



## Taste the future - Report

*"The potential of food horticulture in Colombia"*

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## **Disclaimer**

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## Foreword

Colombia is a country with great agricultural potential and has been called on several occasions as a future worldwide food supplier. Nevertheless, the horticultural sector in Colombia must improve its way of producing, both in the implementation of technology and certifications and in the training of producers to be able to reach its potential, and to fulfill the growing demand for safe and healthy food.

This report, which was commissioned by the Netherlands Enterprise Agency - RVO, is the result of a qualitative research and literature review, validating the results of different interviews conducted throughout the chain of vegetables production and distribution in the country, from the producer to the retail stores.

We would like to thank entrepreneurs, producers and entities that gave us their time and allowed us to visit them in their operations.

We would like to give special thanks to the Agricultural Department of the Embassy of The Kingdom of the Netherlands in Colombia for encouraging and looking for alternatives for the improvement of the horticultural sector in Colombia.

Colombia, March 2020

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## Index

<b>Disclaimer</b> .....	2
<b>Foreword</b> .....	3
<b>Summary</b> .....	5
<b>1. Introduction</b> .....	7
1.1 Background.....	7
1.2 Focus of this study.....	8
1.3 Structure of this study.....	8
<b>2. Colombia 2020</b> .....	9
2.1 Demographics.....	9
2.2 Consumption.....	10
2.2.1 Stratum and income level.....	10
2.2.2 Consumption and income level.....	11
2.3 Production.....	14
2.3.1 Situation agricultural sector in Colombia.....	14
2.3.2 Vegetable sector.....	16
2.3.3 Generalities of the vegetable sector in Colombia.....	18
2.3.4 Types of growers.....	19
2.3.5 Technology in the cultivation of vegetables.....	21
2.3.6 Greenhouses in Colombia.....	23
2.3.7 Training.....	27
2.3.8 Food safety and good agricultural practices in the country.....	29
2.3.9 Monitoring programs for pesticide residues in fruit and vegetable products.....	31
2.3.10 Exports of fresh vegetables.....	33
2.4 Distribution channel.....	35
2.4.1 Distribution chain.....	35
2.4.2 Wholesale markets.....	39
2.4.3 Road infrastructure.....	42
2.4.4 Retail.....	43
2.4.5 Food service and horeca a growing sector.....	46
<b>3. Colombia 2030</b> .....	49
3.1 Demographics 2030.....	49
3.2 Consumption trends 2030.....	51
3.3 Production 2030.....	52
3.4 Distribution channel 2030.....	54
3.4.1 Distribution channel.....	54
3.4.2 Smart logistics - direct supply.....	55
<b>Appendix 1. Persons interviewed in Colombia</b> .....	56
<b>Bibliographic references</b> .....	60

## Summary

Colombia needs to feed its constantly growing cities. More than 90% of Colombia's population already lives in urban areas. This percentage will increase even more in the coming years. By 2020, 33% of the population in Colombia lives in one of the six largest cities. The strata that predominate in the main cities of the country are strata 1, 2 and 3 with more than 70% of the urban population. Consumers in these strata do not easily buy certified agricultural products, and generally buy basic products such as potatoes, carrots, tomatoes, and onions.

The average daily consumption of fruit and vegetables of the population between the ages of 5 and 64 in Colombia only reaches 133 grams, about 3 times less than the recommended quantity of fruits and vegetables. Of this quantity, only 45,8 grams correspond to vegetables. However, an elastic behavior has been identified according to the income level of the population for fruits and vegetables. As the income of Colombian families increases the consumption of vegetable increases. But still the Colombian consumer is not very demanding in food quality and safety which contributes to the low competitive development of vegetable production.

Food Farmers receive insufficient technical assistance and the technical assistance they receive is provided mainly by companies importing and distributing seeds, agrochemicals and fertilizers. However, government entities and public projects claim that they are reaching small producers with technical assistance. The products are mainly aimed for local markets, wholesalers and wholesale markets. There is a high level of intermediation, which is why they are subject to prices governed by supply

and demand, set by the wholesale markets. Producers without storage possibilities, must therefore sell their products the day they have been harvested.

Food Producers supply the main chain stores, and they guarantee a steady supply of volume to their customers. The method of production does not necessarily involve high technology. Normally they use a traditional production system without large long-term investments.

Through the interviews carried out, professional producers were identified as farmers who invest in technology, have different crops and/or varieties and have certifications in good agricultural practices for their products. Their products are sold in different markets.

The main vegetables planted in the country are tomato, carrot and bulb onion. These vegetables do not have a high level of technological development. Tomato cultivation has been introducing technology such as greenhouses and irrigation systems for 12 years. Low investments are required for the construction of these greenhouses compared to those used in other regions of the world.

Producers argue that it is difficult to pass from their open field crops to production in greenhouses, because the initial investment is high, and they are afraid of accessing a bank loan due to the price uncertainty that the sector experiences. Additionally, they do not have the knowledge of the benefits of producing in a greenhouse, the impact of increased productivity and the agronomic technical management to implement under this technology.

As previously mentioned, the sector has low technical knowledge and a great need for technical training in production aspects, greenhouse management, fertigation, integrated pest, and disease management, post-harvest and logistics. There is also a lack of specialized horticultural knowledge on the part of agronomists in the country, where there is not yet enough information to manage controlled greenhouse conditions and to manage irrigation and fertigation.

Currently, exports to the Caribbean islands and other export markets are incipient and need more technical knowledge and development of the logistics chain. The increase in exports of the horticultural sector is very important, since this drives the development of the sector and the use of technologies to improve productivity, quality and be competitive in the international market.

Among the main difficulties of the vegetable distribution chain is the disconnection of the production farms from the markets and, additionally, the travel times are high from the municipalities to the destination markets in the main cities (due to the distance and the bad road infrastructure). The logistics chain in Colombia is long, due to the number of buyers that intervene between the producer and the trade marketer, and also because the logistics chain lacks adequate technologies for preserving product quality.

The Food Service sector has been driving change in the value chain of vegetables in the country, since they require products with traceability, food safety compliance, certified in good agricultural practices, different varieties and with added value such as processing

(washing, disinfection, pre-cutting) to be delivered to restaurants and food franchises in the country.

In general, an increase in the income of Colombian households and a consolidation of the country's middle class are expected. Consequently, given that a higher level of income is related to higher consumption of fruits and vegetables, it is expected that in the next decade the consumption of this type of food will continue to maintain a positive trend in the country. In Colombia, higher income levels have been associated with healthier eating patterns, including more expensive foods like herbs, fish and vegetables, and with the quest for a better and healthier life.

These trends require a change in the Colombian production system for fruit and vegetable products with a different focus on farming systems. Food productivity and quality need to be increased when produced in a sustainable way. And there is also a need to reduce food losses by better connecting farmers to the market and better post-harvest technologies and agricultural logistics.

By 2030, distribution chains between producer and consumer are expected to be shorter. It is also expected that the products must have certification in good agricultural practices (GAP) in the different sales channels. Therefore, large and medium farmers will also have to invest in technology to improve the productivity and food security of their products to become part of this distribution channel.

# 1. Introduction

## 1.1 Background

Two and a half years ago, the Embassy of the Kingdom of the Netherlands in Bogota opened an Agricultural office. In the Netherlands, there is a strong interest in the developments of the horticultural food sector in Colombia. Different studies have been carried out to identify business opportunities between the two countries. Various initiatives have been developed, not all of them successful. However, the objective of this study is to serve as input to develop a strategy and action plan for the agricultural department at the Embassy of the Netherlands in Bogota and the Ministry of Agriculture, Nature and Food Quality with recommended interventions on how to maximize the contribution of Dutch companies and knowledge institutes to the sustainable and inclusive development of this sector in Colombia. But also with recommendations on how the knowledge and technology base of the local private sector could be strengthened.

Colombia needs to feed its ever-growing cities. Already more than 90% of Colombia's population lives in urban areas. This percentage will increase even further in the coming years. In Latin American megacities like Bogota, access to food as well as access to food of sufficient quality is increasingly important. What also matters is the inclusive growth of the often-small producers in the rural areas around these megacities. These small farmers often play a key role in the local food supply. At the same time, the middle class living in these cities with increasing purchasing power is growing. This middle class wants to have access to higher quality, healthier, more sustainable and more diversified food.

This requires a future change in the Colombian production system for horticulture food products with a different approach in the cropping systems. The current level of technology consists of greenhouses made mainly with a structure of bamboo and polyethylene plastic and wood. The greenhouse has a simple irrigation system and fertilizers are generally applied twice a week.

Particularly the horticultural sector, more specifically the segment of protected cultivation of fruit vegetables like tomatoes, bell peppers and cucumbers but also lettuce and herbs, have potential, because at the moment it is practically greenfield, and production mainly takes place in open fields. Induced by sustainability, food safety, quality but also food security, protected and more controlled cultivation will (have to) be developed. There is a need to increase sustainably produced food, productivity and quality. And there is a need to reduce food losses by better connecting farmers with the market and better postharvest technologies and agro-logistics.

Dutch knowledge institutes and companies, for example, those specialized in cropping systems, post-harvest and logistics for horticulture food products could make an important contribution to a dynamic and at the same time sustainable growth and development of this sector in Colombia, providing healthy and safe food to an ever-increasing urban population.

Although protected cultivation of vegetables is still in its infancy, it is important to have a better understanding of the present situation, expected developments and future challenges and opportunities.

## 1.2 Focus of this study

This study will present the current situation of production and market of horticulture food products in Colombia and, mainly looking from a consumer perspective, expected developments, challenges and potential of the sector. Thereby, focusing on production for the local market however not necessarily excluding export potential for the mentioned products.

The focus will be on the more intensive crops like fruit vegetables (tomato, cucumber, bell peppers, etc.), lettuce and fresh herbs. Other less intensive and field-grown crops (like potatoes, onions, and carrots) will not be included in the study.

The vision of the Ministry of Agriculture, Nature and Food Quality of the Netherlands on circular agriculture is an area where the Netherlands, considering its knowledge, technology and innovations, could make an important contribution to a dynamic and at the same time sustainable and inclusive growth and development of this sector in Colombia. A sector providing healthy and safe food to an increasingly urban population, at the same time facing ever-increasing pressure from climate change, lack of employees and rising labor costs.

This analysis can also help Colombian stakeholders in developing a strategy and action plan for a sustainable development of their horticultural sector in order to feed their ever-growing megacities.

## 1.3 Structure of this study

For the structure of this report we have used a framework of pre-requisites for Dutch companies and organizations to become successful in the Colombian horticulture food production (focused on a domestic market) on a distant market with little Dutch presence in the sector:

**1. Market:** Domestic demand for diverse, good quality and safety certified food by a growing upper and middle class conscious of the benefits of consuming nutritious and healthy food in comparison to low income households.

**2. Supply chain:** Presence of a network of mid-to-high end supermarket outlets, food service, infrastructure to access markets, logistic systems, links to markets.

**3. Business environment:** Organization of growers, local incentives to invest, access to markets for foreign companies, presence of medium / large scale vegetable companies.

**4. Knowledge and capacity:** Knowledge structure in the country to educate extensionists, advisors and growers.

**5. Quality regulation:** Government regulations for quality and food safety requirements (supervision, enforcement, capacity for implementation, traceability of products).

The analysis of these pre-requisites will serve as input for the recommendations of possible strategies both in the Netherlands and Colombia presented in the report Taste the Future - Strategy document (RVO, 2020).

We will describe the current situation (2020) and have a look at the future situation (2030) for these five pre-requisites in the following chapters.

## 2. Colombia 2020

### 2.1 Demographics

By 2020, according to the data of 2019 of the National Administrative Department of Statistics (DANE in Spanish) Colombia will have a population of 50 million people in 32 departments with an annual population growth of 1,06%. Currently, the largest populated center is Bogota DC, capital of the country and main city of the department of Cundinamarca, which concentrates 16,5% of the population, approximately 8,4 million people. It is followed by the department of Antioquia with 13,4% of the population equivalent to 6,8 million inhabitants with its main city Medellin with 2,6 million people. In Colombia, 33% of the population lives in one of the six larger cities namely Bogota, Medellin, Cali, Barranquilla, Cartagena and Villavicencio<sup>1</sup>.

Colombia is in the midst of a demographic transition resulting from steady declines in its fertility, mortality, and population growth rates. The birth rate has fallen from more than 6 children per woman in the 1960's to just above replacement level today as a result of increased literacy, family planning services and urbanization. However, income inequality is among the worst in the world, and more than a third of the population lives below the poverty line (CIA, The World Factbook, 2018).

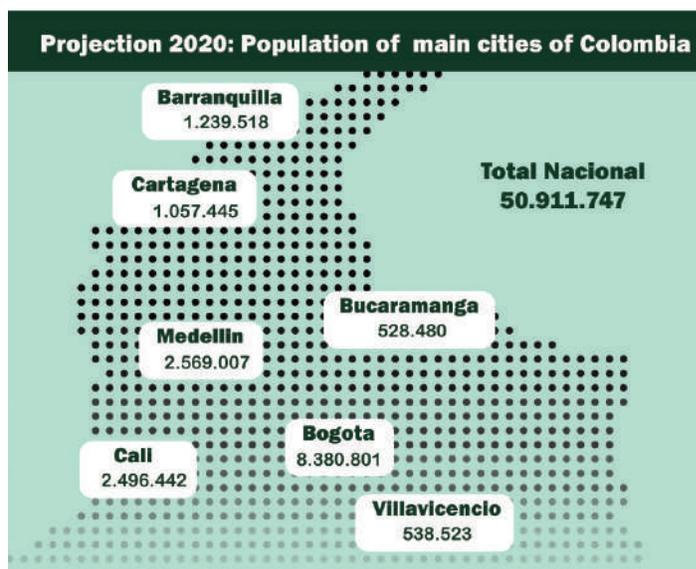


Figure 1. Population of main cities of Colombia (2020). Own preparation with data from DNP. Sistema de Estadística Territorial. TerriData\_Dim. Recovered online from: <https://terridata.dnp.gov.co> (04//07/2019).

<sup>1</sup>For more detailed information on demographics in Colombia see e.g. The World Factbook (<https://www.cia.gov/library/publications/the-world-factbook/geos/co.html>) and RVO International ondernemen (<https://www.rvo.nl/onderwerpen/internationaal-ondernemen/landenoverzicht/colombia>).

## 2.2 Consumption

### 2.2.1 Stratum and income level

Colombia has a socioeconomic stratification. It is a classification in the real estate stratum that should receive public services. Contributions for public services are collected based on this system because subsidies are assigned to the lower strata. The stratification includes six strata, with 1 being the stratum with the lowest income level and subject to subsidies and 6 with the highest income level and the highest tax contribution.

In addition to this, the socioeconomic stratification of the country is often used to guide the planning of public investments, create social programs in the areas that require it most, and which must pay cost overruns (contribution) on the value of public services to the government. In the figure below the distribution of socioeconomic strata of the main cities of Colombia is shown.

Profile of consumer			
Class	Lower class	Middle class	High class
Stratum	1-2	3	4-5-6
Income	\$359.000	\$1.133.000	\$4.041.000
Homes (14 millions)	31%	46%	23%
Consume diary of vegetables for person	35gr	52,8gr	58,3gr
Frecuency of buy vegetables	Dialy	Weekly	Weekly
Where do they buy vegetables	Neighborhood store	Chain stores or supermarket	Chain stores or specialized stores
Vegetable consumption	Tomato, onion and carrot	Tomato, onion, carrot, lettuce,pepers	Organic and special vegetables

Figure 2. Profile of consumer. Source: National Family Budget Survey (EPNH) of the DANE.

The strata that predominate in the main cities of the country are strata 1, 2 and 3 and account for more than 70% of the urban population. The consumers of these strata do not easily purchase organic or Good Agricultural Practices certified agricultural products since these are more costly. They are unaware of the importance of consuming agricultural products with Good Agricultural Practices and they buy basic products such as potatoes, carrots, tomatoes and onions.

power. Therefore, these strata consume more differentiated products of vegetables like different varieties of lettuce, cherry tomatoes, zucchinis, cucumbers and certified and organic vegetables.

