way to obtain organic food while preserving the fertility of the land and respecting the environment. All this in a sustainable, balanced and maintainable way.

This new way of doing agriculture has been growing in recent years as an alternative to traditional farms, since environmental problems often arise in traditional farms causing a decline in food quality and environmental ecosystems. Until 2018, more than 71 million hectares were registered in the world, where organic agriculture is practiced. Latin America occupies the third place with 11% of the organic farms in the world; this means that it has almost 8 million hectares practicing organic agriculture.

The graph number 27 below shows the distribution of hectares under the organic farm system in the world, divided by continents.

**Graph 27. Distribution of organic agricultural land by region 2018**

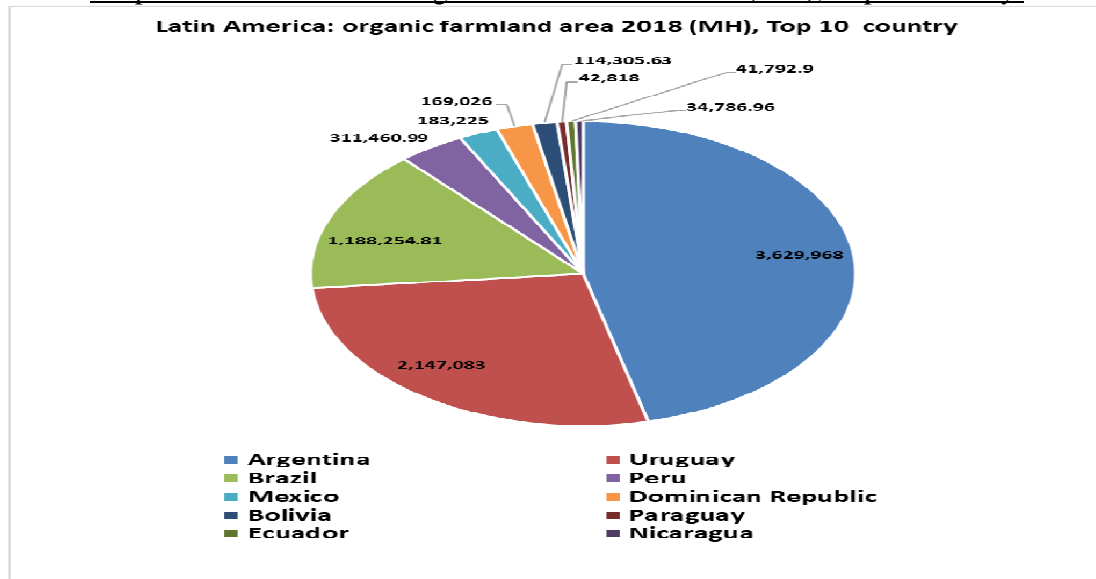


Source: self-processing based on FAOSTAT

It is important to mention that Argentina is the country that leads the list of countries in Latin America with the most hectares in organic agriculture with around 3 million hectares, followed by Uruguay with more than 2 million hectares and Brazil with more than 1

million hectares. The graph number 28 below shows the distribution of hectares under the organic farm system in the Latin America.

Graph 28. Latin America: organic farmland area 2018 (MH), Top 10 country.



Source: self-processing based on FAOSTAT

### 5.6 Analysis of illegal crops in Latin America

An illicit crop is a crop that is grown with the intention of making a prohibited use and against its laws. It is used in Colombia among other countries to refer to a series of crops under the argument that the crop as such is not illegal, but its use after being cultivated. Among the best-known illegal crops are the coca leaf, poppy and marijuana. The measurement of these crops are obtain through estimates made by non-governmental organizations and the police authorities in the countries of origin of the crops. Since there are no real data, nor sure methods of obtaining them.

#### **5.6.1 Coca Leaf Production**

In the estimates made by the Colombian Drug Observatory, coca leaf production increased by almost 130% between 2012 and 2018. This growth was mainly concentrated in Colombia and the reason for this growth is due to the peace agreement of the Colombian government with the communist guerrilla FARC in 2016. The agreement liberated from FARC many of the lands that today are used for the cultivation of the coca leaf.



