



**UNIVERSIDAD
DEL AZUAY**

University of Azuay

Faculty of Law

School of International Studies

**FEASIBILITY STUDY FOR THE CREATION OF A
PRODUCTION PLANT OF ESSENTIAL OILS FOR
EXPORT TO THE FRENCH MARKET**

Graduation work prior to obtaining the title of:

**Bachelor in International Studies with a Bilingual Mention in
Foreign Trade**

Authors:

Emily González Merchán; Daniela Ron Barrero

Director:

Ing. Antonio Torres

Cuenca – Ecuador

2019

DEDICATION

There are no words to describe a culminated goal. I dedicate this degree work to my family, my parents and my sister, who have been the main people to place their trust in me, they have given me their support and affection from the beginning of this milestone until the end. Without a doubt this is also true for the help of God, who has filled me with blessings and has been the one that has allowed me to reach my professional goal.

To my sister Helen, my little friend, who with my example, showing her that dreams can be fulfilled with effort, I want to get farther than me. To my parents, Christian and Johanna, whose support and effort helped me become a professional, because I never missed a hug or a wise word. They did not let me faint and they knew how to guide me.

To my grandparents Jovany, Elizabeth, Nardo and Janeth, from whom I obtained the best example of perseverance and effort towards life, being the fundamental pillars of my family and my life.

Emily Gonzales Merchan

I dedicate my graduation work primarily to God for giving me the pleasure of reaching this point in my life. To my mother Marcela, for being my unconditional companion in this professional path; for having raised me with the necessary values to emphasize real life, for teaching me that I can get ahead and achieve everything I set my mind to. To my husband Victor, for helping me and supporting me to the end, because his smile was always an incentive to continue and to want to provide a better future for our family. To all my family, my parents, brothers, sisters, aunts, uncles, grandmothers and grandparents for always giving me encouragement and being proud of the person that I have become, because they always knew how to guide me with their knowledge.

But above all I dedicate this professional achievement to me.

Daniela Alejandra Ron Barrero

ACKNOWLEDGMENTS

I thank God and my whole family for accompanying me on the path I have traveled to reach my professional goal, for guiding me and giving me love and strength to move forward and fulfill my dreams. To our great friend and teacher Ing. Antonio Torres who has accompanied us in the trajectory of this degree work, guiding us, supporting us and giving us his knowledge to reach the end. To my great friends who made the path to a professional life more bearable, sowing moments that will be marked forever within university life, because in addition to being colleagues, we formed friendships that will last over time. To Valeria, Elayne, Malena, Jim, Karlitos, Belén and without a doubt my friend with whom I completed this degree work, Daniela, thanks for your constant support and your words of encouragement and to all those I can call friends.

The phrase “thank you” is too small for everything that this means to me.

Emily Cristina González Merchán

In first instance I thank God for helping me and giving me the wisdom to fulfill one of the greatest achievements of my life. Likewise, I thank my parents and my family for always being there, supporting me unconditionally. Because the road was not easy but without them, this would have been impossible, without their motivation and love, showing me every day that I can achieve all the things that I want. I thank my mom for being my fundamental pillar on this path, for being my unconditional companion of laughter, tears, desperation but most of all the happy moments in these years of study. And to my love, to get up and give me a hand in all my dreams and adventures, because I know that by his side I can fulfill one and a thousand more dreams; Thank you.

To my thesis tutor, who more than a teacher has been a friend, thank you very much Toñito for your affection, understanding, patience and wisdom in this path. And thanks to you my friend Emily, for doing this degree work with me, for your perseverance and joy.

Thank you very much, to each one of you for being part of this special moment in my life.

Daniela Alejandra Ron Barrero

ABSTRACT:

The objective of the following investigation is to determine the feasibility and profitability of elaborating a production plant of essential oils for export to France. Currently, the demand for essential oils has increased, as it is a product that functions as a main component in multiple industries. The analysis of the proposed project will contribute to the solution of the current problem in Ecuador, which is the exportation of commodities with added value generated through productive processes. Since it is a project focused on foreign trade, a plan will be made to determine the political, economic, social and technological analysis of the environment between Ecuador and France to establish a method of long-term negotiation. Through research and analysis, a market study will be carried out to demonstrate the viability of the established destination and thus be able to determine the product that Ecuador will offer, and that complies with the standards and requirements established by the defendant country. Through the technical study, the optimum production plant size can be established. The economic study will be directed towards the income and expenses of the project, which will result in a financial study to conclude the feasibility, profitability and viability that will determine the creation of the production plant of essential oils and describe the influence of the investment in the project. The methods that will be applied for the analysis of the feasibility will be quantitative, inductive and analytical.

Keywords: costs, export, France, investment, production, profitability and utility.

RESUMEN:

La siguiente investigación tiene como objetivo determinar la factibilidad y rentabilidad del proyecto propuesto de la elaboración de una planta productora de aceites esenciales para su exportación hacia Francia. Actualmente, la demanda de aceites esenciales ha incrementado, por la razón de que es un producto que funciona como componente principal en múltiples industrias. El análisis del proyecto propuesto va a contribuir con la actual problemática del país ecuatoriano que abarca la exportación de productos commodities, generando un valor agregado mediante procesos productivos. Al ser un proyecto enfocado al comercio exterior, se realizará una planificación que determine el análisis político, económico, social y tecnológico del entorno entre Ecuador y Francia, para lograr establecer el método de la negociación a largo plazo. Mediante investigaciones y análisis se realizará un estudio de mercado y su entorno que demuestre la viabilidad del destino establecido y así lograr determinar el producto que Ecuador va a ofertar, cumpliendo con los estándares y requerimientos establecidos por el país demandado. A través del estudio técnico, se podrá establecer el tamaño óptimo de la implementación de la planta productora, mientras que el estudio económico será direccionado hacia los ingresos y egresos del proyecto, los mismos que darán como resultado el estudio financiero para concluir con la factibilidad, rentabilidad y viabilidad que aprobará la creación de la planta productora de aceites esenciales y logre denotar la influencia de la inversión en el proyecto. Los métodos que serán aplicados para el análisis de la factibilidad serán cuantitativos, inductivos y analíticos.

Palabras claves: costes, exportación, Francia, inversión, producción, rentabilidad y utilidad.

Table of Contents

DEDICATION.....	I
ACKNOWLEDGMENTS	II
ABSTRACT:	III
RESUMEN:	IV
List of Tables	VII
LIST OF FIGURES	VIII
CHAPTER 1	1
1. PLANNING	1
Introduction	1
1.1 Political factors.....	1
1.2 Economic Factors	4
1.3 Social Factors.....	8
1.4 Technological Factors.....	9
Conclusions	11
CHAPTER 2	14
2. STUDY OF THE FRENCH MARKET	14
Introduction	14
2.1 Product description.....	14
2.2 Analysis of the offer	15
2.3 Demand analysis	17
2.4 Price Analysis.....	22
2.5 Marketing of the product.....	24
2.6 Chosen product.....	26
2.7 Sales Projection	28
Conclusions	34
CHAPTER 3	36
3. TECHNICAL STUDY	36
Introduction	36
3.1 Location of the production plant of essential oils	37
3.2 Size of the essential orange oil producing plant	39
CHAPTER 4	64
4. ECONOMIC STUDY	64
Introduction	64
4.1 Determination of costs.....	65

4.2 Determination of the investment	82
4.3 Financing and depreciation.....	87
4.3.2 Depreciation.....	88
4.4 Net Cash Flow.....	89
4.5 Break-Even Point.....	91
Conclusions.....	94
CHAPTER 5.....	96
5. FINANCIAL STUDY	96
Introduction.....	96
5.1 Minimum Acceptable Rate of Performance.....	96
5.2 Net Present Value	97
5.3 Internal Rate of Return	99
Conclusions.....	101
CONCLUSIONS AND RECOMMENDATIONS	103
Conclusions:.....	103
Recommendations:	106
APPENDICES	108
Appendix A: Export process determined by the CUSTOMS OF ECUADOR	108
Appendix B: Technical standard for vegetable oils.....	109
Appendix C: Amortization table.....	110

List of Tables

Table 1 Tariff classification	16
Table 2 Different classifications of essential oils imported by France.....	22
Table 3 France imports of orange essential oils	31
Table 4 Sales projection	33
Table 5 Share in imports from France.....	34
Table 6 Forecast of sales of the project.....	35
Table 7 Location of the orange essential oil plant.....	40
Table 8 Budget of the necessary machinery	54
Table 9 Analysis of the orange raw material annually	69
Table 10 Payrolls for the year 3	71
Table 11 Payrolls for the year 2	73
Table 12 Payrolls for the year 3	75
Table 13 Payroll for the year 4.....	77
Table 14 Payrolls for the year 5	79
Table 15 Summary of the payrolls in the horizon of the project	80
Table 16 Office supplies annually.....	81
Table 17 Costs of production materials.....	82
Table 18 Maintenance costs	83
Table 19 Costs of basic services.....	84
Table 20 Packing cost.....	84
Table 21 Total investment of land and civil works	85
Table 22 Investment of company constitution	86
Table 23 Investment in imports of machinery.....	87
Table 24 Investment of office furniture and equipment	88
Table 25 Working capital	89
Table 26 Total investment.....	90
Table 27 Contributions from investors and banking entities.....	91
Table 28 Depreciation of intangible and tangible assets	92
Table 29 Net Cash Flow	94
Table 30 Fixed costs.....	96
Table 31 Variable costs	96
Table 32 Break-even point	97
Table 33 IRR and NVP	104

LIST OF FIGURES

Figure 1 Digital Economy and Society Index	11
Figure 2 Evolution of French imports of essential oil in the last 10 years	20
Figure 3 Product marketing chain	27
Figure 4 Percent growth of imported orange essential oil in tons.....	29
Figure 5 Participation in imports from France	34
Figure 6 Block diagram of the production process	45
Figure 7 Distillation process	46
Figure 8 Cold room	47
Figure 9 Fruit washer	47
Figure 10 Orange peeler	48
Figure 11 Fruit dehydrator	49
Figure 12 Alembic.....	50
Figure 13 Bacterial counter	51
Figure 14 Microbiological incubator.....	52
Figure 15 Packaging tank.....	53
Figure 16 Organization of human resources	56
Figure 17 Distribution plan of the orange essential oil production plant.....	58
Figure 18 Incoterm FOB	60
Figure 19 Economic study process.....	68
Figure 20 Break- even point.....	98
Figure 21 Timeline of VNP.....	102
Figure 22 IIR y VNP	104

CHAPTER 1

1. PLANNING

Introduction

Before starting the operation of a company, one has to analyse the macro-environment and the factors and variables that could benefit or harm the operation. To achieve this end, there are several analytical systems including PEST, which according to Narváez and Vergara (2012), is a tool that allows to see the growth or decrease of a certain market and know if it is feasible to produce a certain product or service. This tool includes the diagnosis of the political, economic, social and technological factors of a place, country, etc., in such a way that the effect on the product or service to be initiated can be known.

Therefore, in the next chapter, a PEST analysis will be carried out taking into account that it is a tool that allows analysing the project's political, economic, social and technological factors, to obtain an interrelation between them and to determine both the positive and negative aspects that could affect the start of a company and over which it has no control even if it could be directly affected by them. In fact, as these factors are external, the company can use this mechanism to evaluate the market it wants to address with the aim of entering it in a satisfactory manner with high possibilities of effectiveness. In this work specifically, a venture into the French market is intended.

1.1 Political factors

France, officially the French Republic, is the largest country in Western Europe, with an area of 549,087 km², a population of 67,221,943 people and a population density of 122 inhabitants per km². Its capital is Paris and its currency is the Euro. It is a sovereign country, constituted as a Social and Democratic State of Law. Its form of government is organized as a semi-presidential republic and its motto is Freedom, Equality, Fraternity. (Datosmacro.com, 2017).

The current Constitution of France (Constitution of the Fifth Republic) was approved by a public referendum on September 28, 1958. Under this Constitution, the President is

directly elected for a period of 5 years, renewable once consecutively and whose arbitration ensures the regular operation of the public powers and the continuity of the State. The current president is Emmanuel Macron, a position he held since May 14, 2017, who has the faculty to preside over the Cabinet, the armed forces and concludes treaties (Pedraza, Angulo, Méndez, & Rodríguez, 2014).

For the signing of treaties, the President is governed by the French Constitution specifically by articles 52, 53, 54, and 55; where it is specified that the President of the Republic will be in charge of negotiating and ratifying international agreements so that they may be valid within the country and will have superior authority to the laws (Senat, 2008). This aspect is very important in any country since the bilateral investment treaties (BITs) allow economic cooperation between the nations involved in the agreement, in addition to regulating the different economic relations of investment and implementing mechanisms for dispute resolution and / or controversies between the States.

Another important fact is France's membership of the European Union (EU), a regional, economic and political association of European countries, currently composed of 28 countries representing a large percentage of the continent. One of the main principles on which the European Union is based is to achieve free trade among its member countries.

In fact, the European Union, an organization with great transcendence, has managed to grow over time and is currently recognized as the leading commercial power in the world, with a high percentage of imports and exports. In addition, they negotiate the different proposed agreements based on the rules of the World Trade Organization (WTO), because they seek to maintain world order and regulations. Trade relations between third countries are managed through commercial agreements with the aim of improving business opportunities and overcoming different obstacles that may intervene in trade (European Union, 2018).

Regarding imports, the European Union has different strategies and regulations that seek to guarantee and ensure that the products brought in by foreign trade activities are distributed at a fair and equitable price. To this end, it supports commercial regulations with trade defence instruments to protect EU producers, avoiding unfair competition,

such as the issue of dumping (selling below the price) and subsidies (European Union, 2018).

Likewise, establishing treaties with France is particularly interesting because of its membership of the EU, and its adherence to the Vienna Convention on the Law of Treaties (Vienna Convention, 1969). International companies have the same assistance as French companies and currently, administrative procedures for the establishment of international companies in the country have decreased. Specifically, in the bilateral investment treaty from France with Ecuador, which went into effect on June 10, 1996 (United Nations UNCTAD, 2013).

Among the different international relations that France has had through this bilateral treaty of 1996, it can be mentioned that in November 2013 the Ecuadorian President at the time, Rafael Correa, made an official visit to Paris where, after his meeting with his counterpart, then president of France, François Hollande, a declaration was published in which they agreed to develop cultural, scientific and commercial exchange cooperation and which was to be seen as the starting point for the encouragement of the bilateral relationship between France and Ecuador (France Diplomatie, 2016).

Previously, there had been several meetings in which France and Ecuador held various bilateral consultations in Paris in the year 2012, which were chaired by the Deputy Secretary General of the Ministry of Foreign Affairs and by the Deputy Minister of Foreign Affairs, Marco Albuja; the Deputy Minister of Foreign Trade, Francisco Rivadeneira and the Minister of Foreign Trade, Nicole Bricq, and in which important decisions were made concerning the trade between France and Ecuador

Also in other agreements, Ecuador benefited from the Generalized System of Preferences, (SGP-PLUS) therefore the products that enter the European Union and therefore France pay 0% Ad-Valorem (PROECUADOR, 2013). This benefit is renewable indefinitely and in fact, in an interview on April 2018, the current president of Ecuador, Lenin Moreno, ratified the agreements with the members of the European Free Trade Association (EFTA) allowing exports to continue entering the member countries free of tariffs (Unión Europea, 2018).

To conclude the analysis of the French policy, it is evident that they make international agreements and treaties seeking a benefit and stability of the compromised parties, without going against the rights of the citizens or the established Constitution. In addition, because France is a member of the European Union, it has been working on different issues increasing stability and efficiency in trade, politics and tourism. Also, because it belongs to a regional organization that includes 28 countries, it is involved in adapting to the system that is managed within the EU, an organization that has helped to regulate the fair trade of the member countries, as it benefits and gives greater control for any unfair practice and in the same way, through different treaties that have been held within the EU, has helped to make commercial administrative systems more agile; making it easier for countries around the world, including Ecuador, to establish trade relations with member countries of the European Union, which have the advantage that they foster relations through international treaties.

1.2 Economic Factors

France is among the ten most important powers in the world in terms of its economy. One of the reasons is due to the ranking of its Gross Domestic Product (GDP) in terms of purchasing power parity, which consists of measuring the internal production of a country of goods and services based on a set time (Callen, 2008). It is important to highlight that the GDP of France reached a value of 2.3% in the year 2017 (CIA FACTBOOK, 2018). Another reason is its strategic location on the planet and the high development of its main industries, where its work staff is highly trained and qualified for maximum productivity. However, the most important characteristic for which France is recognized internationally is the favourable business environment that they offer and the model of transparency that is managed within the country. In fact, according to Vaca (2015), France is a power that is in the sixth position worldwide, despite the financial crisis that presented itself internationally in 2009, because it has withstood the onslaught thanks to a varied economy. On the other hand, France belongs to the Group of Eight (G8), which includes major industrialized countries and has great relevance worldwide in political, economic and military aspects (República de Francia, 2017).

In France, the sectors of the economy are divided into three, which are primary, secondary and tertiary; the primary sector, agriculture, represents 2% of the GDP in France, which is not only active within the country, but also throughout Europe, where France is positioned as the number one producer. The majority of its agricultural export is directed towards its main trading partner, which is the European Union. Being one of the countries with the most benefits geographically, as indicated in previous paragraphs, for the variety of its climates, soils and the technification of their production, they use mechanisms to produce their products in their natural state, adding value to them since they can be preserved and are better for consumption (Oficina Económica y comercial de España en Paris , 2016).

Within the secondary sector, France is located as the fourth power in the world, being one of the leading countries of the industrial revolution after which it developed different sections on the industrial ladder. France has always been one of the pioneering countries in all innovations, highlighting its business knowledge and since ancient times France has constantly been implementing new ways and ideologies and diversifying its industrial structure. However, the French industry had a decline due to the crisis that occurred worldwide and this caused its production to decrease with 3.1% in the year 2009 (Oficina Económica y comercial de España en Paris , 2016).

Nevertheless, from 2010 to 2012 it has been growing in manufacturing production, which has allowed its economy to grow 2.9% and, from 2014 to 2015, the French government has incentivized production, resulting in billing revenues representing 12.4% of the GDP, which clearly is not as high as in its best times but the difference is clear. Likewise, through research and investment programs France has tried to encourage the recuperation of the loss of the industrial sector (Oficina Económica y comercial de España en Paris , 2016).

Finally, the tertiary sector represents 80% of the French GDP. The analogy can be made to know that it represents almost three quarters of the French workforce. This sector includes the services offered by the French government to the population, which are essential for their needs to be met. It includes several commercial activities, communication, social services, transportation and tourism, among others. Specifically, tourism can be seen as an emphasized industry since 2017. France was ranked as the first

tourist destination in the world having a figure of 89 million tourists (Oficina Económica y comercial de España en París , 2016).

The GDP per capita, which is an indicator to measure the internal wealth of a country distributed equally for each person, is used internationally to express the economic potential of a country (Robles Vásquez, 2011). The French standard of living is considered positive since the standard of living tends to generally increase and, causing the purchase power to increase to the same extent that GDP per capita increases (Santander TradePortal , 2018).

In fact, France has recovered slowly after the crisis, but has managed to stabilize GDP in 2010 and 2011, although it suffered a fall in 2012 due to a decrease in foreign investment and national production. However, in 2013 it improved and moved forward to position itself as the sixth economic power in the world by 2017, even surpassing the projections that the IMF had for France, obtaining a growth of GDP of 1.08% in 2017 (Santander TradePortal , 2018).

For the year 2018, the IMF foresees a GDP growth of 1.08% based on these analyses and achievements. At the moment, the country seeks to attract foreign investment to stabilize the economy, especially in the field of technology and innovation, because technology has been shown to be a relevant issue that will never end. On the contrary, it will continue to increase and goes hand in hand with innovation to become an attractive market worldwide (Santander TradePortal , 2018)

Also, by 2018, France was expected to show structural challenges according to the budget allocated for the year, since tax cuts have been proposed for households and businesses, trying to reduce public spending in different sectors. Likewise, the international arena is a challenge, since it seeks to improve competitiveness and position itself as a commercial market at an international level. In the same way, it is expected to stimulate European integration, obtaining better solvency and stability. According to the European labour environment, in 2017 the unemployment level fell to reach 9.2% at the end of the year and it is expected that by 2018 it will be further reduced, with the reform approved in 2017 to provide greater flexibility to the labour market (Santander TradePortal , 2018).

Indeed, during his first months in office, President Emmanuel Macron has managed to pass fiscal reforms and lower the public deficit below the European target of 3% of GDP (2.9% compared to 3.4% in 2016). However, public debt seems to keep rising: it reached 98.1% of the GDP in the third quarter of 2017. However, in general, the business environment in France has seemed to improve, due to his negotiating nature, Macron seeks to attract investments to France through the renewal of economic treaties with companies and hence the 2018 budget, will be used in particular to finance tax cuts for business (Santander TradePortal , 2018).

However, since December 2018, Emmanuel Macron has faced several structural challenges: reducing public spending to improve the country's competitiveness, and at the international level stimulating European integration, a line which is affected by the Brexit (exit) of the United Kingdom and the long process to form a government coalition in Germany (Santander TradePortal , 2018).

However, France has managed to overcome the crisis and obtain an increase in GDP knowing that this is an indicator that measures the standard of living. As France has been obtaining a good position year after year, one can conclude that the French have a good quality of life. Regarding international commercial relations, the country obtains good results both in its exports and in its imports, being a great supplier of several countries with different industries.

Ecuador has commercial relations with France, ranking 75th among suppliers for France. In fact, in 2012 the French Republic reached a record in the level of its exports destined to Ecuador, which has increased with 52.06% in two years, without reaching its historical record of 2012 (163.6 M €). On the other hand, imports to France from Ecuador have increased by 5.5% to € 359 million, at a faster rate than the total of French imports, thus reaching a deficit in the trade balance in France due to the high import income in relation to exports. According to the investment, in recent years France has been ranked the number three investor at European level. Approximately 20 French companies located in Ecuador have opened the way for more French companies to find business opportunities in different areas in Ecuador (France Diplomatie).

On the other hand, the economic growth of France is projected to remain solid in a biannual analysis of the economic perspectives by the Organisation for Economic Co-

operation and Development (OECD), the body in charge of coordinating the main policies of the member states in relation to the economy.

This agency specifically believes that economic growth in France will remain at 1.6% in 2019 before falling to 1.5% in 2020. Planned fiscal and labour market reforms will sustain business investment and exports. Public investment will continue to recover. However, a weaker international impulse will weigh on exports and business investment towards the end of the projection period. Nevertheless, companies may prefer to reduce their debt, which would weaken growth. The renewed turbulence of the financial market and the economic crises in the large European economies could also reduce exports and investment (OCDE, 2017).

To this tenure and according to the World Bank's classification of Doing Business, which classifies countries according to the ease to do business there, France was ranked 32nd out of 190 countries in 2018 and, in terms of the Human Development Index or HDI, developed by the United Nations to measure the progress of a country ultimately showing the standard of living of its inhabitants, indicates that the French are located in a "good" ranking. Additionally, the Perception of Corruption Index of the public sector in France is at 70 points, implying that its inhabitants have a low level of perception of government corruption (Doing Business, 2019).

1.3 Social Factors

The internationalization of a company requires a long process that starts from the study of the acceptance of a foreign product in the target society. The social and cultural factors of said country which in our specific case is France, must be analysed. In France the official language is French and almost all their negotiations and transactions are handled in this language; exceptions could be made for the English language, but if they are made in French, a closer approach with the possible buyer is achieved.

In fact, in imports to France, the requirements based on the European Union's standards on linguistic diversity specify that the languages used for the labelling of a product vary according to the destination of the product. If the product goes directly to final consumers, the label is strictly required to be in the official language, which in this

case is French. Otherwise, if the product is not destined for consumers, it can be labelled in the language of the origin country (Unión Europea, 2018).

In Ecuador, the culture of France is highly appreciated since it has the precedents of the works of Charles-Marie de la Condamine, who in the 18th century chose the region of Quito to measure the length of a meridian arc in Ecuador and the role played by the values of the French Revolution in the process of Latin American emancipation. Likewise, Ecuadorian civil law is based on the French Civil Code. In addition, France ranks 7th in the list of countries that receives most Ecuadorian students. There has been a large increase in student mobility over the last decade: 182 students in 2000, 285 in 2006, more than 400 in 2018.

Ecuador has the Institute of Investigation for the Development of France (IRD); the French Institute of Andean Studies (IFEA); the INRIA Foundation (French Institute for Research in Digital Sciences) and, in 2016, the French Embassy launched the 3rd French Geodetic Mission in Ecuador through a program of scientific and cultural events. There is also a centre of the Delegation for International Cooperation of the Ministry of Interior Affairs (created in 1976, the oldest in Latin America) which carries out technical and operational cooperation activities in the field of justice and policing. In addition, agreements have been signed on tourism in the field of adventure sports and mountaineering, which arouse more and more interest among both domestic and foreign tourists from Ecuador (France Diplomatie, 2016)

On top of that, by analysing and knowing the social and cultural characteristics of the French population, it has been determined that the country tries to inject philosophies of commercial, social, political and economic cooperation among its citizens.

1.4 Technological Factors

Looking at technology factors, France has had continuous technological investments over time, meaning that some of its main strengths are related to technology, biotechnology, nanotechnology, and software and systems development. Of these technologies, biotechnology has shown the highest growth thus becoming a fundamental motor of the economic growth in the country and a strategic axis of the development of the pharmaceutical, medicinal, agricultural-nutritional, chemical and environmental industries. An example of this are the 296 companies that produce or manufacture

products that keep France on the 13th spot of regions of the world with the highest number of patents (Uriarte Beitia, 2010).

On the other hand, the majority of inhabitants have knowledge of, and are widely connected to this digital age. Specifically, in 2016 it was noted that 85.6% of the French population use the internet from a device (Knoema, 2016). This helps to grow and be intercommunicated with the world, learn from other places without having the need to go there and facilitate business relationships. However, it also has several disadvantages and with a high percentage of the population that uses the Internet, France sees the responsibility of protecting citizens from any threat from the digital world. For this reason, it has created protection organizations to prevent the possibility of the information of their governments, companies and private information to be disseminated worldwide. In fact, at the beginning of 2010, Prime Minister Manuel Valls created the French national strategy for digital security with the aim of promoting the management of the internet, but with protection and guidance towards the users so they use it with support of professionals in the digital sector and state aid (Valls, 2015).

Likewise, France allocated 39,500 euros for research and development of technology, a figure equivalent to 2.1% of its GDP with the aim of encouraging technological advances within the country (France Diplomatie, 2016). This has resulted in the technological modernity of each of its cities, which is why France is 15th of 130 Economies on the world ranking of technology and innovation. This ranking is evaluated through innovation and development activities taking into account that innovation is the driving force of a country's constant economic growth and transformation (OMPI, 2017).

However, the transformation is not possible without the help of solvent organizations such as the European Union. The EU facilitates the ability of member countries to adapt and see future results, which are measured by the Digital Economy and Society Index (DESI). This index determines the digitization leaders and provides information on the level of technological growth of European countries in each year, according to the following indicators: connectivity, human capital and integration of digital technology in companies (Nadal, 2018).

Figure 1 shows the level at which each of the member countries of the European Union are located in the Index of Economy and Digital Society conducted in 2018 with each of the variables that are required to be measured its analysis.

Figure 1 Digital Economy and Society Index



Source: (European Commission , 2015)

According to the information presented in the figure 1, four countries top the list of those classified as the most technological: Denmark, Sweden, Finland and the Netherlands. On the contrary, Romania, Greece, Bulgaria and Italy are the ones that are at the lowest level of this indicator. France is ranked 18th out of the 28 countries that make up this study.

Connectivity was considered for the analysis of these indicators; it refers to landline, mobile, narrowband and broadband. Human capital considers the use of the internet and digital skills. On the other hand, the use of internet service is the use of content and communication; integration of digital technology is business digitalization and electronic commerce and digital public services refer to the government's share in the DESI. The results of each country were calculated with these indicators to know their scores and classify them. In 2018 France had a score of 51.5% through these data.

France has achieved a technological development in basic and advanced digital skills due to the fact that most universities and research institutions are training young scientists to establish technological supremacy and hence the population includes a large number of professionals for which reason its technological level has reached a world ranking position that is relevant among other countries (Smith, 2015).

Conclusions

After conducting the PEST analysis on France, it has been demonstrated that in the political aspect, there is stability and harmony within its laws, norms, rights and obligations providing a well-being to its population and in the same way, getting into international organizations that promote a stable international cooperation at internal and external level. In addition, and in terms of policies for importation, France seeks to guarantee and ensure that products that entered through foreign trade activities are traded at a fair and equitable price. It also supports commercial regulations with trade defence instruments to protect EU producers, avoiding unfair competition such as the issue of dumping (selling below the price) and subsidies (Unión Europea, 2018).

Likewise, establishing treaties with France is particularly important because it belongs to the EU and adheres to the Vienna Convention on the Law of Treaties, international companies have the same assistance as French companies. Through the agreements and investment treaties of France with Ecuador, the latter has obtained various benefits among which is the benefit obtained with the Multiparty Agreement that indicates that the products entering the European Union and therefore France pay 0% of Ad-Valorem import duties.