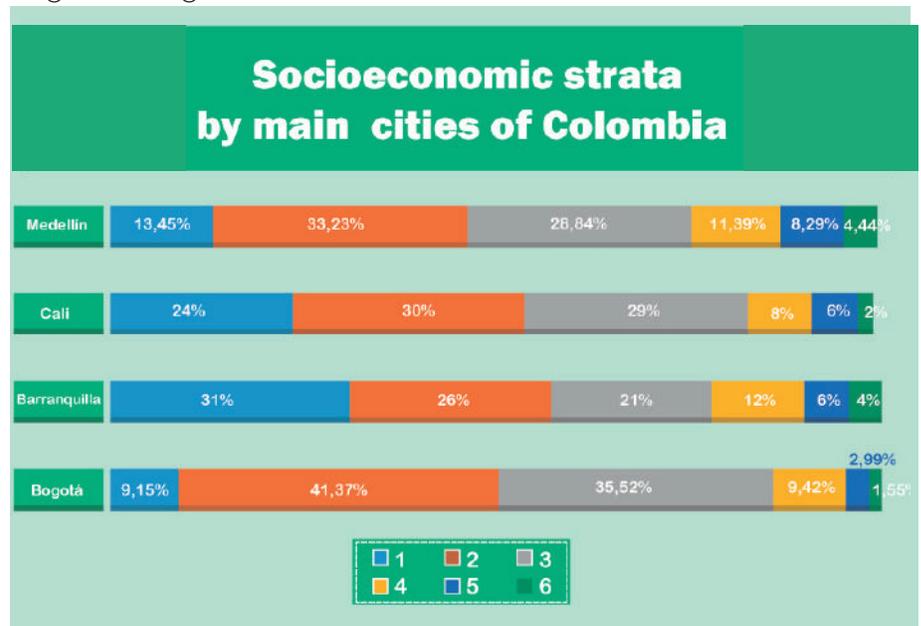


Figure 3. Socioeconomic strata by main cities of Colombia. Own preparation with data from: Cigüenza Riaño, Noelia. LR. La Republica News Paper.

Medellin (24%) and Barranquilla (22%) are the cities with the highest percentage of people in high strata (4, 5 and 6), which have the highest purchasing

### 2.2.2 Consumption and income level

According to the National Family Budget Survey (EPNH in Spanish) of the DANE conducted nationwide between 2016 and 2017, there are around 14 million households in Colombia (approximately three million more than between 2006 and 2007) which

have an average monthly income of 1.773.000 Colombian pesos (equivalent to 405 Euros). This represents 17% more than the average income recorded in the last measurement ten years before (between 2006 and 2007) (El Tiempo, 2018a).

The distribution of households according to their income is as follows:

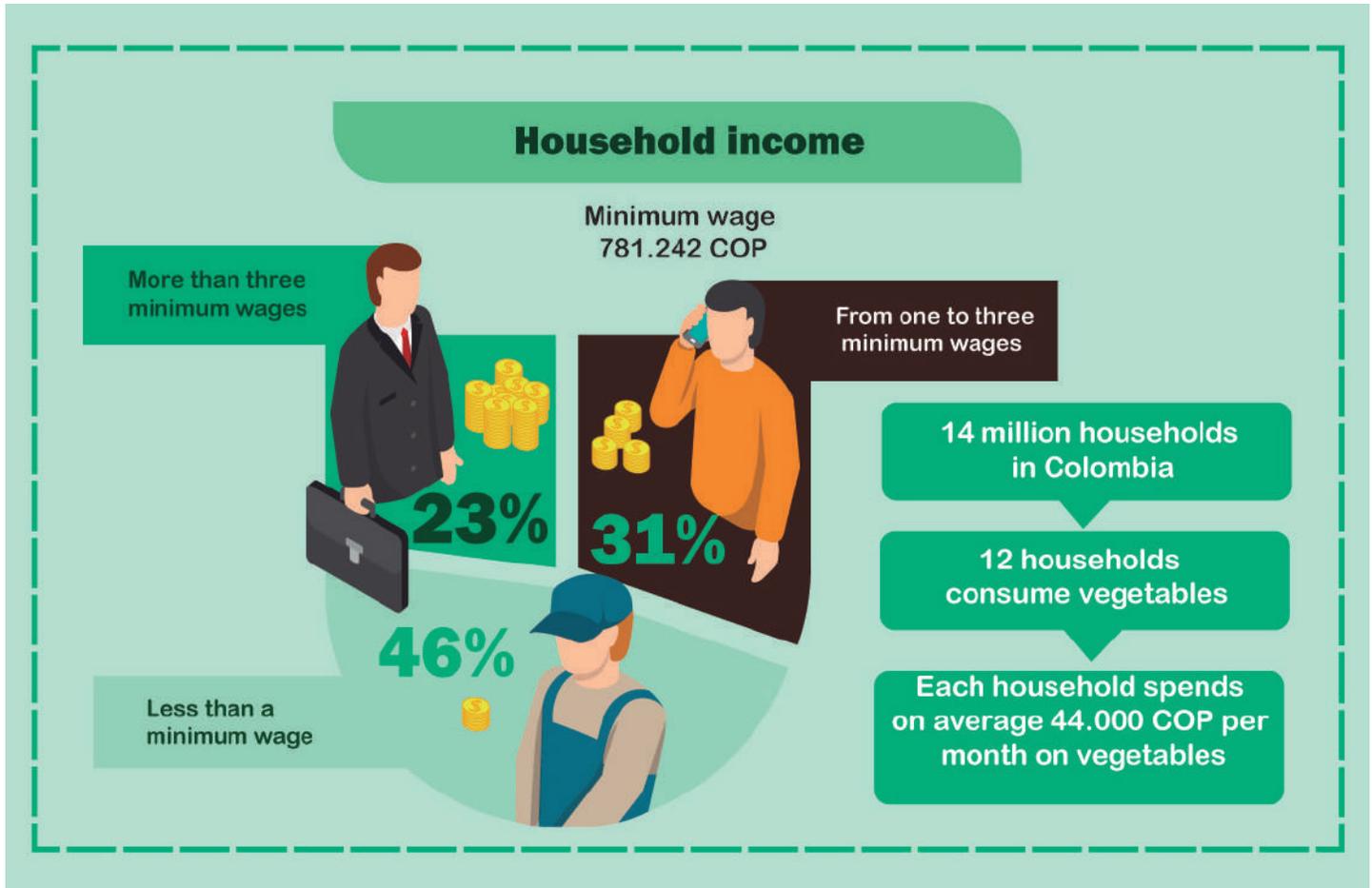


Figure 4. The distribution of households according to their income. Own preparation with data from DANE (2018). Consumption of vegetables data taken from the Ministry of Health and Social Protection and FAO (2013).

The same survey estimates that 12 million households consume vegetables, spending a total of 572.260 million Colombian pesos monthly, and that, per household, on average,

they spend 44.000 Colombian pesos per month to buy these vegetables (equivalent to 10,05 Euros).

## Vegetable consumption

- Five out of seven Colombians, (71,9%) do not consume vegetables daily
- Low consumption for people under 18 years of age, where 3 out of 4 do not consume vegetables at all on a daily basis
- Stratum 1 and 2 (76,7% ) do not consume vegetables daily



Figure 5. Vegetable consumption. Own preparation using data from DANE (2018). Health and Social Protection and FAO (2013).

In general, these consumption levels are lower than the recommendations of organizations such as the World Health Organization (WHO) and the FAO, which recommend that an individual between 5 and 64 years of age should consume an average of 400 grams of vegetables and fruits daily. The average daily consumption of the same population group in Colombia only reaches 133 grams, about 3 times less than the world recommendation, and of these only 45,8 gr correspond to vegetables (Ministry of Health and Social Protection and FAO, 2013).

According to the Ministry of Health and FAO (2013), among the main factors that influence these low consumption levels are food prices, sociodemographic changes, food services,

individual preferences and beliefs, cultural traditions, geographic and environmental factors and income. Regarding the latter, as aforementioned, there seems to be a positive relationship between household income and vegetable consumption; that is, as the income of Colombian families increases, so does their consumption of vegetables.

Indeed, an elastic behavior has been identified between the level of income of the population and the demand for fruits and vegetables, which estimates that an increase of 1% in wages could mean an increase of 0,6% in the case of fruits and 0,7% in the average consumption of vegetables (Ramírez, 2015).

## 2.3 Production

### 2.3.1 Situation agricultural sector in Colombia

In terms of technology, the Third National Census of Agriculture (3rd CNA) carried out by DANE (2016) revealed that agricultural production units (that produce agricultural, forest, livestock or aquaculture products) have the following technology in their production units.

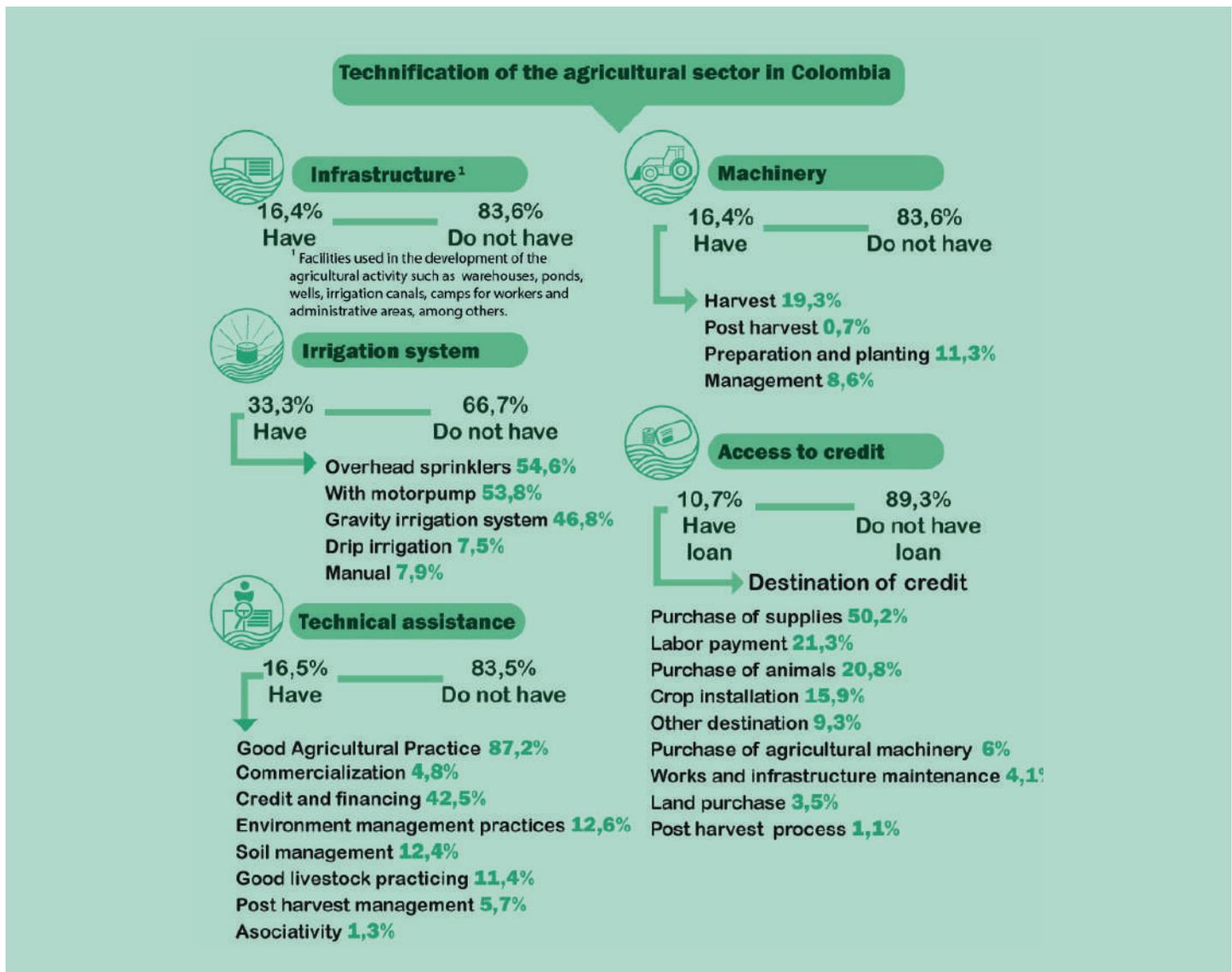


Figure 6. Technification of the agricultural sector in Colombia. Own preparation using data from CNA 2016 – DANE.

The agricultural sector in Colombia can be divided in the following crops. Vegetable crops only account for 4,2% of the total harvested area in Colombia but it's more intensive in production, land use and generation of (indirect) jobs.

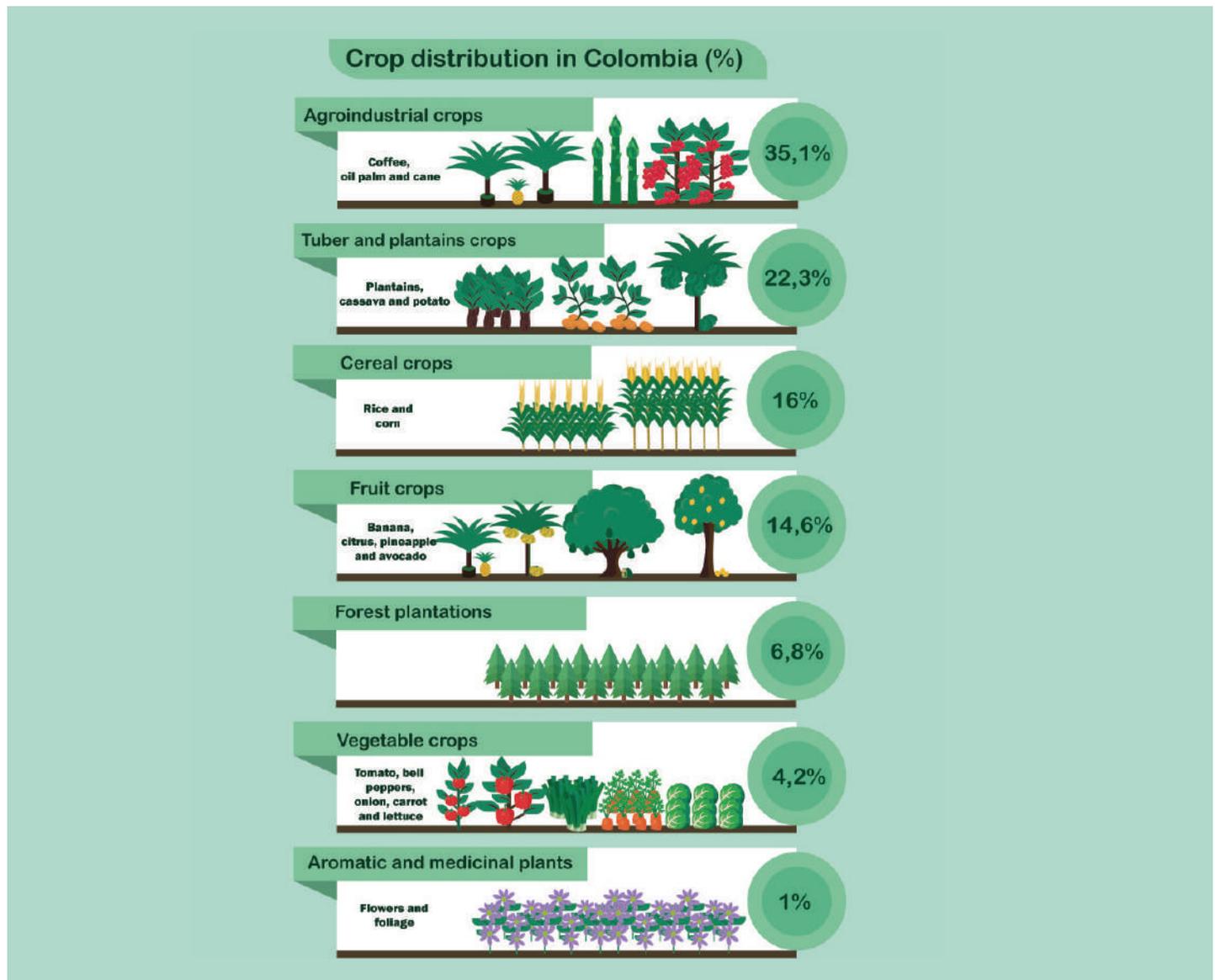


Figure 7. Crop distribution in Colombia. Own preparation using data from CNA 2016 – DANE.