While in Bolivia, the increase in coca leaf production was due to the political support granted by President Evo Morales to the coca leaf production unions. It is important to mention that in Bolivia, the coca leaf is used as a traditional and millennial method of relaxation, but it is not a secret for the world that the consumption of the coca leaf as a traditional use only occupies less than 10% of the demand, the rest goes to the creation of cocaine.

The index table number 3 below shows the development of coca leaf production from the period 2012 – 2018. Where can be observed an increase of coca leaf per hectare in 2012 (123 HT) to 2018 (254 HT).

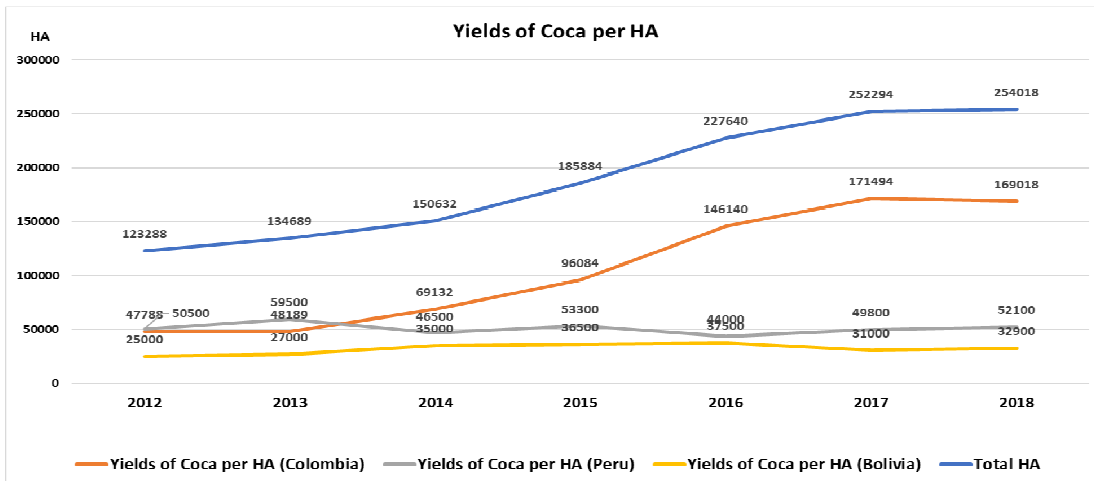
Table 3. Yields of Coca per HA from 2012 to 2018

Years	Yields of Coca per HA (Colombia)	Yields of Coca per HA (Peru)	Yields of Coca per HA (Bolivia)	Total HA
2012	47788	50500	25000	123288
2013	48189	59500	27000	134689
2014	69132	46500	35000	150632
2015	96084	53300	36500	185884
2016	146140	44000	37500	227640
2017	171494	49800	31000	252294
2018	169018	52100	32900	254018

Source: self-processing based on COD Data

The graph 29 with time series below shows the trend of coca leaf production from the period 2012 – 2018, appointing the production by country (Colombia, Peru & Bolivia)

Graph 29. Yields of Coca per HA from 2012 to 2018



Source: self-processing based on COD Data

There are also estimates of the tons of cocaine produced. According to the Colombian Drug Observatory, cocaine production went from 953 tons in 2012 to 1221 tons in 2018. The index table number 4 below shows the development of cocaine production within the period 2012 – 2018.

**Table 4. Production of Cocaine per TN from 2012 to 2018 Latin America**

Years	Production of Cocaine per TN (Colombia)	Production of Cocaine per TN (Peru)	Production of Cocaine per TN (Bolivia)	Total TN
2012	481	307	165	953
2013	446	359	190	995
2014	532	353	225	1110
2015	777	409	255	1441
2016	1040	409	275	1724
2017	611	486	249	1346
2018	458	509	254	1221

Source: self-processing based on COD Data

### 5.6.2 Poppy Production

Another illicit crop is poppy, which is used as a base for heroin and other synthetic drugs. Poppy crops in Latin America are concentrated in Mexico in an area called the Golden Triangle. It is a mountainous area, with a temperate climate, which makes it perfect for growing poppies. In Colombia, there are also poppy crops but they have already been decreasing due to the high production in Mexico.