In the field of economics, it was possible to demonstrate that France, after going through several crises that directly attacked its economic stability, managed to recover and obtain the security that is sought as a country, even surpassing projections of its GDP growth at 1.08%, given by international organisations. France is seeking to position itself in a global market and, in the same way, be an attractive country for foreign investments based on the innovation of the three sectors in which its economy is involved. It is possible to show that, in the tertiary sector, tourism provides great economic income to the country due to its strategic central location.

Likewise, and based on international commercial relations, the country has obtained good results both in its exports and in its imports, as it is a great supplier to several countries with different industries. Ecuador is ranked 75th among French suppliers.

On the other hand, regarding the social and cultural field of France, it is perceived that one must have certain prior knowledge when trying to promote commercial relations.

In Ecuador, the cultural prestige of France is very important since the works of Charles-Marie de la Condamine are still remembered and French culture has always been present, with Ecuadorian civil law is based on the French Civil Code.

Finally, in the analysis of the technological field, it was possible to demonstrate that progress and technological innovation are essential elements for the development of the country and France has a technological level that has helped it to stand out in the international arena since it is a developed country that has encouraged its population to adapt to the technological era. In fact, France allocated 39,500 € for research and development of technology, a figure equivalent to 2.1% of its GDP. For this reason, France is in 15th place out of 130 economies in the world ranking of technology and innovation evaluated through innovation and development activities.

In short, it is understood that France is recognized internationally for its good management. It has established political, economic, social and technological procedures to have achieved the stability and growth that it has, thus achieving the development and recognition within the world through industrialized, technological and innovative methods. For this reason, a plant producing essential oils of heading 330129 for exportation to the French market is feasible.

CHAPTER 2

2. STUDY OF THE FRENCH MARKET

Introduction

This chapter is based on conducting a market study to establish the potential demand for essential oil. This will be done through the analysis of secondary information sources to obtain information to help decision-making based on the product and the analysed market based on real results that allow the investor to make a decision according to the needs demanded by the market. In the same way, the quantity that is currently offered in the market will be determined. The demand will be analysed to determine the unsatisfied demand of essential oils in the different industries of the French market, which use essential oil as a raw material in the elaboration of their products. Similarly, the analysis of the offer will be carried out to obtain the quantity of essential oil producers that make their product available in the French market at a certain price as a result. Afterwards, the prices that are offered internationally and within of the local French market will be analysed through quotations from the different industries that require the product. The analysis of the essential oil marketing channels will conclude this study, as our product is focused on the industries that use it as raw material in the production chain. The information that will be analysed will be supported by the methods offered by the author of this research, Gabriel Baca Urbina.

2.1 Product description

It is important to express exactly what an essential oil is to achieve the understanding of this research. Essential oils are products that can be used as a final product or as a raw material. According to the French National Agency for Safety of Medicines and Medical Devices (ANSM) and the ISO 9235 standard, it is an aroma that is obtained by means of a raw material of vegetable origin through the process of steam, dry distillation or mechanical procedures (Sección Económica y Comercial - Embajada Argentina en Francia, 2018). The Centre for the Promotion of Imports from developing countries "CBI" of the Ministry of Foreign Exchange emphasizes that essential oils can

be obtained through different parts that make up the plant: it can be extracted from the stem, root, leaves, peel, fruits, seed, flowers, etc. as long as the main requirement of 100% pure plant origin is met (CBI, 2017). Essential oils can be used for different uses within the cosmetics industry - perfumery, pharmaceuticals - health and food.

There is a Harmonized System (SA) that regulates the codification established for each product that is going to be marketed at an international level, and within the essential oils the following codifications of tariff items exist (CBI, 2017):

Table 1 *Tariff classification*

Tariff Item	Description
330112	Sweet and sour orange oil
330113	Lemon oil
330119	Other citrus oils
330124	Peppermint oil
330125	Other mint oils
330129	Other essential oils

Source: (CBI, 2017)

Authors: Emily González & Daniela Ron

It is worth mentioning that essential oils are desired by consumers for the different advantages offered by this product, among which is hygiene as it is 100% pure and naturally free of bacteria and chemicals, has a strong aroma, and does not colour the product (Linares, 2017).

2.2 Analysis of the offer

The information provided in a market study can come from secondary sources or primary sources. In this case secondary sources will be used because it is an international study with completely valid information. According to Gabriel Baca Urbina (2013), the sources of information are direct and reliable. However, when analysing the supply of a market, the external factors that influence when marketing the product have to be determined.

The analysis of the offer is made with the objective of determining the quantities, characteristics and necessary conditions, that the bidders can make available to a good or

service, at a determined price. In order to establish this, it is necessary to analyse the following variables according to Baca Urbina (2013): prices in the product market, available inputs and their price, technological changes, government support for production and the economic environment in which the project is developed.

However, it must be emphasized that there are different types of offers that can be analysed taking the existing number of producers into account. The first type is the competitive offer, also called free market offer. This is where the producers have a free competition since there is a large number of manufacturers of the same product. Consumers catalogue the article for quality, price and service offered as there is no company or manufacturer that dominates the market, on the contrary, consumers are the ones who dominate due to the great offer that exists. On the other hand, there is the oligopolistic offer, in which there is not so much competition between the producers of the same product or service, therefore they are the ones that determine the offer and the price of what is offered. However, this is quite risky due to the fact that it is not always possible to have a control that the demand will be matched to the offer that is being implemented. Finally, there is a monopoly offer, which is the offer of the product through a single producer. Here, the manufacturer has total control of the market to which it is directed and the consumer imposes neither its price, nor its quality, nor its quantity, since there is only one producer who can offer it (Baca Urbina, 2013). The monopolistic offer refers to the existence of different suppliers of the same product in the long term, taking into account that its acquisition will be determined by the price, quality and added value that is included in the final product. Finally there is the imperfect offer where the price is determined by the place of origin where the product is located, but not by consumers due to the existence of different goods or services in the same establishment (Sapag Chain & Sapag Chain, 2011).

In order to build the essential oil production plant, the theory has to be put into practice. It is necessary to determine the type of offer according to the existing suppliers of essential oils in France and diagnose the quantity of product that can be offered by the producers to a certain price. In this way, France has become the great exporter of essential oils that it is today. On the other hand, it has a variety of medicinal and aromatic plants in its local environment, facilitating its production and creating a greater local supply of the product (Sección Económica y Comercial - Embajada Argentina en Francia, 2018).

According to the Profile of Essential Oils of France conducted in 2018 by the Argentine Embassy in France, the leading companies within the essential oil industry in France are: Mane, Givaudan, Robertet, Charabot and IFF. However, it must be emphasized that the main company within the market is Pure Essentiel, since they export their products to more than 40 countries worldwide. Their company is located in the Provence-Alpes-Cote d'Azur region in the southeast of France and groups approximately 58% of jobs in the sector. This is how it can be seen that companies located in the Paris region are more specialized towards aromatic plants, resulting in a variation of more than 120 different types of essential oils within France. The main European countries that produce essential oils are Hungary, Bulgaria, France, Germany, Italy and Spain (Sección Económica y Comercial - Embajada Argentina en Francia, 2018).

After verifying all the variables proposed in the offer, determining that they are very important for the creation and elaboration of the production plant of essential oils, strategic planning must be considered to achieve that the company can be competitive and insert its product into the French market, taking the stability between price and quality into account.

2.3 Demand analysis

Currently, the trend towards a more natural lifestyle has increased. Every day consumers demand the presence of natural products for mass consumption and in the same way the different industries seek to increase their natural products to meet consumer demands. In the cosmetic, food and pharmaceutical industries, there is a growing supply of natural products due to consumer demand. France, as the second country in the European Union in number of inhabitants, has managed to increase its manufacturing industry of natural products due to the tendency of functional natural ingredients that are adopted as raw material in these industries and for this reason essential oil has become a raw material of different industries.

This is how the idea of implementing an essential oil within the French market is evolving as its consumption is increasing internationally. At present, countries such as the United States, Germany, Spain and others have begun to consume this product for their daily life. Choosing France as a final destination made sense because this industry occupies the fourth place among most important industries considering income and

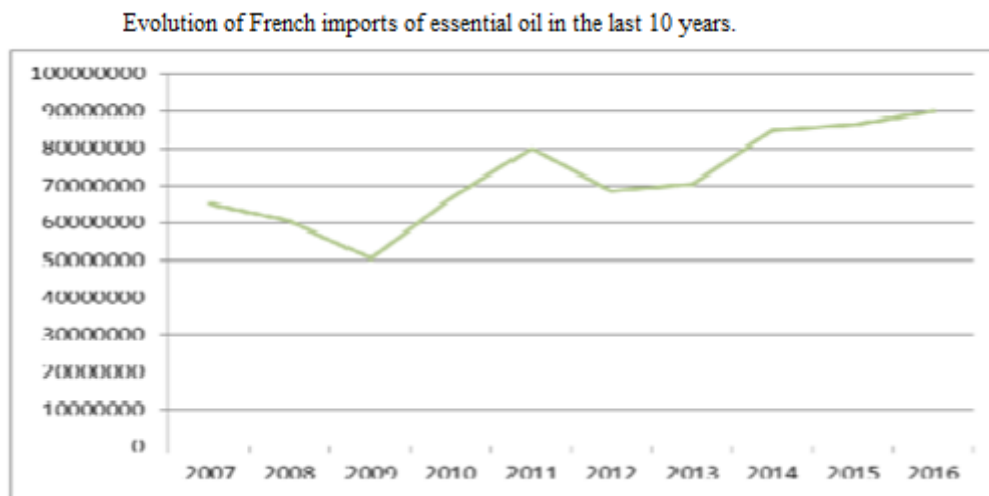
expenses in France and a high quality is demanded from the producers. As such the French local market houses 123 companies with 4,800 employees who make essential oils. According to what is established in France, a small company has less than 20 employees and these small companies represent more or less one third of the industry.

Consequently, France, a country with the sixth highest economy in the world, adopts fairly high quality schemes in its products, both in the products that enter and in the products that leave the country. These schemes or standards are mainly imposed by the demands of the consumer, who have a pattern of established behaviour, in which responsible consumption is one of the main factors when choosing a product. France is one of the main countries of the European Union to consider organic agriculture. Another factor considered by the French at the time of acquiring and consuming a product is the price, nevertheless, quality is the indispensable requirement. Consumers are constant in this aspect, since they require that the product has the quality mark, demonstrating that the product is fair trade and organic (Santander TradePortal , 2018).

Taking all this progress within this industry of essential oils into account, France has achieved a higher growth and a lower deficit in its trade balance, thus obtaining a positive balance. Nevertheless, France imports a large quantity of essential oils from developing countries. According to the profile for essential oils in France, 46% of its total imports came from these countries in 2016 and the percentage of imports from tertiary countries keeps increasing, obtaining an annual growth of 8% (Sección Económica y Comercial - Embajada Argentina en Francia, 2018). Considering the great production that exists in France, it can be noted that it only represents 20% of its exports and it is for this reason that they choose to depend on importation to be able to supply the market they already have established.

France is the largest importer of high-value, high-quality essential oils, while Germany is the largest volume importer of essential oils. Figure 2 shows the evolution of importation into France in the decade from the year 2007 until the year 2016.

Figure 2 Evolution of French imports of essential oil in the last 10 years.



Source: (Sección Económica y Comercial - Embajada Argentina en Francia, 2018)

Authors: Emily González & Daniela Ron

In analysing figure 2, it can be seen how the French imports of essential oils have increased and it is possible to show the growth of each year. Over these ten years, a growth of 38% was established. It is evident that the supply over the years has increased because the use of essential oils has become important, becoming indispensable in different industries and in the lives of consumers.

Also, the profile of consumers depends a lot on where they live, since in France there is a very notable cultural difference between rural and urban areas. Also, France is a country where the population is imbalanced as it is aging, as in most European countries. Life expectancy is 78.6 in men and 85.71 in women. There are also different religions such as Catholicism, Judaism, Islam and others due to migration that came mainly from the countries of Algeria, Morocco and Portugal. It is worth highlighting that the second largest religion is Islam due to immigration from different countries and the fact that they have large families. On the other hand, it must be noted that the main concern of French society in general, is the environmental issue as well as natural and organic products.

As for the specific business culture, the French are quite formal, so they have to be addressed with a lot of respect, courtesy, seriousness and trust. Additionally, according to Vaca (2015), to carry out negotiations in France, it is necessary to have time and patience since the French like to take their time to make important decisions. One should

not take business lightly and of course, when conducting the negotiation, it should be done with courtesy, seriousness, trust and a lot of respect.

Because of this, it is preferable to make the appointment of the meeting at least two weeks in advance and punctuality is a must when it comes to complying with the agreement. In addition, the French are very detailed with the way they present themselves and for this reason they translate their business cards according to the person with whom they are going to have the meeting so that it is of their complete understanding. It is also very important for them to specify their academic achievements on the cards, as well as part of their professional experience. The negotiation processes are carried out with a hierarchical base and the decisions are usually taken by the highest level officials within the company (Santander TradePortal , 2018).

Because of consumer demands, the production plant of essential oils of heading 330129 for export to the French market, will have to obtain established procedures in the value chain to achieve the production of essential oils that comply with the required quality standards. By acquiring international certifications that certify the quality of the production, it would give the added value within the market that the consumer seeks. By analysing the profile of the consumer, the company adapts and manages to meet the challenges set by the expectations of consumers, seeking the optimal relationship between quality and price that the customer requires.

According to the profile of essential oils in France made by Argentina, the world production of essential oils reaches approximately 110,000 tons (Sección Económica y Comercial - Embajada Argentina en Francia, 2018) and the information from Trademap shows that among the oils imported by France are those of orange, lemon, citrus fruit, mint and terpene.

Table 2 *Different classifications of essential oils imported by France*

Different classifications of essential oils imported by France							
Classification	Tariff heading	Amount imported in tons					Total
		Year 2013	Year 2014	Year 2015	Year 2016	Year 2017	
Orange	330112	1,498	1,555	1,689	1,764	1,78	8,286
Lemon	330113	380	624	475	440	405	2,324
Citrus fruit	330119	356	406	381	412	417	1,972
Mint	330125	315	330	352	192	368	1,557
Peppermint	330124	285	296	283	229	132	1,225
Unclassified	330129	3,877	4,264	3,888	4,407	4,307	20,743

Source: (Trademap, 2017)

Authors: Emily González & Daniela Ron

As can be seen in the table above, the essential oils that top the list of French imports are the unclassified ones, in which they eliminate the terpenes, a kind of chemical component found in the essential oil, to help concentrate its taste and smell and improve the solubility in water (Arraiza Bermúdez). The oil becomes raw material for the aroma and fragrance industry. On the other hand, the import of orange oil also has representativeness in the imports of essential oils in France, followed by lemon and citrus fruit.

The main industries that require essential oils as a raw material for various products are health, food, and perfumery and cosmetics. In the health industry the medicines that require natural essences are in the range of 40 to 70% and in the same way aromatherapy is increasing in demand in especially France and Germany where consumers seek to resort to these alternatives to solve specific health problems through the exclusive use of essential oils, because often the quality is required is 100% natural so that it can be used in aromatherapy and even orally (Sección Económica y Comercial - Embajada Argentina en Francia, 2018). On the other hand, the food industry increases the use of essential oils in various products, due to the demands of consumers to obtain natural products. They use this product as flavouring to improve their food recipes. Essential oils are also used in cleaning products, veterinary products and animal feed (Sección Económica y Comercial - Embajada Argentina en Francia, 2018).

Finally, the fragrance and cosmetic industry have increased the use of natural products in their ingredients to obtain the final product due to the demands for natural products in recent years. They begin with positioning their brands as cosmetics that are

based on natural extracts of which they contain a high percentage. This trend is intensified by the concern of consumers to use less chemicals and more natural products. Nevertheless, not all consumers agree to pay large amounts of money for an organic product, but industries have aligned their formulas to the new trend of consumer demands (Sección Económica y Comercial - Embajada Argentina en Francia, 2018).

Subsequently, the main claimants of essential oils are the large industries that require this ingredient for the production of final products, that is, for whom essential oil functions as a raw material and part of its supply chain. Within the projected table, it can be noted that the demand for essential oils in the French market has generally increased year after year, becoming a product desired by large industries because of the demands of the current consumer. It should be mentioned that the highest volumes are used by the food industry, especially spice and herbal oils, which lend themselves for important functionality in food manufacturing. Also essential oils of citrus, orange, lavender, rose, geranium, rosemary, ginger and garlic are on the list demanded by the food industry. According to publications made by the CBI on essential oils in Europe, it is estimated that the demand for essential oils will increase between 8.4% and 11.3% per year until the years 2024-2025, due to the comment that the Cosmetics industry use essential oil for the purpose of providing fragrances in natural cosmetics (CBI, 2017). In the same way it is known that Europe is one of the largest markets for natural fragrance ingredients and, similarly, within the food industry, essential oils are used with the aim of producing aromas in the different foods and beverages produced by these industries (CBI, 2017).

As a result, it is known that growth is the result of the increase in consumer demand for natural cosmetics, food and pharmaceutical products including aromas for processed foods, without neglecting that the demand for aromatherapy is growing by leaps and bounds at world level (CBI, 2017). The current demand trends towards what is 100% pure and 100% natural. Pure refers to what is not mixed with another similar oil or one with comparable characteristics and natural refers to what has not been subjected to processes of adulteration by the addition of chemical products. Later on, with the data obtained from supply and demand, the projection of sales of the project will be established.

2.4 Price Analysis

The price analysis serves to determine and study the best way to enter and sell the product or service offered in a given market to see if it is viable or not. However, it cannot be forgotten that for the manufacturer the quality of the product is a main factor to give a competitive price in the market and is what leads to a new company being successful.

To continue with this analysis, it is important to give a description of what is understood under price. Price has been defined as "The monetary amount to which producers are willing to sell and consumers willing to buy a good or service, when supply and demand are in balance" (Baca Urbina, 2013). This balance is not only regulated by the offer and demand of producers and consumers within a society but also by governmental regulatory bodies. On the other hand, the price is also regulated by the production cost of manufacturing the product in order to have a certain percentage of profit and that is supposedly the final price at which a good is offered. Nevertheless, one should not forget that apart from these three concepts of what "price" is, one must also consider production cost. That is, the price is determined through the raw material and elaboration procedures of the product in order to know a cost and determine the price, not only for the demand and supply given by the consumers, but for the quality and distinction of the product. It is for this reason that today companies have decided to modernize their production and lower the cost of production by saving on labour and certain other factors in the manufacture of the final product in order to have a more competitive price.

There are different types of prices. The first type is the international price, which is used for products that are destined to be exported or imported. Usually these products are valued in US dollars, placed in the country of origin. On the other hand, there is the external regional price. This talks about the price that is given to a good or service in a single continent and is usually used between commercial agreements within a given region. On the other hand, the internal regional price is the one that is attached to an article but is only valid for a specific part of a country; it is regulated and normalized by internal laws and when marketing the same product elsewhere in the same or another country, the price changes. Subsequently there is the local price that is valid for a certain group of a certain population, usually it is applied where that article is being produced. Finally, there is the national price which includes the same price for a whole country, these are given by large companies, specialized in a sector, where they can have a more precise

management of the price, demand and supply of the product. That is why it is essential to have knowledge of the real price within the destined market in order to calculate future income and be able to project them to five years. However, this is controlled by the demand market to which our final product will be directed (Baca Urbina, 2013).

It is very important to know the price of the product within the market since it is the basis for the projection of the sales of the project that can be expected five years from now. The type of price that is going to be used is the international price, according to the aforementioned definition, it is the export price within the foreign market that the project wants to penetrate and to do this, it must be stressed that there is no standardized price for essential oils since there are several factors that act to make this variation. The primary factor that determines the price is the percentage that can be extracted from the essence of the raw material, *i.e.* each fruit or vegetable produces an oscillating percentage and according to this the price is established. Undoubtedly the price that the producer of the raw material offers to the market is also another very important factor, since buying a costly raw material will cause a product with a higher cost, and buying a more available raw material will give a more economic product which can become more competitive in the international market. On the other hand, the cost of production and the quality of the product that is going to be offered within this market needs to be analysed, since the price is closely related to the quality of the product offered (CBI, 2017).

According to the CBI, orange oil is one of the most economical oils in this industry and costs € 7 – 8 per kg. However, the prices of essential oils from 2014 to the present have increased more or less by three dollars per kg (2017).

It is important to emphasize that our final product is the raw material which is the basis for the creation of different products in the different industries mentioned above for which the price is determined based on our raw material and procedures for obtaining the essential oil that is required. An example could be the essential oil that is required for the production of a perfume, which would be a final product with a high value compared to ours, due to the added value that was added to the essential oil.

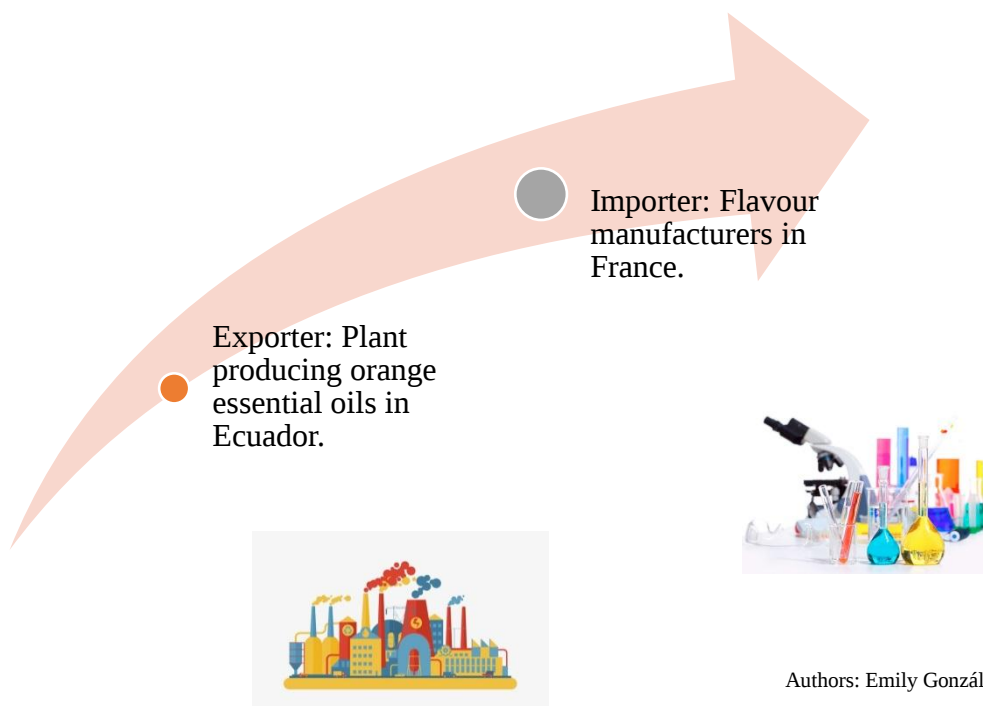
2.5 Marketing of the product

The commercialization of the product is an important point in the analysis, because here the optimum means for the product to reach the hands of the consumer or

industrial user is determined. Baca Urbina defines that the distribution channels are organized system that transmits the communication of the product until it reaches the hands of who will consume it. In the case of essential oils, the distribution channel to an industrial user will be used, which are those that require the product as an input (Baca Urbina, 2013).

Essential oils are a product that at the time of being exported will not reach the hands of consumers directly, on the contrary, they will reach the large industries that demand this product which they require within their supply chain for the production of different products. It is estimated that a distribution channel will be established so the company will export the essential oil to the different food flavouring, cosmetics, aromatherapy, pharmaceutical and tea industries in France, for the reason that each one of these different manufacturers are responsible for researching and developing new flavours to distribute to different industries in their area. It is in this way that it will directly arrive to the manufacturer importer of flavourings of an established area because they are the ones that are in charge of giving the added value according to the different researches and new essences that they make, while in the process of exportation they are taken care of by giving the added value according to the transformed product, that is, the essential oil itself.

Figure 3 Product commercialization chain



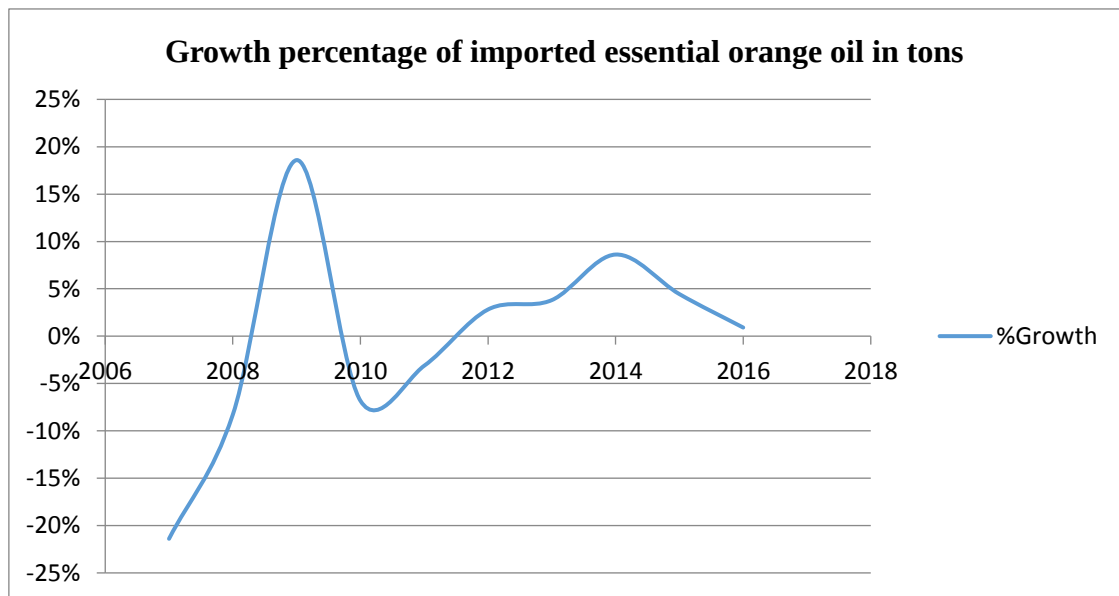
Authors: Emily González & Daniela Ron

2.6 Chosen product

When concluding the analysis of the market study of essential oils in France, it was determined that the plant producing essential oils for export to the destination of interest, will be the essential oil of orange. As such it has been observed in the demand analysis that it is one of the products that France imports the most and has shown a positive result in the growth statistics of the last 5 years. On the other hand, the supply analysis has shown that the local production of France does not supply the demand of the large existing industries within the country, it is for this reason that they have partners from several countries from where they import in order to supply the raw material required by France's industries such as health, food, and cosmetics and perfumery. Similarly, the price analysis has made it possible to show that orange oil is among the most economical oils to produce and market which allows Ecuador, having a large quantity production of oranges, the raw material for the production of the essential oil of the product of interest, to start with the production of the essential oil of orange with the objective of marketing it to French companies in a competitive way worldwide in terms of quality and prices.

The growth percentage of the last 10 years of the import in tons of the essential oil of orange can be seen in figure 4.

Figure 4 *Percentage of growth of imported essential orange oil in tons*



Source: (Trademap, 2017)

Authors: Emily González & Daniela Ron

Figure 4 shows the growth percentage of France's imports of the essential oil of orange in the last 10 years, with the result that despite the instability in terms of growth, it is noted that it has a tendency to positive growth within the French market, which has the consequence that the essential oil of orange has excelled in the imports of essential oils in general. In this way it can be determined what kind of essential oil is the one with the greatest demand and that the trend towards growth is positive in the market of interest to which one want to venture.

2.7 Sales Projection

In the data obtained from the demand and supply of the essential orange oil, the sales projection of the essential oil production plant was elaborated with the aim of exporting to France. This projection was made to determine the 5 future years through an analysis of the last 10 years of imports from France concerning the essential oils of orange. The policy established in the company based on sales is that 60% of the sale payment will be cash and 40% will be at a credit of 45 days. For this reason, Trademap information that contributes to obtain the unit value in tons, is collected to make a table that includes the weight in tons of imports from France and the FOB price of orange oil in the last 10 years (Table 3).

Table 1 France imports of orange essential oils

France imports of essential oils of orange						
Year	Weight- Tons	FOB \$	Percentage of total weight	Percentage of total FOB	Unit value in dollars per tonne	Unit value in dollars per Kg
2007	1,888	\$ 10,776.00	10.73%	6.59%	\$ 5,707.63	\$ 5.71
2008	1,484	\$ 12,747.00	8.43%	7.79%	\$ 8,589.62	\$ 8.59
2009	1,361	\$ 8,532.00	7.74%	5.21%	\$ 6,268.92	\$ 6.27
2010	1,614	\$ 12,459.00	9.17%	7.61%	\$ 7,719.33	\$ 7.72
2011	1,504	\$ 17,791.00	8.55%	10.87%	\$ 11,829.12	\$ 11.83
2012	1,457	\$ 12,354.00	8.28%	7.55%	\$ 8,479.07	\$ 8.48
2013	1,498	\$ 12,142.00	8.51%	7.42%	\$ 8,105.47	\$ 8.11
2014	1,555	\$ 13,925.00	8.84%	8.51%	\$ 8,954.98	\$ 8.95
2015	1,689	\$ 15,635.00	9.60%	9.55%	\$ 9,256.96	\$ 9.26
2016	1,764	\$ 20,662.00	10.03%	12.63%	\$ 11,713.15	\$ 11.71
2017	1,780	\$ 26,616.00	10.12%	16.27%	\$ 14,952.81	\$ 14.95
Sum	17,594	\$ 163,639.00	100.00%	100.00%		

Source: (Trademap, 2017)

Authors: Emily González & Daniela Ron

At the end of the development of table 3 it was possible to determine that the unit value of the orange oil in the last 10 years has achieved a growth. Despite the fact that in 2007 the unit value per kilogram was at \$ 5.71, it has been increasing little by little until by the year 2011 it reached the value of \$ 11.83, with 2011 being one of the most representative years of the table and according to the last 10 years the highest value was in the year 2017 being \$ 14.95. These unit values confirm the sale price range obtained from the essential oil profile. This is how it can be shown that up to now the importation of essential oils in France has had a noticeable growth in the quantity and price.