### 2.3.2 Vegetable sector

Colombia produces fresh products mainly in the departments of Antioquia, Norte de Santander, Cundinamarca, Boyaca and Nariño (MINAGRO PPT, 2018). The vegetable subsector only occupies 4,2% of the agricultural sector but created by 2012 about 93.000 direct jobs. The total production was valued at 1,4 billion Colombian pesos.

Between 2008 and 2013, the area cultivated

with fruits and vegetables grew at an annual rate of 2,5%, from 952.000 to 1.083.010 hectares. This increase was based mainly on crops such as bananas, potatoes, yams and mango. This increment also affected crop practices and created a slight reduction in production costs (MINAGRO PPT, 2018). According to the interview with the Ministry of Agriculture of Colombia (2019), horticultural production has increased by at least 3% per year (between 2008 and 2013).

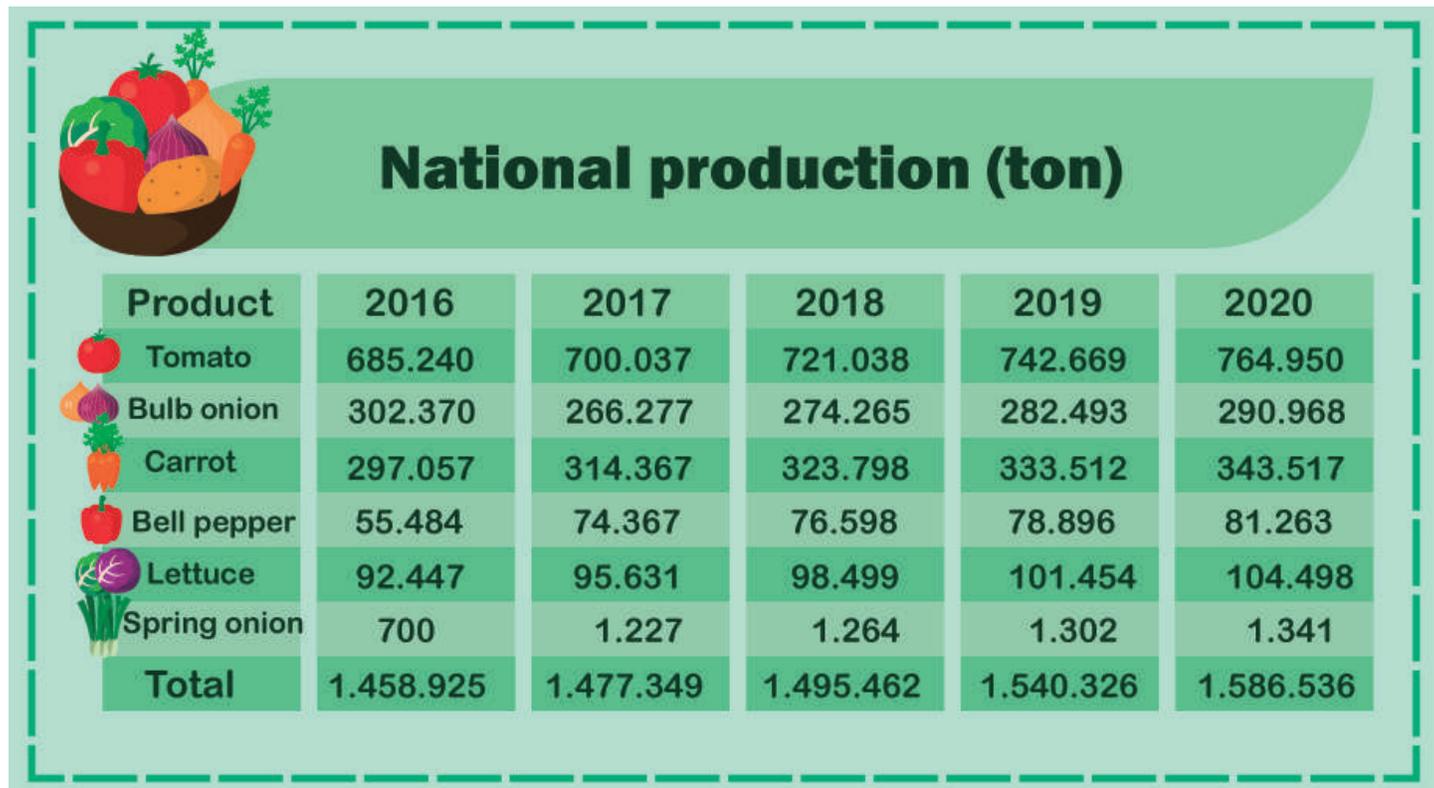


Figure 8. National production horticulture in 2018 in Colombia. Own preparation with data from ASOHOFRUCOL.

Below, the estimated figures for production in tons by the department are shown. The department of Boyaca with 463.953 tons

comes in first place followed by the department of Antioquia with 460.663 tons and by the department of Cundinamarca with 371.847 tons in 2018.

## Colombian horticulture by production zones - 2018

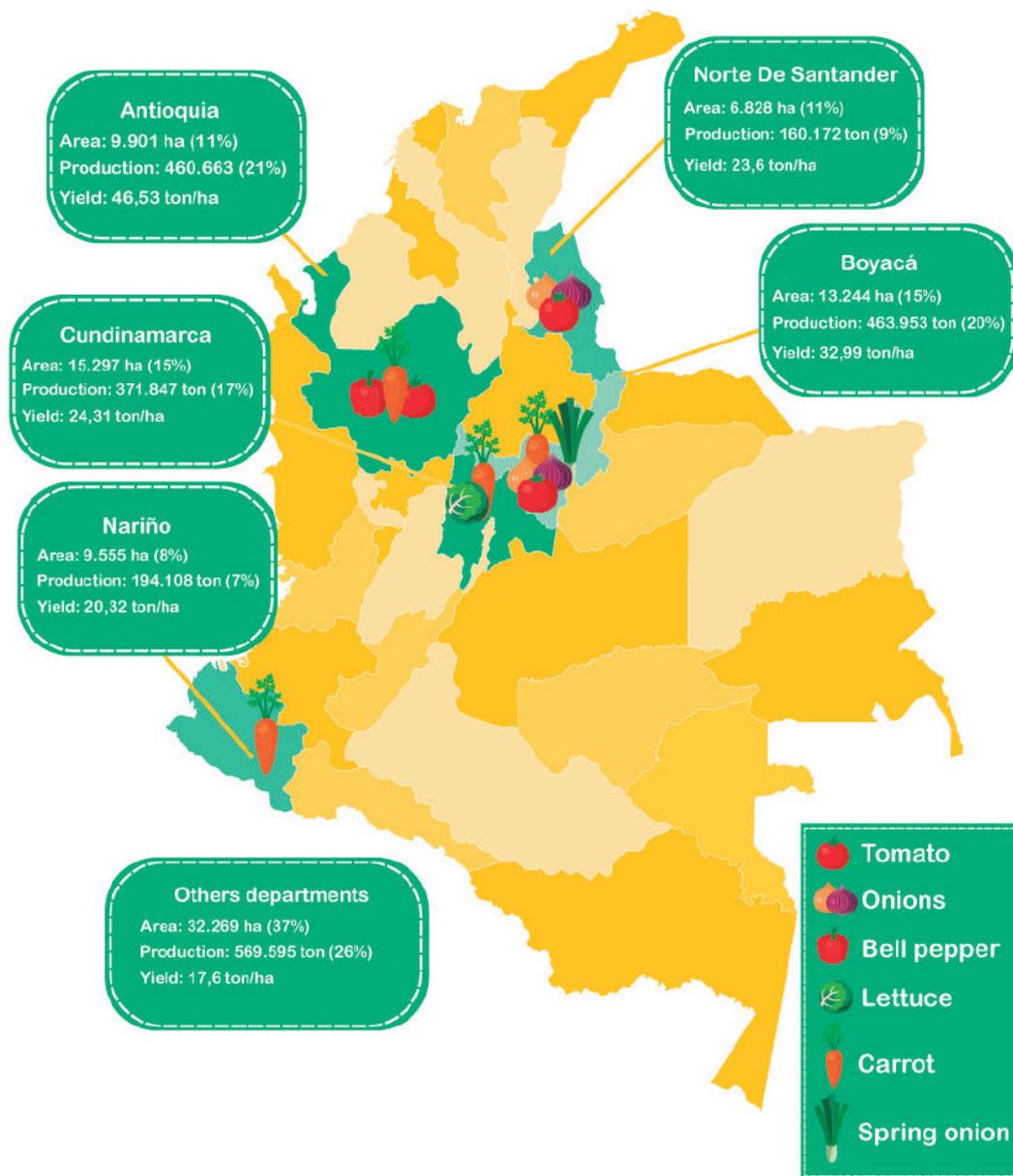


Figure 9. Colombian horticulture by production zones in 2018. Own preparation with data from: Bareño, Felipe. Ministry of agriculture development "Evaluaciones agropecuarias municipales- EVA" March 2019.

### 2.3.3 Generalities of the vegetable sector in Colombia

The horticultural grower is subject to the price based on supply and demand, determined by the intermediary. The lack of postharvest infrastructure obliges the grower to harvest the product without physiological maturity. The harvested products are selected by size and packed in bags of 50 kilos (e.g. carrots, onions and cabbage) or plastic crates of 20 kilos (e.g. tomatoes and peppers).

Horticultural production in Colombia is a farmers' economy and destined to satisfy the domestic market. The horticultural producer generally is a small producer, where 75% of the farms has an area of less than 3,0 hectares and 40% has less than 1,0 hectare. Vegetable production in Colombia is made up of more than 30 types of crops, and according to CNA – 2016 it is carried out throughout the country and more than 1.000 municipalities. The largest

area harvested is for peas, tomatoes, onions, carrots, squash ('ahuyama') and onions. The largest production volume is found in tomato crops. The highest yields in kilograms per hectare are obtained from the production of tomato under cover (greenhouse).

#### 2.3.4 Types of growers

In Colombia, three types of producers can be identified, grouped according to the level of technology, but there is no information that allows quantifying the percentage of each of these groups. According to the interviews conducted for the study, between 10% to 15% of vegetables producers are so called professional growers.

- Food farmer;
- Food producer; and,
- Professional grower.

## Types of grower in Colombia

Types	Level of technology	Customers	Vegetables	Certification
<b>Professional grower</b> 	<b>Medium</b> -Greenhouses -Fertigation -Substrates -Mechanization	-Chain stores in high strata -Special restaurants	Tomato "Cherry", different varieties of lettuce, zuquinis, bell pepper	GAP and organic
<b>Food producer</b> 	<b>Low</b> -Greenhouses -Irrigation system -Mechanization	-Chain stores in medium strata -Wholesale places	Tomato "chonto", carrot, onion, lettuce "Batavia"	GAP (low %)
<b>Food farmer</b> 	<b>Low</b> -Free exposure and greenhouses	-Local dealer -Local market -Wholesale places	Tomato "chonto", carrot, onion, lettuce "Batavia"	Do not have

Figure 10. Types of growers in Colombia. Own preparation with information obtained from interviews (Appendix 1).

**Food farmers** receive insufficient technical assistance. In the 2016 Census of Agriculture around 90% of producers stated they had never received technical assistance. Nevertheless, government entities and public projects state they are reaching out to the

small producers with technical assistance. The horticultural grower is subject to the offer price, determined by the intermediary, in part because the Food farmer has to sell the product on the day of maturity, due to the lack of storage possibilities.

With food farmers we can identify two types of production models:

**Individual grower:** food farmers with an area not bigger than the Family Agricultural Unit, acronym UAF<sup>2</sup>, obtains his seeds and agricultural materials on his or her own and then sells to an intermediary who offers to collect the product with no surcharge on the logistics.

**Partnership:** food farmers set up an alliance with an investor (which in most cases is a seller or a large producer), which provides the necessary seeds and supplies, and the Food farmer picks up the labor cost. In this model, intermediation decreases and usually the income of the production is divided between the two partners.

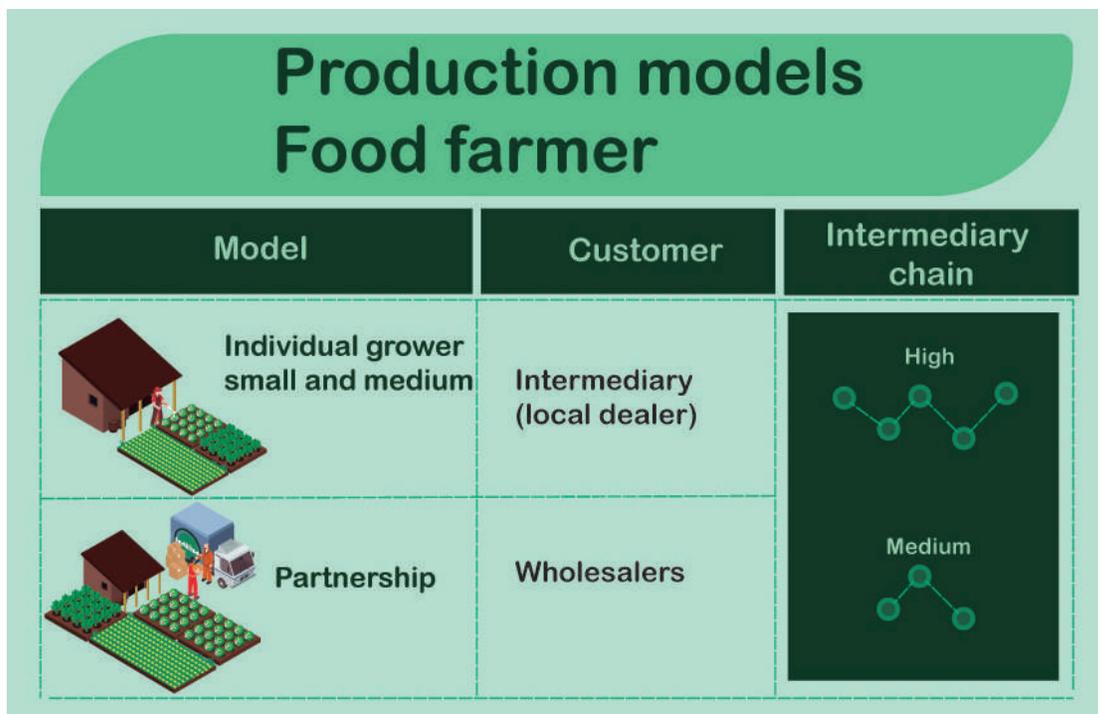


Figure 11. Production models Food farmer in Colombia. Own preparation with information obtained from interviews (Appendix 1).

<sup>2</sup>Family agricultural unit, acronym UAF. Family agricultural production unit, one that employs the owner or possessor and his immediate family, generally for subsistence and whose production is sufficient to meet the basic needs of the family. UAF is also a legal concept in Colombia, defined by Law 160 of 1994. Incora Resolution 41 of 1996 defines the sizes of the UAF, according to the characteristics of the location area and the predominant use of the land: agricultural, livestock or mixed.

**Food producers** are largely those that supply the main chain stores, and they guarantee a steady supply of volume to their customers. Some producers say they cover the whole chain (production, logistics and delivery) to guarantee the quality of their products. The method of production does not necessarily involve high level of technology. Normally they use a traditional production system (plastic covers, irrigation systems without high technology) without large and/or long-term investments.

**Professional growers** are farmers who invest in technology, some have hydroponic systems, substrate management, technical irrigation systems, greenhouses, technical assistance and have certifications in Good Agricultural Practices of their products certified by the Colombian Agricultural Institute (ICA). These producers are characterized by producing differentiated products such as cherry tomato, different varieties of lettuce (crispy lettuce, arugula and iceberg lettuce), baby bell peppers and organic vegetables. These producers sell in high-end markets and chain stores.