The growth of poppy crops in Mexico reached 32 thousand hectares in 2018, almost 220% more than in 2012. This growth is due to the presence of drug cartels that previously were only dedicated to the production of marijuana and the transport of cocaine. At present, these drug cartels have occupied key areas for poppy production, which has reflected the increase in production. The index table number 5 below shows the development of poppy per hectare in Mexico and Colombia from the period 2012 – 2018. In the index is visible the growth in hectares of poppy from 10 HT in 2012 to 32 HT in 2018.

**Table 5. Yields of Poppy per HA from 2012 to 2018**

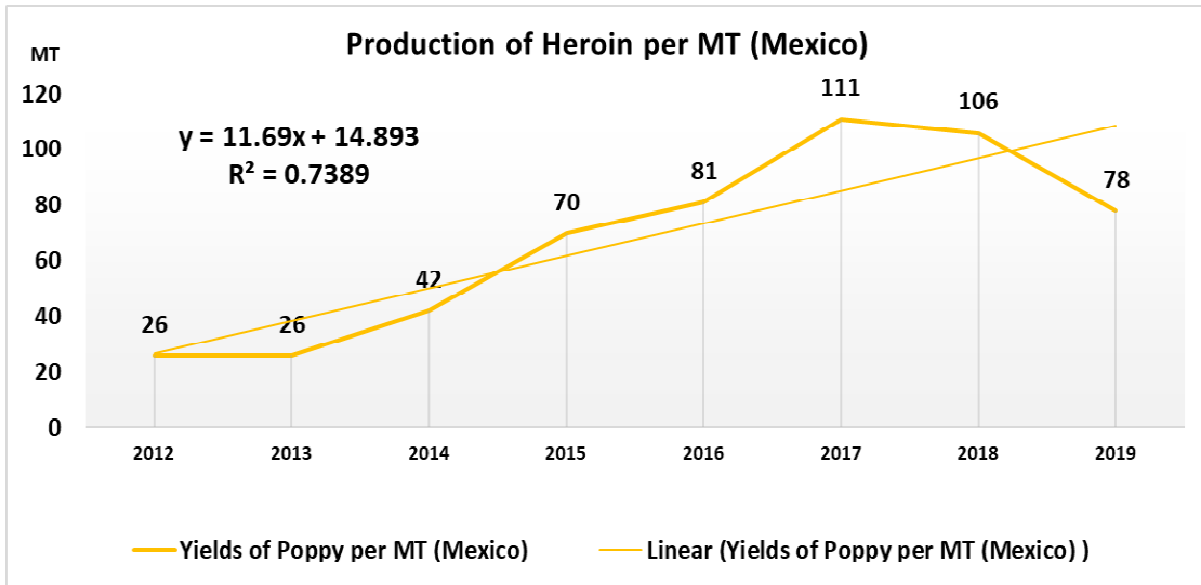
Years	Yields of Poppy per HA (Colombia)	Yields of Poppy per HA (Mexico)	Yields of Poppy per HA
2012	337	10500	10837
2013	312	11000	11312
2014	298	17000	17298
2015	591	28000	28591
2016	462	32000	32462

Source: self-processing based on ONDCP Data

There are also estimates of the tons of heroin produced. According to the Office of National Drug Control Policy in the United States, the heroin production in Mexico went from 26 thousand tons in 2012 to 106 thousand tons in 2018.

The graph number 30 below shows the trend of heroin production from the period 2012 – 2018

Graph 30. Production of Poppy per MT from 2012 to 2018



Source: self-processing based on ONDCP Data

As mentioned above, the growth of these crops is based on the lack of presence of the state in the most vulnerable rural communities. Without the presence of the state in these places, it is almost impossible to generate a change in the growth trend of these crops.

## 6. Conclusions & Discussions

The purpose of the analyzes exposed in this thesis is to evaluate the productive processes in Latin American agriculture, describe some of the economic benefits that the agricultural sector can deployed for the Latin American population and also to understand some of the challenges Latin America faces in terms of environmental impact and rural population.