Table 4 shows the projected basis performed through the moving average method, which consists of attaching the data to obtain an average series. In this case, there are 10 years that will be grouped by 3 in order to obtain the projected year 11, using this same method until the year 19 with the Excel formula: = AVERAGE (YEAR2007; YEAR2008; YEAR2009).

Taking this as a result for our projected base which was made through the Excel formula: = AVERAGE (YEAR 11; YEAR 12; YEAR 13; YEAR 14; YEAR 15) which represents the 5 years in the future.

Table 2 Sales projection

Sales Projection	
Year	Projected weight in tons
Year 11	1,577.67
Year 12	1,486.33
Year 13	1,493.00
Year 14	1,525.00
Year 15	1,486.33
Year 16	1,503.33
Year 17	1,580.67
Year 18	1,669.33
Year 19	1,744.33
Projected base	1,562.89

Source: (Trademap, 2017)

Authors: Emily González & Daniela Ron

It can be determined that our projected base of sales in tons for the first year in the future is 1,562.89 t. The amount of year 1 projected gives us a vision of the size of the

plant producing essential oils that is required for the future. Thus, in the following graph, the sales projection of the following 4 years will be prepared to establish the optimum size of the production plant. As a first condition it is important to emphasize the participation of the countries in the imports from France, with the aim of obtaining the projections of the participation of the project in the French market as a country which can be seen in table 5 and figure 5.

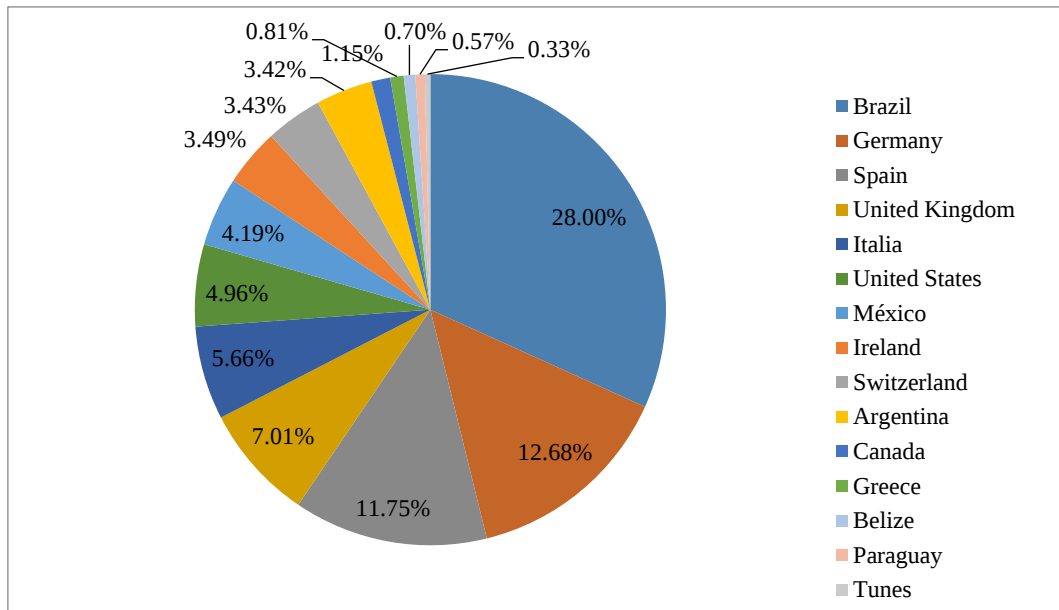
Table 3 *Share in France's imports*

Share in imports from France in tons in the year 2017		
Country's	Share in France's imports	Tons
Brazil	28.00%	813
Germany	12.68%	217
Spain	11.75%	122
United Kingdom	7.01%	113
Italia	5.66%	95
United States	4.96%	86
Mexico	4.19%	75
Ireland	3.49%	70
Switzerland	3.43%	35
Argentina	3.42%	29
Canada	1.15%	18
Greece	0.81%	18
Belize	0.70%	15
Paraguay	0.57%	7
Tunisia	0.33%	5
Average	2.31%	36

Source: (Trademap, 2017)

Authors: Emily González & Daniela Ron

Figure 5 Share in the importation into France



Source: (Trademap, 2017)

Authors: Emily González & Daniela Ron

The group of 15 participating countries that were classified as follows: the first five countries correspond to the group with the largest share in imports to France, followed by the other five that correspond to the group of medium participation and the last five within the small participation group. Thus, an average of the group of medium and small participation was made to obtain the percentage of participation of the production plant. The percentage that was obtained was 2.31%, that is to say that this will be the percentage of sales participation towards the French market that the project will acquire at its start in year 1. Showing the projection of sales of the five following years, table 6 reconfirms this with the information previously mentioned.

Table 4 *Project sales forecast*

Project sales forecast					
	Year 1	Year 2	Year 3	Year 4	Year 5
Total sales amount in tons	1,562.89	1,687.92	1,822.95	774,997.33	6,199,978.67
Project sales percentage	2.31%	3.31%	4.31%	5.31%	6.31%
Amount of project sales in tons	36.10	55.87	78.57	104.54	134.17
Unit price (US \$)	\$ 9,234.28	\$ 9,345.09	\$ 9,457.23	\$ 9,570.72	\$ 9,685.57
Total revenue	\$ 333,382.70	\$ 522,111.60	\$ 743,048.03	\$ 1,000,549.10	\$ 1,299,503.67

Source: (Trademap, 2017)

Authors: Emily González & Daniela Ron

The analysis of the forecast of the sales of the project was made at five years in the future, where year 1 is where the plant producing essential oil of orange determines the percentage of sales of the project, the unit price per ton and the total income of that year to be able to project the next future years until reaching year 5, which is our goal. It must be emphasized that the total amount of sales to France, 1,562.89 t, is obtained through the projected basis of France's imports of the essential orange oil. The percentage of sales of the project for the first year, 2.31%, was obtained through the medium and small participations of different countries that are the suppliers of France. On the other hand, the amount of project sales in tons was achieved through the multiplication of total sales by the percentage of sales of the project. The unit price, \$ 9,234.28 per ton, was determined by the average of the unit value in tons shown in table # 3. Finally, the total income of the project, \$ 333,382.70, was given by the multiplication of the unit price by the amount of sales of the project.

To obtain the projection of year 2, the amount of total sales to France was obtained by multiplying the amount of total sales of year 1 by the annual growth of the essential oils industry based on the studies carried out by the CBI, which determines that its growth will be 8%, with a result of 1,687.92 tons. Based on the same procedure, the projection is carried out until year 5 of the project. It was determined that the percentage of sales of the project will have an annual growth of 1%, for the reason that the CBI announced on its page that essential oils will have an annual growth of 8 to 11% until 2024-2025, which was a conservative decision to put pressure on the normal scenario of the project, since a risk analysis showed that Ecuador does not have representativeness in the imports of essential oil of orange in France and for this reason a minimal growth is taken within the

projected period. The unit price was determined for year 2 based on what was projected for year 1 by inflation in France which according to the CIA FACTBOOK, has a representation of 1.2% (2018), resulting in a value of \$ 9,345.09 per ton. This was carried out in the same way for the following years. Nevertheless, as Ecuador has the resources before a growing market due to demand, it has not been able to take advantage of the raw material by offering this product worldwide. Due to the analysis that was made of the tables, it has been possible to show the growth of the imports of essential oil of orange in France, therefore, the market requirements of the plant producing essential oils will seek to enter this global trend in a positive way. Achieving that the quantities, the unit value and the total income will increase over time according to the needs and demands of consumers.

Conclusions

At the end of the preparation of the French market study carried out in this chapter, it has been possible to obtain results that allowed correct decisions to be made to the interested parties. This is how it was confirmed that France will be the final destination of exports of the project for the reason that the essential oil industry is among the four most important industries according to French income and expenditure. It was possible to show that the trend towards natural, organic and healthy is growing in large quantities. Consumers increasingly demand what they consume to be natural, organic and healthy and in relation to essential oils, it has been determined that the demand is increasing. Based on studies that were carried out, it is foreseen that the demand will have an annual growth of 8% until 2024 due to the fact that it is required as raw material within different industries for the elaboration of its products.

The orange oil was chosen, considering the CBI that corroborated with the obtained in the study on the French market, since according to the study of the demand it was possible to demonstrate that the essential oil of orange is desired by different industries, obtaining a greater relevance because it is required for the elaboration of several products, therapies, aromas, foods and cosmetics, and in the same way it can be denoted that the price is among the most economical, in relation to the prices of the different classifications of essential oils, having a market price of € 7 to € 8 per kg.

The projected sales of the project were determined for the first year as 36.10 tons to be exported to France, with a unit price per ton of \$ 9,234.28 and for the following years it was determined that the growth percentage of the project sales of 1% annually through year 5 is represented by 6.31%, reaching a unit cost of \$ 9,685.57.

On the other hand, to be able to venture into the French market, it is necessary to be competitive in terms of quality and price because the distribution channel will be directed towards the research industries of essential oils that are responsible for distributing these products to different industries that require this product as raw material. It is for this reason that the commercialization of the product will be directed at the industries that manufacture flavours in France.

CHAPTER 3

3. TECHNICAL STUDY

Introduction

The technical study is necessary to determine the size of the project, and the importance of this analysis lies in the data it provides us with to determine the feasibility, investment and what is necessary to meet the projected goal. This study helps to determine the different methods necessary to have an efficient production by describing the processes and methods required for its realization in detail, and to know if it is technically profitable. There will be a specific analysis of the machinery and equipment that will be used, the raw material, the adequacy of the facilities, labour, suppliers and costs. In order to be able to determine the working capital that is needed for the elaboration of the project in the next chapter. There are two authors who support the importance of this analysis within the creation and preparation of a project: Gabriel Baca Urbina (2013) and Nassar Sapag Chain *et al* (2011). In their respective books they talk about the importance of analysing the investment to be made for the implementation of the plant. Here the quantifiable information of the relevant operating costs can be evidenced. This is how Baca Urbina cites in his book's project evaluation, that the technical study aims to solve the following questions within the creation of the project: where, when, how and with what can one produce what is desired, in order to determine the operation of the project as such.

This research will be carried out using qualitative and quantitative methods and characteristics. Using qualitative methods will enable the observation of how events and situations that need to be faced at the time of carrying out this project are described. Quantitative methods enable the analysis and determination of the operating costs and the necessary investment to provide evidence that the creation of the plant of essential oils that has the optimal production to offer the best product within the market, complies with all the norms and standards of quality, and is at the same time competitive, not only in quality but also in price, is feasible or not.

The technical study aims to analyse and determine all that entails the technical development of a project, therefore they are clear and precise. This will lead to the decision of where the plant should be located correctly. It will also verify if the creation of the product is possible and what the optimal project size, the availability and the cost of supplies and raw materials that will be necessary, are, as well as the identification and description of the process and finally the determination of the human organization that is required for the elaboration of the creation of the plant producing essential oils.

3.1 Location of the production plant of essential oils

At this point the place where the plant producing essential orange oils has to be located will be determined, taking all the variables into account to have a high profitability margin in the sector where it is going to be produced, and as a result a maximum cost-benefit rate of the product. However, for Sapag Chain *et al.* (2011) it is important that two points are taken into account in this study: the macro and the micro location. The macro location consists of identifying the best place for the location of the production plant; here the location of the consumers or users of the product, and the location of the supplies for the preparation of the essential oil are analysed, as well as the proximity of the production plant to the communication routes within the city, its ease of access, the suitable transport modes, the presence of public services, whether climate, environment and soils are ideal for the creation and finally that the rules and regulations of the city allow to allocate a production plant. The micro location is the analysis of where the construction will be carried out and how it will be distributed. Therefore, the availability and costs of the necessary resources, labour, raw materials, location of the competition, ecological considerations and transportation cost will be analysed.

However, to perform this analysis there are several methods that provide us with the appropriate variables to make the best decision about its location. The chosen method to analyse the essential oil production plant's location is Baca Urbina's (2013) qualitative point method. This method consists of determining the qualitative factors for its location, resulting in a weighting of these factors, in order to make a decision.

As a first point, a list of relevant factors must be drawn up within the location. In the case of the essential orange oil production plant the decided upon relevant factors are: the available raw materials, the available labour force, the costs of the inputs, the cost of living and the cost of transportation, as these factors influence the raising or reducing of

the product price. On the other hand, there is a relative allocation to the importance that will be given to each of the factors, the total sum cannot be greater than one. Subsequently, two or more locations are compared: in this case the cities of Cuenca and Guayaquil will be analysed; the city of Cuenca as it is the place where the idea of the creation of the production plant of essential oils of orange was conceived, and Guayaquil since it has great advantages concerning transportation, raw materials and most of the suppliers are located in this City. Having determined this, each factor will be qualified according to a pre-established scale from 0 to 10, due to the importance of these factors for their location. Finally, the weighting is done by multiplying the rating with the assigned weight (Baca Urbina, 2013). This procedure is visualized in table 7.

Table 5 Location of the orange essential oil production plant

		Cuenca		Guayaquil	
Relevant factor	Assigned weight	Qualification	Weighted qualification	Qualification	Weighted qualification
Raw material available	0.38	6	2.28	10	3.8
Labour available	0.12	4	0.48	6	0.72
Cost of supplies	0.22	9	1.98	10	2.2
Cost of living	0.1	8	0.8	4	0.4
Transport cost	0.18	3	0.54	10	1.8
Sum	1		6.08		8.92

Authors: Emily González & Daniela Ron

Table 7 shows that according to the sum of the weighted rating the most profitable location and the one with the highest benefit is the city of Guayaquil, with an end result of 8.92 compared to a sum of 6.08 for the city of Cuenca. As such, according to the most relevant factors for the location of the production plant, the available raw material, labour, cost of inputs, cost of living and transportation, it can be concluded that Guayaquil has more facility and lower costs for the product.

3.2 Size of the essential orange oil producing plant

The determination of the size of the project depends on the analysis of different variables according to Nassir Sapag *et al* (2011). The variables that will help us make the best decision concerning the size of the essential orange oil production plant are the demand, the availability of inputs, the location and the commercial projection of the project that will be the ones. Among the variables to determine the size of the plant, there is unmet demand to supply, which could be found through the projection made in the previous chapter. The projection of sales to France for the fifth year, will be the one that establishes the size required for the plant. The size of the plant will be based on fulfilling the objective of the project, that is, that the production of essential orange oil be valid and effective as many times as necessary at the lowest cost. At the same time optimization in each of its productive processes should be maintained, taking into account that optimization goes hand in hand with the technology that is implemented in the plant. In the same way, the size correlates the availability of financing that can be directed to the project. There are five factors that determine the optimal size of the plant, which are the demand, supplies and raw materials, technology, equipment and finally the organization.

According to the analysis of the demand and market growth, it was concluded that the amount of production in tons of the project for the fifth year will be 134.17 tons per year, which is interpreted as the capacity of the plant in machinery. The size of the plant producing orange essential oil will be determined by the growth strategy that has been projected in the sales and is to be planned for the production that is determined for the fifth year. The size of the project can only be accepted if its projected demand is higher (Baca Urbina, 2013).

The conclusion of the location analysis of the project was that it would be raised in the city of Guayaquil, due to the proximity of the inputs. This is important in the determination of the size of the plant, because the further away it is located from the sources of inputs, the higher expenses will be incurred in the transportation of inputs to the plant and this will cause surcharges to the cost of the product. Because the inputs and supplies are essential to obtain the product, one must choose the size based on the supplies that different suppliers will supply to achieve the projected amount of essential orange oil.

The technology that is decided to be implemented in the essential oil production plant together with the machinery is correlated in the optimization of resources. The technology and machinery that is implemented, is related to the investment, the size and cost of production which gives us a broad vision of the capacity in machinery that is required for objective production.

In the case of our project, the manpower that is required is of a medium level in technical worker knowledge. As such, it will be easy to find the organization that is required to make essential orange oil.

3.2.1 Supply chain

The supply chain is one of the most important parts in the development and creation of a project. Over the years, this concept has evolved since the approach is much broader and has a more effective system to determine the factors that directly affect the project, thus resulting in a precise investment knowledge. According to Baca Urbina (2013), it is necessary to first analyse the suppliers of raw materials and inputs and the corresponding machinery. The reason why it is essential to have a sufficient supply of raw material is because the project cannot be developed without it, and for this reason large companies have often been slowed down by the lack of inputs. In addition, the growth of the input must have a correlation with the growth of the company, in order to demonstrate that the company is going to obtain growth. That is, in this case the production of orange must be greater than the projection of sales obtained in the previous chapter to know that there is a necessary supply for its production.

It is for this reason that the following paragraphs will describe the production processes that have to be given, to obtain the essential oil of orange. The transformation of the raw material is studied until it reaches the target market. Therefore, an analysis will be made of the project's engineering, this point analyses everything that includes the installation and operation of the plant producing essential oils of orange in order to comply with its general objectives. Therefore, there must be a technical knowledge of all the necessary tools to produce this finished product, clearly having the required quality standards for the country to which it will be exported and the quantity that the orange oil producing plant will produce, thus avoiding downtime in its development.

Nassir Sapag *et al.* stipulate that the procedure consists of the transformation of the raw material that is subjected to industrialization processes by technological methods to obtain the desired product (2011), in our case, the essential oil of orange. The first required point for the elaboration of the essential oil of orange is obtaining the raw material, in this case the orange peel. By not needing an established standard of quality in colour, taste, shape or size of the orange, it has been determined to establish commercial relationships with the raw material farmers in the city of Guayaquil and its surroundings, since according to its geographical position there exists a great production thanks to the city's climate. Because there is no standard of appearance, one can choose to negotiate products that do not look suitable for the consumption. In this costs get lowered, and the supply is larger. On the other hand, it was decided to implement a beneficial system for the plant, by establishing a contract with the portfolio of formal suppliers, such as those who manufacture industrialized orange juices, or those companies producing orange pulp, with the objective of collecting their orange peel waste, since what is required for the preparation of the essential oil of orange is the peel, but not the fruit, however, it is important to emphasize that although there is no established standard of appearance, it is required that the peel is not decomposed.

3.2.2 Productive processes

Within the production process will be a description of each of the activities required to obtain essential orange oil after which a flow chart will be made that will show the processes with the times needed for the completion of each activity and finally a table will be developed with each of the machines that is required. The extraction method that is commonly used because of its advantages and will be adopted in the project, will be by steam water dragging, which consists of the separation process using water vapour to vaporize the components of the raw material, in this case the essential orange oil. To obtain the essential oil, steam is let through the raw material, *i.e.* the orange peel. After cooling the vapours are condensed forming a liquid that can be separated by decanting due to the different density that exists between the water and the essential oil (Guenther, 1948). The steam distillation method is the one most used in industrial processes, due to the simplicity of the process, and the quantity, quality and purity of the oil.

Next the block diagram will be analysed (Figure 6) as it is a method that is used to demonstrate the productive process of the creation of the essential oil of orange. This

method consists in representing each one of the operations by means of a sequence with implementation of the due times that are needed to generate certain activities (Baca Urbina, 2013). It should be emphasized that the activities that will be exposed are parallel through the production cycles.

Figure 6 Block Diagram of the productive process

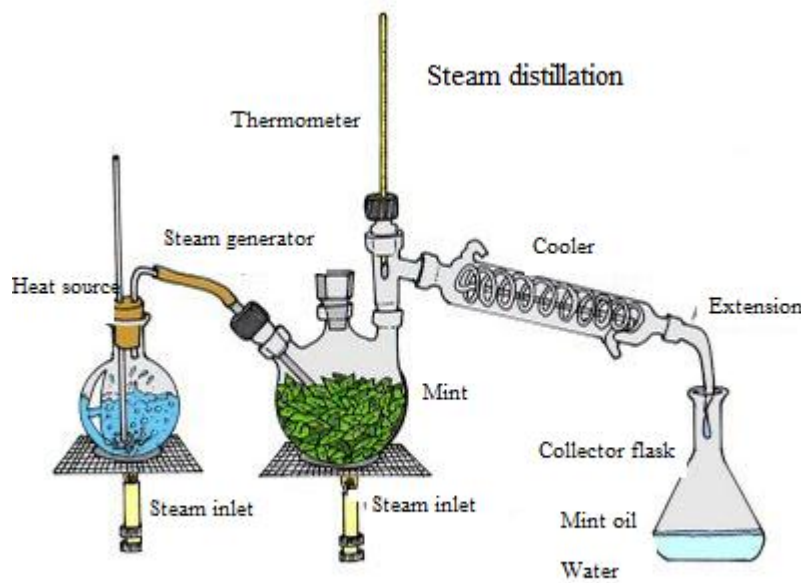


Prepared by: Emily González and Daniela Ron

As can be seen in figure 6 that encompasses the production process, it has been determined that the bottleneck is in phase #8, because the time spent in this activity is 4 hours. For this reason, the company needs to look for methods that help the technification of the process, to be more efficient and effective in hydro-distillation.

Next, the distillation process of the essential oil that has been selected for the implementation of the productive chain in the production plant will be projected:

Figure 7 Distillation process



Source: (Paredo Luna & Lope Malo, 2009).

The distillation process that has been selected is through steam drag. Here the sequence of the production process by which the essential oil producing plant has to pass in order to obtain a drop of essential orange oil can be demonstrated.

3.2.2.1 Collection of raw material

After the harvest of the oranges and the husks, the raw material is taken to the production plant where it will be placed in the cold room of the RUIXUE model to keep the fruit in its optimum state, that is to say fresh and to avoid damage and losses of the raw material.

Figure 8 Cold room

Model: RUIXUE

Budget: \$ 500.00 per unit.



Source: (Alibaba, 2018)

3.2.2.2 Process of disinfection and washing of the raw material

As a next point, the fruit is disinfected and washed with the help of an industrial fruit washing machine TPP-800 which is designed to clean the fruit with water and soft brushes around it, which leaves it in excellent condition to proceed with with treatment. On the other hand, it should be emphasized that it has a capacity to wash 500 to 800 kg per hour, which helps us to supply the need for our production plant.

Figure 9 Fruit washer

Model: TPP-800

Budget: \$ 1,000.00 per unit.



Source: (Alibaba, 2018)

3.2.2.3 Peeling of the orange peel

As it is required to peel the oranges that will be bought from the farmers, an industrial machine of model DQ-XP28 will be used to extract all the contour of the orange keeping the bark in optimal conditions. Its production per hour is from 1,200 to 1,500 units.

Figure 10 orange peelers

Model: DQ-XP28

Budget: \$ 1,000.00 per unit.



Source: (Alibaba, 2018)

3.2.2.4 Dehydration of the peel

Afterwards, it is required that the orange peel is completely dry to proceed to its grinding. At industrial level there are different types of dryers which are: two-floor dryer, tray dryer, tunnel dryer, cross flow dryer and conveyor belt dryer. The function of the different dryers is that because the citrus peel, in this case the orange peel is humid, it is necessary to eliminate the moisture to conserve the purity of the oil so it is not mixed with other substances that alter the essence of the oil. The dryer that is going to be used in this production plant is the tray dryer, since the placement of the peels is much easier in the trays. One can also adjust the air temperature by means of the machine's internal fans, its cleaning is easy and fast, and its cost is accessible (Paredo Luna & Lope Malo, 2009).

Figure 11 Fruit dehydrator

Model: WADLEY ST-02

Budget: \$ 300.00 per unit.



Source: (Alibaba, 2018)

3.2.2.5 Hydro-distillation

In the extraction of essential oils different methods can be used that facilitate the obtaining of the desired product; among the most common are steam distillation, extraction with solvents, extraction with supercritical fluids and microwave extraction (Paredo Luna & Lope Bad, 2009).

In this case the hydro-distillator is used, which consists in generating heat to the raw material to produce steam and create a usually natural steam flow is natural. The retort is where the material to be distilled is placed. It is suggested that the material of this machinery be made of stainless steel so that it does not contaminate the product and colorations in the orange essence is avoided. The screen is located in the lower part of the retort and this is what will support the material to be distilled. The connection tubes should be large because the larger it is, the faster the procedure will be. Below the screen is the steam inlet pipe where the water condensation will occur; it is important to mention that the pipe must be large enough to produce condensation (Paredo Luna & Lope Malo, 2009).

The retort must be hermetic and the load of the raw material must be handled with care so that it is not compressed. It is recommended that separations be made to avoid

that the raw material is compressed because the mission is that the steam passes through the orange peels correctly and do not agglomerate or slide. The recommended baskets are those that do not have holes but are perforated in the bottom; this facilitates the loading and unloading of the material in large stills. With the help of forklifts, time is saved in the mobilization of the raw material (Paredo Luna & Lope Malo, 2009).

Figure 12 Alembic

Model: FFAITH

Budget: \$ 20 000.00



Source: (Alibaba, 2018)

3.2.2.6 Condensation

The condenser is next to the retort, in this process condensed vapours and volatile products become liquid again. The most used condenser is one that is composed of a coil that is located in a tank. The water used for cooling must be potable to avoid contamination.

3.2.2.7 Quality control

Having the essential oil, the process is proceeded by taking a representative sample that verifies the quality of the plant's production, assuring that it complies with all the standards for it to be exported. The quality control will be done every hour based on the production that has been developed so far. To this aim specialized equipment such as bacteria control and the microbiology incubator will be needed. In the same way, a chemistry specialist is required.

Figure 13 Bacterial counter

Model: MSLZJ 017

Budget: \$ 150.00

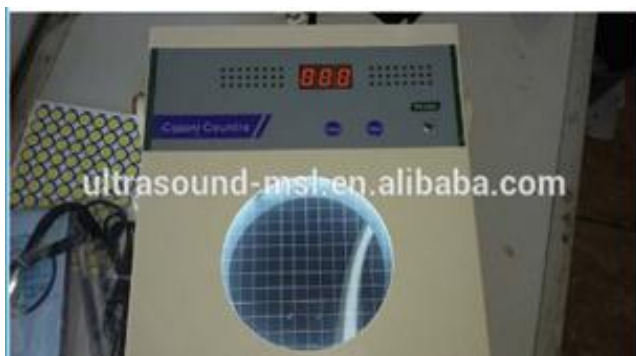


Source: (Alibaba, 2018)

Figure 14 Microbiological incubator

Model: 303-1AS

Budget: \$ 220.00



Source: (Alibaba, 2018)

3.2.2.8 Pre-packaging and packaging

Afterwards it is packaged for export. The commonly used containers are glass compounds because they preserve the natural state, the quality and purity of the product avoiding chemical or physical reactions. However, the essential orange oil produced in this production plant is intended to be exported, so another type of packaging is needed. The containers that will be purchased will come from the city of Guayaquil and have a capacity of 55 gallons; these are made of plastic, and are ideal for transporting liquids. They will be acquired from the company Disensa. In the same way, these are generally used for chemical, industrial or liquid products that require maximum care to avoid contamination. On the other hand, packaging is an important point to be able to complete the description of this process, since it helps protect the entire trajectory from departure, in this case Ecuador, to final destination in France, to preserve it from bumps or damage.

Figure 15 Packing tank

Model: 55 gallon plastigama tank

Budget: \$ 20.00



Source: (Disensa, 2018)

3.2.3 Required machinery

The projection of the amount that the project is going to export to France in the fifth year is 134.16 tons per year, which requires a production of 11.18 tons monthly. On a daily basis, establishing that working days are from Monday to Friday, with 313 business days in total, a total production of 0.43 tons per day is required. In other words, the daily capacity of the essential orange oil production plant must be greater than 0.43

tons. The following table shows the capacity of the machinery that will exist in our production plant.

Table 8 Budget of the necessary machinery

Quantity	State	Model of the equipment	Characteristics	Physical size in meters	Unit price in USD.	Capacity
1	Used	Hyundai Porter H100 year 2006	Truck	5.12 X 1.97	\$ 9,900	1.200 kg
2	New	RUIXUE	Cold room	500 m3	\$ 500.00	2.500 units
1	New	TPP-800	Orange washing machine	1.12 x 1	\$ 1,000.00	500-800 kg
1	New	DQ-XP28	Orange peel slicer	1.03 X 0.83	\$ 1,000.00	240-260 kg
10	New	Wadley ST-02	Tray dryer	0.42 X 0.52	\$ 300.00	3,37 kg
1	New	FFAITH	Alembic - hot and cold pressing machine for essential oil	2 X 1.04	\$ 20,000.00	1 ton per day
1	New	MSLZJ 017	Bacterial counter	0.28 X 0.23	\$ 150.00	33 samples per day
1	New	303- 1AS	Microbiological incubator	0.50 X 0.40	\$ 220.00	50 samples per day

Source: (Alibaba, 2018)

Prepared by: Emily González and Daniela Ron

In this table it can be rectified that the machinery that will be implemented in the production plant of essential orange oil are apt to meet the requirement of daily oil production.