### 2.3.5 Technology in the cultivation of vegetables

The main vegetables planted in the country are tomato, carrot and bulb onion. The producers of these vegetables have not implemented technology in these crops. Tomato cultivation has been introducing technology such as greenhouses and irrigation systems for 12 years. It is estimated

that in the country 60% of tomato producers already have this technology. The technology implemented in this crop consists of a fertigation system, consisting of a pumping system with a motor, two plastic tanks where irrigation solutions are being prepared with drip irrigation with hoses. The current system in Colombia is similar to that used in Spain 20 years ago.

The cultivation of vegetables (for example, cucumber or bell pepper) under a greenhouse structure allows to increase productivity and helps to reduce the risks related to phytosanitary problems generating in this way greater economic benefits for the producers. In areas less suitable for the production of vegetables, the use of greenhouses makes it possible to establish crops due to the improvements obtained in climatic conditions.

In the interviews (Appendix 1), it is stated that only 10% of tomato production is managed technically by an agronomic engineer specially for different varieties like cherry tomatoes. For the rest of the producers, this level of technology consists of greenhouses made mainly with a structure of bamboo and polyethylene plastic and wood (similar to the structures that flower crops have in the areas of Cundinamarca and Antioquia). The greenhouse has a simple irrigation system and fertilizers are applied generally twice a week. A tutored system is made with steel wire and polypropylene fiber. Low investments are required for the construction of these greenhouses compared to those used in other regions of the world.

The production of tomato in the greenhouse or protected conditions is a practice that has advanced in the country as an option for the conversion of crops, making the areas with severe limitations more productive and minimizing adverse conditions, obtaining excellent results, such as higher productivity, profitability and quality, not only in the physical appearance of the product but also in its food safety due to the reduction in the application of pesticides. The yields under this production system have improved from, for example, 1,5 and 2 kilograms per plant obtained in the open field compared to 5 and 8 kilograms per plant in the greenhouse, thus increasing productivity up to 300% per plant (CORPOICA, 2013).

The president of Asohofrucol, Mr. Álvaro Palacio, mentions that in recent years the progressive use of innovative technologies in the cultivation of greenhouse tomatoes and fertigation, complemented with an excellent integral management of the tutored plants, pruned plants, plants with leaves cut and irrigation system, has contributed to a notable

increase in productivity in these regions of the country (Portafolio, 2018).

The departments that have the largest greenhouse tomato area are Antioquia, Boyaca and Cundinamarca. In departments like Santander and Norte de Santander crops in the open field still dominate.

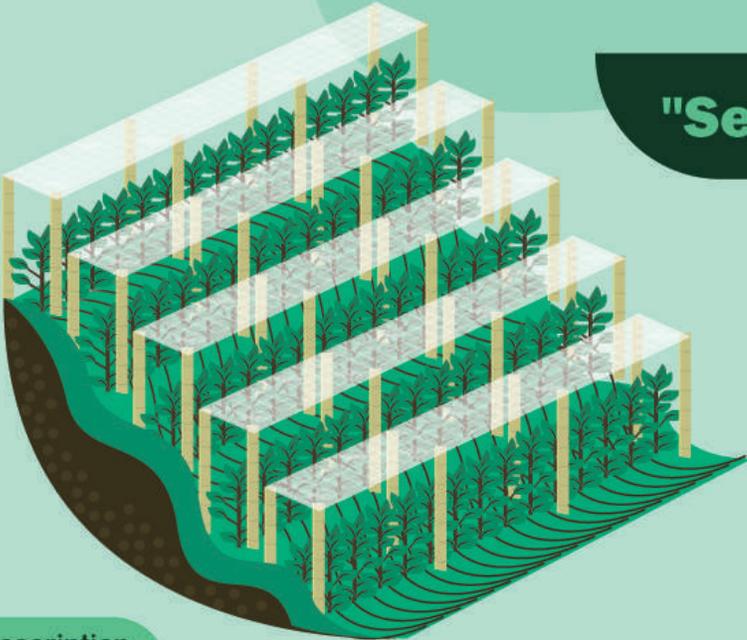
Tomato is one of the vegetables in which the practice of grafting is more commonly used. Grafting in tomato and bell pepper, facilitates the management and control of diseases, using rootstocks with some resistance to soil-borne diseases, which allows maintaining healthy and vigorous plants for a longer time. Additionally, crop production increases. The main limitations of the grafting method used in tomato and bell pepper production are the additional cost and labor required. Currently, this technique has been implemented in pepper growers in the Antioquia and Valle del Cauca regions, along with the assistance of seed importing companies for the introduction of rootstocks with potential for use in Colombia.

### 2.3.6 Greenhouses in Colombia

Most of the greenhouses used in Colombia do not have active climate control systems. This limitation to control climatic factors contrasts with the objectives of protected agriculture, in which one of the principles is to increase the

degree of control over biological processes (Cooman, 2002). The most common types of greenhouses in Colombia and the technology used are described below.

## "Semi techo"





**Description**

"Structures designed to protect crops from direct rain. They are widely used in the coffee region in the center of the country, in tomato crops, their structure is composed of bamboo and wire posts for plastic support. They differ from the covers basically because this type of construction does not cover with plastic the entire planted area but basically to the upper area of the crop row. Its efficiency is very questioned."

<b>Structure</b>	Bamboo	<b>Cost per square meter (COP)</b>	\$8.000 - \$6.000
<b>Climate control</b>	No	<b>Crops</b>	Tomato
<b>Measurement of environmental conditions inside the greenhouse</b>	No		

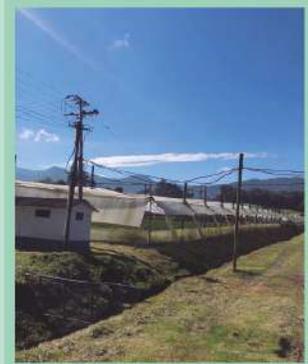
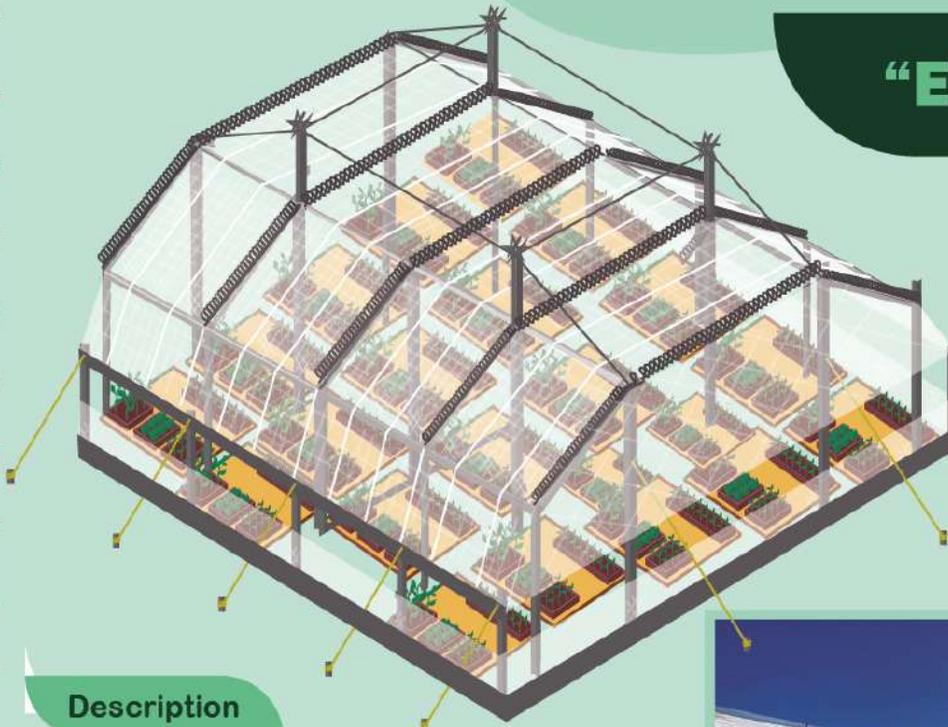



Figure 12. Greenhouse "Semi techo". Own preparation with information obtained from interviews (Appendix 1).



Figure 13. Greenhouse “Capilla”. Own preparation with information obtained from interviews (Appendix 1).

# “Espacial”



## Description

Structures that are characterized by no truss in the area of the roof, which favors the transmission of light to the crop, due to less shading, because the amount of structural elements in the area of the roof is less than the traditional model. The plastic is fixed to cables that are generally suspended to concrete posts. They are high-rise structures, increasing the thermal inertia of the structure, which undoubtedly gives it characteristics that significantly improve the climatic behavior within the greenhouse.

## Cost per square meter (COP)

\$25.000 - \$30.000

## Structure

Central posts in concrete or immunized wood, wiring and steel fittings

## Measurement of environmental conditions inside the greenhouse

Temperature

## Climate control

Manual curtains

## Crops

Flowers

Figure 14. Greenhouse “Espacial”. Own preparation with information obtained from interviews (Appendix 1).

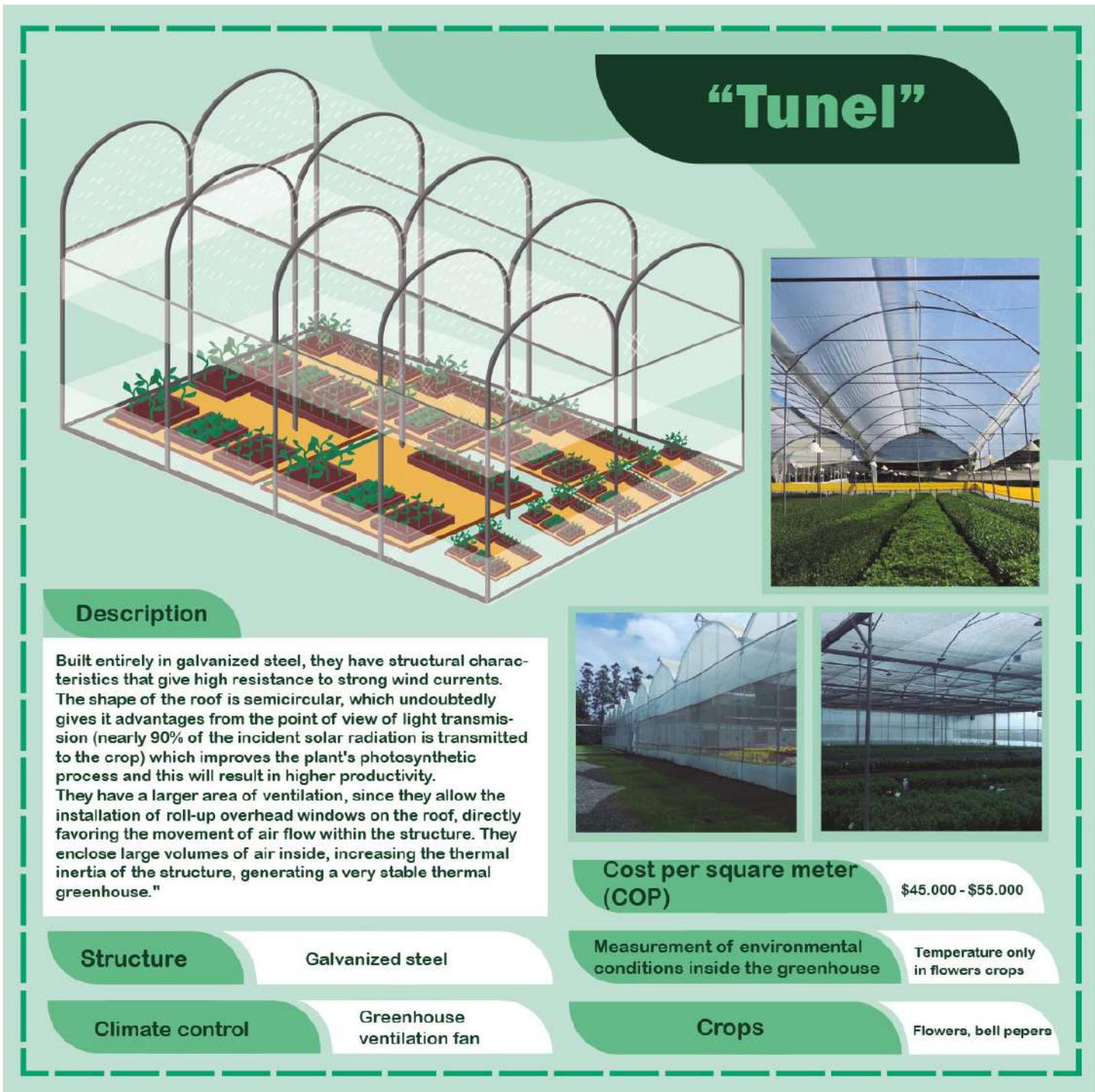


Figure 15. Greenhouse “Tunel”. Own preparation with information obtained from interviews (Appendix 1).

Approximately, in Colombia there are 5.500 hectares under greenhouse structures of which 85% is in flower crops, 14% vegetables and 1% in aromatic fresh herbs. The largest area of greenhouses in Colombia is occupied by the floricultural sector. The infrastructure used in these crops has been implemented in other crops. Mainly, workers who carry out the maintenance of greenhouses in the ornamental flower sector migrate to build greenhouses at lower cost in the horticultural food sector without sufficient technical knowledge.

Producers argue that it is difficult to change from their open field crops to production under greenhouses, because the initial investment is high and it is not feasible to have a loan, due to the uncertainty of market prices.

Additionally, producers do not have the knowledge to cultivate correctly in a greenhouse, nor on the positive impacts that greenhouse systems have to increase productivity and to reduce the use of agrochemicals.

Furthermore, UPRA (Unidad de Planificación Rural Agropecuaria - Rural Agricultural Planning Unit) reports that 54% of rural properties are informal. Present informal tenure situations generate legal insecurity and limit access to the institutional offer. Therefore, it also limits access to credit by banks.

### 2.3.7 Training

As mentioned before, the sector has a low technical knowledge and a great need for technical training in productive aspects, greenhouse management, fertigation, integrated pest and disease management, post-harvest and logistics. Most producers receive technical assistance from the commercial distributors of agrochemicals and seeds. Therefore, this technical assistance is very much focused on the purchase or sales of the inputs.

There is also a lack of specialized knowledge in horticulture by agronomists in the country, where there is still not enough information for the management of cultivated crops under controlled conditions in the greenhouse and irrigation and fertigation management. Currently, there are different educational programs available in the country. At the level of professional training the following careers are being offered: Professional studies and Technical studies.

#### Professional studies

A university career in agronomy lasts for 10 academic semesters. This career is offered in Colombia, in universities such as:

- **Agronomy:** Catholic University of the East.
- **Agronomic Engineering:** National University of Colombia, University of Caldas, University of Applied and Environmental Sciences, University of Cundinamarca, University of La

Salle, University of Los Llanos, University of Nariño, University of Pamplona, University of Magdalena, University of Tolima, Francisco de Paula Santander University, Pedagogical and Technological University of Colombia, University Institute of Peace and University of Córdoba.

**-Specialization in Technology in Protected Horticulture<sup>3</sup>** : Tadeo Lozano University in Bogota. This program is new and started in 2020 with a duration of 1 year.

## Technical studies

At the level of producers and farm workers,

vocational training is being offered by entities such as SENA (Servicio Nacional de Aprendizaje – National Learning Service). SENA is a governmental entity that offers free training to millions of Colombians who benefit from technical, technological and complementary programs that focus on the economic, technological and social development of the country, the productive activities of companies and industry, to obtain better competitiveness and production with globalized markets. Programs offered by SENA related to the horticultural sector are given below. Most of the programs focus on the post-harvest process and processing of the fruit and vegetables.