In order with the objectives of this thesis, it was necessary to examine the role of the agricultural economy of Latin America in terms of GDP. It was found that in Latin America the share of agriculture in regional GDP decreased between the years 2000 and 2019. According to the United Nations, this decrease is due to the growth of other economic sectors such as the manufacturing industry, the service economy and tourism. (United Nations, 2020)

In the theoretical part and in the results, some detail was given on the properties that make up the trade of agricultural products in Latin America. The productive growth of recent years in the Latin American agricultural sector has led to a significant balance of agricultural exports over other exports. Latin America has maintained the share of agricultural exports an average of 20% of total exports in the period between 1990 and 2018. Although it is true that agricultural productivity has improved, according to the FAO, this balance is largely due to the dependence that exists in some countries on the export of agricultural products (FAO, 2020)

Based on the investigation of this thesis, it was found that Latin America has a very stable trade balance since its agricultural imports still do not exceed agricultural exports. Agricultural exports in 2018 reached 219 billion dollars while agricultural imports were 75 billion dollars, this leaves a super habit of around 144 billion dollars. This allows the region a greater margin to negotiate trade agreements with other regions of the world.

Despite of this, the World Bank says that many of the agricultural exports in Latin America are extremely dependent on the largest economies in the world such as China, the USA and the EU, this dependence can keep agricultural exports with very low growth and limiting the regions to trade with other regions. (FAO, 2019)

Among the most exported products from Latin America, you can find fruits, cereals, raw material and livestock derivatives. Among the main exported fruits are; avocado, pineapple, mango, papaya and bananas. There are also very important cereals such as rice, wheat and corn. Among the main crops, the most important is the soybean production that has grown in recent years. Going from 54 million tons in 1990 to 136 million tons in 2018. Which makes this crop the one with the highest productivity in the region. The livestock had a positive balance in recent years also with a total production of more than 120 million tons of meat in 2018 including the three most important meat segments Chicken, Pork and Beef.

All this variety of agricultural products exported, consolidates Latin America as one of the great generators of food in the world.

After analyzing the indicators and commercial performance, it was also sought to analyze some of the environmental impact factors generated by this agricultural productivity. Among these factors, it was found that the emission of greenhouse gases related to agricultural activity did not have a significant increase in recent years. To cite an example, the CO<sub>2</sub> emissions generated by livestock were 985 thousand GG in 2010, while in 2018 they reached 1,027,615 GG. Despite this, FAO concludes that 70% of CO<sub>2</sub> emissions in Latin American agriculture come from livestock. (Moreno-Moreno, 2018)

Among other points analyzed was the reduction of forest areas between 1990 and 2016, between these periods the forest areas of Latin America were reduced by 6%. This reduction was verified under a regressive analysis that resulted in the relationship between the growth of agricultural land and the decrease of forestland. If the reduction of forest areas continues, this could put more risks on ecosystems in Latin America.

Other direct impacts generated by agricultural production in Latin America, is focused on the rural population. This population segment was affected in recent decades by the lack of organization and participation of the rural population in the productive sectors of agriculture. According to the World Bank, the rural population in Latin America

represented 29% in 1990 and in 2018; it barely reached 19%, this despite the growth of agricultural exports.

In the theoretical part, the plans for 2030 were conceived in terms of food production worldwide, where it is believed that Latin America leads the production; this fact has a very bad contrast with the decrease in the rural population, since if the reduction of the population follows the same trend. Latin American governments would be approving the concentration of productive lands on the large economic sectors.

Among the factors that were reviewed that influence the productive sectors of agriculture in Latin America are illicit crops. This scourge only applies to a few countries in the region such as Colombia, Mexico, Peru and Bolivia. Among the data found, it could be observed that the production of coca leaf has grown by around 130 in the last 8 years. These illicit crops are occupying 255 thousand hectares of arable land that can be used for the cultivation of other products. This growth is due to the abandonment of these rural areas and in another case, such as Bolivia, direct government support for coca leaf producers.

The social impact of these illicit crops is significantly negative for agriculture and for the rural population. This is also an important factor in the reduction of the rural population and the low productivity of some regions of Latin America.