3.3 Management model

To optimize the remaining waste resources at the end of the essential orange oil production, the decision has been made to make a management model that will help have an extra income and not have so much waste. This management model ensures sustainable development for the production plant, obtaining commercial advantage in the waste taking into account interested third parties to promote social responsibility with the environment.

The management model was born because the fruit is obtained as waste, for the reason that the peel is the component that is needed to obtain the essential oil of orange. For this reason, commercial venture strategies have been provided, establishing strategic alliances with those companies that require the fruit as raw material for the development of their final products, for instance formal producers of the following products: natural juices, pulps, sweets, etc. The cost of sale would be lower than the market since the important thing is that valuable products from which it is possible to obtain economic income do not go to waste for humanity.

On the other hand, it is intended to implement a strategic plan that will serve as a management model for obtaining the raw material required for the production of essential orange oil. This management model consists of establishing commercial links with the orange juice outlets in the city of Guayaquil, and those companies that discard the orange peel for the production of their product. As it is a waste for them and a necessity for us, the cost of the raw material will be of lesser value, as it will have advantages for our production plant. This will be done through a collection route established through the route of a company truck.

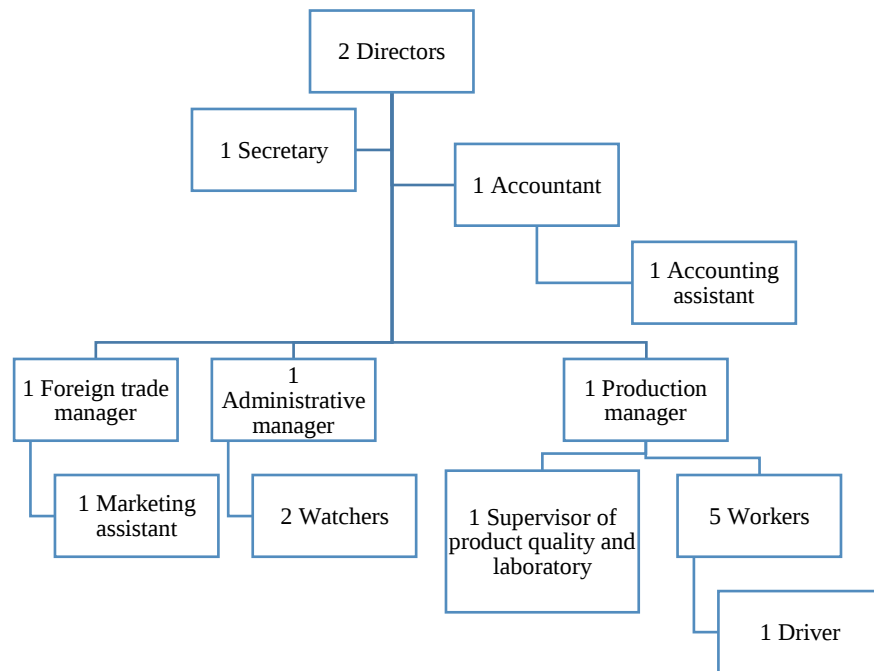
3.4 Organization of human resources and general organizational chart of the company

The structure of the human organization required for the production of the essential orange oil production plant is an important point in the technical study since here one will be able to analyse how much capital has to be allocated monthly to the human resources of the company. This directly affects the final cost of the product and the efficiency of its preparation, since each stage has to be coordinated, controlled and programmed so that it has a sequence and an efficiency in its preparation. Baca Urbina recommends that the chosen personnel have to be changeable since the company cannot depend on someone else, which is why for the production plant the respective positions must be established according to the necessary aptitudes so that they can perform correctly in the labour sphere. Also, the structure as such can be changing over the years as new opportunities can present themselves and new jobs can be discovered in the production of the essential oil (2013). It is for this reason that there must be flexibility

within the determined labour field. It is important to mention that the costs of this organization will be analysed in the next chapter that corresponds to the economic study.

Figure 16 shows the position in which each employee is going to perform to reflect all of the aforementioned.

Figure 16 Organization of human resources



Prepared by: Emily González and Daniela Ron

3.5 Distribution of the plant

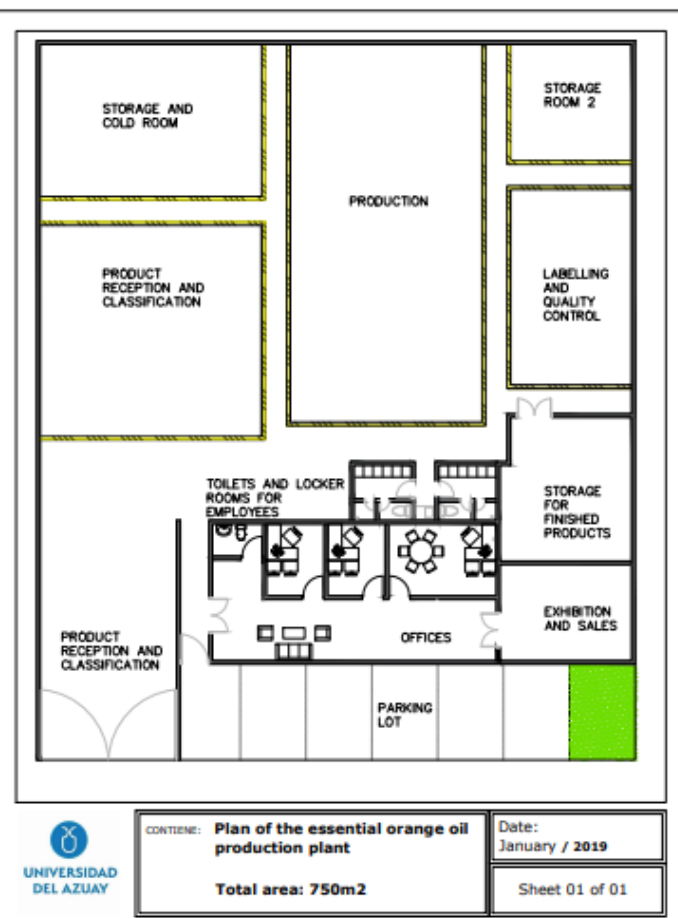
After having determined the size, location and productive process focus must be put on the distribution of the essential orange oil production plant, which is important to provide an acceptable work environment, which allows us to have a great performance, having all the securities and always watching over the welfare of the people that make up the production plant. For this reason, Baca Urbina expresses in his project evaluation book that there are basic objectives that must be met within the distribution of a plant, which as a first point is the total integration of the entire distribution process in order to have a better management of the adversities existing in the work area. Likewise, it expresses that the distance of travel in the plant must be minimized in order to follow a frequency within its distribution process, and there must be safety and care for the people inside the plant.

The distribution of the plant directly affects the handling of the materials, the manipulation of the machines, inventories and productivity of the workers. The distribution that will be chosen for the production plant of essential orange oil is the distribution by product, because this distribution is correlated with the sequence of the production that is carried out, that is to say, the sequence of the machineries, with the respective workers who will be the ones who manipulate them. The assemblies of the productive chain are strategic to avoid the waste of time or product because the work is continuous and is guided by standardized processes. This distribution is commonly used for large quantities, specialized personnel and expensive machinery.

The balance of raw material is determined so that in each process of the productive chain there is a main product and by-products that can generate commercial value. In our case of the production plant of essential orange oil, the sub product with commercial value will be the orange without peel, the same that will be sold to the outlets where they make juices, desserts, or pulps or to any type of company that requires oranges as a raw material for the elaboration of final products.

To verify this theory, the route diagram method which consists of determining the distribution of the areas that are needed for the production of the essential oil of orange, will be used. This can be evidenced in the construction plan outlined in figure 17.

Figure 17 Construction plan of distribution of the essential orange oil production plant.



Prepared by: Ing. Víctor Parra

3.6 Export process of essential oil

In order to export the product, it must comply with the current regulations established by the public entity "Customs of Ecuador", which provide a service to Ecuadorian citizens to export. Therefore, in the following paragraphs the respective export process will be described. In the same way, it will be possible to observe in detail the process found on the Customs website as Annex # 1.

According to Customs, what is understood as an export to a customs regime is what facilitates the definitive exit of merchandise from the Ecuadorian customs territory abroad, complying with the provisions and regulations established (ADUANA, 2018). To start with this process an electronic signature has to be obtained. This signature is given by the Central Bank of Ecuador with the objective of making an export customs declaration (DAE) in the system called ECUAPASS, this Ecuadorian system, helps specialists of the branch of foreign trade carry out imports and exports. The data that will be mentioned in the DAE are all the basic data of the exporter, the description of the

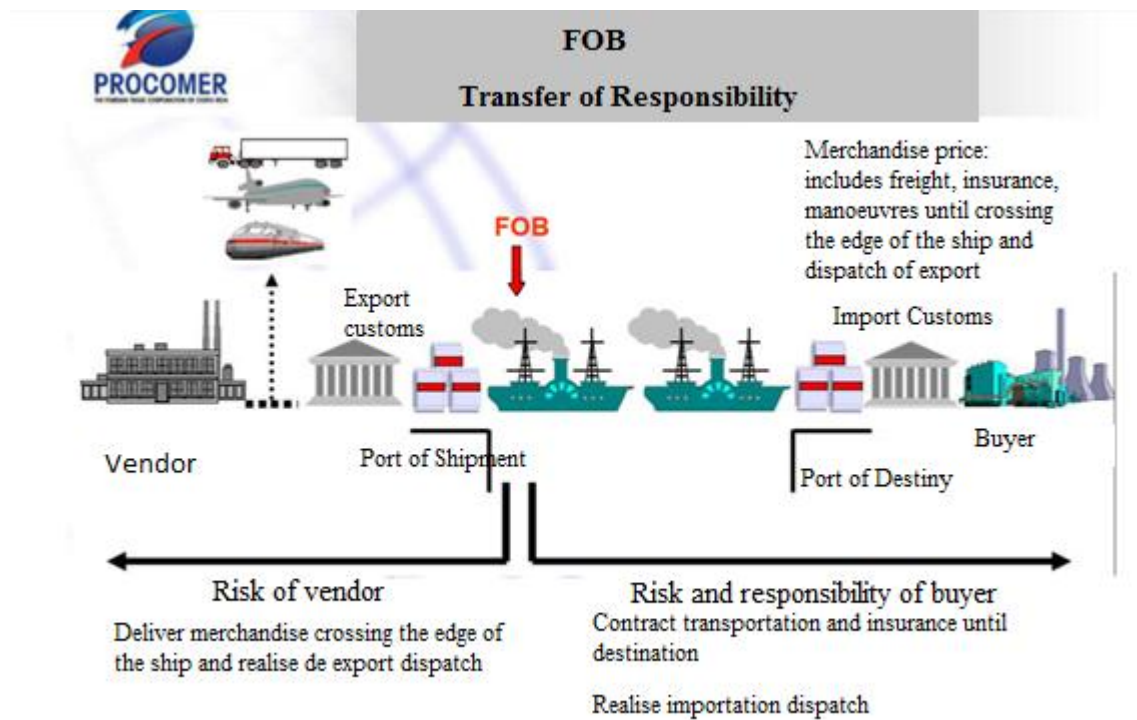
merchandise as mentioned on the original invoice, data of the consignor, the destination where the merchandise will be imported, the quantities that are being exported, the weight of the merchandise and more. Likewise, an original commercial invoice, prior authorizations for loading and an electronic certificate of origin must be attached to ECUAPASS if the product to be exported has it (ADUANA, 2018).

Once these papers are uploaded and accepted; the merchandise enters the Primary Zone of the district where it will be shipped, since a Primary Zone is the docks, ports airports, public or private warehouses where goods are stored and received, and the customs authority has control and surveillance, this is where everything is stored and checked to make sure it is good for export. Subsequently, the exporter will be notified if the merchandise has been assigned any type of capacity; There are three types of gauging, the first is the automatic which consists in the merchandise being validated through the customs declaration given by the ECUAPASS. Here the authorization for the exit of the merchandise is fast and automatic, there is also the documentary capacity which serves to confirm the data exposed in all the documentation presented to the ADUANA so that someone in charge of the procedure is assigned and the electronic data and the exposed documentation are reviewed in order to give the permission of exit of the merchandise if there is not any novelty in the load, and finally there is the intrusive physical gauge which serves in the same way to verify or physically examine that the declared merchandise is in the same state in which it is found in the container, which has not been replaced, to make sure that it complies with the description and real origin of the declared merchandise (ADUANA, 2018).

By complying with this sequence arranged by the regulating entity, ADUANA, dispatches our goods from Ecuador to the destination country, in this case France, and for this the exporter has to follow the French regulations and thus customs clearance to reach our consumer. However, as a policy of the essential orange oil production plant, the customs clearance has to be carried out by our French client, which is why our responsibility ends when the merchandise is shipped. Therefore, FOB terms will be negotiated. Both the seller and the buyer have certain obligations. The seller, on the one hand, has the obligation to deliver the goods on board the vessel chosen by the buyer in the nearest and most preferred port, that is, he has to make the clearance of the merchandise export, following all the steps mentioned above for their dispatch. The buyer

also has to comply with certain obligations, which is to designate and reserve the ship so that the merchandise can be dispatched, to bear the expenses and risks inherent to the merchandise, meaning that in case something happens to the product the responsible person is the buyer, and to organize the customs clearance of their merchandise (PROCOMER, 2010). The process will be demonstrated in figure 18.

Figure 18 Incoterm FOB



Source: (PROCOMER, 2010)

On the other hand, as a policy of the essential orange oil production plant, commercial responsibility is held until after the product arrives at its destination, since this policy is included through the guarantee of quality.

However, it is necessary to bear in mind that the merchandise produced from essential orange oil must comply with technical standards that regulate the quality of the product to be exported. These standards developed by the World Health Organization are called CODEX ALIMENTARIUS which talks about specific vegetable oil standards. The full document can be found in Appendix B. This regulation regulates the quality and standards that should be fulfilled internationally.

However, there are several procedures that must be met when importing a product into France, among which is the indication that if goods have a value of less than 1,000

euros and a weight of less than 1,000 kg, a verbal declaration has to be made to customs presenting the invoice. On the other hand, if the values are higher than that, a summary declaration has to be filed with customs; that is, manifesting whether transportation is through air or maritime, as well as making a declaration of common law, that is, presenting the single administrative document as well as all the documents that support the merchandise, so that it proceeds to the authorization of entry. The authorization will be notified through the PRODOUANE portal, where through an internet connection an automatic result can be obtained, which facilitates and expedites the customs service (European Union, 2018).

In addition, on January 1, 2011, the World Customs Organization jointly with the European Union implemented a new import control system called Import Control System (ICS) (European Commission, 2016), with the objective of having greater control over flows of goods at the time of importation. One of the requirements is that they must present a summary declaration of income before the entry of the merchandise to the customs office of the country of arrival (Santander TradePortal, 2018).

Likewise, one of the first and most necessary documents for the customs clearance within the European Union according to the Trade Helpdesk is the commercial invoice, which is a document of proof of payment or cancellation between merchant and consumer, and contains the basic information about the transaction and includes specific data of the operations that are carried out, detailing the goods traded. No specific format is required for the preparation of the same, but the original and at least one copy is delivered and these can be presented in any language. Secondly there is the Declaration of Customs Value, which is a document that must be presented stating that the value of the merchandise does not exceed 20,000 euros and must be delivered in a special format; Downloading the model figure in Annex 8 of the Delegate Act of Transitory Measures of the Customs Code of the Union (CAU) established by the Regulation of the European Union, where the application of the Community Customs Code is documented. This form must be presented with the Single Administrative Document.

Likewise, the value of the transaction must be defined to set the customs value; this value is that of the goods, including all costs, up to the first point of entry into the

European Union. According to the clearance of goods, depending of the means of transport that are going to be used, it is required to comply with the established documents, such as the Bill of Lading, the FIATA bill of lading, road bill of lading (CMR), knowledge air (AWB), transport letter (CIM), ATA notebook and TIR notebook. According to the means of transport used in the importation, it is necessary to present the respective document to the customs authorities of the Member State of the European Union (European Commission, 2015).

The different documents used according to the means of transport established are those detailed below:

The bill of lading (B / L) is a document that serves as proof that the goods were received by the carrier. This document is issued by a shipping company, and gives details of the merchandise, the ship and the port of destination. The carrier is obliged to provide the document to the recipient. When the merchandise is damaged or in poor condition, the bill of lading is delivered with reservations, on the contrary, when the merchandise has been received in good condition, it is a clean bill of lading (European Commission, 2015).

The FIATA bill of lading is a document created by the International Federation of Freight Forwarders Associations (FIATA) that serves in cases where transport is multimodal or combined (European Commission, 2015).

The road transport document (CMR) is a document that allows the sender to obtain the goods available to them during transport. This document denotes the data of the international transport, it must be signed by the carrier and the sender, and there are four documents: the first goes to the sender, the second to the carrier, the third includes the goods and is delivered to the recipient and the fourth must be returned to the sender when it has been signed and stamped by the recipient.

The airway bill of lading (or AWB airway bill) is a document confirming the contract between the sender and the airline. It consists of three original documents and several copies, the originals are for each one of the interested parties and the copies can be for proof or to deliver in different places that may be required.

The transport letter by rail (CIM) is a document that is required when the goods are transported by railway transportation. Five documents are delivered: the original includes the goods, another is delivered to the sender and the others are kept by the carrier (European Commission, 2015).

The ATA notebooks (Admission Temporaire / Temporary Admission) these customs documents are provided by the Chambers of Commerce of most industrialized countries that allows temporary importation with exemption from customs duties and liens (United Nations Economic Commission for Europe, 2018).

The TIR notebooks are customs documents for customs transit which applies when the goods are transported in vehicles for international transport or in secure containers with guarantee of international validity (United Nations Economic Commission for Europe, 2018).

On the other hand, there is the insurance of transport of goods, which is a contract that is given between the insurer and the insured, where the cargo is compensated if something goes wrong on the way to its destination, since it can be given bad handling, transport or disturbances on the road. Here it is important to clarify that the liability insurance of the carrier is very different from the transportation insurance, since it covers the responsibility of the risk holder, and compensation of the cargo. In contrast, the other only covers the liability of the carrier and is regulated in another way.

It should be noted that the compensation is given depending on the means of transport in which the cargo and the value of the merchandise comes. If the cargo comes by road transport, it is governed by the Convention on the Contract for the International Carriage of Goods by Road (CMR Convention), signed in Geneva in 1956. This expresses that the carrier is not responsible for the losses or damages caused to the merchandise if it meets the following three requirements: it was due to a defect in the merchandise, due to force majeure and due to a fault attributable to the shipper or the consignee.

However, within the norm of the European Union there is no talk about compensation related to the transportation of goods. Rail transport is regulated in the Convention on International Carriage by Rail (CIM Convention), signed in Bern in 1980. Here it is stated that the railway company is not responsible for the damage of the merchandise if the damage was caused by defect of the merchandise itself, force majeure or for a fault attributable to the shipper or the consignee. The maritime transport is regulated by the International Convention for the unification of certain rules on bill of lading of 1968. The shipping company is not responsible for loss or damage caused to the goods if they are due to defects of the merchandise and weight loss during transport, negligence or lack by the crew, fire, if not caused by the carrier's fault, unfavourable navigability conditions, force majeure, strikes or lockouts, negligence of the shipper, hidden defects on board, rescue or attempt to save lives or property in the sea.

The loading list (P / L) or packing list is a document that is attached to the commercial invoice and transport documents. This document provides information about the merchandise like weights, dimensions, trademarks and other characteristics that help to understand the nature of the imported products. It is necessary for customs clearance and can be presented in any language; however it is recommended that it is translated into English (European Commission, 2016).

Finally, there is the Import Declaration (DAU), which indicates that all goods entering the European Union must be declared at the customs of the state to which it was imported. This declaration is made through the Single Administrative document according to the Customs Code of the European Union. This can be presented through a computerized system connected to the customs authorities, or in person at the designated customs offices. The most relevant data that should be included in the declaration are: who are the representatives of the import and export of the merchandise, the customs destination, the identification of the merchandise, location and packaging, all the information of the means of transport, the country of origin, the country of destination, commercial and financial information, import licenses, inspection certificates, documents of origin, original invoice and the declaration and mode of payment of import taxes. Three copies are usually used, the first one is left with the authorities of the Member State in

which the procedure begins, the second is sent to the destination state and the third is sent to the recipient as soon as the customs authority seals it (European Commission, 2016).

Conclusions

To conclude the technical analysis, it was made evident that for the selection of the optimal location of the production plant of essential orange oil, a table was made assigning values for the assigned weight and the weighted grade. Through this process a value of 8.92 was obtained for a location in the city of Guayaquil, which had the advantage of accessibility to the raw material and the possibility for lower costs for the production plant of essential orange oil. On the other hand, it was possible to analyse the size of the plant because it is required that the production is 134.16 tons by the fifth year. Analysing the supply chain and production, the production process could be determined to be distillation by drag of steam, getting the best machines that manage to produce the required quantity with the operation of the projected 5 years.

The productive analysis was also carried out with the due time required to carry out a certain activity and it was concluded that the most time-consuming activity is the hydro-distillation process, which takes up 4 hours a day in the process to obtain the essential oil. For this reason, the best machinery has been required, in order to be productive in the shortest possible time. On the other hand, it was possible to determine that the machinery established for the production plant is suitable to meet the daily production requirement.

Following this analysis, it was possible to obtain a management model for receiving the raw material at lower costs, by getting the orange peel from formal outlets where contracts are allowed to determine the quality and quantity needed, where their waste is the peel while the fruit without peel is obtained during the plant's production process. Selling the waste to those who require it as a raw material was obtained as a policy of the production plant of essential orange oil.

The organizational chart of the company concluded that 18 people are required to work in the production plant including 2 people in the administrative board, since they are creating this essential oil production plant.

Considering the distribution of the plant it was concluded that the machines must go in process sequence to obtain the final product, to avoid waste of inputs and time.

Finally, with the export process it was concluded that our responsibility will only be until the merchandise is shipped and the importer will be the one who performs all the customs clearance procedures, this resulting in negotiations in FOB terms. However, it must be emphasized that according to internal policies of the plant, a post-sale commercial responsibility exists with regards to the quality and quantity of the essential oil that has been commercialized.

CHAPTER 4

4. ECONOMIC STUDY

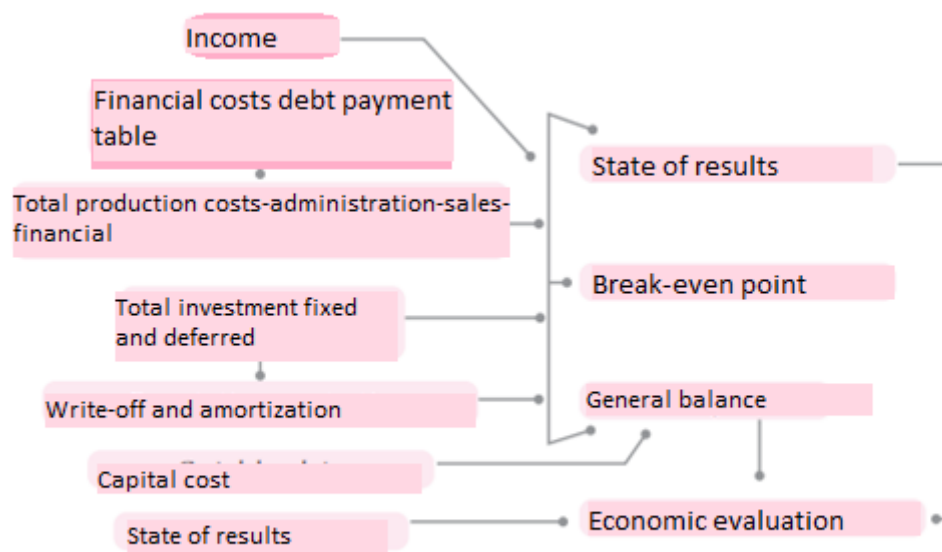
Introduction

The economic study helps to analyse the project from a monetary viewpoint focused on the profitability of the project. The amount of investments, and amount of money needed to start the production silver carry out the project will be analysed, for which an analysis of the relevant costs is necessary. In order to carry out this analysis, accounting knowledge and the management of information and communication technologies called TICS will be used in order to obtain the profitability of the project.

Following Baca, the cost determination will be analysed, which covers production costs, administrative costs, sales costs and financial costs, in order to see the total cost of the operation of the essential orange oil production plant. This will conclude with the determination of the total investment of the project, that is to say the fixed and deferred investment, which are the basis for calculating the amount of annual depreciations and amortizations, which is a starting point to determine the equilibrium point. Nevertheless, the investment schedule and working capital have to be done gradually in order to collect the necessary information, create the minimum acceptable rate of return (TMAR) and the debt payment table, resulting in the net cash flow of the essential orange oil production plant (2013).

This process will be summarized in figure 19 according to Baca Urbina (2013):

Figure 19 *Economic Study Process*



Source: (Baca Urbina, 2013)

4.1 Determination of costs

The cost is a consumption made in a virtual or effective way to fulfil a determined purpose for the realization of certain activities (Baca Urbina, 2013). The cost is the need for the raw material, the time spent and all those expenses that define their partitioning in the production process. For this reason, the cost is taken into account when planning and forming a project. However, it is important to emphasize that for Gabriel Baca Urbina there are operating and non-operating costs (2013). These costs will be analysed from year 0 to year 5, as would be appropriate.

4.1.1 Cost of raw material

The cost of the raw material is based on the quantity that is required for the annual sales projection that was established in the market study. Next, the annual quantity and cost of the required production of the essential orange oil will be projected.

Table 9 Analysis of the annual raw material of orange

Analysis of the annual raw material of orange					
	Year 1	Year 2	Year 3	Year 4	Year 5
Orange peel in tons	93.89	145.30	204.34	271.88	348.92
Orange peel in kg	93,887.45	145,304.49	204,341.75	271,883.50	348,918.02
Oil obtained in tons to export	36.1	55.87	78.57	104.54	134.16
Oil obtained in kg	36,100.00	55,870.00	78,570.00	104,540.00	134,160.00
Cost per unit	\$ 0.03	\$ 0.03	\$ 0.03	\$ 0.03	\$ 0.03
Amount of oranges needed for the procedure	1,877,749.05	2,906,089.73	4,086,834.98	5,437,669.96	6,978,360.46
Total annual cost	\$ 46,943.72	\$ 87,182.69	\$ 122,605.05	\$ 163,130.10	\$ 209,350.81

Authors: Emily González & Daniela Ron

Table 9 shows the quantity in tons of orange required to obtain the peel that is needed to obtain the essential orange oil. An analysis is made of the amount of raw material in tons with their respective costs to obtain the cost that will be generated annually from the raw material to determine whether it is within the profitability parameter of the project. Determining that the orange peel weighs 50 grams, that is to say 0.00005 tons and an entire orange weighs 200 grams, that is, 0.00020 tons.

According to the study done in the year 2010 conducted by María José Velásquez Núñez from the University of the Americas in Mexico City, 0.000684 tons of peel gives 0.00236 tons of essential orange oil. This study helps us to correlate the amount of tons required to obtain the amount of essential oil necessary for export.

In the same way, the acquisition of oranges has been carried out by Ecuadorian farmers in the area of the provinces of Guayas and Bolívar, as these are the areas that according to the statistical report of the agricultural sector made by the National Institute of Statistics and Census, have permanent crops with higher production.

For the purpose of maintaining a standard price in all periods of orange production, agreements are made at \$ 0.03 per unit. Similarly, the application of fair trade is sought in order to contribute to our Ecuadorian economy (Velásquez Núñez, 2010). The costs of the raw material are required to obtain what is necessary for production to

achieve the annual projected export. Each year the required value of the raw material varies based on the necessary annual sales.

4.1.2 Labour cost

The cost of salaries and wages are denominated as administrative costs, thus it is necessary to determine the salary values for the creation of the essential orange oil production plant, bearing in mind that the projected labour time is a single eight hour shift from Monday to Friday. This can be seen below in the payrolls performed each year until completing the fifth year which is the projected time. The payrolls are performed on an annual basis and likewise, the benefits are taken annually, so it includes all the monthly provisions.