Code	Program name	Version	Status	Hours
72310109	Adapt the land, according to the technical procedures in the crop of vegetables	1	Active	40
73310271	Ecological production of vegetables	1	Active	80
73311550	Handling and post-harvest of fruit and vegetables (virtual)	2	Active	40
73311595	Entrepreneur in production of vegetables	1	Active	340
76130585	Post-harvest fruit and vegetable operations	1	Active	40
936101	Fruit and vegetable processing (technician)	102	Active	2.200
96151388	Technical transform fruits and vegetables	1	Active	220
96151451	Entrepreneur in processing and commercialization of products derived from fruits and vegetables	1	Active	300
96151455	Preparation of canned fruit and vegetables	1	Active	40
96151518	Entrepreneur in artisan processing of fruit and vegetable derivatives	2	Active	340
96151524	Entrepreneur in post-harvest of fruits and vegetables	2	Active	340
96151527	Preparation of canned fruit and vegetables	1	Active	40
96151528	Elaboration of osmo-dehydrated fruit and vegetable products	2	Active	48
96151531	Post-harvest handling of fruits and vegetables.	1	Active	40

<sup>3</sup><https://www.utadeo.edu.co/es/facultad/ciencias-naturales-e-ingenieria/programa/chia/especializacion-tecnologica-en-horticultura-prottegida>

## 2.3.8 Food safety and good agricultural practices in the country

Food safety is the guarantee that food will not cause harm to the consumer when they are prepared and consumed according to the intended use. The entities involved in this process in Colombia are:

- **Ministry of Agriculture and Rural Development – MADR**  
- Colombian Agricultural Institute – ICA
- **Ministry of Health and Social Protection – MSPS;**  
-National Institute for Medicines and Food Surveillance – INVIMA  
-Territorial health authority / Territorial health entities (including the Secretary of Health)

The functions are grouped as follows:

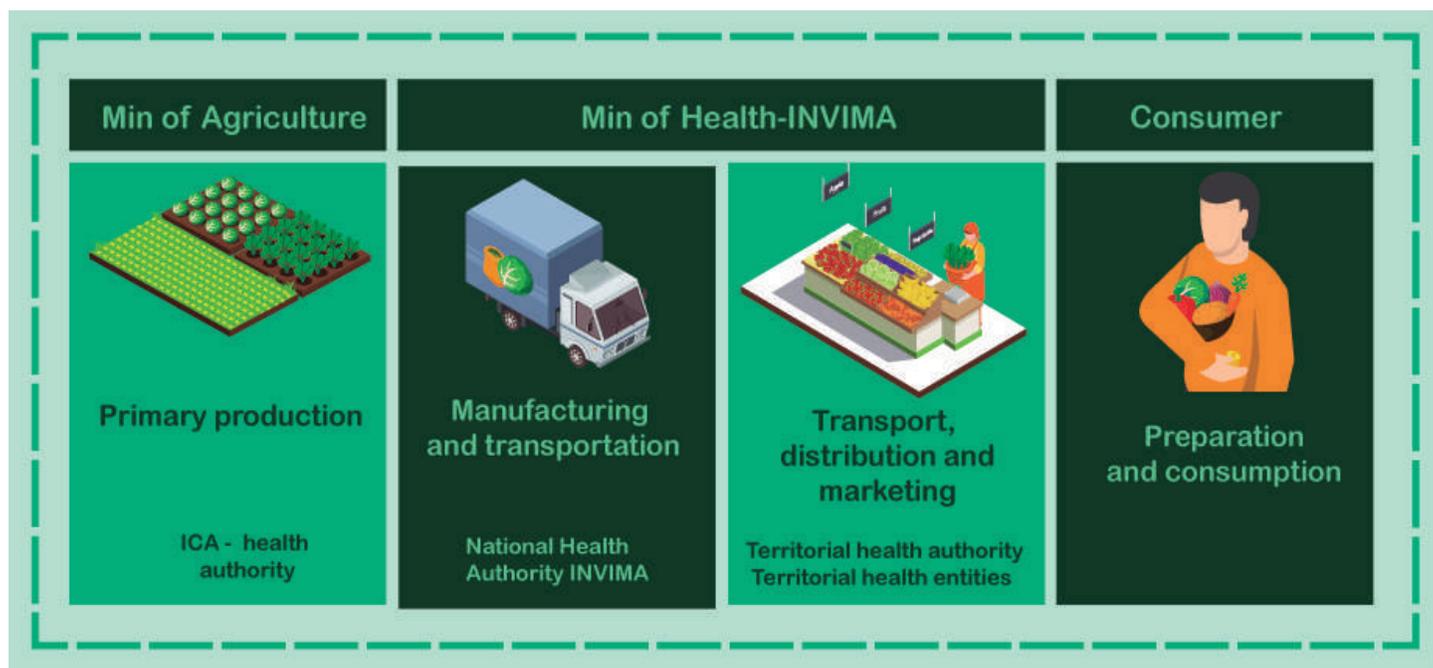


Figure 16. Entities responsible for food safety in Colombia.

In the production sector, the ICA is responsible for guaranteeing agricultural health and agri-food safety. ICA manages the certification of Good Agricultural Practices (GAP) described in resolution 30021 of April 28, 2017 and the registration of farms for export described in resolution 448 of January 20, 2006.

On the other hand INVIMA, together with the territorial health entities, is in charge of produce processing, such as in the handling, transport, distribution and supervision in the produce industry.

Consumers are responsible for food safety during preparation and consumption in their homes.

The entities mentioned, under the direction of the Ministry of Health and Social Protection, have carried out “the Ten-Year Public Health Plan, 2012-2021: Health in Colombia is built by you” in which the strategies to guarantee food safety are found, which are:

### 1. Regulation

The set of the legal framework that establishes the general principles for the control of food in the country and regulate the aspects of food production, handling and marketing, as a means to protect the health of consumers.

### 2. Management of Sanitary and Phytosanitary Measures Policies

The permanent process of planning, organization, monitoring and communication, in an integrated way, of numerous decisions based on risk analysis, and of different measures to guarantee the safety and quality of both national and imported food.

### 3. Inspection, surveillance and control

Health protection actions by the health authority, with the support of the citizens, consisting of the systematic and constant process of inspection, surveillance and control of compliance with standards and processes to ensure an adequate health and safety situation of all the activities that are related to human health.

### 4. Information, education and communication

The process of preparation, presentation and dissemination of appropriate messages for specific recipients, in order to improve

the knowledge, techniques and motivation necessary to make decisions that improve food safety and quality.

### 5. Strengthening of the Public Health Surveillance System

Systematic and constant actions of collection, analysis, interpretation and dissemination of specific health-related data, for use in the planning, execution and evaluation of public health practice.

### 6. Development of technical and analytical capabilities and strengthening of food analysis laboratories

To be able to monitor and guide the adoption of appropriate measures to protect consumers.

Current regulations on food safety, applicable to the fresh vegetable sector are:

- **RESOLUTION 2155 of 2012:** establishes the technical regulation on the sanitary requirements that must be met by vegetables that are processed, packaged, transported, imported and marketed in the national territory.

- **RESOLUTION 14712 of 1984:** specifies the technical standards related to produce such as fruits and vegetables.

- **RESOLUTION 3709 of 2015:** establishes the maximum levels of contaminants in foods intended for human consumption in order to protect people’s health.

Currently in Colombia the following number of producers of vegetables are registered in Good Agricultural Practices certified by ICA,

which is estimated to be a low percentage of the total number of producers in the country.

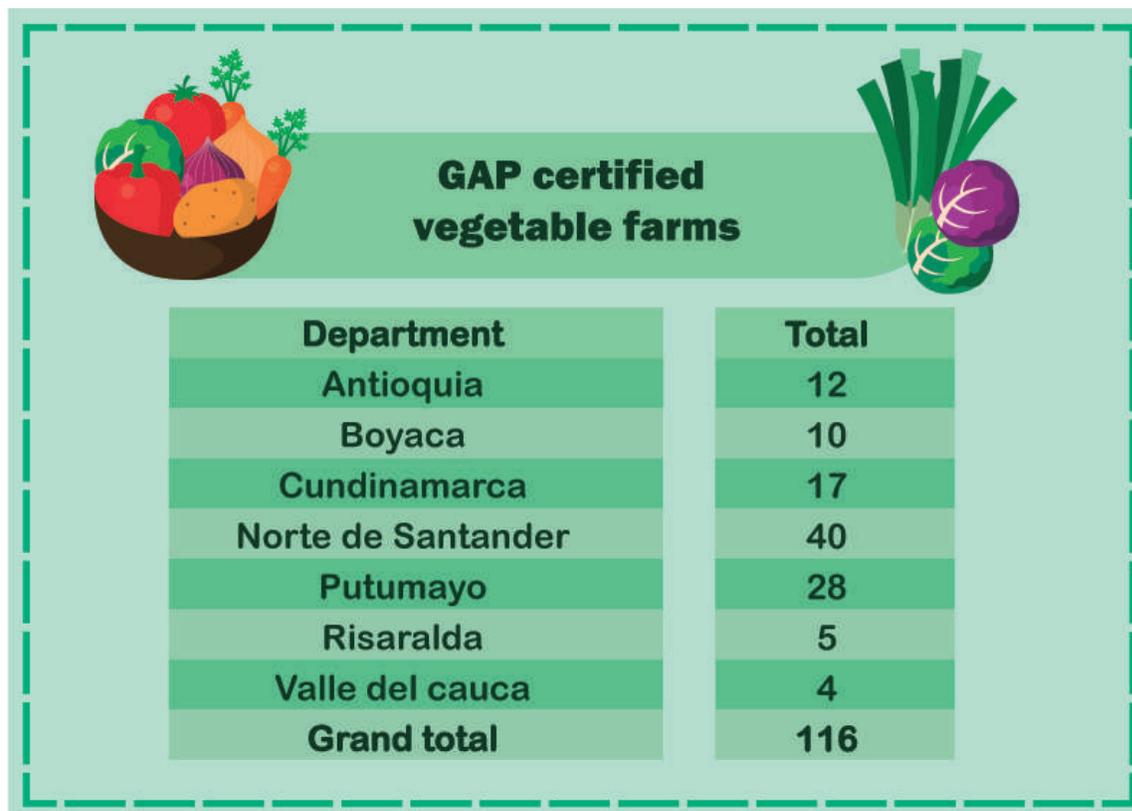


Figure 17. GAP certified vegetable farms in Colombia 2019. Own preparation with data from ICA.

According to interviews it is estimated that 10-15% of producers that distribute to chain stores and supermarkets located in upper class sectors have Good Agricultural Practices certified by ICA

### 2.3.9 Monitoring programs for pesticide residues in fruit and vegetable products

The analysis of samples on Maximum Residue Limit (MRL's) is carried out by the INVIMA, supported

by ICA. This monitoring is carried out within the National Sub-sectoral Plan for Monitoring and Control of Pesticide and Metal Residues in Plant-based Foods belonging to the National Program for Surveillance and Control of chemical residues and contaminants in food and beverages. The guidelines are established by Resolution 770 of 2014 issued by the Ministry of Agriculture and Rural Development and the Ministry of Health and Social Protection.

The MRL analyses are only carried out on the produce of the farms that are certified GAP by ICA from the year 2011 to date.

Figure 18 shows the information on pesticides exceeding the Maximum Residue Limit according to the Colombian regulations and international reference from Codex Alimentarius. The results of pesticide residue analysis were performed by an external laboratory, using the multi-residue methodology.

### Results of active ingredient residue analysis for the year 2011 - 2015 in vegetables

Year	Vegetables	Number of samples	Active ingredient	Number of samples with MRL exceedance	% of samples with MRL exceedance
2011	 Potato	86	--	0	0
2014	 Onion	142	Dithiocarbamates	2	1,4%
	 Potato	154	Metamidophos Fipronil dimetomorf	4	2,6%
	 Tomato	145	Cypermethrin Carbendazim	4	2,8%
2015	 Onion	110	Difenoconazole Deltamethrin	2	1,8%
	 Spring onion	38	--	--	0
	 Tomato	162	Carbenzadim Cypermethrin Imidacloprid Tebuconazole	4	2,5%

Figure 18. Results of pesticide residue analysis for the years 2011 – 2015. Own preparation with data from ICA.

In this plan, target population or producers that this standard governs are producers of fruit and vegetable produced on farms which are inspected by the ICA. The steps to perform the plan for the monitoring are as follows:

- Prioritize the national and imported horticultural products that will be part of this National Sub-sectoral Plan based on the products analyzed in 2014 and 2015, together with the ICA.
- Prioritize pesticides and metals to be monitored.
- Establish the appropriate statistical sampling design.
- Determine and quantify the present residues of pesticides and metals in the different matrices (food of plant origin) for later analysis and management.
- Evaluate the results obtained against the current Colombian health regulations or, failing that, to the parameters of the international reference in food safety (Codex Alimentarius).
- Make available the necessary information to provide feedback on the Risk Analysis System in the use of chemical pesticides in the country.

-Report the results obtained to ICA, which is the national authority competent in primary production for the performance of relevant risk management.

In accordance with the results obtained in this plan, it will form the basis for the management of risks in primary production by the competent authority in order to minimize the possible risks. Preventive actions in primary production such as the implementation of Good Agricultural Practices (GAP), largely guarantee the safety of food of plant origin for human consumption, thus avoiding subsequent control actions in final or processed products. These actions are carried out by ICA.

### 2.3.10 Exports of fresh vegetables

Currently, Colombian fresh vegetables' exports are destined to the Caribbean islands. Export to other markets is incipient and needs more technification, technical knowledge and development of the logistics chain. The main exported vegetables and open markets are presented in the following table.

Product	Exported Kg		% Increase	Destination country
	2016	2017		
Onion	549.310	1.042.518	47%	ABW - CAN - CHL - CUW USA - NLD - PAN - PER
Lettuce	149.768	136.949	-9%	ABW - CUW - USA - PAN
Tomato	217.680	176.242	-24%	ABW - CUB - CUW
Carrot	17.547	16.888	-4%	ABW - CUW - PAN
<b>Total</b>	<b>934.306</b>	<b>1.372.597</b>	<b>32%</b>	

Figure 19. Vegetable exports from Colombia and their destination 2018. Own preparation with data from ASOHOFRUCOL.

The increase in exports of the sector is very important, as this drives the development of the sector and the use of technologies to improve

productivity, quality and competitiveness in the international market.

Regarding the vegetables of interest in the study there are no significant export quantities. For example, the Colombian government has

been working on access to the market of the United States for bell peppers.

## Bell pepper exports

The national government has advanced in a process of admissibility with the United States for the export of bell pepper. In May 2019 Colombia received the notification that the US authorities received the request for access of the Colombian bell pepper to its market. According to the Ministers of Foreign Trade, José Manuel Restrepo, and former Minister of Agriculture and rural development, Andrés Valencia, the country is one step away from the U.S. Animal and Plant Health Inspection Service (APHIS) accrediting compliance with the requirements of the export plan for this vegetable, prior agreement with the ICA (González, 2019).

In 2018 Colombia exported bell pepper worth US\$ 178,285 - an increase of 47.8% in the value of exports of this product compared to 2017 - mainly to Curaçao and Aruba, the main export destinations for this vegetable. In the first months of this year, bell pepper exports amounted to US\$ 22,878 (González, 2019). With the opening of the United States market, the export of bell pepper would be strengthened and consolidated. It is estimated that this country is the main import market in the world, participating in 2018 with 28.6% of world imports, doubling Germany which is the second (Ministry of Industry, Tourism and Commerce, 2019), and in 2018 its imports of this product reached US \$ 1,279 million, with Mexico being the main supplier of its demand (73.7%) followed by Canada (19.4%).

In 2017, the production of bell pepper in Colombia reached 37,058 tons, being the highest result of the last 10 years. The departments that have the highest participation in this production were Santander (9,934 tons), Valle del Cauca (9,016 tons) and Norte de Santander (6,565 tons). In addition to these departments Antioquia also has an important participation in the national production of bell peppers (Portafolio, 2018).

Figure 20. Bell pepper exports. Own preparation based on information from various sources.

## 2.4 Distribution channel

### 2.4.1 Distribution chain

Among the major difficulties of the vegetable distribution chain is the disconnection of the producing farms from the marketplaces and the wholesale markets, as evidenced by the high travel times from the municipalities to the destination markets. These routes last between 1 to 2 hours for 29,4% of the products, 3 to 4 hours for 18,1% of them, 5 to 6 hours for 14,6% of the products, 7 to 15 hours for 11% and more than 21 hours for the remaining 3,2%. UPRA reports that in Antioquia 47% and in Cundinamarca 91% of rural areas are less than 3 hours from the capital.