According to FAO, if the peace process with the Colombian guerrilla FARC and the government ends in a positive way, Colombia could recover around 22 million hectares of arable land, which could generate a great increase in agricultural productivity in the region. (FAO, 2017)

To sum up, the causes and factors, which influence the productivity of the agriculture in Latin America, must be addressed individually and simultaneously. The factors are numerous and complex but with high possibility to be solved, in order to achieve the conditions so that agriculture can fully perform its essential functions and vigorously manifest its true potential. Similarly, the current productive balance allows us to continue to trust the productivity of the Latin American agricultural sector.

## 7. References

- 1) AGENCIAS, 2020. *Dinero.com*. [Online]  
Available at: <https://www.dinero.com/sv/es/economia/sector-empresarial-latinoamericano-dispuesto-a-cooperar-para-impulsar-la-agricultura.html>  
[Accessed 15 03 2021].
- 2) Aranda, M., 2012. *Cultivos ilícitos, territorios y drogas en Latinoamérica: Perspectivas comparativas*. [Online]  
Available at: <https://revistas.ufri.br/index.php/dilemas/article/download/7406/5955>  
[Accessed 15 03 2021].
- 3) Arias, J., 2020. *Inter-American Institute for Cooperation on Agriculture*. [Online]  
Available at: <https://iica.int/en/press/news/agricultural-exports-latin-america-increase-85-while-total-foreign-sales-drop-30>  
[Accessed 15 03 2021].
- 4) Bake, R., 2011. *Transnational Crime and the Developing World*. [Online]  
Available at: [https://secureservercdn.net/45.40.149.159/34n.8bd.myftpupload.com/wp-content/uploads/2017/03/Transnational\\_Crime-final.pdf#page=13](https://secureservercdn.net/45.40.149.159/34n.8bd.myftpupload.com/wp-content/uploads/2017/03/Transnational_Crime-final.pdf#page=13)  
[Accessed 15 03 2021].
- 5) Bravo, E., 2015. *Espacio Abierto*. [Online]  
Available at: <https://produccioncientificaluz.org/index.php/espacio/article/view/1711>  
[Accessed 15 03 2021].
- 6) Carr, D. L. A. & B. R., 2009. *Springer Link*. [Online]  
Available at: <https://link.springer.com/article/10.1007/s11111-009-0090-4#citeas>  
[Accessed 15 03 2021].
- 7) Chavarría, H., 2017. *Perspectivas de la agricultura y del desarrollo rural en las Américas*. [Online]  
Available at: <http://www.fao.org/3/i8048es/i8048ES.pdf>  
[Accessed 15 03 2021].
- 8) FAO Articale, 2020. *FAO*. [Online]  
Available at: <http://www.fao.org/americas/prioridades/seguridad-alimentaria/es/>  
[Accessed 15 03 2021].
- 9) FAO Articule, 2019. *Apoyo a la inversión responsable en la agricultura*. [Online]  
Available at: <http://www.fao.org/in-action/responsible-agricultural-investments/our-work/trabajando-con-el-sector-privado/es/>  
[Accessed 15 03 2021].
- 10) FAO Media, 2020. *FAO Agro News*. [Online]  
Available at: <http://www.fao.org/in-action/agronoticias/es/>  
[Accessed 15 03 2021].
- 11) FAO, 2016. *Puntos destacados del informe La agricultura: hacia 2015/2030*. [Online]  
Available at: <http://www.fao.org/spanish/newsroom/news/2002/7833-es.html>  
[Accessed 15 03 2021].
- 12) FAO, 2017. *Colombia asks FAO to collaborate in implementation of peace agreements*. [Online]  
Available at: <http://www.fao.org/news/story/en/item/430924/icode/>  
[Accessed 15 03 2021].