Table 10 Payroll for year 1

Payroll for year 1													
Position	Required staff	Salary per person	Salary per person annually	Payment XIII Annual salary	Payment XIV Annual salary	Total annual income	Employer Contribution 11.15%	IECE/SECAP 1%	Personal contribution 9.45%	Total Cost Employee	Total contributed to the IESS 21.60%	Liquid to receive	Total cost per charge
Directors	2	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 386.00	\$ 6,886.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 7,048.00	\$ 1,296.00	\$ 6,319.00	\$ 14,096.00
Secretary	1	\$ 393.48	\$ 4,721.76	\$ 393.48	\$ 386.00	\$ 5,501.24	\$ 526.48	\$ 47.22	\$ 446.21	\$ 5,628.73	\$ 1,019.90	\$ 5,055.03	\$ 5,628.73
Accountant	1	\$ 424.76	\$ 5,097.12	\$ 424.76	\$ 386.00	\$ 5,907.88	\$ 568.33	\$ 50.97	\$ 481.68	\$ 6,045.50	\$ 1,100.98	\$ 5,426.20	\$ 6,045.50
Accounting assistant	1	\$ 393.48	\$ 4,721.76	\$ 393.48	\$ 386.00	\$ 5,501.24	\$ 526.48	\$ 47.22	\$ 446.21	\$ 5,628.73	\$ 1,019.90	\$ 5,055.03	\$ 5,628.73
Foreign trade manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 386.00	\$ 6,886.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 7,048.00	\$ 1,296.00	\$ 6,319.00	\$ 7,048.00
Marketing assistant	1	\$ 393.48	\$ 4,721.76	\$ 393.48	\$ 386.00	\$ 5,501.24	\$ 526.48	\$ 47.22	\$ 446.21	\$ 5,628.73	\$ 1,019.90	\$ 5,055.03	\$ 5,628.73
Administrative manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 386.00	\$ 6,886.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 7,048.00	\$ 1,296.00	\$ 6,319.00	\$ 7,048.00
Watchers	2	\$ 390.00	\$ 4,680.00	\$ 390.00	\$ 386.00	\$ 5,456.00	\$ 521.82	\$ 46.80	\$ 442.26	\$ 5,582.36	\$ 1,010.88	\$ 5,013.74	\$ 11,164.72
Production manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 386.00	\$ 6,886.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 7,048.00	\$ 1,296.00	\$ 6,319.00	\$ 7,048.00
Quality supervisor and laboratory technician	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 386.00	\$ 6,886.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 7,048.00	\$ 1,296.00	\$ 6,319.00	\$ 7,048.00
Workers	5	\$ 393.41	\$ 4,720.92	\$ 393.41	\$ 386.00	\$ 5,500.33	\$ 526.38	\$ 47.21	\$ 446.13	\$ 5,627.79	\$ 1,019.72	\$ 5,054.20	\$ 28,138.97
Driver	1	\$ 397.58	\$ 4,770.96	\$ 397.58	\$ 386.00	\$ 5,554.54	\$ 531.96	\$ 47.71	\$ 450.86	\$ 5,683.36	\$ 1,030.53	\$ 5,103.68	\$ 5,683.36
Total	18	\$ 5,286.19	\$ 63,434.28	\$ 5,286.19	\$ 4,632.00	\$ 73,352.47	\$ 7,072.92	\$ 634.34	\$ 5,994.54	\$ 75,065.20	\$ 13,701.80	\$ 67,357.93	\$ 110,206.73
Unified basic salary	\$ 386.00												

Authors: Emily González & Daniela Ron

Source: (Ministry of labor, 2018)

The payroll developed for the first year of the production plant of essential orange oil takes the 18 employees that are required for this period into account. The salary per person was established based on the data of the Ecuadorian Ministry of Labour, which projects a list of sectoral salaries for 2018 while following the employee protection law that states that no one can receive a salary below the basic unified salary (SBU) that has been established for a certain year, that is \$ 386.00 for the first year. The administrative cost for the first year is \$ 110,206.73. In the first year, vacations and reserve funds are not taken into account, because these items are taken into account as of the first year that the employer complies. On the other hand, employers will say that this value is subtracted from the salary.

Table 11 Payroll for year 2

Payroll for year 2															
Position	Required staff	Salary per person	Salary per person annually	Payment XIII Annual salary	Payment XIV Annual salary	Total annual income	Employer Contribution 11,15%	IECE/SECAP 1%	Personal contribution 9.45%	Reserve Fund 8.33%	Holiday provisions	Total Cost Employee	Total contributed to the IESS 21,60%	Liquid to receive	Total cost per charge
Directors	2	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 394.00	\$ 6,894.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,056.00	\$ 1,296.00	\$ 7,076.80	\$ 15,611.60
Secretary	1	\$ 394.00	\$ 4,728.00	\$ 394.00	\$ 394.00	\$ 5,516.00	\$ 527.17	\$ 47.28	\$ 446.80	\$ 393.84	\$ 197.00	\$ 5,643.66	\$ 1,021.25	\$ 5,660.05	\$ 6,234.50
Accountant	1	\$ 424.76	\$ 5,097.12	\$ 424.76	\$ 394.00	\$ 5,915.88	\$ 568.33	\$ 50.97	\$ 481.68	\$ 424.59	\$ 212.38	\$ 6,053.50	\$ 1,100.98	\$ 6,071.17	\$ 6,690.47
Accounting assistant	1	\$ 394.00	\$ 4,728.00	\$ 394.00	\$ 394.00	\$ 5,516.00	\$ 527.17	\$ 47.28	\$ 446.80	\$ 393.84	\$ 197.00	\$ 5,643.66	\$ 1,021.25	\$ 5,660.05	\$ 6,234.50
Foreign trade manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 394.00	\$ 6,894.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,056.00	\$ 1,296.00	\$ 7,076.80	\$ 7,805.80
Marketing assistant	1	\$ 394.00	\$ 4,728.00	\$ 394.00	\$ 394.00	\$ 5,516.00	\$ 527.17	\$ 47.28	\$ 446.80	\$ 393.84	\$ 197.00	\$ 5,643.66	\$ 1,021.25	\$ 5,660.05	\$ 6,234.50
Administrative manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 394.00	\$ 6,894.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,056.00	\$ 1,296.00	\$ 7,076.80	\$ 7,805.80
Watchers	2	\$ 394.00	\$ 4,728.00	\$ 394.00	\$ 394.00	\$ 5,516.00	\$ 527.17	\$ 47.28	\$ 446.80	\$ 393.84	\$ 197.00	\$ 5,643.66	\$ 1,021.25	\$ 5,660.05	\$ 12,469.00
Production manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 394.00	\$ 6,894.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,056.00	\$ 1,296.00	\$ 7,076.80	\$ 7,805.80
Quality supervisor and laboratory technician	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 394.00	\$ 6,894.00	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,056.00	\$ 1,296.00	\$ 7,076.80	\$ 7,805.80
Workers	5	\$ 394.00	\$ 4,728.00	\$ 394.00	\$ 394.00	\$ 5,516.00	\$ 527.17	\$ 47.28	\$ 446.80	\$ 393.84	\$ 197.00	\$ 5,643.66	\$ 1,021.25	\$ 5,660.05	\$ 31,172.49
Driver	1	\$ 397.58	\$ 4,770.96	\$ 397.58	\$ 394.00	\$ 5,562.54	\$ 531.96	\$ 47.71	\$ 450.86	\$ 397.42	\$ 198.79	\$ 5,691.36	\$ 1,030.53	\$ 5,707.90	\$ 6,287.57
Total	18	\$ 5,292.34	\$ 63,508.08	\$ 5,292.34	\$ 4,728.00	\$ 73,528.42	\$ 7,081.15	\$ 635.08	\$ 6,001.51	\$ 5,290.22	\$ 2,646.17	\$ 75,243.14	\$ 13,717.75	\$ 75,463.30	\$ 122,157.82
Unified basic salary	\$ 394.00														

Authors: Emily González & Daniela Ron

Source: (Ministry of labor, 2018)

The payroll shown above corresponds to the second projected year of the plant. For the projection of the SBU of that year the amount was set at \$ 394.00, as this was stated to be the SBU of the following year by the current president of Ecuador, Lenin Moreno. In this payroll the provisions for vacations and the reserve fund that corresponds to an 8.33% of the salary are required. The total administrative costs for the second year is \$ 122,157.82.

Table 12 Payroll for year 3

Payroll for year 3															
Position	Required staff	Salary per person	Salary per person annually	Payment XIII Annual salary	Payment XIV Annual salary	Total annual income	Employer Contribution 11,15%	IECE/SECAP 1%	Personal contribution 9.45%	Reserve Fund 8.33%	Holiday provisions	Total Cost Employee	Total contributed to the IESS 21,60%	Liquid to receive	Total cost per charge
Directors	2	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 404.80	\$ 6,904.80	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,066.80	\$ 1,296.00	\$ 7,087.60	\$ 15,633.20
Secretary	1	\$ 404.80	\$ 4,857.60	\$ 404.80	\$ 404.80	\$ 5,667.20	\$ 541.62	\$ 48.58	\$ 459.04	\$ 404.64	\$ 202.40	\$ 5,798.36	\$ 1,049.24	\$ 5,815.19	\$ 6,405.39
Accountant	1	\$ 424.76	\$ 5,097.12	\$ 424.76	\$ 404.80	\$ 5,926.68	\$ 568.33	\$ 50.97	\$ 481.68	\$ 424.59	\$ 212.38	\$ 6,064.30	\$ 1,100.98	\$ 6,081.97	\$ 6,701.27
Accounting assistant	1	\$ 404.80	\$ 4,857.60	\$ 404.80	\$ 404.80	\$ 5,667.20	\$ 541.62	\$ 48.58	\$ 459.04	\$ 404.64	\$ 202.40	\$ 5,798.36	\$ 1,049.24	\$ 5,815.19	\$ 6,405.39
Foreign trade manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 404.80	\$ 6,904.80	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,066.80	\$ 1,296.00	\$ 7,087.60	\$ 7,816.60
Marketing assistant	1	\$ 404.80	\$ 4,857.60	\$ 404.80	\$ 404.80	\$ 5,667.20	\$ 541.62	\$ 48.58	\$ 459.04	\$ 404.64	\$ 202.40	\$ 5,798.36	\$ 1,049.24	\$ 5,815.19	\$ 6,405.39
Administrative manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 404.80	\$ 6,904.80	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,066.80	\$ 1,296.00	\$ 7,087.60	\$ 7,816.60
Watchers	2	\$ 404.80	\$ 4,857.60	\$ 404.80	\$ 404.80	\$ 5,667.20	\$ 541.62	\$ 48.58	\$ 459.04	\$ 404.64	\$ 202.40	\$ 5,798.36	\$ 1,049.24	\$ 5,815.19	\$ 12,810.79
Production manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 404.80	\$ 6,904.80	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,066.80	\$ 1,296.00	\$ 7,087.60	\$ 7,816.60
Quality supervisor and laboratory technician	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 404.80	\$ 6,904.80	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,066.80	\$ 1,296.00	\$ 7,087.60	\$ 7,816.60
Workers	5	\$ 404.80	\$ 4,857.60	\$ 404.80	\$ 404.80	\$ 5,667.20	\$ 541.62	\$ 48.58	\$ 459.04	\$ 404.64	\$ 202.40	\$ 5,798.36	\$ 1,049.24	\$ 5,815.19	\$ 32,026.97
Driver	1	\$ 404.80	\$ 4,857.60	\$ 404.80	\$ 404.80	\$ 5,667.20	\$ 541.62	\$ 48.58	\$ 459.04	\$ 404.64	\$ 202.40	\$ 5,798.36	\$ 1,049.24	\$ 5,815.19	\$ 6,405.39
Total	18	\$ 5,353.56	\$ 64,242.72	\$ 5,353.56	\$ 4,857.60	\$ 74,453.88	\$ 7,163.06	\$ 642.43	\$ 6,070.94	\$ 5,351.42	\$ 2,676.78	\$ 76,188.43	\$ 13,876.43	\$ 76,411.14	\$ 124,060.20
Unified basic salary	\$ 404.80														

Source: (Ministry of labor, 2018)

This table corresponds to the projected payroll for the third year, where an average of the SBU increase was made based on the last 5 years to extrapolate its approximate increase. This resulted in a projected increase of the SBU of \$ 10.80 for this year, resulting in a total of \$ 404.80. Realizing all the pertinent values that are to be paid according to Ecuadorian law, it gives us a total annual value for the third year of \$ 124,060.20.

Table 13 Payroll for year 4

Payroll for year 4															
Position	Required staff	Salary per person	Salary per person annually	Payment XIII Annual salary	Payment XIV Annual salary	Total annual income	Employer Contribution 11,15%	IECE/SECAP 1%	Personal contribution 9.45%	Reserve Fund 8.33%	Holiday provisions	Total Cost Employee	Total contributed to the IESS 21,60%	Liquid to receive	Total cost per charge
Directors	2	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 414.96	\$ 6,914.96	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,076.96	\$ 1,296.00	\$ 7,097.76	\$ 15,653.52
Secretary	1	\$ 414.96	\$ 4,979.52	\$ 414.96	\$ 414.96	\$ 5,809.44	\$ 555.22	\$ 49.80	\$ 470.56	\$ 414.79	\$ 207.48	\$ 5,943.89	\$ 1,075.58	\$ 5,961.15	\$ 6,566.16
Accountant	1	\$ 424.76	\$ 5,097.12	\$ 424.76	\$ 414.96	\$ 5,936.84	\$ 568.33	\$ 50.97	\$ 481.68	\$ 424.59	\$ 212.38	\$ 6,074.46	\$ 1,100.98	\$ 6,092.13	\$ 6,711.43
Accounting assistant	1	\$ 414.96	\$ 4,979.52	\$ 414.96	\$ 414.96	\$ 5,809.44	\$ 555.22	\$ 49.80	\$ 470.56	\$ 414.79	\$ 207.48	\$ 5,943.89	\$ 1,075.58	\$ 5,961.15	\$ 6,566.16
Foreign trade manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 414.96	\$ 6,914.96	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,076.96	\$ 1,296.00	\$ 7,097.76	\$ 7,826.76
Marketing assistant	1	\$ 414.96	\$ 4,979.52	\$ 414.96	\$ 414.96	\$ 5,809.44	\$ 555.22	\$ 49.80	\$ 470.56	\$ 414.79	\$ 207.48	\$ 5,943.89	\$ 1,075.58	\$ 5,961.15	\$ 6,566.16
Administrative manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 414.96	\$ 6,914.96	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,076.96	\$ 1,296.00	\$ 7,097.76	\$ 7,826.76
Watchers	2	\$ 414.96	\$ 4,979.52	\$ 414.96	\$ 414.96	\$ 5,809.44	\$ 555.22	\$ 49.80	\$ 470.56	\$ 414.79	\$ 207.48	\$ 5,943.89	\$ 1,075.58	\$ 5,961.15	\$ 13,132.32
Production manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 414.96	\$ 6,914.96	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,076.96	\$ 1,296.00	\$ 7,097.76	\$ 7,826.76
Quality supervisor and laboratory technician	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 414.96	\$ 6,914.96	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,076.96	\$ 1,296.00	\$ 7,097.76	\$ 7,826.76
Workers	5	\$ 414.96	\$ 4,979.52	\$ 414.96	\$ 414.96	\$ 5,809.44	\$ 555.22	\$ 49.80	\$ 470.56	\$ 414.79	\$ 207.48	\$ 5,943.89	\$ 1,075.58	\$ 5,961.15	\$ 32,830.81
Driver	1	\$ 414.96	\$ 4,979.52	\$ 414.96	\$ 414.96	\$ 5,809.44	\$ 555.22	\$ 49.80	\$ 470.56	\$ 414.79	\$ 207.48	\$ 5,943.89	\$ 1,075.58	\$ 5,961.15	\$ 6,566.16
Total	18	\$ 5,414.52	\$ 64,974.24	\$ 5,414.52	\$ 4,979.52	\$ 75,368.28	\$ 7,244.63	\$ 649.74	\$ 6,140.07	\$ 5,412.35	\$ 2,707.26	\$ 77,122.58	\$ 14,034.44	\$ 77,347.83	\$ 125,899.76
Unified basic salary	\$ 414.96														

Authors: Emily González & Daniela Ron

Source: (Ministry of labor, 2018)

In the payroll for the fourth year, the average for obtaining the SBU was an increase of \$ 10.16, resulting in \$ 414.96. It should be noted that the salary per person changed based on the SBU reached for that year. The annual required value for the fourth year is \$125,899.76.

Table 14 Payroll for year 5

Payroll for year 5															
Position	Required staff	Salary per person	Salary per person annually	Payment XIII Annual salary	Payment XIV Annual salary	Total annual income	Employer Contribution 11,15%	IECE/SECAP 1%	Personal contribution 9.45%	Reserve Fund 8.33%	Holiday provisions	Total Cost Employee	Total contributed to the IESS 21,60%	Liquid to receive	Total cost per charge
Directors	2	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 424.75	\$ 6,924.75	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,086.75	\$ 1,296.00	\$ 7,107.55	\$ 15,673.10
Secretary	1	\$ 424.75	\$ 5,097.00	\$ 424.75	\$ 424.75	\$ 5,946.50	\$ 568.32	\$ 50.97	\$ 481.67	\$ 424.58	\$ 212.38	\$ 6,084.12	\$ 1,100.95	\$ 6,101.79	\$ 6,721.07
Accountant	1	\$ 424.76	\$ 5,097.12	\$ 424.76	\$ 424.75	\$ 5,946.63	\$ 568.33	\$ 50.97	\$ 481.68	\$ 424.59	\$ 212.38	\$ 6,084.25	\$ 1,100.98	\$ 6,101.92	\$ 6,721.22
Accounting assistant	1	\$ 424.75	\$ 5,097.00	\$ 424.75	\$ 424.75	\$ 5,946.50	\$ 568.32	\$ 50.97	\$ 481.67	\$ 424.58	\$ 212.38	\$ 6,084.12	\$ 1,100.95	\$ 6,101.79	\$ 6,721.07
Foreign trade manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 424.75	\$ 6,924.75	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,086.75	\$ 1,296.00	\$ 7,107.55	\$ 7,836.55
Marketing assistant	1	\$ 424.75	\$ 5,097.00	\$ 424.75	\$ 424.75	\$ 5,946.50	\$ 568.32	\$ 50.97	\$ 481.67	\$ 424.58	\$ 212.38	\$ 6,084.12	\$ 1,100.95	\$ 6,101.79	\$ 6,721.07
Administrative manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 424.75	\$ 6,924.75	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,086.75	\$ 1,296.00	\$ 7,107.55	\$ 7,836.55
Watchers	2	\$ 424.75	\$ 5,097.00	\$ 424.75	\$ 424.75	\$ 5,946.50	\$ 568.32	\$ 50.97	\$ 481.67	\$ 424.58	\$ 212.38	\$ 6,084.12	\$ 1,100.95	\$ 6,101.79	\$ 13,442.15
Production manager	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 424.75	\$ 6,924.75	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,086.75	\$ 1,296.00	\$ 7,107.55	\$ 7,836.55
Quality supervisor and laboratory technician	1	\$ 500.00	\$ 6,000.00	\$ 500.00	\$ 424.75	\$ 6,924.75	\$ 669.00	\$ 60.00	\$ 567.00	\$ 499.80	\$ 250.00	\$ 7,086.75	\$ 1,296.00	\$ 7,107.55	\$ 7,836.55
Workers	5	\$ 424.75	\$ 5,097.00	\$ 424.75	\$ 424.75	\$ 5,946.50	\$ 568.32	\$ 50.97	\$ 481.67	\$ 424.58	\$ 212.38	\$ 6,084.12	\$ 1,100.95	\$ 6,101.79	\$ 33,605.37
Driver	1	\$ 424.75	\$ 5,097.00	\$ 424.75	\$ 424.75	\$ 5,946.50	\$ 568.32	\$ 50.97	\$ 481.67	\$ 424.58	\$ 212.38	\$ 6,084.12	\$ 1,100.95	\$ 6,101.79	\$ 6,721.07
Total	18	\$ 5,473.26	\$ 65,679.12	\$ 5,473.26	\$ 5,097.00	\$ 76,249.38	\$ 7,323.22	\$ 656.79	\$ 6,206.68	\$ 5,471.07	\$ 2,736.63	\$ 78,022.72	\$ 14,186.69	\$ 78,250.40	\$ 127,672.34
Unified basic salary	\$ 424.75														

Authors: Emily González & Daniela Ron

Source: (Ministry of labor, 2018)

In the payroll for the fifth year the calculation of the SBU average shows an increase of \$ 9.79, giving a total of \$ 424.75. It is estimated that to cover the administrative costs of the fifth year a value of \$ 127,672.34 is required to cover each of the corresponding roles that exist within the production plant of essential orange oil.

Table 15 Summary of the payrolls in the project horizon

Projection of payrolls						
Position	Required staff	Year 1	Year 2	Year 3	Year 4	Year 5
Directors	2	\$ 14,096.00	\$ 15,611.60	\$ 15,633.20	\$ 15,653.52	\$ 15,673.10
Secretary	1	\$ 5,628.73	\$ 6,234.50	\$ 6,405.39	\$ 6,566.16	\$ 6,721.07
Accountant	1	\$ 6,045.50	\$ 6,690.47	\$ 6,701.27	\$ 6,711.43	\$ 6,721.22
Accounting assistant	1	\$ 5,628.73	\$ 6,234.50	\$ 6,405.39	\$ 6,566.16	\$ 6,721.07
Foreign trade manager	1	\$ 7,048.00	\$ 7,805.80	\$ 7,816.60	\$ 7,826.76	\$ 7,836.55
Marketing assistant	1	\$ 5,628.73	\$ 6,234.50	\$ 6,405.39	\$ 6,566.16	\$ 6,721.07
Administrative manager	1	\$ 7,048.00	\$ 7,805.80	\$ 7,816.60	\$ 7,826.76	\$ 7,836.55
Watchers	2	\$ 11,164.72	\$ 12,469.00	\$ 12,810.79	\$ 13,132.32	\$ 13,442.15
Production manager	1	\$ 7,048.00	\$ 7,805.80	\$ 7,816.60	\$ 7,826.76	\$ 7,836.55
Quality supervisor and laboratory technician	1	\$ 7,048.00	\$ 7,805.80	\$ 7,816.60	\$ 7,826.76	\$ 7,836.55
Workers	5	\$ 28,138.97	\$ 31,172.49	\$ 32,026.97	\$ 32,830.81	\$ 33,605.37
Driver	1	\$ 5,683.36	\$ 6,287.57	\$ 6,405.39	\$ 6,566.16	\$ 6,721.07
Total	18	\$ 110,206.73	\$ 122,157.82	\$ 124,060.20	\$ 125,899.76	\$ 127,672.34

Authors: Emily González & Daniela Ron

Source: (Ministry of labor, 2018)

In this table a summary of administrative costs can be seen. The payrolls for the 18 employees that will be involved in different activities and positions in the production plant of essential orange oil, indicate the annual administrative cost that the production plant requires to cover these costs according to sales. Within this value is each of the salary contributions received by the employee and in the same way the salaries for each worker according to their position, was obtained from the list of sectoral wages exposed by the Ecuadorian Ministry of Labour 2018.

4.1.3 Indirect manufacturing and logistics costs

Continuing with the analysis, the indirect costs of manufacturing and logistics are obtained. Within this group are the office items that have been quoted by the wholesale office supply company located in the city of Guayaquil called Olmedo Álvarez C.A. The data can be seen in the following table.

Table 16 Office supplies annually

Office supplies annually							
Product	Quantities in units	Unit cost	Year 1 cost	Year 2 cost	Year 3 cost	Year 4 cost	Year 5 cost
Reams of paper	156	\$ 3.00	\$ 408.00	\$ 468.00	\$ 468.00	\$ 468.00	\$ 468.00
Pen	120	\$ 0.25	\$ 25.00	\$ 30.00	\$ 30.00	\$ 30.00	\$ 30.00
Clips	500	\$ 0.02	\$ 5.00	\$ 10.00	\$ 10.00	\$ 10.00	\$ 10.00
Staples	2000	\$ 0.01	\$ 10.00	\$ 20.00	\$ 20.00	\$ 20.00	\$ 20.00
Stapler	3	\$ 5.00	\$ 10.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00
Folders	100	\$ 0.05	\$ 2.50	\$ 5.00	\$ 5.00	\$ 5.00	\$ 5.00
Drill	3	\$ 1.00	\$ 2.00	\$ 3.00	\$ 3.00	\$ 3.00	\$ 3.00
Highlights	4	\$ 0.50	\$ 1.00	\$ 2.00	\$ 2.00	\$ 2.00	\$ 2.00
Correctors	4	\$ 0.50	\$ 1.00	\$ 2.00	\$ 2.00	\$ 2.00	\$ 2.00
Agendas	20	\$ 3.00	\$ 30.00	\$ 60.00	\$ 60.00	\$ 60.00	\$ 60.00
Total			\$ 494.50	\$ 615.00	\$ 615.00	\$ 615.00	\$ 615.00

Authors: Emily González & Daniela Ron
Source: (Olmedo Álvarez C.A, 2018)

In the detail of office item costs that has been made, an annual cost of \$ 615.00 can be seen for these office items for proper operation in administrative areas.

4.1.4 Costs of production materials

In the same way the annual costs of production materials are analysed. These costs are analysed according to the needs of the employees based on the quantity existing within the production plant. The price quotation was obtained in Mi Comisariato in the city of Guayaquil. The table of costs will be presented next.

Table 17 *Costs of production materials*

Costs of production materials							
Product	Quantities in units	Unit cost	Year 1 cost	Year 2 cost	Year 3 cost	Year 4 cost	Year 5 cost
Nitrile gloves	\$ 5,500.00	\$ 0.06	\$ 275.00	\$ 330.00	\$ 330.00	\$ 330.00	\$ 330.00
Industrial toilet paper	\$ 104.00	\$ 2.60	\$ 225.33	\$ 270.40	\$ 270.40	\$ 270.40	\$ 270.40
Industrial hand soap	\$ 100.00	\$ 1.50	\$ 125.00	\$ 150.00	\$ 150.00	\$ 150.00	\$ 150.00
Bath towel	\$ 6.00	\$ 1.00	\$ 5.00	\$ 6.00	\$ 6.00	\$ 6.00	\$ 6.00
Robes	\$ 14.00	\$ 20.00	\$ 233.33	\$ 280.00	\$ 280.00	\$ 280.00	\$ 280.00
Uniforms	\$ 36.00	\$ 10.00	\$ 300.00	\$ 360.00	\$ 360.00	\$ 360.00	\$ 360.00
Mesh for fabric hair	\$ 14.00	\$ 1.25	\$ 14.58	\$ 17.50	\$ 17.50	\$ 17.50	\$ 17.50
Total			\$ 1,178.25	\$ 1,413.90	\$ 1,413.90	\$ 1,413.90	\$ 1,413.90

Authors: Emily González & Daniela Ron
Source: (Mi Comisariato , 2018)

The presentation of the table of costs of production materials gives us information of the annual budget that is required for these products. These products will be for the use of the employees within the production plant and to correctly develop the process of the productive chain of the essential orange oil.

4.1.5 Maintenance costs

Subsequently, the maintenance costs of the production plant of essential orange oil that were quoted in Mi Comisariato of the respective city are analyzed. For maintenance articles it is established that the purchase will be made every 2 months except for the grease for the machines, which will be purchased monthly, and disinfectant because an amount of 100 units is required annually due to the handling of food and oil, so employees can frequently use the disinfectant. Table 18 shows the respective values.

Table 18 Maintenance costs

Maintenance costs							
Product	Required quantity	Unit cost	Year 1 cost	Year 2 cost	Year 3 cost	Year 4 cost	Year 5 cost
Broom	6	\$ 5.00	\$ 25.00	\$ 30.00	\$ 30.00	\$ 30.00	\$ 30.00
Picker	6	\$ 2.00	\$ 10.00	\$ 12.00	\$ 12.00	\$ 12.00	\$ 12.00
Mop	6	\$ 6.00	\$ 30.00	\$ 36.00	\$ 36.00	\$ 36.00	\$ 36.00
25kg detergent	20	\$ 15.00	\$ 285.00	\$ 300.00	\$ 300.00	\$ 300.00	\$ 300.00
Chlorine mug	6	\$ 20.00	\$ 105.00	\$ 120.00	\$ 120.00	\$ 120.00	\$ 120.00
Lubricant for machines	12	\$ 15.00	\$ 160.00	\$ 180.00	\$ 180.00	\$ 180.00	\$ 180.00
Industrial disinfectant	100	\$ 1.50	\$ 148.50	\$ 150.00	\$ 150.00	\$ 150.00	\$ 150.00
Total			\$ 763.50	\$ 828.00	\$ 828.00	\$ 828.00	\$ 828.00

Authors: Emily González & Daniela Ron
Source: (Mi Comisariato , 2018)

As visualized in table 18, the acquisition of a series of products is required for the annual maintenance of the production plant, the same amount is required each year, obtaining a result of \$ 828 annually, which are destined for maintenance.

4.1.6 Costs of basic services

The following costs, which are those that encompass basic services, are analysed in the same way. These costs are established for machinery, personnel and facilities within the production plant of essential oil that require the use of these services. The contributions were made to the public companies of basic services in Guayaquil such as the Electric Company, Interagua and CNT. The analysis can be visualized in the following table.