Given the travel times the vegetables remain a long time in the transport vehicles. More than half of the products, 51,2%, spend between 5 and 21 hours in the transport vehicles, which mostly do not have the best technical conditions. Only 0,7% have air conditioning and only 6,5% of vegetable transport vehicles are ventilated vans, while about three quarters of them are trucks with wooden bodywork.

In terms of packaging three periods exist simultaneously in Colombia: the “stone age” (sack and self-made wooden crate called ‘guacal’), the age of plastic (crates and bags) and the ecological age (recyclable materials such as cardboard).

The main packaging to sell vegetables are in synthetic fiber bags: 22,7% of vegetables are packed in synthetic fiber bags; 20,4% are packed in natural coastal fiber; 18,4% packed

in plastic crates; 14,6% packed in wooden box (guacal); 22% are packed tied and 3,2% are packaged by bulk.

The commercialization of food in the country is characterized by a traditional centralized marketplace. There is a large number of producers and consumers, but it is quite closed in the center of the chain while there are few retailers (Ministry of Health and Social Protection and FAO, 2013). There are numerous agents and intermediaries that have a significant impact on prices and that make the information along the vegetable chain asymmetrical (Ministry of Health and Social Protection and FAO, 2013).

As far as government contracts are concerned, they are carried out through tenders, according to the interviewees (Appendix 1). Attempts have been made to buy from associations and producers directly, but it has not been implemented until now.

The distribution chain of vegetables has many channels, this affects the producers since a higher margin of profits of the products go to the supply distributors and not to the producers. The chain of distribution is different for professional growers and food producers since they can sell directly to wholesalers or hypermarkets, which is not the case for food farmers.

The following images describe the distribution chain channel for each of the producers identified in the study:

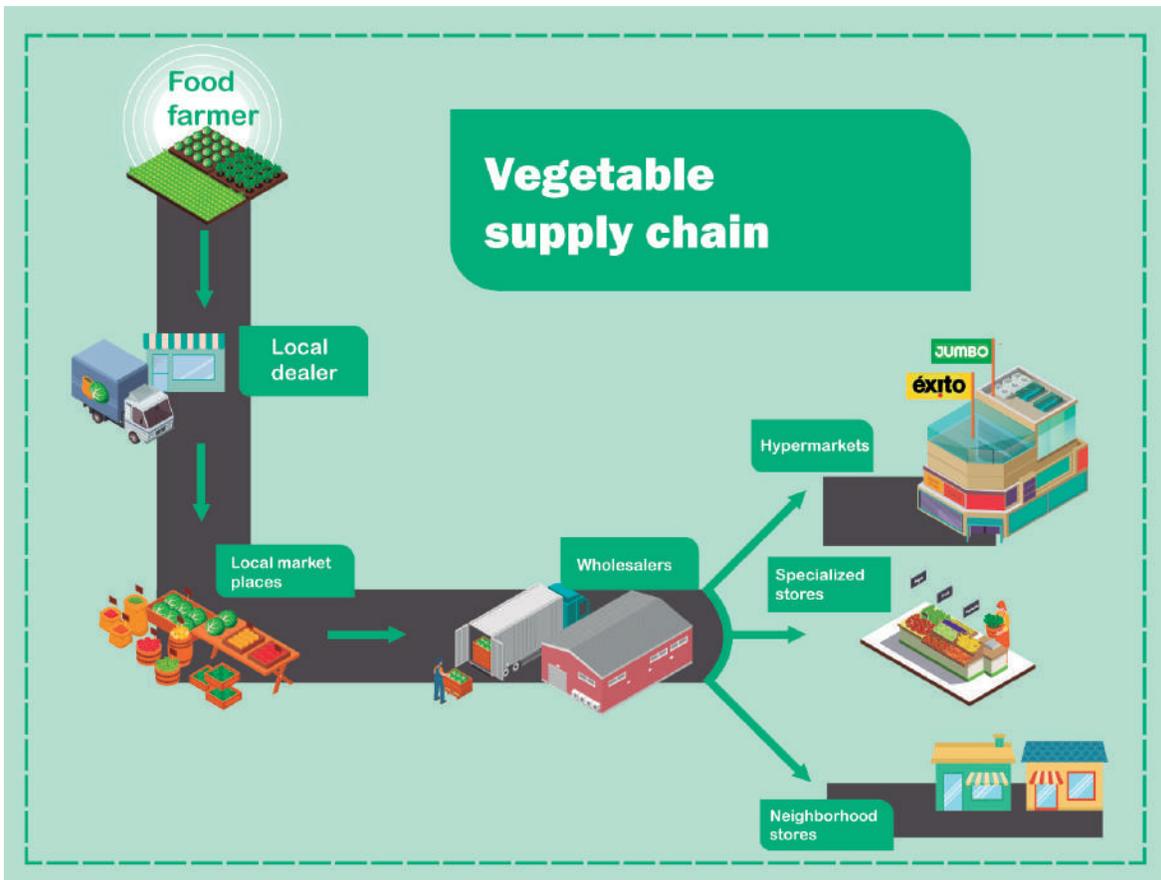


Figure 21a. Composition of the vegetable chain for food farmers in Colombia. Own preparation with information obtained from interviews (Appendix 1).

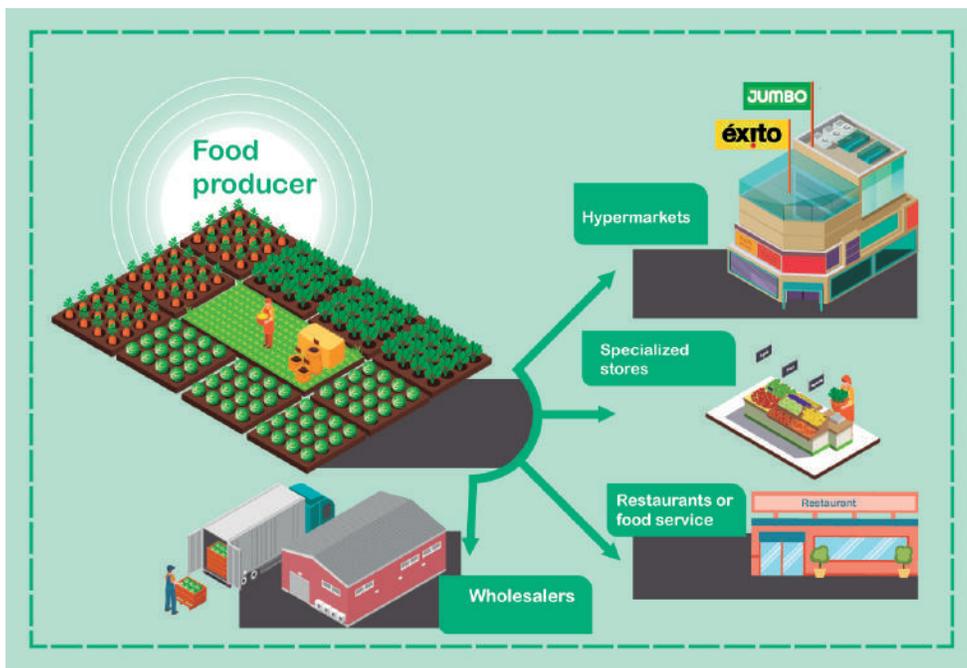


Figure 21b. Composition of the vegetable chain for food producers in Colombia. Own preparation with information obtained from interviews (Appendix 1).

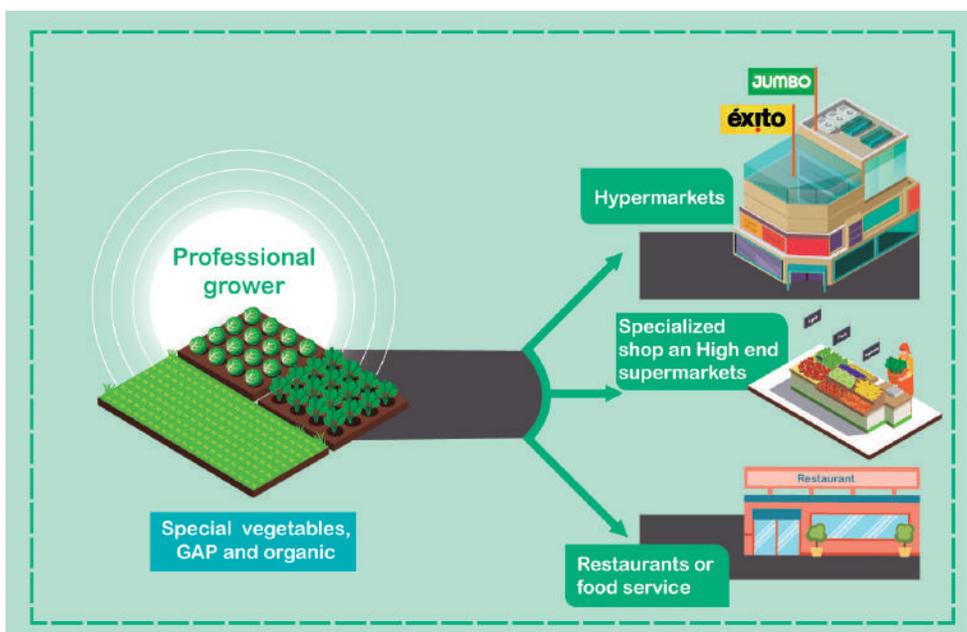


Figure 21c. Composition of the vegetable chain for professional growers in Colombia. Own preparation with information obtained from interviews (Appendix 1).

The country's distribution chain for vegetables is very long. There are many intermediaries between the producer and the final consumer, according to Palacios and Gonzalez (2016). According to the interviewees (Appendix 1), in a city like Bogota an agricultural product must pass through more than 7 actors to arrive to the consumer, and at least three of those can be intermediaries or buyers. Approximately 80% of vegetable producers in the country use this type of supply chain.

Due to logistical difficulties and the amount of production it is recurrent for the local intermediary to pick up the vegetables at the door of the farm and then take them to the local marketplace and from there to the wholesale markets. It is common that from the main wholesale markets the vegetables are distributed to large stores (supermarkets), specialized stores (produce) and neighborhood stores.

The distribution chain is long and with different intermediaries. The determination of prices is usually based on supply and demand mechanisms. 41,2% of the intermediaries surveyed claim to have established their sales prices in this way to wholesalers. According to the National Horticultural Plan (PHN) carried out by ASOHOFrucol in 2013, in addition to these mechanisms, 18% of sales prices are set by buyers and only 2,3% of sales prices are set by the reference of the wholesale markets. In general prices tend to be variable and are governed by wholesalers and only in 13% of cases are prices pre-established between intermediaries and wholesalers.

The most traditional vegetable sales channel continues to be through the wholesale markets, which supply large cities and markets where intermediaries, retailers and nearby producers generally coincide. Wholesale markets do not have adequate hygienic conditions for the management of perishable products or the necessary infrastructure to serve consumers. In addition to market places, other marketing channels for vegetables are supermarkets, large stores, neighborhood stores and some shops specializing in fruits and vegetables, the latter being popular mostly in middle-class neighborhoods (stratum 3 and 4).

Consumer buying habits are segmented according to their income level, so strata 1 and 2 acquire their vegetables in the neighborhood store, and with daily frequencies according to the availability of resources. While the middle strata go to neighborhood stores, specialty stores or self-services. An important segment of this stratum is even directed towards supermarket chains and may have daily or weekly shopping habits. Finally, the upper strata carry out their purchases mainly in supermarket chains and hypermarkets, as they have a greater capacity to travel, and have weekly, biweekly or monthly purchase frequencies.

## 2.4.2 Wholesale markets

The main wholesale markets of the country are grouped in the “National Network of Wholesale Markets”. This network integrates 14 points of distribution and marketing of

food throughout the country. This network is also part of the Latin American Federation of Wholesale Markets and the World Union of Wholesale Markets.



Figure 22. Wholesale market network of Colombia. Source: Red de Centrales de Abastos de Colombia, 2019: [www.centralesdeabastos.com.co](http://www.centralesdeabastos.com.co).

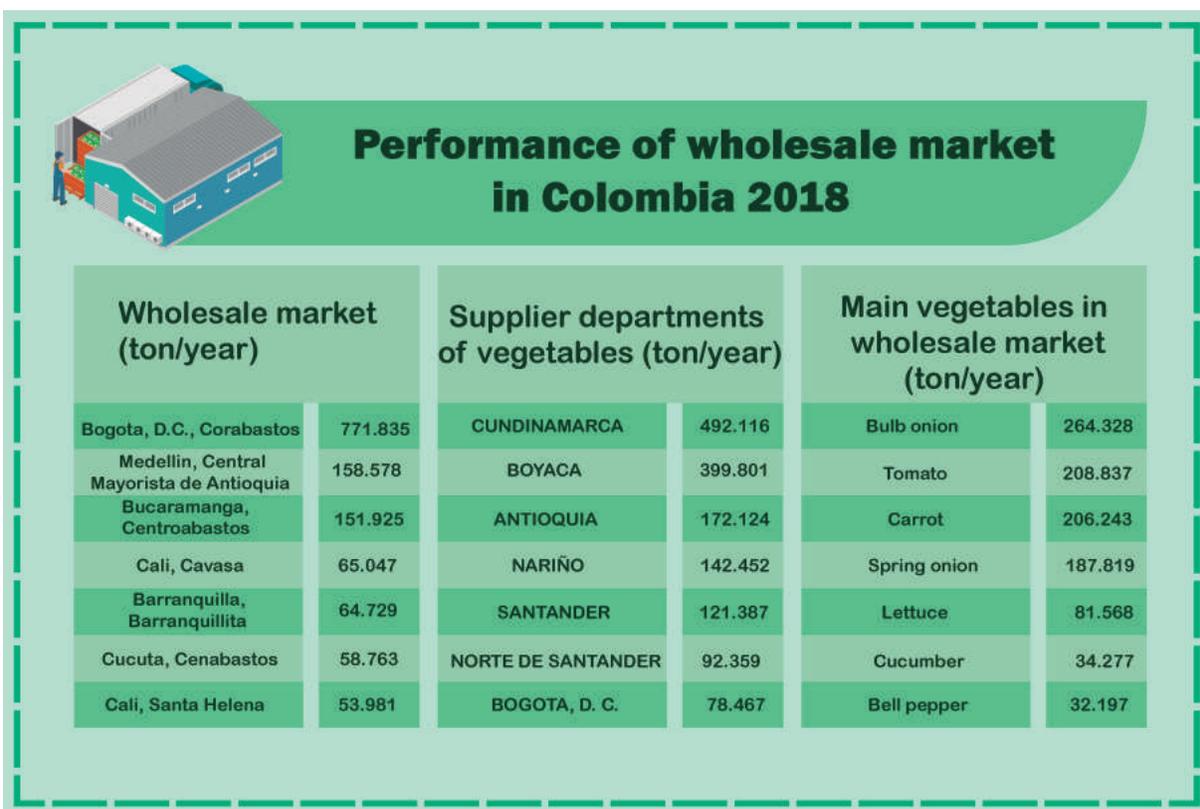


Figure 23. Performance of the main wholesale markets in Colombia – 2018. Source: DANE, 2018.

Wholesale markets have little differentiation of agricultural products, predominantly “chonto” tomatoes, carrots, potatoes and onions are being sold. Certificates of Good Agricultural Practices are not required from producers in these markets. Important changes have been made in the infrastructure of the markets to improve the food safety conditions, such as use of pallets, crates and requirements related to food transport. The wholesale market that has the most differentiated products is Medellin. It has also advanced in matters of food safety in terms of its infrastructure, handling of pallets, crates and transport of food products. This marketplace also differs from the rest by its public since housewives also buy their products regularly in this place.

The following graph shows the behavior of the goods’ flow between the main wholesale locations in the country where we can identify the departments that produce more vegetables: Boyaca (self-supply + supply to 11 departments), Bogota (supply to 8 departments), Norte de Santander (self-supply + supply to 7 departments) Santander, Antioquia and Cundinamarca (self-supply + supply to 4 departments). The percentages of the arrows represent the demand for vegetables in each department.

The departments with the highest self-supply ratios are Nariño (91%), Boyaca (84%) and Antioquia (75%).