- 13) FAO, 2020. *CONFERENCIA REGIONAL DE LA FAO*. [Online]  
Available at: <http://www.fao.org/3/nc776es/nc776es.pdf>  
[Accessed 15 03 2021].
- 14) FAO, H. R. -, 2010. *Calidad de los Alimentos y Tradiciones de America Latina*. [Online]  
Available at: <http://www.fao.org/3/au691s/au691s.pdf>  
[Accessed 15 03 2021].
- 15) FAO, O. a., 2019. *LATIN AMERICAN AGRICULTURE*. [Online]  
Available at: <http://www.fao.org/>  
[Accessed 15 03 2021].
- 16) Foster, A. V. & W., 2010. *Evolución y distribución del ingreso agrícola en*. [Online]  
Available at:  
[http://www.fao.org/fileadmin/user\\_upload/AGRO\\_Noticias/docs/LCW\\_338\\_ValdezEtAl.pdf](http://www.fao.org/fileadmin/user_upload/AGRO_Noticias/docs/LCW_338_ValdezEtAl.pdf)  
[Accessed 15 03 2021].
- 17) Giordano, P., 2019. *TRADE TRENDS ESTIMATES LATIN AMERICA AND THE CARIBBEAN*. [Online]  
Available at:  
[https://www.wto.org/english/tratop\\_e/devel\\_e/a4t\\_e/gr19\\_e/trade\\_trends\\_estimates\\_latin\\_america\\_and\\_the\\_caribbean\\_2019\\_edition\\_1q\\_update\\_en\\_e.pdf](https://www.wto.org/english/tratop_e/devel_e/a4t_e/gr19_e/trade_trends_estimates_latin_america_and_the_caribbean_2019_edition_1q_update_en_e.pdf)  
[Accessed 15 03 2021].
- 18) Glossary, O., 2021. *OECD*. [Online]  
Available at: <https://stats.oecd.org/glossary/detail.asp?ID=1100>  
[Accessed 15 03 2021].
- 19) Gómez, F. S., 2018. *The land market in Latin America and the Caribbean*. [Online]  
Available at: <http://www.fao.org/3/i4172e/i4172e.pdf>  
[Accessed 15 03 2021].
- 20) Green Peace, 2019. *Cifras actualizadas Incendios Amazonas*. [Online]  
Available at: <https://www.greenpeace.org/argentina/story/issues/bosques/cifras-actualizadas-25-millones-de-hectareas-quemadas-en-el-amazonas/#:~:text=Cifras%20actualizadas%3A%20%2C5%20millones%20de%20hect%C3%A1reas%20quemadas%20en%20el%20Amazonas,-Prensa%20Argentina%2>  
[Accessed 15 03 2021].
- 21) Grisaffi, T., 2018. *DRUG POLICY REFORM IN LATIN AMERICA - 2018*. [Online]  
Available at: <https://research.reading.ac.uk/coca-cocaine-bolivia-peru/wp-content/uploads/sites/127/Unorganized/Drugs-Policy-Reform-2018-website-.pdf>  
[Accessed 15 03 2021].
- 22) Guardian, T., 2009. *Drug money saved banks in global crisis, claims UN advisor*. [Online]  
Available at: <https://www.theguardian.com/global/2009/dec/13/drug-money-banks-saved-un-chief-claims>  
[Accessed 15 03 2021].
- 23) Haar, J., 2015. *Global Americans*. [Online]  
Available at: <https://theglobalamericans.org/2015/10/latin-americas-agricultural-challenges/>  
[Accessed 15 03 2021].