Table 19 Basic service costs

Cost of basic services					
Service	Year 1 cost	Year 2 cost	Year 3 cost	Year 4 cost	Year 5 cost
Water	\$ 2,386.88	\$ 2,864.25	\$ 2,864.25	\$ 2,864.25	\$ 2,864.25
Light	\$ 1,047.61	\$ 1,257.14	\$ 1,257.14	\$ 1,257.14	\$ 1,257.14
Telephone	\$ 117.78	\$ 120.00	\$ 120.00	\$ 120.00	\$ 120.00
Internet	\$ 270.00	\$ 300.00	\$ 300.00	\$ 300.00	\$ 300.00
Total	\$ 3,822.27	\$ 4,541.39	\$ 4,541.39	\$ 4,541.39	\$ 4,541.39

Authors: Emily González & Daniela Ron

Table 19 shows the annual cost of basic services, which specifies the use of these services for the employees' own consumption and within the productive processes.

4.1.7 Packing costs

Next, the required quantity of the tanks for export of the elaborated product will be detailed.

Table 20 Packing cost

Packing cost			
Year	Quantity in units	Unit cost	Total cost per year
Year 1 cost	\$ 150.00	\$ 20.00	\$ 3,000.00
Year 2 cost	\$ 269.00	\$ 20.00	\$ 5,380.00
Year 3 cost	\$ 378.00	\$ 20.00	\$ 7,560.00
Year 4 cost	\$ 503.00	\$ 20.00	\$ 10,060.00
Year 5 cost	\$ 645.00	\$ 20.00	\$ 12,900.00

Authors: Emily González & Daniela Ron

Source: (Disensa, 2018)

For the determination of the tanks needed for the export of the essential orange oil, the capacity of the tank will be analysed in comparison to the amount that is required to be exported per year. A tank has a capacity of 55 gallons, which transformed to tons gives 0.208175 per tank. In the first year an exportation of 36.10 tons is required, equalling to an annual quantity of 180 tanks.

4.2 Determination of the investment

On the other hand, it is also necessary to analyse the investment necessary for the implementation of the production plant. For this all the cash expenditures that are required to be made only once, at the start of the project, including working capital need to be determined (Allen, Myers, & Brealey, 2010).

4.2.1 Investment of land and civil works

In table 21 the investment of the land and civil works for the creation of the plant producing essential orange oil will be exposed. To this aim different real estate companies were evaluated according to the necessary location established in the Technical Study, in which the optimal location was determined. It was determined that Ecuador Vive has the best offer. In the same way, quotes were made with different Engineers and Architects for which the cost includes labour and the materials required for its realization, out of which the best offer of all was chosen. Table 21 shows the established costs.

Table 21 Total investment of land and civil works

Total investment of land and civil works			
Concept	Number of square meters	Price per square meter	Total price
Ground	750	\$ 110.00	\$ 82,500.00
Civil work	750	\$ 300.00	\$ 225,000.00
Total			\$ 307,500.00

Authors: Emily González & Daniela Ron

The necessary land was determined by pre-established construction regulations within the Construction Chamber and according to the equipment and needs of the production plant established in the Technical Study. Because the real estate company Ecuador Vive, gave us the best quote with a price of \$ 110.00 dollars per square meter, and a land surface area of 25 x 30 square meters is required, a total value of \$ 82,500.00 was obtained. In the same way there are the civil works listed by Víctor Parra, who detailed the price including material and labour in his preform corresponding to \$ 300.00 per square meter, giving a total cost of \$225,000.00, giving a total investment in civil works and land of \$ 307,500.00. This is determined in the investment, because it is a cost that must be obtained before starting the operation of the plant's production.

4.2.2 Investment of the constitution of the company

Next, the investment in the constitution of the company that the project requires will be analysed. As this includes the creation of the company, there is no need to carry it out again in the following years.

Table 22 Investment of the constitution of the company

Investment of the constitution of the company	
Concept	Total price
Lawyer	\$ 650.00
Notary	\$ 250.00
Registration of trademarks and patents	\$ 208.00
Advertising and design	\$ 1,200.00
Total	\$ 2,308.00

Authors: Emily González & Daniela Ron

It can be verified that the expenditures in this projected table are made only once, that is, they belong to the investment to start with the functionality of the essential oil production plant. The total required is \$ 2,308.00.

4.2.3 Investment in the importation of machinery

In the same way the values that are required for the investment in obtaining the machinery for the production of the essential oil of orange were obtained. It is important to emphasize that these expenditures will be made only once because the machinery necessary for the projection to the fifth year was chosen, that is, it will not be necessary to renew the machinery in order to produce the necessary amount in the following years.

Table 23 Investment in machinery import

Investment in machinery import											
Quantity	State	Equipment Model	Unit price in USD	Freight	Insurance 1% freight + machine value	Total CIF value	Ad valorem	Local expenses	0.05% FODINFA	12% IVA	Total value placed in Ecuador
1	Used	Hyundai Porter H100 year2006	\$ 9,900	-	-		-	-	-	-	\$ 9,900
2	New	RUIXUE	\$ 500.00	\$ 199.32	\$ 11.99	\$ 1,211.31	\$ 60.57	\$ 250.00	\$ 60.57	\$ 159.89	\$ 1,742.34
1	New	TPP-800	\$ 1,000.00	\$ 132.88	\$ 11.33	\$ 1,144.21	\$ 57.21	\$ 250.00	\$ 57.21	\$ 151.04	\$ 1,659.67
1	New	DQ-XP28	\$ 1,000.00	\$ 132.88	\$ 11.33	\$ 1,144.21	\$ 57.21	\$ 250.00	\$ 57.21	\$ 151.04	\$ 1,659.67
10	New	Wadley ST-02	\$ 300.00	\$ 398.65	\$ 33.99	\$ 3,432.64	\$ 171.63	\$ 250.00	\$ 171.63	\$ 453.11	\$ 4,479.01
1	New	FFAITH	\$ 20,000.00	\$ 2,657.64	\$ 226.58	\$ 22,884.22	\$ 2,288.42	\$ 250.00	\$ 1,144.21	\$ 3,158.02	\$ 29,724.87
1	New	MSLZJ 017	\$ 150.00	\$ 19.93	\$ 1.70	\$ 171.63	\$ 8.58	\$ 250.00	\$ 8.58	\$ 22.66	\$ 461.45
1	New	303- 1AS	\$ 220.00	\$ 29.23	\$ 2.49	\$ 251.72	\$ 12.59	\$ 250.00	\$ 12.59	\$ 33.23	\$ 560.12
Total				\$ 3,570.53	\$ 299.41	\$ 30,239.94	\$ 2,656.21	\$ 1,750.00	\$ 1,512.00	\$ 4,128.98	\$ 50,187.12

Authors: Emily González & Daniela Ron

What is shown in the table is the amount of money that is required to be made as an investment to achieve the production of the essential oil of orange. The car that will be acquired is a small truck that will be used to collect raw material, this car will be purchased in the city of Quito, and the quotation was obtained from Mercado Libre de Ecuador. On the other hand, there is the machinery that will be obtained based on an import from China from the virtual platform Alibaba, the exposed data is the total of what each machine costs including taxes and other customs logistic costs that were provided by agent Nardo González, which increase the FOB value of the machinery. That is to say that a total machinery value of \$50,187.12 is required.

4.2.4 Investment in furniture and office equipment

On the other hand, there is the established investment in furniture and office equipment, necessary for the proper functioning of the offices within the established horizon of the production plant. It will be displayed in the following table.

Table 24 *Investment in furniture and office equipment*

Investment in furniture and office equipment			
Product	Quantity	Unit price	Total price
Computers	9	\$ 300.00	\$ 2,700.00
Office chairs	9	\$ 28.00	\$ 252.00
Desks	9	\$ 120.00	\$ 1,080.00
Copier	1	\$ 350.00	\$ 350.00
File cabinet	2	\$ 100.00	\$ 200.00
Chairs	5	\$ 10.00	\$ 50.00
Phones	3	\$ 20.00	\$ 60.00
Total			\$ 4,692.00

Authors: Emily González & Daniela Ron

It was determined that the total investment in furniture and office equipment corresponds to \$ 4,692.00 which includes all the necessary and vital equipment so that employees can fulfil their functions and have a better performance within their field of work.

4.2 Working capital

Working capital focuses on the money that the company needs to obtain reserves in raw material and to cover the different expenses that are required when starting with the company, even without obtaining sales (Allen, Myers, & Brealey, 2010).

Table 25 corresponds to the working capital that belongs to the investment of the project.

Table 25 *Working capital*

Working capital	
Description	Total cost
Raw material costs	\$ 9,388.75
Labour costs	\$ 17,976.23
Costs of production materials	\$ 235.65
Maintenance costs	\$ 64.50
Basic service costs	\$ 756.90
Packaging costs	\$ 600.00
Total working capital	\$ 29,022.03

Authors: Emily González & Daniela Ron

As can be seen in table 25, prepared with the total value of each of the working capital values for the necessary investment, the total value is \$ 29,022.03 taking into account that this value is the investment required to start the project before obtaining sales income and capital to cover the costs of the first 2 months of the project.

Concluding the breakdown of the expenditures necessary for the project in its first 2 months, the following table includes the total investment that is required.

Table 26 *Total investment*

Total investment	
Description	Total cost
Land and civil works	\$ 307,500.00
Machinery	\$ 50,187.12
Constitution of the company	\$ 2,308.00
Furniture and office equipment	\$ 4,692.00
Working Capital	\$ 29,022.03
Total	\$ 393,709.14

Authors: Emily González & Daniela Ron

A total value of \$ 393,709.14 is necessary for the creation of the essential orange oil production plant. It is important to emphasize that in order to comply with this, the plant will obtain financing from banking entities and project investors, having each one of them participate and contribute to cover the investment values.

4.3 Financing and depreciation

4.3.1 Financing

According to Baca Urbina (2013), financing is that amount of money that is required for the investment needs of the plant so that the elaboration of the project is possible. A part of the monetary amount is contributed by investors, while the difference is required through financing by financial institutions. In this way, it was decided that the contribution of 5 investors with the respective percentage of investment would be required within the production plant of essential orange oil. The difference will be obtained through a loan of 20% of the total amount of the required investment, which corresponds to \$ 78,741.83 and the amortization table that has been made in the Cooperative CACPE can be evidenced.

Table 27 Contributions from investors and banking entities

Contributions from investors and banking entities		
Investors	Percent investment	Monetary investment
Investor 1	30%	\$ 118,112.74
Investor 2	30%	\$ 118,112.74
Investor 3	5%	\$ 19,685.46
Investor 4	5%	\$ 19,685.46
Investor 5	10%	\$ 39,370.91
Total contribution of Investors		\$ 314,967.31
Remaining balance		\$ 78,741.83
Loan from the CACPE cooperative bank		\$ 78,741.83

Authors: Emily González & Daniela Ron

Source: (CACPE, 2018)

It can be seen that with the contributions of the investors a total value of \$314,967.31 is collected, corresponding to 80% of the required investment, leaving a remaining balance of \$ 78,741.83 that will be obtained through the loan from the financial entity CACPE for which the five-year amortization table will be displayed in the second annex. It is possible to prove that a commercial credit will be made for a term of 5 years, which has a percentage of interest of 11.23% and a tax exemption insurance equivalent to 0.007%. This results in monthly instalments of \$ 1,798.39, having as a taxable base, although the value to achieve the main objective of obtaining the capital required for the operation of the production plant of essential orange oil will increase month by month through interest. When the total payment of the loan ends, the value of \$ 105,361.33 will have been paid.

4.3.2 Depreciation

It is important to determine the depreciation of the assets acquired for the plant. According Baca Urbina, as defined in his book Project Evaluation, the term “depreciation” is important to know the useful life of tangible goods based on time. For this reason, a graph showing the assets with their respective depreciation (2013) will be displayed below.

Table 28 Depreciation of intangible and tangible assets

Depreciation of intangible and tangible assets									
Concept	Value	Residual value	%	Year 1	Year 2	Year 3	Year 4	Year 5	Salvage value
Vehicle	\$ 9,900.00	\$ 990.00	20%	\$ 1,782.00	\$ 1,782.00	\$ 1,782.00	\$ 1,782.00	\$ 1,782.00	\$ 990.00
Machinery	\$ 43,004.66	\$ 4,300.47	10%	\$ 3,870.42	\$ 3,870.42	\$ 3,870.42	\$ 3,870.42	\$ 3,870.42	\$ 23,652.56
Furniture and office equipment	\$ 2,607.00	\$ 260.70	10%	\$ 234.63	\$ 234.63	\$ 234.63	\$ 234.63	\$ 234.63	\$ 1,433.85
Computers	\$ 2,700.00	\$ 270.00	33%	\$ 801.90	\$ 801.90	\$ 801.90	\$ 801.90	\$ 801.90	\$ 294.30
Other materials required for the preparation of the essential oil of orange annually	\$ 2,261.90	\$ 226.19	10%	\$ 203.57	\$ 203.57	\$ 203.57	\$ 203.57	\$ 203.57	\$ 1,244.05
Total									\$ 27,614.76

Authors: Emily González & Daniela Ron

In this projected table, the goods acquired by the plant with their respective depreciation can be observed annually. It is possible to show that computers have a useful life of three years, as the value required for a new acquisition will be achieved by the third year, and the residual value is established from the third year. However, for the other products the balances are outstanding because in five years it is not possible to recover the values required for the new acquisition of these goods. The important thing about the realization of the depreciation by product is that an annual percentage is required so that when the useful life of the good ends, it is not necessary to inject money again.

4.4 Net Cash Flow

The analyses performed previously are an aid to realize the net cash flow. (Lawrence J. Gitman, 2007) indicates in his book “Principles of Financial Management” that the cash flow refers to the real inflows and outflows of money to maintain the solvency of the company through a necessary planning of the company and acquire the amount of money necessary to meet the obligations of the orange oil production plant. In other words, regardless of their profits or losses, a company must always comply with sufficient cash flow to meet its respective obligations. An overview can be seen in the following table.

Table 1 Net Cash Flow

Net Cash Flow																		
	Year 0			Year 1			Year 2			Year 3			Year 4			Year 5		
	Sales	Clients on credit 40%	Balance due for the next year of the last 2 months	Sales	Clients on credit 40%	Balance due for the next year of the last 2 months	Sales	Clients on credit 40%	Balance due for the next year of the last 2 months	Sales	Clients on credit 40%	Balance due for the next year of the last 2 months	Sales	Clients on credit 40%	Balance due for the next year of the last 2 months	Sales	Clients on credit 40%	Balance due for the next year of the last 2 months
Cash 60%	\$ 33,338.27			\$ 166,691.35			\$ 313,266.96			\$ 445,828.82			\$ 600,329.46			\$ 779,702.20		
40% credit at 45 days	\$ 22,225.51	\$ 16,669.14	\$ 5,556.38	\$ 111,127.57	\$ 92,606.31	\$ 18,521.26	\$ 208,844.64	\$ 174,037.20	\$ 34,807.44	\$ 297,219.21	\$ 247,682.68	\$ 49,536.54	\$ 400,219.64	\$ 333,516.37	\$ 66,703.27	\$ 519,801.47	\$ 433,167.89	\$ 86,633.58
Income	\$ 443,716.55			\$ 658,563.17			\$ 505,825.42			\$ 728,318.93			\$ 983,382.36			\$ 1,279,573.37		
Expenses	\$ 397,426.42			\$ 181,830.15			\$ 243,380.17			\$ 282,724.11			\$ 327,431.26			\$ 378,088.48		
Basis calculation utility	\$ 46,290.12			\$ 476,733.03			\$ 262,445.25			\$ 445,594.83			\$ 655,951.10			\$ 901,484.89		
15% worker participation	-			\$ 71,509.95			\$ 39,366.79			\$ 66,839.22			\$ 98,392.67			\$ 135,222.73		
Basis calculation utility	-			\$ 405,223.07			\$ 223,078.46			\$ 378,755.60			\$ 557,558.44			\$ 766,262.15		
10% reservation	-			4.052.230.745			\$ 22,307.85			\$ 37,875.56			\$ 55,755.84			\$ 76,626.22		
Basis calculation utility	-			\$ 364,700.77			\$ 200,770.61			\$ 340,880.04			\$ 501,802.59			\$ 689,635.94		
22% payment of income tax	-			\$ 80,234.17			\$ 44,169.54			\$ 74,993.61			\$ 110,396.57			\$ 151,719.91		
Basis calculation utility	-			\$ 284,466.60			\$ 156,601.08			\$ 265,886.43			\$ 391,406.02			\$ 537,916.03		
Total utility	\$ 46,290.12			\$ 284,466.60			\$ 156,601.08			\$ 265,886.43			\$ 391,406.02			\$ 537,916.03		

Authors: Emily González & Daniela Ron

Within the production plant of essential orange oil, it was established that monthly sales will be paid 60% in cash and 40% of the total sale on a 45-day credit. The purpose is to see the gain or loss that the project will have. It is for this reason that the income that for the year 0 consists of the sales made in the first 2 months subtracting the financing and contribution of the investors, in the same way the credit that is provided is calculated for each year, obtaining a balance pending for the next year of the last two months. For year zero the profit balance is \$ 46,290.12, which will be taken as liquidity for the plant. For the following year there is a utility balance of \$ 284,466.60. For year 2, the total sum of the utility is \$ 156,601.08. In the same way, a plant liquidity of \$ 265,886.43 is obtained in year 3. Continuing with year 4 the utility is of \$ 391,406.02 and finally for year 5 the total sum of profits of the plant is of \$ 537,916.03. Obtaining these amounts of the income that will be obtained from the sales and expenditures that the plant will have throughout the year, it can be seen that the results are positive, it has no losses and its revenues increase year after year. This qualifies us as a profitable project within the companies' regime, since sufficient capital will be obtained to continue improving and innovating the final product, reaching to meet the demands of consumers.

4.5 Break-Even Point

The break-even point serves to have a more precise analysis between three variables: the total fixed costs of the creation of the plant, the variable costs and finally the projected net sales of the essential oil of orange. This provides a mid-point where the company knows that if that amount of money is reached, it neither wins, nor loses, that is, there is enough money to cover production and processing costs of the essential orange oil, but there is no profit from it. Therefore, the objective of a company is always to place itself above the break-even point in order to be able to obtain a representative profit from the production of the essential oil (Baca Urbina, 2013).

Therefore, the costs have to be divided into fixed and variable costs. The fixed costs are all those that have to be covered regardless of the variation of production. Among these are the salaries of employees, basic services, office costs and the payment of financial obligations in this case is the loan made to finance the investment as it has a projection of 5 years. On the other side are the variable costs, which are the purchase of raw materials, inputs and international logistics in terms of FOB, that is, the cost when

transporting the product to the port since they are the pre-established negotiation terms (Baca Urbina, 2013). This can be seen in tables 30 & 31.

Table 30 *Fixed costs of the production plant*

Fixed costs per ton	
Salaries	\$ 3,091.36
Basic services	\$ 51.51
Office costs	\$ 14.17
Payment of financial obligations	\$ 509.33
Total	\$ 3,666.37

Authors: Emily González & Daniela Ron

Table 31 *Variable costs of the production plant*

Variable costs per ton	
Raw material	\$ 1,345.48
Supplies	\$ 1,264.23
International logistics	\$ 159.93
Total	\$ 2,769.64

Authors: Emily González & Daniela Ron

It was concluded that for fixed costs a total cost of \$ 3,666.37 per ton was obtained resulting from the total annual costs divided by the amount of annual tons that will be produced in year 1. In the same way variable costs were determined and a total of \$ 2,769.64 per ton was obtained.

Having this base information, the break-even point analysis can be performed with the following formula to obtain the expected result in quantities. The formula is Break-Even = $FC / (P - VC)$, as established by Lawrence J. Gitman in his book Financial Management Principles (2007). In other words, the equilibrium point is equal to the division of the fixed cost for the price minus the variable cost. This can be visualized in the following summary table by applying the formula. The break-even point can be

determined in price or quantities, in this case it will be determined in price and quantity in tons.

Table 32 Break-even point

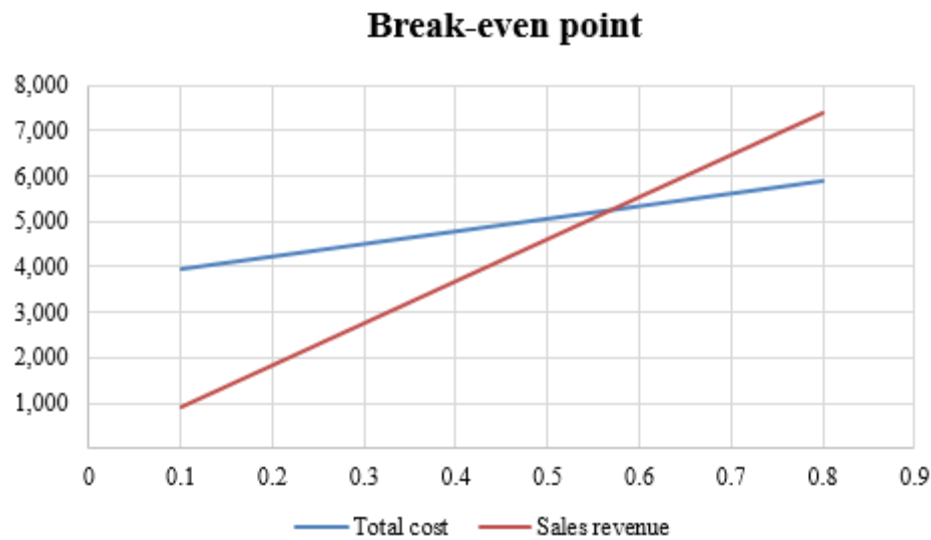
Break-even point	
Net sales	\$ 9,234.28
Total variable costs	\$ 2,769.64
Total fixed costs	\$ 3,666.37
Balance point in units of tons	0.57
Balance point in dollars	\$ 5,237.15

Authors: Emily González & Daniela Ron

When formulating the break-even point formula, it was possible to demonstrate that the essential orange oil production plant, has to produce a minimum of 0.57 tons to cover its costs, which is within the projected production standard since monthly they are going to produce 2.90 tons that is to say in a week the plant produces 0.72 tons already surpassing the established break-even point, which can be reached in four days, in which it is possible to produce 0.58 tons, resulting in a utility of what is produced monthly.

Figure 20 was made to demonstrate the determined break-even point. For this columns of units sold, the total cost and the sales income were made to determine the graph with the equilibrium point representing the results that had been previously exposed.

Figure 20 Break-even point



Authors: Emily González & Daniela Ron

Conclusions

To conclude, it can be determined that the economic study helped us determine the appropriate income and expenditure information that the project will have on the horizon, taking into account the variables within the financial sphere and to be able to interweave them in order to see if the creation of the production plant is feasible or not. In the determination of the costs, the amount of money that will be destined to the annual purchase of raw materials was made: for year 1, \$ 46,943.73 is needed, increasing each year based on the sales growth. Subsequently, the payrolls for the 18 employees that belong to the essential orange oil production plant were analysed. It was obtained that for year 1, \$ 110,206.73 was required for salaries, increasing each year based on the average extrapolation of the SBU increase. In the same way, the necessary costs were determined for office items with a required annual value of \$ 615.00 and the costs requested for production materials with an annual total of \$ 1,413.90. The maintenance costs necessary for the machinery and different areas of the production plant are \$ 828.00 per year. Basic services with a value of \$ 4,441.39 were also calculated and packaging costs vary annually due to sales growth, for year 1 a value of \$ 3,000.00 is needed.

Advancing with the analysis of the necessary investment for the essential orange oil production, it was determined that the land and civil work, the machinery, the

constitution of the company and the office furniture and equipment, as well as the working capital, would require a total value of \$ 393,709.14.

The working capital required by the essential oil producing plant, which was determined to begin its operation before obtaining sales rotation, was established to be required for the first 2 months with a needed value of \$ 29,022.03.

The analysed financing will be obtained for 20% from the CACPE bank, corresponding to \$ 78,741.83 and 80% from 5 shareholders corresponding to \$ 314,967.31.

The net cash that was made based on the movements of income and expenses, gave us a positive result for each year, obtaining high values of liquidity for the company. This tool is important to determine the feasibility of the project based on whether profits or losses will be obtained. According to the net cash flow a profit value corresponding to \$ 284,466.60 will be reached in the first year, which tells us the realization of the project is feasible obtaining increasing profits for each year.

Finally, the break-even point, determined by the fixed costs, variable costs and net sales within the project can be visualized, giving a positive result, as the project is located above the equilibrium point. In fact, there is a high profit margin, having calculated that on the fourth day of essential orange oil production, the minimum production of 0.57 tons corresponding to \$ 5,237.15 is already fulfilled.

CHAPTER 5

5. FINANCIAL STUDY

Introduction

In the last chapter of this study, different analyses will be carried out to help determine the profitability of the creation of the essential orange oil production plant with the aim of demonstrating through accounting indicators whether the implementation of this project is profitable or not, and providing a vision to investors so they can make the best decision to be part of this project. The vision they will be provided with will be about the current situation of the project and what is expected in the projected future.

The methods to be evaluated serve to measure the value of money over time. Because if up to this point no abnormality has been analysed in the creation of this project, the different previously conducted studies can establish that there is a potential market to meet the objectives. After all the place and the optimal size was determined, a productive process was established, that is to say, a description on how the product will be elaborated, and the amount of money necessary to carry out the project was calculated. However, all of this is not enough since the project will be composed of investors, which leads us to determine whether the proposed investment is economically viable or not in the future (Baca Urbina, 2013).

The methods that will be analysed below will be: The Minimum Acceptable Rate of Performance (TMAR), Net Present Value (NPV) and the Internal Rate of Performance (IRR).

5.1 Minimum Acceptable Rate of Performance

The Minimum Acceptable Rate of Return (TMAR) is the percentage that is taken into consideration when investing in the project, because it shows the risk that the investor will assume to be part of it.

For this, two important variables are considered, the risk rate and inflation. In his book Gabriel Baca Urbina states that the rate of irrigation is catalogued as a low risk if

the range will be 1% - 10%. It is considered in this way as the demand for the product or service is maintained and there does not exist a great competition in the field where it is going to play. Subsequently, the range of 11% - 20% is considered as medium risk, since they will be those that encompass a variable demand within the market and their competition is stable. Finally, the high risk refers to those with a range greater than 20%, this is established by the instability of the price due to constantly changing supply and demand (2013)

The formula for obtaining the TMAR is as follows:

Equation 1 TMAR formula

$$TMAR = i + f + if;$$

Fuente: (Baca Urbina, 2013)

According to the formula presented above, the TMAR is determined to be equal to the annual inflation of the country in which the project resides, in this case the inflation of Ecuador according to the Central Bank of Ecuador corresponds to 3.33% per annum (2019). The factor f is equal to the risk rate that has been established for the production plant, which is 15%, because there is considerable competition in the international market. Therefore, the formula with the corresponding data will be displayed.

$$TMAR = \frac{3.33}{\%} + \frac{15}{\%} + (\frac{3.33}{\%} * \frac{15}{\%})$$

$$TMAR = \frac{18.80}{\%}$$

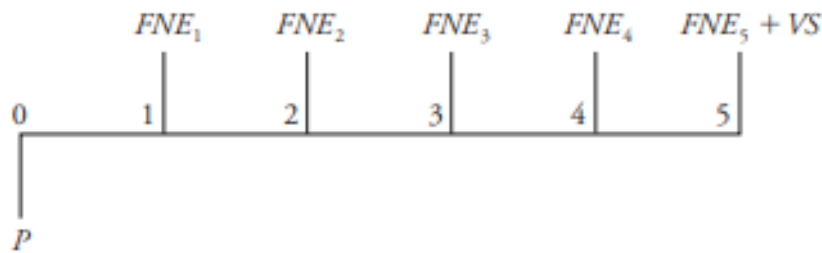
As a result, the TMAR is 18.80%, which is acceptable because the TMAR is intended to be higher than the inflation of the project since this shows that investors show interest in it. This is the axis point to analyse the NPV and the IRR, since the result must be less than the IRR for it to be acceptable.

5.2 Net Present Value

As a second point, the Net Present Value (NPV) will be studied. Which Gabriel Baca Urbina establishes as the monetary amount in which the flows of the initial investment are subtracted (2013). With the objective of obtaining the profits against the disbursements that are required to produce essential orange oils in the production plant.

The acceptance of a project occurs when the earnings are greater than the expenses, that is, the result of the NPV is greater than zero. Therefore, it is carried out through a timeline where the operational value of the project horizon is taken to the initial value of the investment. Which can be reflected below.

Figure 21 Time line of NPV



Source: (Baca Urbina, 2013)

In the timeline drawn by Baca Urbina (2013), P is defined as the initial value of the investment required for the production of the essential orange oil production plant. FNE is the Net Cash Flow that includes the revenues minus the expenses of each year foreseen on the horizon. Up to the fifth year, the Salvage Value is added, which is the residual value that remains after the depreciation of the fixed assets of the production plant. Having this information, the formula dictated by Baca Urbina (2013), which will be explained below, is implemented.