For example, the department of Norte de Santander has a self-supply rate of 53%, whereas 26% is supplied by Santander and 19%

by Boyaca. In contrast, Norte de Santander supplies to seven departments in the Northern region of Colombia.

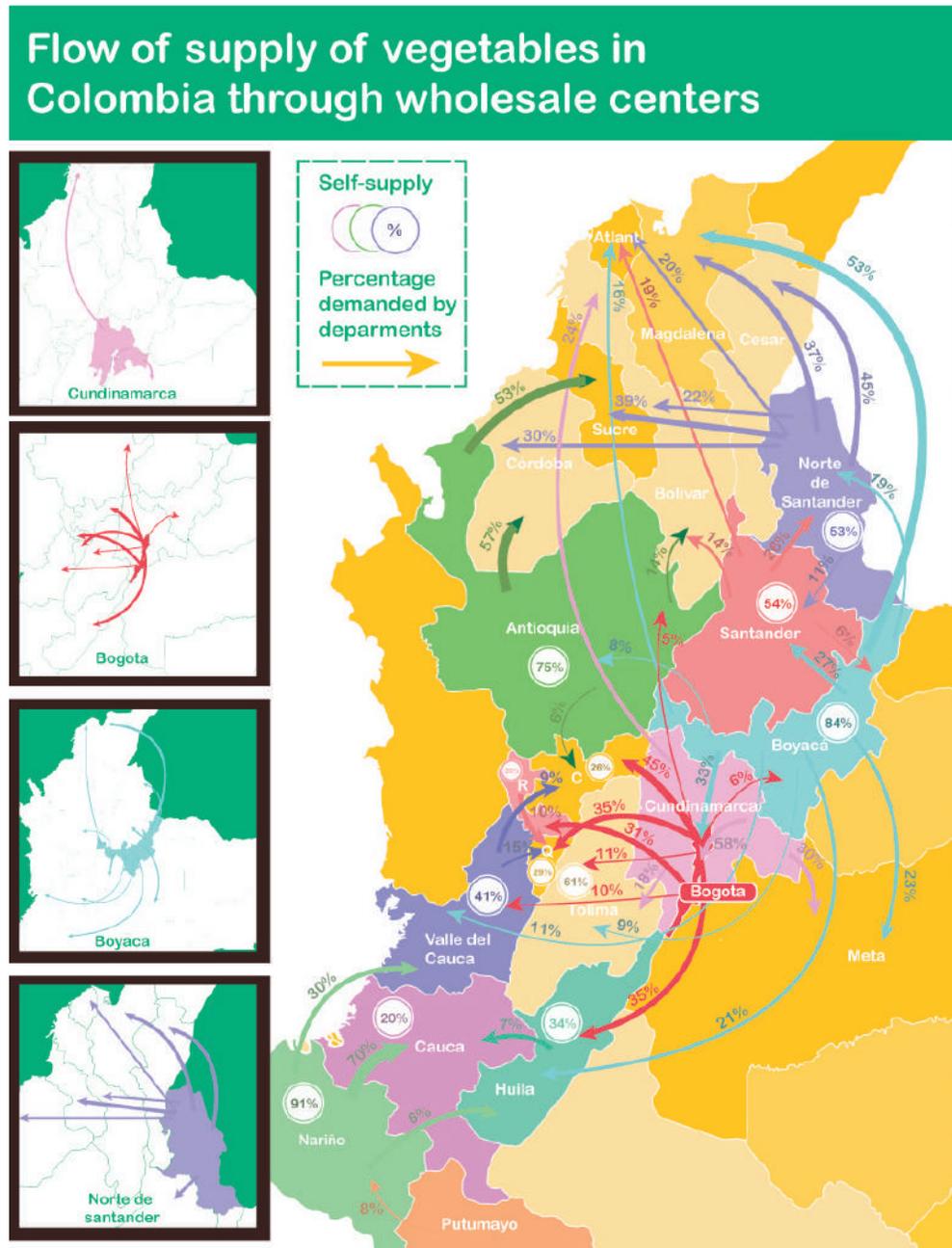


Figure 24. Flow of supply of vegetables in Colombia through wholesale markets. Source: DANE, 2018.

### 2.4.3 Road infrastructure

One of the factors most related to the productivity and competitiveness of the agricultural sector and crop yield is the existence of adequate road infrastructure that allows temporary and spatial integration of producers with markets and the wholesale markets (Lozano and Restrepo, 2016).

The main factor that affects the quality of the vegetables is the logistical aspect:

- Long trips from rural areas to urban areas put the products at risk due to non- refrigerated vehicles.
- The type of vehicles used to transport food vary significantly in loading capacity, being from pick-ups and trucks with a capacity of one ton to trucks with a capacity of twenty tons
- The capacity is related to the type of products and the volume of cargo they handle.
- Due to destinations and the periodicity of negotiations mostly they do not handle refrigeration.
- Products are packed in bulk, stacked or on pallets. Most products are stacked and packed in bags, rarely in crates.

Currently, Colombia has a fairly insufficient and precarious road system. The country has 206.708 kilometers of roads (Rodríguez, 2019) and a deficit calculated at 45.000 kilometers, corresponding to 26% of the total (Delgado, 2018). It is estimated that the 96% of the country's roads are in poor condition and that of the paved roads only a third is in good

condition (Rodríguez, 2019). The roads that connect the rural areas with the municipal villages or tertiary roads are no exception and for the most part they are unpaved and in a regular state. Only 5% of them are paved and more than half are in regular or bad shape.

The poor state of the country's roads has placed Colombia in position 110 among 137 countries in the index of the World Economic Forum that measures the quality of the road network (Rodríguez, 2019), has placed the country in the highest range of costs of ton transported per kilometer (Lozano and Restrepo, 2016) and with the highest logistics costs in the entire region (Janica, 2016). According to the World Bank in 2013, merchants paid 1.500 USD on average for each container transported up to one port, which represents double the cost in the rest of Latin American countries and three times that of the OECD countries (Delgado, 2018).

## 2.4.4 Retail

In Colombia, large stores are establishments characterized by operating under the scheme of a department store and focusing on final consumer sales and retail trade (Cañón and Correa, 2014).

In 2019, five companies covered 90,6% of the participation in the retail sector. In recent years, the presence of these large companies in the market increased and in 2018 recorded movements of at least 80 trillion pesos (La Republica, 2019).

Although they have been losing some percentage of sales to the discount stores that have recently been growing in the country; the large stores remain an important commercialization channel compared to traditional stores, especially among the population upper-middle class.

A large part of the population buys the vegetables it consumes in this type of establishments, turning the hypermarkets into excellent showcases for this type of products due to the number of points of sale they have, and because the population they serve has a high consumption level of fruits and vegetables. The vegetables are being bought by the big supermarket chains through commercial links with Colombian and foreign producers. The most illustrating case being Éxito stores which directly purchases around 82% of the fruits and vegetables from Colombian producers. About 670 small and medium producers supply this chain with fruits and vegetables (Cardona, 2018).





Figure 25. Distribution of the main chain stores in Colombia. Own preparation.



Figure 26. Points of sale of vegetables in Colombia. Own preparation.

## 2.4.5 Food service and horeca a growing sector

Food Service is a type of market in which a whole network of production and distribution of food, equipment and services is aimed at the provision of supplies for restaurants, business or institutional dining rooms and catering (La Barra Magazine, 2019). This concept arrived in the country in the mid-1990s, driven by actors from the Colombian gastronomic sector at that time (El Tiempo, 1994). Since then, Food Service has been growing based on the increase of the income of Colombian households, the percentage of expenditure dedicated to eating in commercial establishments, the positive perspectives of the hotel and commercial sector, and the increase of franchises in the country.

Among the main Food Service companies in the country is Atlantic Food Service - AFS, recently acquired by the Nutresa group (51%); and the Alpina dairy produce group (19%), which has logistical operation in the main cities of the country. AFS is mainly engaged to the distribution of food in the institutional channel (Vargas, 2019) and the company La Recetta, created in 2008 also by the companies Nutresa (70%) and Alpina (30%). Since then, AFS has had warehouses and multi-ambient trucks and collection centers in Bogotá, Medellín, Cali and Barranquilla (El Espectador, 2013).

According to estimates from La Recetta, part of the horeca's market can move 20 billion

COP per month and is so far an unexplored market. In the past this sector also had participations by hypermarkets such as Alkosto and Makro.

Despite a slight contraction in 2017 due to the impact of the tax reform of that year, the outlook for the horeca sector remains positive, it generated 12% of GDP and 28% of employment in the country, creating 6 million jobs (Unipymes, 2017). In addition, it is expected that by 2021 the horeca sector will reach 38 billion pesos in sales (Agencia PYME, 2017).

Regarding restaurants, for example, during 2016 the percentage of Colombians who ate out of home one or more times a week reached 38%, although it is still lower than the Latin American average (41%) and world average (48%) (Nielsen, 2016). In this way Colombian consumers don't only keep out-of-home food for special occasions but have now included this consumption habit for convenience and practicality. Consumers have less time to prepare their meals at home, including breakfast. Previously, consumers prepared breakfast in their homes. This has changed and consumption of breakfast outside homes has increased in percentage.

In the In Nielsen's Global Survey, the food establishments preferred by Colombians are fast food establishments (53% of pollsters state this fact), followed closely by casual food establishments (to which 46% attend) and formal restaurants (with 44%) (Nielsen, 2016). When choosing a place to eat outside of home, consumers look above all for reasonable prices (50%), that the food has good quality (45%) and that the service provided is good (30%), adding to these other factors with lower prevalence such as hygiene standards (14%) and the type of food offered by the restaurant (11%) (Nielsen, 2016).

Likewise, the hotel sector has also been showing some dynamism driven by the devaluation of the Colombian peso and the changes in the country's image after the peace process. Hotel occupancy reached 55,46% in 2018, the highest rate along with the one of 2016. The growth of tourism in the country was 9% in the same year, above the regional (3%) and global (6%) averages. These indicators were reflected in the more than 4 million non-resident visitors who arrived in the country that year, mainly from the United States, Brazil, Argentina and Spain (Portafolio, 2019).

In the case of vegetables, the horeca sector is changing the value chain in the country, due to the required quality standards and the variety of products consumers require. A movement from the consumer towards

the producer has been developed, mainly imposed by the food processing companies that wash, disinfect, cut and pack the vegetables to be delivered to restaurants and food franchises in the country.

These processing companies see the need to train and teach producers cleaner ways to produce with new technologies. They also indicate that farmers in Colombia have to adapt these technologies, since other companies already have projects underway and obtain better results and better profitability.

# Vive Agro



Vive Agro is a fruit and vegetable processing company that generates 130 direct jobs and provides a business opportunity for 180 farm families as per our interview with General manager Mr. Pablo Arbelaez.

Vive Agro's raw material is fresh fruits and vegetables. They generate added value by delivering their products ready for consumption to restaurants, food chains and other food companies. In this way, they not only solve the producer's need by buying their products with a constancy and a profitable price, but they also solve the cleaning and cutting process for their final customer, saving time and money. Therefore Vive Agro is in the middle of the production chain, and adds value to improve it. This is the key to its success and therein lies the innovation.

During the last few years, Vive Agro has focused on post-harvest transformation and for the coming years the focus will be more on the production and technical assistance to their suppliers.

Vive Agro has an Innovation and Development Department, from which not only the development of new products is managed, but also improvements to current ones can be proposed to make them more profitable, for example, improving the packages or prolonging the shelf life and improving quality of the product. They have customers such as Metro, El Corral, Frisby, Kokoriko, Presto and Crepes & Waffles.



Figure 27. Vive Agro company profile. Own preparation with information obtained from interviews (Appendix 1).

### 3. Colombia 2030

#### 3.1 Demographics 2030

DANE's latest census measurement revealed that the country did not exceed 50 million inhabitants as foreseen in the 2005 census, largely because such projection did not take into account the sustained reduction in the country's fertility rate. In effect, the most recent statistical figures indicate that Colombia would

have lived rapidly, compared to other countries in Latin America and the world, its demographic transition process. In other words, for the past 20 years, it has passed from high fertility and mortality rates to low rates for both indicators (Urdinola, 2018).

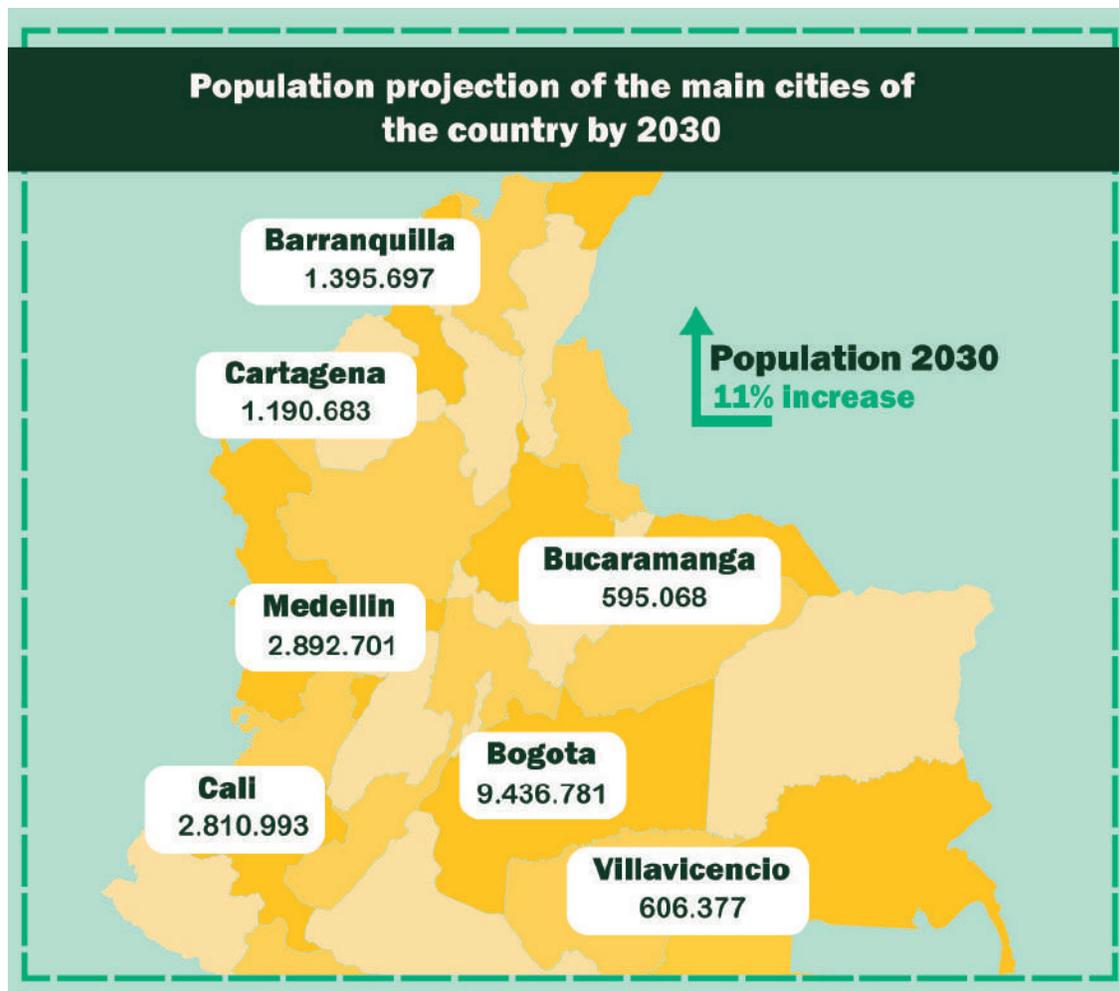


Figure 28. Population projection by 2030. Source: Own preparation based on population projection of World Data Lab.

Likewise, the demographic situation produced what experts call a “demographic bonus”: the existence of a greater proportion of the population in productive ages is today larger than that of the dependent population (children, adolescents and older adults) (Urdinola, 2018).

However, it is estimated that this will change over the next two decades, in relative tune with the gradual exhaustion of this demographic slack in Latin America. By 2023, it is projected that in the region there will be more dependent population (under 15 years of age and 65 years and over) than the total productive population (ECLAC, 2019).

