NOVA IMS Information Management School

MGI

Mestrado em Gestão de Informação
Master Program in Information Management

Software design for an Awareness score of coffee products

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Dissertation presented as partial requirement for obtaining the Master's degree in Information Management

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A SOFTWARE APPLICATION TO CROSSCHECK COFFEE SECURITY

by

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Dissertation presented as partial requirement for obtaining the Master's degree in Information Management, with a specialization in Knowledge Management and Business Intelligence

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November 2021

DEDICATION

This work is dedicated to my parents, for always believing in me and never letting me to give up on my dreams.

ACKNOWLEDGEMENTS

First of all, I would like to thank my familiy. For being my rocks and re assurance in the most difficult times. For never letting me give up on my dreams and always pushing me to be better, and do better. Thank you for just being yourselfs and be there for me.

Thank you to my friends, for always encouraging me to continue and to not give up. For always taking me for a coffee, without complaining about my computer. For being my second family.

I would like to thank my advisors, Prof. Vítor Manuel Pereira Duarte dos Santos, Ph.D. and Prof. Ana Cristina Costa, Ph.D., for believing in my work, pushing me to do better and always having a re assuring word everytime we spoke. For their kindness, availability and suggestions to improve my work.

ABSTRACT

All over the world, the food industry faces several challenges, such as food security and life conditions of agricultural workforce. The population holds an increasing interest in agricultural products to achieve a healthy lifestyle but might be promoting unethical practices at the farming process.

Without knowing nothing but the country of origin of the product, the consumer is doing uninformed shopping. This study aims to develop a model, able to crosscheck the coffee products sold at the supermarket with their country of origin's classification regarding food security, environmental sustainability and sociopolitical ethics. Another major objective is to propose an application to generate the classification of each coffee product, allowing the consumer to make informed shopping.

The Awareness score is proposed to classify the coffee products in terms of its social and political responsibility during the products production. Underlying the proposed score, there is food security, environmental performance, migration integration policy, and child labour occurrence. The proposed prototype design allows developing a software for consumers to consult coffee products' scores during the buying process. A survey allowed to understand that consumers are not deeply concerned with the underlying problems of coffee production, however, an application would allow them to make more concious shopping.

KEYWORDS

Coffee; Agriculture; Food Security; Child Labour; Migrants; Coffee Quality; Norms and Standards; Coffee Security

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LIST OF ABBREVIATIONS AND ACRONYMS

AI	Artificial Intelligence
EPI	Environmental Performance Index
FAO	Food and Agriculture Organization of the United Nations
FK	Foreign Key
GDP	Gross Domestic Product
GNI	Gross National Income
GVA	Gross Value Added
HDI	Human Development Index
ICO	International Coffee Organization
ILO	International Labour Organization
IPPC	International Plant Protection Convention
MIPEX	Migrant Integration Policy Index
PK	Primary Key
SDG	Sustainable Development Goal of the United Nations
SQL	Structured Query Language
WTO	World Trade Organization

1. INTRODUCTION

Agriculture is an important asset to the humankind. The first evidence of farming appeared 23,000 years ago in the Mideast (American Friends of Tel Aviv University 2015), as a mean for population survival, however, with the evolving of the years and culture, agriculture started to produce products that act as a culture and population gathering methods. Agriculture today, gained other outlines with the adherence and increase of biological agriculture that several people follow as, not only a matter of health but also a matter of appearance and lifestyle. Also, in the 19th century, with the industrial revolution, machines were deployed as a substitution or reduction of the human labour. With the continuing developments in the industrial and technological field, machines started to be powered by Artificial Intelligence (Dharmaraj and Vijayanand 2018). Although several advancements were made in agriculture, work in coffee plantations continue to be very manual and needs a complete workforce so coffee can be harvested and exported in the correct time-period (Jimenez-Soto 2020).