Equation 2 NPV

$$VPN = -P + \frac{FNE_1}{(1+i)^1} + \frac{FNE_2}{(1+i)^2} + \frac{FNE_3}{(1+i)^3} + \frac{FNE_4}{(1+i)^4} + \frac{FNE_5 + VS}{(1+i)^5}$$

Source: (Baca Urbina, 2013)

The NPV is calculated through a set of formulas. As a first point the sign of the initial investment will be changed since for the application of this formula it is required

that it be negative. On the other hand, it refers to the interest rate i that the financial entity provides us for the loan, applying the exponential value to the corresponding year. Next, the formula will be observed with the respective data of the essential orange oil production plant.

$$\text{NPV} = -393,709.14 + \frac{303,135.40}{(1+11.23\%)^1} + \frac{167,519.48}{(1+11.23\%)^2} + \frac{171,047.33}{(1+11.23\%)^3} + \frac{458,824.49}{(1+11.23\%)^4} + \frac{657,548.25 + 26,010.96}{(1+11.23\%)^5}$$

$$\text{NPV} = \$ 839,748.18$$

Solving the equation gives us a total value of \$ 839,748.18 in which the investment corresponds to \$ 393,709.14. As such it can be shown that the earnings are greater than the disbursements, and can cover the value of the investment. This result obtained by the calculation of the NPV is considered a Net Absolute Profitability since if it is positive and greater than zero the investor has the confidence of having a gain of the project in the future. If it is equal to zero, it is indifferent, since the project will only work to pay for the investment and expenses. Finally, if it is less than zero, the project is not profitable for the investor to apply to due to the lack of income to recover the investment and cover the expenses, that is, it will not be useful and there will be a deficit within the project.

5.3 Internal Rate of Return

The Internal Rate of Return (IRR) helps us calculate the financial viability of the project. Therefore, it gives us a percentage of profitability based on what was calculated in the NPV, that is, the expected return can be visualized based on the initial investment of the essential orange oil production plant.

To analyse this point, the following equation has to be used:

Equation 3 Formula of the IRR

$$P = - \frac{FNE_1}{(1+i)^1} + \frac{FNE_2}{(1+i)^2} + \frac{FNE_3}{(1+i)^3} + \frac{FNE_4}{(1+i)^4} + \frac{FNE_5 + VS}{(1+i)^5}$$

Source: (Baca Urbina, 2013)

IRR= (-393,709.14; 303,135.40; 167,519.48; 171,047.33; 458,824.49; 657,548.25)

Internal rate of return (IRR)= 66%

Which indicates the percentage of return obtained by the investment is higher than the TMAR. The acceptance ranges of the IRR are measured according to the comparison of the result of the IRR with those of the TMAR. Since if the IRR is superior to the TMAR it is profitable to make the investment, if the IRR is equal to the TMAR it is indifferent to carry out the investment since there is no return based on the investment and finally if the IRR is lower than the TMAR it is not recommended to invest as it is not profitable. That is to say, when obtaining 66% as a result of the equation, it is within the range established as acceptance of the IRR, that is, the profitability to make the investment is demonstrated.

Another method to establish the decision on the project based on profitability is equalling the income of the project with the present value of expenditures, *i.e.* this calculation determines that the NPV is equal to zero. The following table and graph show the percentages of the IRR and the result of the NPV corresponding to the different percentages.

Table 33 IRR and NPV

IRR	NPV
5%	1,087,375.77
10%	\$ 870,493.77
11.23%	\$ 824,470.87
15%	\$ 698,274.13
18.08%	\$ 609,515.31
20%	\$ 559,745.81
25%	\$ 446,987.80
30%	\$ 354,194.91
35%	\$ 277,053.46
40%	\$ 212,316.94
45%	\$ 157,512.91
50%	\$ 110,737.63
55%	\$ 70,510.11
60%	\$ 35,667.13
65%	\$ 5,286.82
66%	\$ 0.00
70%	(\$ 21,367.63)
75%	(\$ 44,889.80)

Authors: Emily González & Daniela Ron

Figure 1 IRR and NPV



Authors: Emily González & Daniela Ron

As can be seen in figure 22, obtaining an IRR of 66% results in an NPV of zero. Which shows us that with this percentage value is neither added, nor destroyed from the project.

Conclusions

The first point in the financial study was to calculate the TMAR, where we obtained a result of 18.08%, which gives us a positive value because it is higher than the inflation rate and lower than the IRR percentage. In other words, the risk of the project is acceptable to investors.

After having made the indicators to measure the profitability of the project, we obtain the conclusion that the NPV is positive and this result gives us the guidelines to determine that the investor should contribute to the project, because the utility will be greater than the required investment, therefore it was evidenced that the profit is greater than the expenses generated by the project.

Similarly, the Internal Rate of Return helped us determine once more that the essential orange oil production plant is profitable to investors since the percentage obtained is 66%, which demonstrates the viability in the forecasted horizon of the project, evaluating the different alternatives within the environment so that the investor has the certainty of making the best decision, and when using this 66% in the NPV, the result is equal to zero.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions:

The analysis of the planning provided a global vision of the French environment in which it was possible to demonstrate that there is political stability, which guarantees security and persistence among the merchants in imports, to avoid unfair procedures and to find a point of equilibrium within the internal and external competition. On the other hand, Ecuador maintains a Multiparty Trade Treaty with the European Union, which helps since the products that enter France pay 0% of *ad valorem* taxes. In the economic sphere, France has had positive results in its commercial relations, since it has developed in several industries, which helps its growth to be positive and effective, avoiding stagnation in possible industrial failures. In the same way, the country has opened the doors to foreign investment. In the social and cultural field, the country is traditionalist in commercial relations. The barriers that exist are the linguistic ones when carrying out negotiations. Finally, a technological analysis is essential for the development of the country, standing out internationally. By obtaining these positive results from the French Republic, it becomes attractive to the investor.

The market study provided information about the current situation of the environment, in which it gave positive results on the customer trend towards natural and organic consumption. Customers demand that industries implement the use of essential oils in different procedures. This suggests that France is the ideal destination for the export of our company. It was concluded that the essential oil that will be marketed for the demands, costs, advantages and benefits will be orange oil due to the availability of the raw material and because it is among the most economical in the classification of essential oils with a value between 7 and 8 Euros per kilogram. Conducted studies established that the demand for essential oils will have an annual growth of 8% until the year 2024. In the different five-year sales projection analyses, it was established that for the first year the amount exported in tons will be of 36.10. This is due to the 2.31% percentage of sales of the project that is obtained from the average of the 10 countries in a range of small and medium participation that export essential orange oil to France, the growth of sales of the project will be 1% per year which was determined based on a conservative decision. The total price per ton in year 1 is \$ 9,234.28, obtaining total

revenues of \$ 333,382.70. A sales policy was established where 60% will be paid in cash and 40% on a 45-day credit.

After carrying out the technical study, it was determined that the essential orange oil production plant will be established in the city of Guayaquil for the different advantages and benefits it offers, as a value corresponding to 8.92 was obtained in table 7, which assessed the cities of Cuenca and Guayaquil. It was determined that the distillation process will be steam drag due to time advantages in time and the avoidance of contamination over time. In the productive analysis it was determined that there is a bottleneck in the hydro-distillation process, which is why the best machinery in capacity, time and quality for this process was quoted. The machinery to be used is the retort with a budget of \$ 20,000.00. In the same way, it was possible to establish a management model that allows the purchase of orange peel from different formal suppliers with whom a contract can be established, such as those who make bottled juices or orange pulp and on the other hand sell the unused oranges to those who require it as raw material. Subsequently, in the organizational chart of the company it was determined that the personnel that works in the essential orange oil production plant will be a total of 18 people and the distribution of the machinery will be made based on the sequence of the productive processes to avoid waste of time and raw material. Finally, it was possible to determine the FOB terms of negotiation that will be implemented and the commercial responsibility policy based on the quality and quantity guarantee until the product reaches its final destination.

Regarding the economic study, it was possible to determine the income and expenses of the project. In year 1, including working capital and investment, it was determined that the income will be \$ 1,102,279.72 and the expenditures correspond to the amount of \$ 579,256.57, thus obtaining a profit of \$ 330,756.72. The amount of investment required for the implementation of the essential orange oil production plant will be obtained by 20% financing from the financial entity CACPE for a total amount of \$ 78,741.83 and 80% of the contribution between the 5 shareholders for an amount of \$ 314,967.31. Finally, in the economic study, the break-even point was made in quantities and values. It was determined that in tons it is necessary to sell 0.57 t, which is valued at \$ 5,237.15, so that from these quantities of sales onwards, earnings can be obtained. This suggests the essential orange oil production plant is feasible.

Finally, the financial study made it possible to evaluate the different indicators to determine the feasibility and profitability of the project. Positive values were obtained allowing investors to participate in the project. The TMAR was obtained as a first analysis with a positive value of 18.08%. The acceptability of the value was determined because it is higher than the value of 3.33% that corresponds to inflation and lower than the value of 66% that corresponds to the IRR. That is, the indicators showed that there is a profitability of the plant producing essential orange oil.

Recommendations:

Generate more information on the different industries, such as market information, information on productive factors that facilitate the investor or researcher to have real, reliable and updated data.

Official pages providing information about the existing participation in commercial relations of different companies participating in this industry should carry out studies that are close to reality so the companies that conduct research to enter the market can obtain real situational analyses, to know their competition with greater certainty.

Provide incentives for projects that want to start a new industry to be able to contributing to the change of the productive matrix. For example, the state can provide low percentage import tariffs on the machinery that needs to be imported for the implementation of a new business in a new industry, in order to facilitate the creation of the production plant.

Provide state loans at a low interest rate to incentivize the projects established by the Ecuadorians that contribute economically to the country and that do not have sufficient capital to carry it out.

Provide technical training in the production processes in order to meet the quality demands required in the international environment and thus be able to compete with the different industries established in the environment.

Start the project as soon as possible to take advantage of the fact that the potential demand is not yet over-exploited and achieve great benefits and growth.

There ought to be a modality that helps facilitate the development of entrepreneurship, so that those who project themselves as entrepreneurs find untapped places.

Support and assistance is recommended for projects whose purpose is to contribute to the change of the productive matrix or seek to increase the added value of Ecuadorian products. This will help Ecuador to be recognized not only for its traditional or primary products, but also as an emerging industry.

Have Ecuador make more international agreements and treaties not only with the European Union, but also with the rest of the world to help and benefit entrepreneurs to conduct business, reach several places with their product and obtain more support.

Incentivize shipping and logistics companies to make agreements to guide entrepreneurs who do not have experience and knowledge in foreign trade procedures.

APPENDICES

Appendix A: Export process determined by the CUSTOMS OF ECUADOR

- How do you obtain the Exporter Registry?

Once the RUC is managed in the Internal Revenue Service, the following must be done:

Step 1

Acquire the Digital Certificate for the electronic signature and authentication granted by the following entities:

Central Bank of Ecuador: <http://www.eci.bce.ec/web/guest/>

Security Data: <http://www.securitydata.net.ec/>

Step 2

Register in the ECUAPASS portal :(<http://www.ecupass.aduana.gob.ec>)

- Here you can:
 1. Update database
 2. Create username and password
 3. Accept the use policies
 4. Register electronic signature

Review the bulletin 32-2012, in which there is a demonstration video about the registration to the ECUAPASS portal.

The National Council of Foreign Trade and Investment (COMEXI) established that exporters additionally register with the Ministry of Industries and Competitiveness when they refer to:

Exports of scrap and waste ferrous and non-ferrous metals. Resolution 400 of September 13, 2007 and published in the Official Registry Supplement 233 of December 17, 2007.

Exports of hides and skins. Resolution 402 of September 13, 2007 and published in the Official Registry 222 of November 29, 2007.

+ Export process

Date of update: April 2017

- Export process

It begins with the electronic transmission of a Customs Declaration of Exportation (DAE) in the new ECUAPASS system, which can be accompanied by an invoice or proforma and documentation that is counted prior to shipment, said statement is not a simple intention of shipment, but a declaration that creates a legal bond and obligations to be fulfilled by the National Customs Service of Ecuador by the exporter or declarant.

- The data that will be recorded in the DAE are:
 - From the exporter or declarant
 - Description of merchandise by invoice item
 - Consignor data
 - Destination of cargo
 - Amounts
 - Weight; and other information related to the merchandise.

The digital documents that accompany the DAE through the ECUAPASS are:

- Original commercial invoice.
- Prior authorizations (when the case warrants it).
- Electronic Certificate of Origin (when the case warrants it)

Once the DAE is accepted, the merchandise enters the Primary Zone of the district where it is shipped, product of which the temporary deposit registers it and stores it prior to its exportation.

When exporting, you will be notified of the assigned capacity channel, which can be:

- Automatic capacity
- Documentary Capacity
- Physical Intrusive Gauging

When the DAE has an Automatic Gauging channel, the exit authorization, meaning the authorization for the merchandise to be shipped, will be automatic at the moment of the loading of the cargo to temporary deposits or primary zones.

When the DAE has a Documentary Capacity Channel, the official in charge of the procedure will be designated, at the moment of loading the cargo to the temporary deposit or primary zone, after which it will proceed to the review of the electronic data and digitalized documentation; and will proceed to the closing if there are no news. It is necessary to indicate that in case of an observation to the procedure, it will be registered through the electronic notification scheme. Once closed the DAE will change its status to authorized departure and the cargo may be loaded

When the DAE has an Intrusive Physical Capacity channel, it proceeds as described in the previous point and additionally a physical inspection of the load is carried out, corroborating it with the electronic and digitalized documentation sent in the DAE.

Date of update: April 2017 Source:
(ADUANA, 2018)

APPENDICES

Appendix A: Export process determined by the CUSTOMS OF ECUADOR

- How do you obtain the Exporter Registry?

Once the RUC is managed in the Internal Revenue Service, the following must be done:

Step 1

Acquire the Digital Certificate for the electronic signature and authentication granted by the following entities:

Central Bank of Ecuador: <http://www.eci.bce.ec/web/guest/>

Security Data: <http://www.securitydata.net.ec/>

Step 2

Register in the ECUAPASS portal : (<http://www.ecuapass.aduana.gob.ec>)

- Here you can:
 1. Update database
 2. Create username and password
 3. Accept the use policies
 4. Register electronic signature

Review the bulletin 32-2012, in which there is a demonstration video about the registration to the ECUAPASS portal.

The National Council of Foreign Trade and Investment (COMEXI) established that exporters additionally register with the Ministry of Industries and Competitiveness when they refer to:

Exports of scrap and waste ferrous and non-ferrous metals. Resolution 400 of September 13, 2007 and published in the Official Registry Supplement 233 of December 17, 2007.

Exports of hides and skins. Resolution 402 of September 13, 2007 and published in the Official Registry 222 of November 29, 2007.

+ Export process

Date of update: April 2017

- Export process

It begins with the electronic transmission of a Customs Declaration of Exportation (DAE) in the new ECUAPASS system, which can be accompanied by an invoice or proforma and documentation that is counted prior to shipment, said statement is not a simple intention of shipment, but a declaration that creates a legal bond and obligations to be fulfilled by the National Customs Service of Ecuador by the exporter or declarant.

- The data that will be recorded in the DAE are:
 - From the exporter or declarant
 - Description of merchandise by invoice item
 - Consignor data
 - Destination of cargo
 - Amounts
 - Weight; and other information related to the merchandise.

The digital documents that accompany the DAE through the ECUAPASS are:

- Original commercial invoice.
- Prior authorizations (when the case warrants it).
- Electronic Certificate of Origin (when the case warrants it)

Once the DAE is accepted, the merchandise enters the Primary Zone of the district where it is shipped, product of which the temporary deposit registers it and stores it prior to its exportation.

When exporting, you will be notified of the assigned capacity channel, which can be:

- Automatic capacity
- Documentary Capacity
- Physical Intrusive Gauging

When the DAE has an Automatic Gauging channel, the exit authorization, meaning the authorization for the merchandise to be shipped, will be automatic at the moment of the loading of the cargo to temporary deposits or primary zones.

When the DAE has a Documentary Capacity Channel, the official in charge of the procedure will be designated, at the moment of loading the cargo to the temporary deposit or primary zone, after which it will proceed to the review of the electronic data and digitalized documentation; and will proceed to the closing if there are no news. It is necessary to indicate that in case of an observation to the procedure, it will be registered through the electronic notification scheme. Once closed the DAE will change its status to authorized departure and the cargo may be loaded

When the DAE has an Intrusive Physical Capacity channel, it proceeds as described in the previous point and additionally a physical inspection of the load is carried out, corroborating it with the electronic and digitalized documentation sent in the DAE.

Date of update: April 2017 Source:
(ADUANA, 2018)

Appendix B: Technical standard for vegetable oils

C O D E X A L I M E N T A R I U S

INTERNATIONAL FOOD STANDARDS



Food and Agriculture
Organization of
the United Nations



World Health
Organization

E-mail: codex@fao.org - www.codexalimentarius.org

STANDARD FOR

NAMED

VEGETABLE OILS

CODEX STAN 210-

1999

Adopted in 1999. Revised in 2001, 2003, 2009, 2017.

Amended in 2005, 2011, 2013, 2015.

1. Scope

This Standard applies to the vegetable oils described in Section 2.1 presented in a state for human consumption.

2. Description

2.1 Product definitions

(Note: synonyms are in brackets immediately following the name of the oil)

Arachis oil (peanut oil; groundnut oil) is derived from groundnuts (seeds of *Arachis hypogaea*

L.). **Babassu oil** is derived from the kernel of the fruit of several varieties of the palm

Orbignya spp. **Coconut oil** is derived from the kernel of the coconut (*Cocos nucifera* L.).

Cottonseed oil is derived from the seeds of various cultivated species of *Gossypium spp.*

Grapeseed oil is derived from the seeds of the grape (*Vitis vinifera* L.).

Maize oil (corn oil) is derived from maize germ (the embryos of *Zea mays* L.).

Mustardseed oil is derived from the seeds of white mustard (*Sinapis alba* L. or *Brassica hirta* Moench), brown and yellow mustard (*Brassica juncea* (L.) Czernajew and Cossen) and of black mustard (*Brassica nigra* (L.) Koch).

Palm kernel oil is derived from the kernel of the fruit of the oil palm (*Elaeis guineensis*).

Palm kernel olein is the liquid fraction derived from fractionation of palm kernel oil (described above). **Palm kernel stearin** is the solid fraction derived from fractionation of palm kernel oil (described above). **Palm oil** is derived from the fleshy mesocarp of the fruit of the oil palm (*Elaeis guineensis*).

Palm olein is the liquid fraction derived from the fractionation of palm oil (described above).

Palm stearin is the high-melting fraction derived from the fractionation of palm oil (described above).

Palm superolein is a liquid fraction derived from palm oil (described above) produced through a specially controlled crystallization process to achieve an iodine value of 60 or higher.

Rapeseed oil (turnip rape oil; colza oil; ravison oil; sarson oil: toria oil) is produced from seeds of *Brassica napus* L., *Brassica rapa* L., *Brassica juncea* L. and *Brassica tournefortii* Gouan species.

Rapeseed oil - low erucic acid (low erucic acid turnip rape oil; low erucic acid colza oil; canola oil) is produced from low erucic acid oil-bearing seeds of varieties derived from the *Brassica napus* L., *Brassica rapa* L. and *Brassica juncea* L., species.

Rice bran oil (rice oil) is derived from the bran of rice (*Oryza sativa* L.).

Safflowerseed oil (safflower oil; carthamus oil; kurdee oil) is derived from safflower seeds (seeds of *Carthamus tinctorious* L.).

Safflowerseed oil - high oleic acid (high oleic acid safflower oil; high oleic acid carthamus oil; high oleic acid kurdee oil) is produced from high oleic acid oil-bearing seeds of varieties derived from *Carthamus tinctorious* L.

Sesame seed oil (sesame oil; gingelly oil; benne oil; ben oil; till oil; tillie oil) is derived from sesame seeds (seeds of *Sesamum indicum* L.).

Soya bean oil (soybean oil) is derived from soya beans (seeds of *Glycine max* (L.) Merr.).

Sunflower seed oil (sunflower oil) is derived from sunflower seeds (seeds of *Helianthus annuus* L.).

Sunflower seed oil - high oleic acid (high oleic acid sunflower oil) is produced from high oleic acid oil-bearing seeds of varieties derived from sunflower seeds (seeds of *Helianthus annuus* L.).

Sunflower seed oil - mid oleic acid (mid-oleic acid sunflower oil) is produced from mid-oleic acid oil-bearing sunflower seeds (seeds of *Helianthus annuus* L.).

Other definitions

Edible vegetable oils are foodstuffs which are composed primarily of glycerides of fatty acids being obtained only from vegetable sources. They may contain small amounts of other lipids such as phosphatides, of unsaponifiable constituents and of free fatty acids naturally present in the fat or oil.

Virgin oils are obtained, without altering the nature of the oil, by mechanical procedures, e.g. expelling or pressing, and the application of heat only. They may have been purified by washing with water, settling, filtering and centrifuging only.

Cold pressed oils are obtained, without altering the oil, by mechanical procedures only, e.g. expelling or pressing, without the application of heat. They may have been purified by washing with water, settling, filtering and centrifuging only.

3. Essential Composition and Quality Factors

3.1 GLC ranges of fatty acid composition (expressed as percentages)

Samples falling within the appropriate ranges specified in Table 1 are in compliance with this Standard. Supplementary criteria, for example national geographical and/or climatic variations, may be considered, as necessary, to confirm that a sample is in compliance with the Standard.

Low-erucic acid rapeseed oil must not contain more than 2% erucic acid (as % of total fatty acids). High oleic acid safflower oil must contain not less than 70% oleic acid (as a % of total fatty acids). High oleic acid sunflower oil must contain not less than 75% oleic acid (as % of total fatty acids).

3.2 Slip point

Palm kernel olein	between 21 to 26 °C
Palm kernel stearin	between 31 to 34 °C
Palm olein	not more than 24°C
Palm stearin	not less than 44°C
Palm superolein	not more than 19.5°C

4. Food Additives

No food additives are permitted in virgin or cold pressed oils.

4.1 Flavouring

The flavourings used in products covered by this standard shall comply with the *Guidelines for the Use of Flavourings* (CAC/GL 66-2008).

4.2 Antioxidants

INS No.	Additive	Maximum Use Level
304	Ascorbyl palmitate	500 mg/kg (Singly or in combination)
305	Ascorbyl stearate	
307a	Tocopherol, d- <i>alpha</i> -	300 mg/kg (Singly or in combination)
307b	Tocopherol concentrate, mixed	
307c	Tocopherol, dl- <i>alpha</i>	
310	Propyl gallate	100 mg/kg
319	Tertiary butyl hydroquinone (TBHQ)	120 mg/kg
320	Butylated hydroxyanisole (BHA)	175 mg/kg
321	Butylated hydroxytoluene (BHT)	75 mg/kg
Any combination of gallates, BHA, BHT, or TBHQ not to exceed 200 mg/kg within individual limits		
389	Dilauryl thiodipropionate	200 mg/kg

Antioxidant synergists

INS No.	Additive	Maximum Use Level
330	Citric acid	GMP
331(i)	Sodium dihydrogen citrate	GMP
331(iii)	Trisodium citrate	GMP
384	Isopropyl citrates	100 mg/kg (Singly or in combination)
472c	Citric and fatty acid esters of glycerol	

Anti-foaming agents (oils for deepfrying)

INS No.	Additive	Maximum Use Level
900a	Polydimethylsiloxane	10 mg/kg

5. Contaminants

The products covered by this Standard shall comply with the maximum levels of the *General Standard for Contaminants and Toxins in Food and Feed* (CODEX STAN 193-1995).

The products covered by this Standard shall comply with the maximum residue limits for pesticides established by the Codex Alimentarius Commission.

6. Hygiene

It is recommended that the products covered by the provisions of this Standard be prepared and handled in accordance with the appropriate sections of the *General Principles of Food Hygiene* (CAC/RCP 1-1969), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

The products should comply with any microbiological criteria established in accordance with the *Principles and Guidelines for the Establishment and Application of Microbiological Criteria related to Foods* (CAC/GL 21-1997).

7. Labelling

7.1 Name of the food

The product shall be labelled in accordance with the *General Standard for the Labelling of Prepackaged Foods* (CODEX STAN 1-1985). The name of the oil shall conform to the descriptions given in Section 2 of this Standard.

Where more than one name is given for a product in Section 2.1, the labelling of that product must include one of those names acceptable in the country of use.

7.2 Labelling of non-retail containers

Information on the above labelling requirements shall be given either on the container or in accompanying documents, except that the name of the food, lot identification and the name and address of the manufacturer or packer shall appear on the container.

However, lot identification and the name and address of the manufacturer or packer may be replaced by an identification mark, provided that such a mark is clearly identifiable with the accompanying documents.

8. Methods of Analysis and Sampling

8.1 Determination of GLC ranges of fatty acid composition

According to ISO 5508: 1990 and 5509: 2000; or AOCS Ce 2-66 (97), Ce 1e-91 (01) or Ce 1f-96 (02).

8.2 Determination of slip point

According to ISO 6321: 2002 for all oils; AOCS Cc 3b-92 (02) for all oils except for palm oils; AOCS Cc 3-25 (97) for palm oils only.

Table 1: Fatty acid composition of vegetable oils as determined by gas liquid chromatography from authentic samples ¹ (expressed as percentage of total fatty acids) (see Section 3.1 of the Standard)

Fatty acid	Arachis oil	Babassu oil	Coconut oil	Cotton-seed oil	Grape-seed oil	Maize oil	Mustard-seed oil	Palm oil	Palm kernel oil	Palm olein ²	Palm kernel olein ²	Palm kernel stearin ²
C6:0	ND	ND	ND-0.7	ND	ND	ND	ND	ND	ND-0.8	ND	ND-0.7	ND-0.2
C8:0	ND	2.6-7.3	4.6-10.0	ND	ND	ND	ND	ND	2.4-6.2	ND	2.9-6.3	1.3-3.0
C10:0	ND	1.2-7.6	5.0-8.0	ND	ND	ND	ND	ND	2.6-5.0	ND	2.7-4.5	2.4-3.3
C12:0	ND-0.1	40.0-55.0	45.1-53.2	ND-0.2	ND	ND-0.3	ND	ND-0.5	45.0-55.0	0.1-0.5	39.7-47.0	52.0-59.7
C14:0	ND-0.1	11.0-27.0	16.8-21.0	0.6-1.0	ND-0.3	ND-0.3	ND-1.0	0.5-2.0	14.0-18.0	0.5-1.5	11.5-15.5	20.0-25.0
C16:0	5.0-14.0	5.2-11.0	7.5-10.2	21.4-26.4	5.5-11.0	8.6-16.5	0.5-4.5	39.3-47.5	6.5-10.0	38.0-43.5	6.2-10.6	6.7-10.0
C16:1	ND-0.2	ND	ND	ND-1.2	ND-1.2	ND-0.5	ND-0.5	ND-0.6	ND-0.2	ND-0.6	ND-0.1	ND
C17:0	ND-0.1	ND	ND	ND-0.1	ND-0.2	ND-0.1	ND	ND-0.2	ND	ND-0.2	ND	ND
C17:1	ND-0.1	ND	ND	ND-0.1	ND-0.1	ND-0.1	ND	ND	ND	ND-0.1	ND	ND
C18:0	1.0-4.5	1.8-7.4	2.0-4.0	2.1-3.3	3.0-6.5	ND-3.3	0.5-2.0	3.5- 6.0	1.0-3.0	3.5-.5.0	1.7-3.0	1.0-3.0
C18:1	35.0-80	9.0-20.0	5.0-10.0	14.7-21.7	12.0-28.0	20.0-42.2	8.0-23.0	36.0-44.0	12.0-19.0	39.8-46.0	14.4-24.6	4.1-8.0
C18:2	4.0-43.0	1.4-6.6	1.0-2.5	46.7-58.2	58.0-78.0	34.0-65.6	10.0-24.0	9.0-12.0	1.0-3.5	10.0-13.5	2.4-4.3	0.5-1.5
C18:3	ND-0.5	ND	ND-0.2	ND-0.4	ND-1.0	ND-2.0	6.0-18.0	ND-0.5	ND-0.2	ND-0.6	ND-0.3	ND-0.1
C20:0	0.7-2.0	ND	ND-0.2	0.2-0.5	ND-1.0	0.3-1.0	ND-1.5	ND-1.0	ND-0.2	ND-0.6	ND-0.5	ND-0.5
C20:1	0.7-3.2	ND	ND-0.2	ND-0.1	ND-0.3	0.2-0.6	5.0-13.0	ND-0.4	ND-0.2	ND-0.4	ND-0.2	ND-0.1
C20:2	ND	ND	ND	ND-0.1	ND	ND-0.1	ND-1.0	ND	ND	ND	ND	ND
C22:0	1.5-4.5	ND	ND	ND-0.6	ND-0.5	ND-0.5	0.2-2.5	ND-0.2	ND-0.2	ND-0.2	ND	ND
C22:1	ND-0.6	ND	ND	ND-0.3	ND-0.3	ND-0.3	22.0-50.0	ND	ND	ND	ND	ND
C22:2	ND	ND	ND	ND-0.1	ND	ND	ND-1.0	ND	ND	ND	ND	ND
C24:0	0.5-2.5	ND	ND	ND-0.1	ND-0.4	ND-0.5	ND-0.5	ND	ND	ND	ND	ND
C24:1	ND-0.3	ND	ND	ND	ND	ND	0.5-2.5	ND	ND	ND	ND	ND

ND - non detectable, defined as $\leq 0.05\%$ ¹ Data taken from species as listed in Section 2.² Fractionated product from palm oil.