- 24) IICA, 2020. *Inter-American Institute for Cooperation on Agriculture*. [Online]  
Available at: <https://blog.iica.int/blog/cuales-paises-america-latina-caribe-marcan-pauta-del-comercio-agricola-mundial-durante>  
[Accessed 15 03 2021].
- 25) Libre, D., 2016. *Agricultura RD*. [Online]  
Available at: <http://otca.gob.do/latinoamerica-mayor-exportador-de-alimentos/#:~:text=El%20an%C3%A1lisis%20difundido%20este%20jueves,observado%20en%20el%20a%C3%B1o%202000.>  
[Accessed 15 03 2021].
- 26) Meyer, P. J., 2016. *Central America Regional Security Initiative: Background and Policy Issues for Congress*. [Online]  
Available at: <https://fas.org/sgp/crs/row/R41731.pdf>  
[Accessed 15 03 2021].
- 27) Moreno-Moreno, J.-J., 2018. *Assessment of the operational and environmental efficiency of agriculture in Latin America and the Caribbean*. [Online]  
Available at: [https://www.agriculturejournals.cz/web/agricecon.htm?type=article&id=260\\_2016-AGRICECON](https://www.agriculturejournals.cz/web/agricecon.htm?type=article&id=260_2016-AGRICECON)  
[Accessed 15 03 2021].
- 28) Nation, U., 2014. *United Nation News - las reservas de tierra cultivable*. [Online]  
Available at: <https://news.un.org/es/story/2014/12/1318361>  
[Accessed 15 03 2021].
- 29) O'NEILL, J., 2016. *THE REVIEW ON ANTIMICROBIAL RESISTANCE*. [Online]  
Available at: [https://amr-review.org/sites/default/files/160525\\_Final%20paper\\_with%20cover.pdf](https://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf)  
[Accessed 15 03 2021].
- 30) Pascual, F., 2003. *La agricultura latinoamericana en la era de la globalización y de las políticas neoliberales*. [Online]  
Available at: <https://www.raco.cat/index.php/RevistaGeografia/article/view/46130>  
[Accessed 15 03 2021].
- 31) Pizarro, J., 2020. *Agricultures*. [Online]  
Available at: <https://agriculturers.com/>  
[Accessed 15 03 2021].
- 32) Rapallo, F. R., 2017. *PANORAMA DE LA SEGURIDAD ALIMENTARIA Y NUTRICIONAL EN AMÉRICA LATINA*. [Online]  
Available at: <http://www.fao.org/3/i7914s/i7914s.pdf>  
[Accessed 15 03 2021].
- 33) Salcedo, F. & S., 2018. *Agricultura Familiar en América Latina y el Caribe*. [Online]  
Available at: <http://www.fao.org/3/i3788s/i3788s.pdf>  
[Accessed 15 03 2021].
- 34) School, K., 2019. *The Factors of the Illegal Drug Trade on Latin America*. [Online]  
Available at: <https://news.kdischool.ac.kr/the-factors-of-the-illegal-drug-trade-on-latin-america/>  
[Accessed 15 03 2021].

- 1) Solution, W. I. T., 2021. *World Integrated Trade Solution*. [Online]  
Available at: [https://wits.worldbank.org/CountryProfile/en/Country/LCN/Year/2018/TradeFlow/Export/Partner/by-region/Product/16-24\\_FoodProd](https://wits.worldbank.org/CountryProfile/en/Country/LCN/Year/2018/TradeFlow/Export/Partner/by-region/Product/16-24_FoodProd)  
[Accessed 15 03 2021].
- 2) United Nations, C., 2020. *CEPAL*. [Online]  
Available at: [https://www.cepal.org/es/comunicados/america-latina-caribe-representa-8-pib-global-la-poblacion-mundial-segun-nuevo-informe#:~:text=Am%C3%A9rica%20Latina%20y%20el%20Caribe%20representa%20el%208%25%20del%20Producto,Caribe%20\(CEPAL\)%20form%C3%B3%20parte.](https://www.cepal.org/es/comunicados/america-latina-caribe-representa-8-pib-global-la-poblacion-mundial-segun-nuevo-informe#:~:text=Am%C3%A9rica%20Latina%20y%20el%20Caribe%20representa%20el%208%25%20del%20Producto,Caribe%20(CEPAL)%20form%C3%B3%20parte.)  
[Accessed 15 03 2021].
- 3) Varangis, P., 2015. *World Bank - Access to finance for smallholder farmers*. [Online]  
Available at: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/965771468272366367/access-to-finance-for-smallholder-farmers-learning-from-the-experiences-of-microfinance-institutions-in-latin-america>  
[Accessed 15 03 2021].
- 4) Vergara, I. - W., 2015. *Agricultura y Clima Futuro en América Latina y el Caribe*. [Online]  
Available at: <https://publications.iadb.org/publications/spanish/document/Agricultura-y-clima-futuro-en-Am%C3%A9rica-Latina-y-el-Caribe-impactos-sist%C3%A9micos-y-posibles-respuestas.pdf>  
[Accessed 15 03 2021].
- 5) World Bank, W., 2020. *World Bank*. [Online]  
Available at: <https://datos.bancomundial.org/indicador/NV.AGR.TOTL.ZS>  
[Accessed 15 03 2021].