Coffee is produced in countries considered in development, known for their poorer living conditions, poor access to health and security. A vast majority of the population, living in coffee producing countries, dedicate their lives to work in coffee plantations, however, this produces a problem since coffee is a seasonal product and there are times, when work does not exist and still, people need to make a living. Food security is a topic that plays a big importance in the society and, with a growing global population, food security is focused on expanding agricultural production (Sunderland, T., et al., 2013). However, solely emphasizing production is not sufficient to guarantee products security, neither population security. People working in coffee plantations, like coffee harvesters, processors and industry workers livelihoods seem to be suffering from seasonal food insecurity (Caswell, Méndez, and Bacon 2012).

Besides food security, production in developing countries poses questions such as child labour and the seasonality of migrant workers, that, finalized the work are fired. According to the International Labour Organization, in 2016, 152 million children were in child labour, of which, 73 million were in hazardous work. As expected, the highest regional prevalence of child labour is in Africa, followed by Asia and the Pacific and finally the Americas. Agriculture is the economic activity that employees most children, 70.9% and, 48% of children are aged between 5-11 years old.

In this thesis, we focus not only on food security as a topic regarding populations health and safety, but also on ethical and sustainability issues associated with the products exported to developed countries. Ethics involves not exposing children or hire seasonal workers to work on the crop during the necessary time and then let them go. Sustainability relates to the impact coffee plantations have on the environment and the concern people have with this topic.

1.1. RESEARCH QUESTIONS

According to the above discussion, the research goal is to answer:

- Is it possible to evaluate the security, ethical and sustainability context of coffee production?
- Is it possible to design a software to disclose security, ethical and sustainability indicators of coffee production to consumers?

1.2. STUDY OBJECTIVES

One of the main objectives of this study is to build a Country of origin score and a Coffee score (based on the bean composition of coffee products) that together will create an Awareness score, which globally ranks the security, ethics and sustainability of coffee products depending on the countries where coffee beans are being produced. Such global score aims to contribute to a better understanding of the level of food security, ethical and enviromental practices at the farming process of coffee products being sold at grocery stores. Another major goal is to design a software prototype to disclose the proposed scores to consumers.

To achieve the main goals, the following specific objectives are defined:

- Study the existent food security norms and the necessary topics in the literature review.
- Identify the relevant available data sources, meaning identify the relevant indexes regarding food security, ethics and sustainability of coffee products.
- Data collection of relevant indexes for a range of countries.
- Collection of sample data of coffee products being sold in Portugal, segmented by type of product, with enough observations to construct the proposed scores.
- Build a database to store the collected sample data.
- Compute the necessary scores.
- Characterize the products from the sample according to the developed scores.
- Design a software prototype to apply the developed scores to real examples.
- Conduct a survey to understand consumers opinion regarding this study and their perceived value of the software prototype.

1.3. STUDY RELEVANCE AND IMPORTANCE

Agriculture plays an important role in human life and, even though there is a lot of research involving this topic and its connection with food security and sustainability, there is no research simultaneously addressing all the problems stated above. For this reason, it seems to exist an opportunity for investigation.

Currently, due to the Sustainable Development Goals (SDGs) of the United Nations (https://sdgs.un.org/goals), it is crucial to create information and knowledge on security, ethics and

sustainability of food products. This research may contribute to the SDG 12 *Ensure sustainable consumption and production patterns*, namely to the following targets:

- 12.6 *Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle*;

- 12.8 *By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature*.

Furthermore, this study is expected to generate awareness about the commercialized coffee products, and that the consumers have an increasing concern about the practices utilized in farming. Creating awareness will, hopefully help in reducing the number of children in farming, working under conditions that no one should be exposed to and create the right conditions for migrants working in agriculture. Farmers employing migrants need to comply with certain housing requirements. However, most of the conditions provided to the workers are deficient, becoming then a health hazard (Culp, K., & Umbarger, M., 2004).