Although there is some uncertainty as to whether or not the country takes advantage of this demographic circumstance that supposes a higher production level and income generation, a large part of the information sources in this regard predict that Colombia will become a middle-class country. According to the world trend that indicates that nearly two-thirds of the world population has already reached this socioeconomic level (Revista Semana, 2015). In this sense, it is expected that the Colombian middle class, the population with incomes between 1 and 10 million Colombian pesos per month, will have increased by 32% by 2030, and that by then, it would no longer be more than half of the population but 64% of it (Portafolio, 2018).

For that same year the DANE estimates that the richest in the country will go from 1,5% of the total population to 3,1% and that the vulnerable people, those with incomes between 450.000

and 1 million Colombian pesos per month, will be 20% of the population and not 25%, as it is today. It is also estimated that there will be a substantial reduction of 26% of the poorest in the country. In Colombia, by 2030, there will be 12 poor people per 100 inhabitants and not 18, as it is at present (Portafolio, 2018). Although these perspectives may sound encouraging, the country presents a lag in its fight against extreme poverty compared to other countries on the continent, so it is expected that it will only achieve the millennium goal of reducing extreme poverty to 3% by 2035 (Portafolio, 2019).

With all this, in general, an increase in the income of Colombian households and a consolidation of the country's middle class are expected. Consequently, and understanding that as stated before a higher level of income is related to higher consumption of fruits and vegetables, it is expected that in the next decade the consumption of this type of food will continue to maintain a positive trend in the country. In Colombia, higher income levels have been associated with healthier consumption patterns, which include more expensive foods such as spices, fish and vegetables, and with the search for a better and healthier life (Ministry of Health and Social Protection and FAO, 2013).

## 3.2 Consumption trends 2030

The abovementioned tendencies require a change in the Colombian production system for horticulture food products with a different approach in the cropping systems. There is a need to increase sustainably produced food, productivity and quality. And there is also a need to reduce food losses by better connecting farmers with the market and better postharvest technologies and agro logistics.

Much of the growth in the consumption of fruits and vegetables in recent years is associated with a greater concern of the population for health and wellness problems, and for consumer preferences that are increasingly directed towards fresh and organic products with less additives, sugar and fats. Both factors have been decisive in the global increase in per capita consumption from 36% to 40% of vegetables in the last half century (Portafolio, 2015).

These trends are also presented at the sub regional level. In Latin America more and more consumers aspire to have a balanced and healthy diet, and to include in it the consumption of vegetables. A recent study by the market consultant Nielsen (2017) revealed that 75% of respondents in Latin America modify their diet in order to take care of their health, that 80% of consumers select foods that help preventing health problems and that 62% are willing to pay more for products that support their health goals. Additionally, a similar percentage of Latin Americans (68%) want to see more natural products on the shelves of supermarkets and other marketing channels.

These trends are also happening in Colombia. A study by Kantar Worldpanel (2018) found that 36% of Colombian households claim to have changed their eating habits, which is higher than the Latin American average at 30%, And 76% of inquired/interviewed households in the country claim to have increased consumption of fruits and vegetables. At the same time, a similar percentage of households (70%) claim to look for fresh products when buying their shopping (Nielsen, 2017). In addition to these trends, consumers are increasingly demanding products with packaging and differential presentations that have nutritional facts, traceability, certifications and increasingly, that meet social, environmental and safety requirements for consumers (Ministry of Health and Social Protection and FAO, 2013).

### 3.3 Production 2030

The world's population is projected to increase from about 7,3 billion today to almost 9,8 billion by 2050, with most of this increase taking place in developing regions. In low-income countries the population could double. To feed humanity, a 50% increase in the production of food and other agricultural products will be necessary between 2012 and the middle of the century (FAO, 2017).

A determining factor in inclusive rural transformation will be the growth in demand from urban food markets, which consume up to 70% of the food supply even in countries with a large rural population. Due to the increase in their income, urban consumers are significantly modifying their diet, reducing the consumption of basic foods in favor of higher value fish, meat, eggs, dairy products, fruits and vegetables, and, in general, foods with a higher level of elaboration (FAO, 2017).

Much of the potential for expansion of agricultural production - about 1.800 million hectares - is found in developing countries. Half of this acreage is concentrated in 7 countries: Brazil, Democratic Republic of Congo, Angola, Sudan, Argentina and Bolivia (Finagro, 2014). Specifically, the increase in the area of food production is projected primarily in sub-Saharan Africa and Latin America, regions that together would have 70 million hectares available to increase food production (FAO, 2017). Among the Latin American countries, Colombia stands out as one of the countries with the best possibilities of increasing its agricultural area without affecting the area of natural forest, as well as other positive factors such as its climatic factors, its natural resources and the production of biomass (Finagro, 2014).

The Administrative Unit of Rural Agricultural

Planning (UPRA in Spanish) is a government institution, created in 2011 and linked to the Ministry of Agriculture and Rural Development, which has budgetary, financial and technical autonomy.

This entity was created due to the shortcomings and weaknesses of the planning processes for the use of rural land in Colombia, mainly in terms of agricultural activities, since the country lacked the technical instruments that allowed it to guide and define sectoral and territorial policies. In this sense, the main function of UPRA is the management of the territory for agricultural uses and this competence is closely linked to the formulation of the Territorial Planning/ Development Plans (POT in Spanish) that are configured at the municipal level. Specifically, UPRA defines the criteria and instruments for the municipal management of rural land suitable for agricultural development in the next years.

More recent estimates from the Rural Agricultural Planning Unit (UPRA) have estimated the Colombian agricultural frontier at some 40 million hectares available for food production, equivalent to 35% of the country's continental area. Of these only 7,6 million (20%) are currently cultivated, the rest is mainly in pastures and savannas, although that does not necessarily mean that they are fully occupied by livestock (Medina, 2018). Additionally, the country has 25 million hectares (23% of the country) in categories of protection or conservation of areas of environmental importance, in which the development of agricultural activities is not allowed.

The Ministry of Agriculture has the following policy for the current government until 2022 to achieve a higher level of technology of the Colombian rural area and achieve more equality in the rural area.



Figure 29. Work plan of the Ministry of Agriculture: pillars for equality. Own preparation based on information obtained from interviews (Appendix 1).

### 3.4 Distribution channel 2030

#### 3.4.1 Distribution channel

For 2030 it is expected that distribution chains will be shorter, between the producer and the consumer. It is expected that products will need to have GAP certifications in the different sales

channels. Therefore, Food farmers and Food producers will also have to invest in technology to improve productivity and food safety of their products if they intend to be part of this distribution channel.

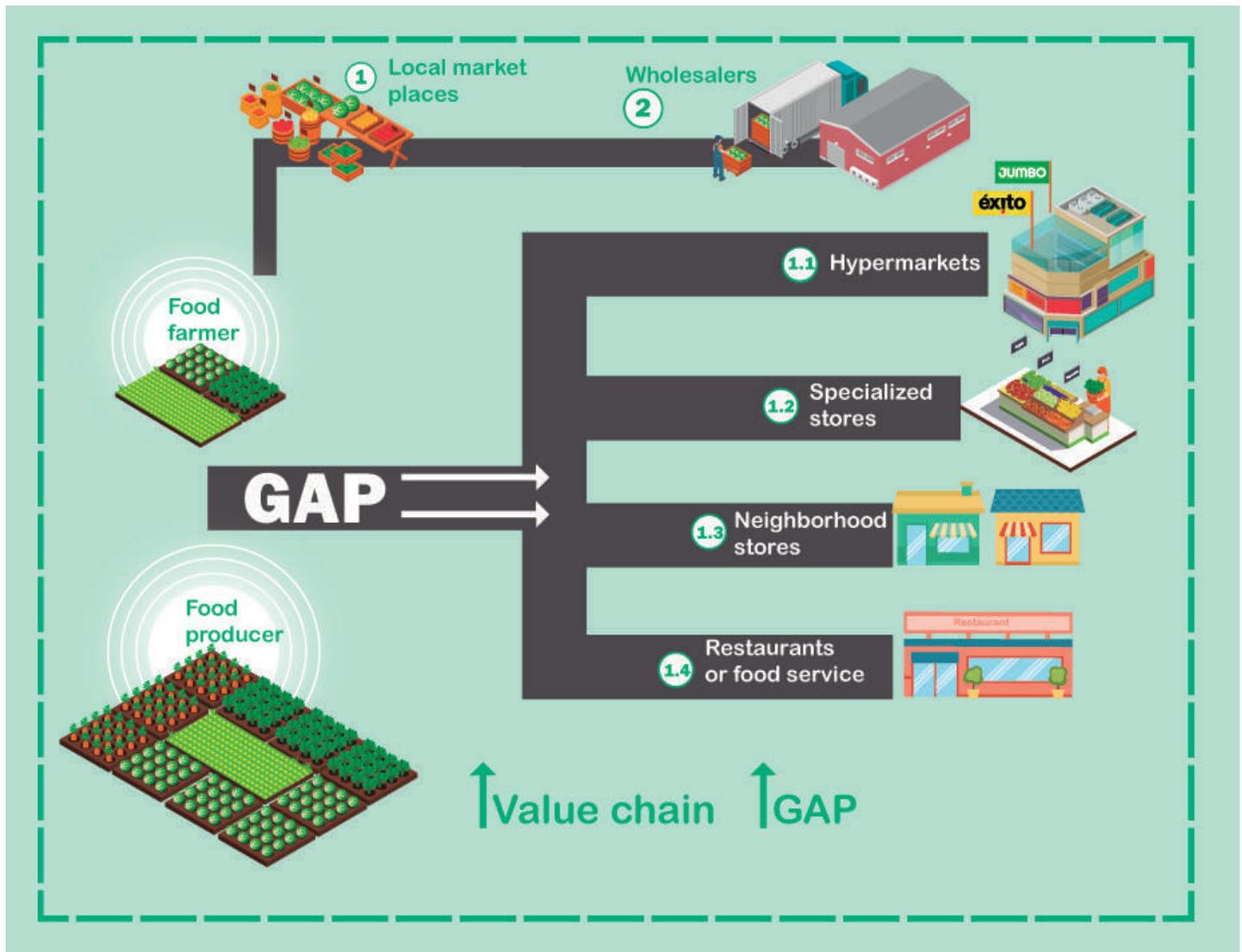


Figure 30. Distribution channel 2030. Own preparation.

### 3.4.2 Smart logistics – direct supply

As aforementioned, the country is changing, and the specialty vegetables sector is growing. The increase in the consumption of vegetables and the purchasing power of Colombians are expected to improve. The distribution chain will have to change to meet the needs of these consumers.

In the interviews carried out for this study, the interviewees identified as a challenge for the sector to shorten the distribution chain and to bring the producer closer to the final consumer “from the farm to the table”, as well as guaranteeing the traceability of the products.

Producers must also have allied companies or anchor companies (which may be food processors or (super)market chains) that support the farmer with technical assistance to achieve Good Agricultural Practices (GAP) in crops, technify infrastructure (greenhouses, fertigation system, fumigation system and post-harvest area) and increase productivity, adding value to the production chains.

Through these value chains where technology is incorporated, post-harvest losses are also reduced, which are currently 30% in volume. Presently, in the transport of the farm to the points of sale, and also in the wholesale markets and the marketplaces, no type of technology is used for the conservation or proper post-harvest handling of the vegetables. Even hypermarkets face problems in today's cold chains, therefore, the implementation of these measures need to be established but won't be operational until 2030.

Currently, at CORABASTOS – Bogota, they have started to implement a campaign so that the handling of tomatoes is in crates rather than the use of coastal bags, this will gradually change. It will improve the transport logistics and by applying these measures, post-harvest losses will be reduced.

The adaptations of this technology (both in the value chain and in the productive part) must be gradual, and the actors involved throughout the chain must be trained. Currently, distributors are not trained and skilled in managing fertigation, greenhouses and cold chain systems. Therefore, it is necessary to start providing training information to producers.

The producer can change his/her system if productivity increases and the product is being sold in the market. The Ministry of Agriculture has proposed these strategies “agriculture by contract” for producers to sell directly and reduce the supply chain channel and with that the number of intermediaries.

## Appendix 1. Persons interviewed in Colombia

<b>Name of entity or company</b>	<b>Type of entity or company</b>	<b>Location</b>	<b>Contact person</b>
CORABASTOS	Wholesale marketplace		Andres Ricardo Prieto
Ministerio de Agricultura	Government entity		Felipe Bareno
AGROSAVIA	Government entity		Rodrigo Alfredo Martínez Sarmiento (Research director) Adriana Carolina Peña (Research Líder Network)
Asohofrucol	Trade entity		Jesús Elías Rivera Velasco Carolina
Centro de Biosistemas	Education entity		Hugo Escobar Luz Stella Fuentes
Embajada del Reino de Los Países	Government entity		Andrés Santana Bonilla
Sáenz Fety	Seeds / substrates company		Fernando Nieto
Impulse semillas	Seed company		Héctor Raúl Carvajal Guillermo Ernesto Fresneda
SURTIFRUFER	Vegetable distributor		Natalia Garzon
BIOPLAZA	Organic vegetable distributor		Alexander Von Lobell
Holland House	Bilateral Chamber Commerce		Jan Willem van Bokhoven

<b>Name of entity or company</b>	<b>Type of entity or company</b>	<b>Location</b>	<b>Contact person</b>
Espacio Agropecuario	Tomato grower	Guarne, Antioquia	Henry Florez
Asociación Agrofenix	Tomato grower	El Peñol, Antioquia	Luz Dary Giraldo Marin
Central Mayorista	Wholesale Marketplace	Medellin Antioquia	Juan Orlando Toro Escobar
Almacenes Éxito	Retail store	Medellin Antioquia	Jose A. Rolong Alejandro Perez
Gobernación de Antioquia	Government entity	Medellin Antioquia	Teresita Rengifo
Pomario	Vegetable grower and distributor	Medellin Antioquia	
San Terra	Vegetable grower and distributor	San Pedro, Antioquia	Rodrigo Castelblanco
Secretaría de agricultura Gobernación de Santander	Government entity	Bucaramanga, Santander	Renato Baldovino
Camara de Comercio Bucaramga	Government entity	Bucaramanga, Santander	Paula Fonseca
Distribuidor y productor de		Bucaramanga, Santander	Hermes Pérez
Distribuidor de hortalizas especiales	Vegetable distributor	Bucaramanga, Santander	Adolfo Botero

<b>Name of entity or company</b>	<b>Type of entity or company</b>	<b>Location</b>	<b>Contact person</b>
Central de Abastos de Bucaramanga Centroabastos	Wholesale Marketplace	Bucaramanga, Santander	
	Research entity	Cali, Valle del	Luz Adriana Jiménez Meike Andersson
Invest Pacífico	Government Foreign Investment entity	Cali, Valle del	Alejandro Ossa Ana Maria Lancheros
Inversiones Agrícolas Tocotá	Grower and exporter of fresh herbs	Cali, Valle del	Juan Carlos Hoyos
Higinio León		Roldanillo, Valle del Cauca	Higinio Leon
Tierra de Frutas Tierra de Acero	Green house construction	Roldanillo, Valle del Cauca	Alvaro García
Alejandro González		Chinchina,	Alejandro Gonzalez
Cámara de Comercio Pereira	Government entity	Risaralda	Daniela Castro
	Agrofuturo	Medellin Antioquia	Tomas Rios Munera
Merkaorganicos	Organic Vegetable Distributor	Medellin Antioquia	Ricardo Londoño
	Government entity	Medellin Antioquia	Humberto Yepes Londoño
		Rionegro, Antioquia	Ferney Perez Duvian Giraldo

<b>Name of entity or company</b>	<b>Type of entity or company</b>	<b>Location</b>	<b>Contact person</b>
	Educational entity	Rionegro, Antioquia	Marcela Giraldo
Aeroponicos		Rionegro, Antioquia	Diego Zapata
Vive Agro	Food service		Pablo Arbelaez
Eurosemillas			Catherine Díaz
Procolombia	Government entity		Juliana Gómez
Camsal			Luis Camargo
	Government entity		Carlos Robles
Banco Agrario	Government entity		Angela Tequi
Agroser / Rijk	Seed company		Javier Parra

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