Table 1: Fatty acid composition of vegetable oils as determined by gas liquid chromatography from authentic samples³¹ (expressed as percentage of total fatty acids) (see Section 3.1 of the Standard) (continued)

Fatty acid	Palm stearin ²	Palm superolein ²	Rapeseed oil	Rapeseed oil (low erucic acid)	Rice bran oil	Safflower seed oil	Safflowerseed oil (high oleic acid)	Sesameseed oil	Soyabean oil	Sunflower seed oil	Sunflower seed oil (high oleic acid)	Sunflower seed oil (mid- oleic acid)
C6:0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C8:0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C10:0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C12:0	0.1-0.5	0.1-0.5	ND	ND	ND-0.2	ND	ND-0.2	ND	ND-0.1	ND-0.1	ND	ND
C14:0	1.0-2.0	0.5-1.5	ND-0.2	ND-0.2	ND-1.0	ND-0.2	ND-0.2	ND-0.1	ND-0.2	ND-0.2	ND-0.1	ND-1
C16:0	48.0-74.0	30.0-39.0	1.5-6.0	2.5-7.0	14-23	5.3-8.0	3.6-6.0	7.9-12.0	8.0-13.5	5.0-7.6	2.6-5.0	4.0-5.5
C16:1	ND-0.2	ND-0.5	ND-3.0	ND-0.6	ND-0.5	ND-0.2	ND-0.2	ND- 0.2	ND-0.2	ND-0.3	ND-0.1	ND-0.05
C17:0	ND-0.2	ND-0.1	ND-0.1	ND-0.3	ND	ND-0.1	ND-0.1	ND-0.2	ND-0.1	ND-0.2	ND-0.1	ND-0.05
C17:1	ND-0.1	ND	ND-0.1	ND-0.3	ND	ND-0.1	ND-0.1	ND-0.1	ND-0.1	ND-0.1	ND-0.1	ND-0.06
C18:0	3.9-6.0	2.8-4.5	0.5-3.1	0.8-3.0	0.9-4.0	1.9-2.9	1.5-2.4	4.5-6.7	2.0-5.4	2.7-6.5	2.9-6.2	2.1-5.0
C18:1	15.5-36.0	43.0-49.5	8.0-60.0	51.0-70.0	38-48	8.4-21.3	70.0-83.7	34.4-45.5	17-30	14.0-39.4	75-90.7	43.1-71.8
C18:2	3.0-10.0	10.5-15.0	11.0-23.0	15.0-30.0	21-42	67.8-83.2	9.0-19.9	36.9-47.9	48.0 -59.0	48.3-74.0	2.1-17	18.7-45.3
C18:3	ND-0.5	0.2-1.0	5.0-13.0	5.0-14.0	0.1-2.9	ND-0.1	ND-1.2	0.2-1.0	4.5-11.0	ND-0.3	ND-0.3	ND-0.5
C20:0	ND-1.0	ND-0.4	ND-3.0	0.2-1.2	ND-0.9	0.2- 0.4	0.3-0.6	0.3-0.7	0.1-0.6	0.1-0.5	0.2-0.5	0.2-0.4
C20:1	ND-0.4	ND-0.2	3.0-15.0	0.1-4.3	ND-0.8	0.1- 0.3	0.1-0.5	ND-0.3	ND-0.5	ND-0.3	0.1-0.5	0.2-0.3
C20:2	ND	ND	ND-1.0	ND-0.1	ND	ND	ND	ND	ND-0.1	ND	ND	ND
C22:0	ND-0.2	ND-0.2	ND-2.0	ND-0.6	ND-1.0	ND-1.0	ND-0.4	NN-1.1	ND-0.7	0.3-1.5	0.5-1.6	0.6-1.1
C22:1	ND	ND	> 2.0-60.0	ND-2.0	ND	ND-1.8	ND-0.3	ND	ND-0.3	ND-0.3	ND-0.3	ND
C22:2	ND	ND	ND-2.0	ND-0.1	ND	ND	ND	ND	ND	ND-0.3	ND	ND-0.09
C24: 0	ND	ND	ND-2.0	ND-0.3	ND-0.9	ND-0.2	ND-0.3	ND-0.3	ND-0.5	ND-0.5	ND-0.5	0.3-0.4
C24:1	ND	ND	ND-3.0	ND-0.4	ND	ND-0.2	ND-0.3	ND	ND	ND	ND	ND

ND - non detectable, defined as $\leq 0.05\%$ ¹ Data taken from species as listed in Section 2.² Fractionated product from palm oil.

Appendix

Other Quality and Composition Factors

These quality and composition factors are supplementary information to the essential composition and quality factors of the standard. A product, which meets the essential quality and composition factors but does not meet these supplementary factors, may still conform to the standard.

1. Quality Characteristics

The **colour, odour and taste** of each product shall be characteristic of the designated product. It shall be free from foreign and rancid odour and taste.

	<u>Maximum level</u>
Matter volatile at 105°C	0.2 % m/m
Insoluble impurities	0.05 % m/m
Soap content	0.005 % m/m
Iron (Fe):	
Refined oils	1.5 mg/kg
Virgin oils	5.0 mg/kg
Crude palm kernel olein	5.0 mg/kg
Crude palm kernel stearin	7.0 mg/kg
Copper (Cu)	
Refined oils	0.1 mg/kg
Virgin oils	0.4 mg/kg
Acid value	
Refined oils	0.6 mg KOH/g Oil
Cold pressed and virgin oils	4.0 mg KOH/g Oil
Virgin palm oils	10.0 mg KOH/g Oil
Peroxide value:	
Refined oils	up to 10 milliequivalents of active oxygen/kg oil
Cold pressed and virgin oils	up to 15 milliequivalents of active oxygen/kg oil

2. Composition Characteristics

The **arachidic and higher fatty acid content** of arachis oil should not exceed 48g/kg.

The **Reichert values** for coconut, palm kernel and babassu oils should be in the ranges 6-8.5, 4-7 and 4.5-6.5, respectively.

The **Polenske values** for coconut, palm kernel and babassu oils should be in the ranges 13-18, 8-12 and 8-10, respectively.

The **Halphen test** for cottonseed oil should be positive.

The **erythrodiol content** of grapeseed oil should be more than 2% of the total sterols.

The **total carotenoids** (as beta-carotene) for unbleached palm oil, unbleached palm olein and unbleached palm stearin should be in the range 500-2000, 550-2500 and 300-1500 mg/kg, respectively.

The **Crismer value** for low erucic acid rapeseed oil should be in the range 67-70.

The **concentration of brassicasterol** in low erucic acid rapeseed oil should be greater than 5% of total sterols. The **Baudouin test** should be positive for sesameseed oil.

The **gamma oryzanols** in crude rice bran oil should be in the range of 0.9-2.1 %.

For the fatty acid range of crude rice bran oil not intended for direct human consumption the ranges as given for rice bran oil in Table 1 apply.

Chemical and Physical Characteristics

Chemical and Physical Characteristics are given in Table 2.

3. Identity Characteristics

Levels of desmethylsterols in vegetable oils as a percentage of total sterols are given in Table 3.

Levels of tocopherols and tocotrienols in vegetable oils are given in Table 4.

4. Methods of Analysis and Sampling Determination

of moisture and volatile matter at 105°C

According to ISO 662: 1998.

Determination of insoluble impurities

According to ISO 663: 2000.

Determination of soap content

According to BS 684 Section 2.5; or AOCS Cc 17-95 (97).

Determination of copper and iron

According to ISO 8294: 1994; or AOAC 990.05; or AOCS Ca 18b-91 (03)

Determination of relative density

According to IUPAC 2.101, with the appropriate conversion factor.

Determination of apparent density

According to ISO 6883: 2000, with the appropriate conversion factor; or AOCS Cc 10c-95 (02)

Determination of refractive index

According to ISO 6320: 2000; or AOCS Cc 7-25

(02) Determination of saponification value (SV)

According to ISO 3657: 2002; or AOCS Cd 3-25

(03) Determination of iodine value (IV)

Wijs - ISO 3961: 1996; or AOAC 993.20; or AOCS Cd 1d-1992 (97); or NMKL 39(2003)

The method to be used for specific named vegetable oils is stipulated in the Standard

Determination of unsaponifiable matter

According to ISO 3596: 2000; or ISO 18609: 2000; or AOCS Ca 6b-53 (01)

Determination of peroxide value (PV)

According to AOCS Cd 8b-90 (03); or ISO 3960: 2001

Determination of total carotenoids

According to BS 684 Section 2.20.

Determination of acidity

According to ISO 660: 1996, amended 2003; or AOCS Cd 3d-63 (03)

Determination of sterol content

According to ISO 12228: 1999; or AOCS Ch 6-91 (97)

Determination of tocopherol content

According to ISO 9936: 1997; or AOCS Ce 8-89 (97)

Halphen test

According to AOCS Cb 1-25 (97).

Crismer value

According to AOCS Cb 4-35 (97) and AOCS Ca 5a-40 (97).

Baudouin test (modified Villavecchia test or sesameseed oil test)

According to AOCS Cb 2-40 (97).

Reichert value and Polenske value

According to AOCS Cd 5-40 (97)

Determination of gamma oryzanol content

Definition

This method is used to determine gamma oryzanol content (%) in oils from spectrophotometer absorption measurements at the wavelength of maximum absorption near 315nm.

Scope

Applicable to crude rice bran oil.

Apparatus

- Spectrophotometer - for measuring extinction in the ultraviolet between 310 and 320 nm.
- Rectangular quartz cuvettes - having an optical light path of 1 cm.

- Volumetric flask - 25mL.
- Filter paper - Whatman no.2, or

equivalent. Reagents

- n-Heptane - Spectrophotometrically pure.

Procedure

- Before using, the spectrophotometer should be properly adjusted to a zero reading filling both the sample cuvette and the reference cuvette with n-Heptane.
- Filter the oil sample through filter paper at ambient temperature.
- Weigh accurately approximately 0.02g of the sample so prepared into a 25mL volumetric flask, make up to the mark with n-Heptane.
- Fill a cuvette with the solution obtained and measure the extinction at the wavelength of maximum absorption near 315nm, using the same solvent as a reference.
- The extinction values recorded must lie within the range 0.3-0.6. If not, the measurements must be repeated using more concentrated or more diluted solutions as appropriate.

Calculation

Calculate gamma oryzanol content as follows:

$$\text{Gamma oryzanol content, \%} = 25 \times (1 / W) \times A \times (1 / E) \text{ Where } W = \text{mass of sample, g}$$

$A = \text{extinction (absorbance) of the solution}$
 $E = \text{specific extinction}$
 $E^{1\%}_{1\text{cm}} = 359$

Table 2: Chemical and physical characteristics of crude vegetable oils (see Appendix of the Standard)

	Arachis oil	Babassu oil	Coconut oil	Cotton seed oil	Grape-seed oil	Maize oil	Mustard-seed oil	Palm oil	Palm kernel oil	Palm kernel olein ²	Palm kernel stearin ²
Relative density (x°C/water at 20°C)	0.909-0.920 x=20°C	0.914-0.917 x=25°C	0.908-0.921 x=40°C	0.918-0.926 x=20°C	0.920-0.926 x=20°C	0.917-0.925 x=20°C	0.910-0.921 x=20°C	0.891-0.899 x=50°C	0.899-0.914 x=40°C	0.906-0.909 x=40°C	0.902-0.908 x=40°C
Apparent density (g/ml)								0.889-0.895 (50°C)		0.904-0.907	0.904-0.906
Refractive index (ND 40°C)	1.460-1.465	1.448-1.451	1.448-1.450	1.458-1.466	1.467-1.477	1.465-1.468	1.461-1.469	1.454-1.456 at 50°C	1.448-1.452	1.451-1.453	1.449-1.451
Saponification value (mg KOH/g oil)	187-196	245-256	248-265	189-198	188-194	187-195	168-184	190-209	230-254	231-244	244-255
Iodine value	77-107	10-18	6.3-10.6	100-123	128-150	103-135	92-125	50.0-55.0	14.1-21.0	20-28	4-8.5
Unsaponifiable matter (g/kg)	□ 10	□ 12	□ 15	□ 15	□ 20	□ 28	□ 15	□ 12	□ 10	<15	<15
Stable carbon isotope ratio *						-13.71 to -16.36					

* See the following publications:

Woodbury SP, Evershed RP and Rossell JB (1998). Purity assessments of major vegetable oils based on gamma 13C values of individual fatty acids. *JAACS*, 75 (3), 371-379.

Woodbury SP, Evershed RP and Rossell JB (1998). Gamma 13C analysis of vegetable oil, fatty acid components, determined by gas chromatography- combustion-isotope ratio mass spectrometry, after saponification or regiospecific hydrolysis. *Journal of Chromatography A*, 805, 249-257.

Woodbury SP, Evershed RP, Rossell JB, Griffith R and Farnell P (1995). Detection of vegetable oil adulteration using gas chromatography combustion / isotope ratio mass spectrometry. *Analytical Chemistry* 67 (15), 2685-2690.

Ministry of Agriculture, Fisheries and Food (1996). Authenticity of single seed vegetable oils. Working Party on Food Authenticity, MAFF, UK.

² Fractionated product from palm oil.

Table 2: Chemical and physical characteristics of crude vegetable oils (see Appendix of the Standard) (continued)

	Palm olein²	Palm stearin²	Palm supero- lein²	Rape- seed oil	Rape-seed oil (low erucic acid)	Rice bran oil	Safflower- seed oil	Safflower- seed oil (high oleic acid)	Sesame- seed oil	Soya- bean oil	Sunflo- wer-seed oil	Sunflower -seed oil (high oleic acid)	Sunflower -seed oil (mid-oleic acid)
Relative density (x° C/water at 20°C)	0.899- 0.920 x=40°C	0.881- 0.891 x=60°C	0.900- 0.925 x=40°C	0.910- 0.920 x=20°C	0.914-0.920 x=20°C	0.910– 0.929	0.922- 0.927 x=20°C	0.913-0.919 x=20°C; 0.910-0.916 x=25°C	0.915- 0.924 x=20°C	0.919- 0.925 x=20°C	0.918- 0.923 x=20°C	0.909- 0.915 x=25°C	0.914- 0.916 x=20°C
Apparent density (g/ml)	0.896- 0.898 at 40°C	0.881- 0.885 at 60°C	0.897- 0.920					0.912-0.914 at 20°C					
Refractive index (ND 40°C)	1.458- 1.460	1.447- 1.452 at 60°C	1.463- 1.465	1.465- 1.469	1.465-1.467	1.460 – 1.473	1.467- 1.470	1.460-1.464 at 40°C; 1.466-1.470 at 25°C	1.465- 1.469	1.466- 1.470	1.461- 1.468	1.467- 1.471 at 25°C	1.461- 1.471 at 25°C
Saponification value (mg KOH/g oil)	194-202	193-205	180-205	168-181	182-193	180 – 199	186-198	186-194	186-195	189-195	188-194	182-194	190-191
Iodine value	□ 56	□ 48	□ 60	94-120	105-126	90-115	136-148	80-100	104-120	124-139	118-141	78-90	94-122
Unsaponifiable matter (g/kg)	□ 13	□ 9	□ 13	□ 20	□ 20	≤ 65	□ 15	□ 10	□ 20	□ 15	□ 15	□ 15	≤15

² Fractionated product from palm oil.

Table 3: Levels of desmethylsterols in crude vegetable oils from authentic samples¹ as a percentage of total sterols (see Appendix 1 of the Standard)

	Arachis oil	Babassu oil	Coconut oil	Cotton-seed oil	Grapeseed oil	Maize oil	Palm oil	Palm olein ²	Palm kernel oil	Palm kernel olein ²	Palm kernel stearin ²
Cholesterol	ND-3.8	1.2-1.7	ND-3.0	0.7-2.3	ND-0.5	0.2-0.6	2.6-6.7	2.6-7.0	0.6-3.7	1.5-1.9	1.4-1.7
Brassicasterol	ND-0.2	ND-0.3	ND-0.3	0.1- 0.3	ND-0.2	ND-0.2	ND	ND	ND-0.8	ND-0.2	ND-2.2
Campesterol	12.0-19.8	17.7-18.7	6.0-11.2	6.4-14.5	7.5-14.0	16.0-24.1	18.7-27.5	12.5-39.0	8.4-12.7	7.9-9.1	8.2-9.7
Stigmasterol	5.4-13.2	8.7-9.2	11.4-15.6	2.1-6.8	7.5-12.0	4.3-8.0	8.5-13.9	7.0-18.9	12.0-16.6	13.4-14.7	14.1-15.0
Beta-sitosterol	47.4-69.0	48.2-53.9	32.6-50.7	76.0-87.1	64.0-70.0	54.8-66.6	50.2-62.1	45.0-71.0	62.6-73.1	67.1-69.2	67.0-70.0
Delta-5-avenasterol	5.0-18.8	16.9-20.4	20.0-40.7	1.8-7.3	1.0-3.5	1.5-8.2	ND-2.8	ND-3.0	1.4-9.0	3.3-4.6	3.3-4.1
Delta-7-stigmasterol	ND-5.1	ND	ND-3.0	ND-1.4	0.5-3.5	0.2-4.2	0.2-2.4	ND-3.0	ND-2.1	ND-0.6	ND-0.3
Delta-7-avenasterol	ND-5.5	0.4-1.0	ND-3.0	0.8-3.3	0.5-1.5	0.3-2.7	ND-5.1	ND-6.0	ND-1.4	ND-0.5	ND-0.3
Others	ND-1.4	ND	ND-3.6	ND-1.5	ND-5.1	ND-2.4	ND	ND-10.4	ND-2.7	2.9-3.7	1.0-3.0
Total sterols (mg/kg)	900-2900	500-800	400-1200	2700-6400	2000-7000	7000-22100	300-700	270-800	700-1400	816-1339	775-1086

	Palm stearin ²	Palm superolein ²	Rapeseed oil (low erucic acid)	Rice bran oil	Safflower-seed oil	Safflower- seed oil (high oleic acid)	Sesame-seed oil	Soyabean oil	Sunflower-seed oil	Sunflower-seed oil (high oleic acid)	Sunflower-seed oil (mid-oleic acid)
Cholesterol	2.5-5.0	2.0-3.5	ND-1.3	ND - 0.5	ND- 0.7	ND-0.5	0.1-0.5	0.2-1.4	ND-0.7	ND-0.5	0.1-0.2
Brassicasterol	ND	ND	5.0-13.0	ND-0.3	ND-0.4	ND-2.2	0.1-0.2	ND-0.3	ND-0.2	ND-0.3	ND-0.1
Campesterol	15.0-26.0	22.0-26.0	24.7-38.6	11.0 – 35.0	9.2-13.3	8.9-19.9	10.1-20.0	15.8-24.2	6.5-13.0	5.0-13.0	9.1-9.6
Stigmasterol	9.0-15.0	18.2-20.0	0.2-1.0	6.0 – 40.0	4.5-9.6	2.9-8.9	3.4-12.0	14.9-19.1	6.0-13.0	4.5-13.0	9.0-9.3
Beta-sitosterol	50.0-60.0	55.0-70.0	45.1-57.9	25.0 – 67.0	40.2-50.6	40.1-66.9	57.7-61.9	47.0-60	50-70	42.0-70	56-58
Delta-5-avenasterol	ND-3.0	0-1.0	2.5-6.6	ND – 9.9	0.8-4.8	0.2-8.9	6.2-7.8	1.5-3.7	ND-6.9	1.5- 6.9	4.8-5.3
Delta-7-stigmasterol	ND-3.0	0-0.3	ND-1.3	ND – 14.1	13.7-24.6	3.4-16.4	0.5-7.6	1.4-5.2	6.5-24.0	6.5-24.0	7.7-7.9
Delta-7-avenasterol	ND-3.0	0-0.3	ND-0.8	ND – 4.4	2.2-6.3	ND-8.3	1.2-5.6	1.0-4.6	3.0-7.5	ND-9.0	4.3-4.4
Others	ND-5.0	0-2.0	ND-4.2	7.5-12.8	0.5-6.4	4.4-11.9	0.7-9.2	ND-1.8	ND-5.3	3.5-9.5	5.4-5.8
Total sterols (mg/kg)	250-500	100	4500-11300	10500-31000	2100-4600	2000-4100	4500-19000	1800-4500	2400-5000	1700-5200	

ND - Non-detectable, defined as $\leq 0.05\%$

¹ Data taken from species as listed in Section 2.

² Fractionated product from palm oil

Table 4: Levels of tocopherols and tocotrienols in crude vegetable oils from authentic samples ¹ (mg/kg) (see Appendix 1 of the Standard)

	Arachis oil	Babassu oil	Coconut oil	Cotton-seed oil	Grape-seed oil	Maize oil	Palm oil	Palm olein ²	Palm kernel oil	Palm kernel olein ²	Palm kernel stearin ²
Alpha-tocopherol	49-373	ND	ND-17	136-674	16-38	23-573	4-193	30-280	ND-44	ND-11	ND-10
Beta-tocopherol	ND-41	ND	ND-11	ND-29	ND-89	ND-356	ND-234	ND-250	ND-248	ND-6	ND-2
Gamma-tocopherol	88-389	ND	ND-14	138-746	ND-73	268-2468	ND-526	ND-100	ND-257	ND-3	ND-1
Delta-tocopherol	ND-22	ND	ND	ND-21	ND-4	23-75	ND-123	ND-100	ND	ND-4	ND
Alpha-tocotrienol	ND	25-46	ND-44	ND	18-107	ND-239	4-336	50-500	ND	ND-70	ND-73
Gamma-tocotrienol	ND	32-80	ND-1	ND	115-205	ND-450	14-710	20-700	ND-60	1-10	ND-8
Delta-tocotrienol	ND	9-10	ND	ND	ND-3.2	ND-20	ND-377	40-120	ND	ND-2	ND-1
Total (mg/kg)	170-1300	60-130	ND-50	380-1200	240-410	330-3720	150-1500	300-1800	ND-260	ND-90	ND-89

	alm stearin ²	Palm superolein ²	Rapeseed oil (low erucic acid)	Rice bran oil	Safflower seed oil	Safflower- seed oil (high oleic acid)	Sesameseed oil	Soyabean oil	Sunflower -seed oil	Sunflower seed oil (high oleic acid)	Sunflower- seed oil (mid-oleic acid)
Alpha-tocopherol	ND-100	130-240	100-386	49-583	234-660	234-660	ND-3.3	9-352	403-935	400-1090	488-668
Beta-tocopherol	ND-50	ND-40	ND-140	ND – 47	ND-17	ND-13	ND	ND-36	ND-45	10-35	19-52
Gamma-tocopherol	ND-50	ND-40	189-753	ND – 212	ND-12	ND-44	521-983	89-2307	ND-34	3-30	2.3-19.0
Delta-tocopherol	ND-50	ND-30	ND-22	ND-31	ND	ND-6	4-21	154-932	ND-7.0	ND-17	ND-1.6
Alpha-tocotrienol	20-150	170-300	ND	ND – 627	ND	ND	ND	ND-69	ND	ND	ND
Gamma-tocotrienol	10-500	230-420	ND	142 – 790	ND-12	ND-10	ND-20	ND-103	ND	ND	ND
Delta-tocotrienol	5-150	60-120	ND	ND – 59	ND	ND	ND	ND	ND	ND	ND
Total (mg/kg)	100-700	400-1400	430-2680	191 - 2349	240-670	250-700	330-1010	600-3370	440-1520	450-1120	509-741

ND - Non-detectable.

Note: Maize oil also contains ND-52 mg/kg beta tocotrienol.

¹ Data taken from species as listed in Section 2. ² Fractionated product from palm oil.

Appendix C: Amortization table

CACPE Biblian (Cooperative Financial Institution)							
Capital:				\$ 78,741.83			
Interest:				11.23%			
Payments in five years:				60 (Monthly)			
Type of Amortization:				French			
Insurance:				0.000670 %.			
Amortization Table							
#	Date	# of days	Subscription capital	Interest	Insurance:	Monthly fee	Capital
1	05/02/2019	31	984.18	761.45	52.76	1,798.39	77,756.82
2	05/03/2019	28	993.39	679.16	52.10	1,724.65	76,763.43
3	05/04/2019	31	1,002.69	742.32	51.43	1,796.44	75,760.74
4	05/05/2019	30	1,012.07	708.99	50.76	1,771.83	74,748.67
5	05/06/2019	31	1,021.54	722.84	50.08	1,794.46	73,727.12
6	05/07/2019	30	1,031.10	689.96	49.40	1,770.46	72,696.02
7	05/08/2019	31	1,040.75	702.99	48.71	1,792.45	71,655.27
8	05/09/2019	31	1,050.49	692.93	48.01	1,791.43	70,604.78
9	05/10/2019	30	1,060.32	660.74	47.31	1,768.37	69,544.46
10	05/11/2019	31	1,070.25	672.51	46.59	1,789.35	68,474.21
11	05/12/2019	30	1,080.26	640.80	45.88	1,766.94	67,393.95
12	05/01/2020	31	1,090.37	651.72	45.15	1,787.24	66,303.58
13	05/02/2020	31	1,100.57	641.17	44.42	1,786.17	65,203.00
14	05/03/2020	29	1,110.87	589.85	43.69	1,744.41	64,092.13
15	05/04/2020	31	1,121.27	619.79	42.94	1,784.00	62,970.86
16	05/05/2020	30	1,131.76	589.30	42.19	1,763.26	61,839.09
17	05/06/2020	31	1,142.35	598.00	41.43	1,781.79	60,696.74
18	05/07/2020	30	1,153.05	568.02	40.67	1,761.73	59,543.69
19	05/08/2020	31	1,163.84	575.80	39.89	1,779.53	58,379.86
20	05/09/2020	31	1,174.73	564.55	39.11	1,778.39	57,205.13
21	05/10/2020	30	1,185.72	535.34	38.33	1,759.39	56,019.41
22	05/11/2020	31	1,196.82	541.72	37.53	1,776.07	54,822.59
23	05/12/2020	30	1,208.02	513.05	36.73	1,757.80	53,614.57
24	05/01/2021	31	1,219.32	518.47	35.92	1,773.71	52,395.25
25	05/02/2021	31	1,230.73	506.68	35.10	1,772.52	51,164.52
26	05/03/2021	28	1,242.25	446.89	34.28	1,723.43	49,922.27
27	05/04/2021	31	1,253.88	482.76	33.45	1,770.09	48,668.39
28	05/05/2021	30	1,265.61	455.46	32.61	1,753.67	47,402.78
29	05/06/2021	31	1,277.45	458.40	31.76	1,767.61	46,125.32
30	05/07/2021	30	1,289.41	431.66	30.90	1,751.97	44,835.91
31	05/08/2021	31	1,301.48	433.58	30.04	1,765.09	43,534.44
32	05/09/2021	31	1,313.66	420.99	29.17	1,763.81	42,220.78
33	05/10/2021	30	1,325.95	395.12	28.29	1,749.35	40,894.83
34	05/11/2021	31	1,338.36	395.46	27.40	1,761.22	39,556.47

35	05/12/2021	30	1,350.88	370.18	26.50	1,747.57	38,205.59
36	05/01/2022	31	1,363.53	369.46	25.60	1,758.58	36,842.07
37	05/02/2022	31	1,376.29	356.27	24.68	1,757.24	35,465.78
38	05/03/2022	28	1,389.17	309.77	23.76	1,722.70	34,076.62
39	05/04/2022	31	1,402.17	329.53	22.83	1,754.53	32,674.45
40	05/05/2022	30	1,415.29	305.78	21.89	1,742.96	31,259.16
41	05/06/2022	31	1,428.53	302.28	20.94	1,751.76	29,830.63
42	05/07/2022	30	1,441.90	279.16	19.99	1,741.05	28,388.73
43	05/08/2022	31	1,455.39	274.53	19.02	1,748.94	26,933.33
44	05/09/2022	31	1,469.01	260.45	18.05	1,747.51	25,464.32
45	05/10/2022	30	1,482.76	238.30	17.06	1,738.13	23,981.56
46	05/11/2022	31	1,496.64	231.91	16.07	1,744.61	22,484.92
47	05/12/2022	30	1,510.64	210.42	15.06	1,736.13	20,974.27
48	05/01/2023	31	1,524.78	202.83	14.05	1,741.66	19,449.49
49	05/02/2023	31	1,539.05	188.08	13.03	1,740.16	17,910.44
50	05/03/2023	28	1,553.45	156.44	12.00	1,721.89	16,356.99
51	05/04/2023	31	1,567.99	158.18	10.96	1,737.13	14,789.00
52	05/05/2023	30	1,582.67	138.40	9.91	1,730.97	13,206.33
53	05/06/2023	31	1,597.48	127.71	8.85	1,734.03	11,608.85
54	05/07/2023	30	1,612.43	108.64	7.78	1,728.84	9,996.43
55	05/08/2023	31	1,627.52	96.67	6.70	1,730.88	8,368.91
56	05/09/2023	31	1,642.75	80.93	5.61	1,729.28	6,726.17
57	05/10/2023	30	1,658.12	62.95	4.51	1,725.57	5,068.05
58	05/11/2023	31	1,673.64	49.01	3.40	1,726.04	3,394.41
59	05/12/2023	30	1,689.30	31.77	2.27	1,723.34	1,705.11
60	05/01/2024	31	1,705.11	16.49	1.14	1,722.74	0.00
Total sum:			\$78,741.00	\$24,864.63	\$1,755.69	\$10,5361.33	