This investigation could be useful for the society, consumers, and agricultural workers as it might generate initiatives to reduce the existing problems in many countries and bring knowledge regarding the coffee products commercialized in Portugal where consumers can be able to differentiate between products coming from certain countries contributing to the phenomenon's referred above.

2. LITERATURE REVIEW

In this chapter the main concepts to be used along the study will be addressed. The literature review chapter is divided into three main topics: agricultural context, agricultural socioeconomics and food security in coffee regions.

2.1. AGRICULTURAL CONTEXT

2.1.1. The industry

For centuries, agriculture has proven to be unquestionably necessary for people to survive. Nowadays, the sector represents much more than just a mean for survival as it produces significant amounts of fibers, for clothing industry, fuel, for energy production, agricultural biomass used to produce industrial chemicals and feed for livestock (Alston and Pardey 2014). Through the years, the structure of agriculture has been socially, politically, and culturally constructed through settlement patterns, subsidization, and regulations. (Lockie and Vanclay 1997) And if through the years the social structure of agriculture has evolved, so has the farming community. There is a perceived diversity between farmers: pro-chemicals and anti-chemicals, innovators, and old methods adopters, rich and poor.

As world countries develop, population share working in agriculture is declining. Currently, only 26,50% of world's population is employed in agriculture, compared with 1991, where 43,68% of the population was working in agriculture. This also affects the share agriculture takes in the global economy, which is declining (Alston and Pardey 2014).

With the years, the international market has become increasingly competitive and globalized, not only in the food sector, but as well in sectors like clothing, automotive or industry. The trade liberalization has allowed for food products to travel more than they used to.

Due to technology development, agriculture is moving towards a more sustainable path. Also, due to consumers demands towards high quality and safe products, the sector is adapting to the information age, using technology for agriculture production and to hear customer's needs. Several approaches are taken to provide the certain amount of information to the segmented and targeted consumers. This will allow to improve their agriculture production by using feedback from customers (Verbeke 2005). Also, the trade liberalization and the growing market share of large retailers is allowing for food products to travel much more than they used to (Central 2001).

Agriculture industry is one of the most powerful when it comes to raise incomes among the poorest population and analysis show that 65 percent of the poor working adults made a living through agriculture (The World Bank 2020).

From being the first big industry to appear, until today, without agriculture the humankind would not survive. It plays an important role in the civilization survival and produces several products that play a role in social interaction, like coffee, that is going to be studied in this thesis.

2.1.1.1. Primary products

Primary products are natural raw materials that are extracted from the land or ocean and do not go through a manufacturing process. The industries producing this type of goods include agriculture, fishing, forestry, or mining. Usually, many primary products are exported for processing to the developed nations because developing countries are rich in resources but lack in capital and education, meaning they can gain revenue through the exports. There is a standard model of development that emerging economies take their initial steps to prosperity by exporting primary products. Primary products include water, oil, fruit, wood, vegetables, cattle.

2.1.1.2. Secondary products

Secondary products have been manufactured or treated from the primary agricultural goods. It has the potential to increase the value of primary agriculture (Yadav et al. 2020) and includes "all practices and process which add value to primary agricultural commodities by using efficient technologies, market information and consumer preference" (Chengappa 2013). Examples of secondary products include bread making, steel manufacture and wood to build furniture.

2.1.2. Agriculture in portugal

Agriculture is part of Portuguese DNA, thinking that most traditions and culture come from agriculture and the primary sector processes. Even though that is true, the sector has been going through a lot of changes and difficulties in the last century. Currently, it is reinventing itself and creating new production techniques as well as new products, being awarded (Portugal; http://www.portugalin.gov.pt/agriculture-and-agri-food-sector/), as one of the most innovative in Portuguese economy. It is, however, important to analyze the difficulties the sector has been going through.

In late 1870s, about two thirds of the Portuguese Labour force was employed in the agricultural sector (Lains and Pinilla 2008). However, the low living standards, the low instruction, and the lack of materials to work with, made Portuguese workers productivity very low when compared to western European countries. From that moment onwards, Portuguese population working in agriculture started to decrease significantly. In 1989, there were 1.560.990 individuals working in the sector, while, in 2016, only 604.511 people worked in agriculture (Pordata 2018). Since 1986, the year Portugal adhered to the European Union, Portuguese agricultural sector receives public support. This support aims to increase the sector competitiveness and market orientation.

Besides the support received from the European Union, Portugal has been severely marked by agriculture abandonment which causes recognizable changes on landscape composition and configuration. This trend is occurring in many Mediterranean landscapes because population chooses accessible and productive locations to live, close to the sea (Azevedo et al. 2011). Rural

abandonment imposes two main challenges for Portugal: food safety and environmental safety. There is the need to understand how to produce enough food to assure food safety without depending immensely on agricultural imports and promote rural areas sustainability. It is important to understand that agriculture and forestry have a fundamental role in preserving environment and landscapes in Portugal.

However, this trend made Portugal highly dependent on agro-forestry imports, accounting for 1.39% of total exports and 4.26% of total imports. In 2007, food industry accounted for 3.132 million euros, representing 2.4% of total GVA in Portugal (Ventura-Lucas et al. 2011).

Portugal's most important crops are grapevine and olive tree (Instituto Nacional de Recursos Biologicos 2008). However, there are other crops important for the country, like apples and pears, almonds, and cereals. Grapevine has an important role because it can be used for direct consumption or for wine making, which is an important sector in the country. Olive tree has several varieties and is produced in the center and south of the country. Its importance accounts for 9% of the agricultural area. Almonds are a very important production in the dry fruits sector, accounting for 40% of the production.

Concerning coffee, Portugal population is an avid consumer, however, coffee production is only encountered in São Jorge island, Azores (Jornal I, 2015; https://ionline.sapo.pt/artigo/409423/a-nica-plantacao-de-cafe-na-europa-fica-em-portugal-e-atrai-gente-de-longe?seccao=Portugal_i). This production is only used for the for sale in the family commercial store, meaning that the remaining country (continent and islands) still needs to import the coffee that is consumed. According to the International Coffee Organization (ICO), Portugal is among the European Union importing countries and, the imports of this product are accounted along with the other countries of the Union. It is expected that, for 2020/21, the Union imports 76 322kg of coffee, in 60-kg bags, which represents a -4,7% change comparing with 2018/19 (ICO 2020). Interestingly, as a former colony, Portugal was the country implementing coffee in Brazil in 1727. During XVIII, other colonies implemented the coffee plant in countries like Angola, Mozambique, that today, are big coffee producers (Associação Industrial e Comercial do Café; http://aicc.pt/origem/).

2.1.3. Coffee agriculture

2.1.3.1. Coffee culture

Coffee is a global commodity that has been evolving over half a Millennium. After petroleum production, coffee has a big importance to developing countries' economies.

Coffee has a big role in the western society and can take several meanings across communities. Drinking coffee can represent productivity improvement, social interaction with friends and a way to relax. Coffee shops turned out as a global phenomenon due to consumers increasing appreciation of high-quality coffee and the search for places to study and socialize while drinking an energizing drink (Tucker 2017). Also, this culture has become rooted in our everyday lives, as we first in the morning drink a coffee to welcome the day and get more energy, drink another coffee with colleagues at work and meet up some friends later in the day for a coffee and chat (Jolliffe 2010).

Coffee is a big center piece of the world's culture whether for social interaction and relaxation, whether for tourism. Besides coffee-based beverages, coffee beans are also very used to produced other type of products such as coffee essence, coffee syrup or coffee caramel (Ismail, Sapari, and Abdul Wahab 2014).

Although coffee has a big role in western society, in the east, the culture is not so ingrained. Therefore, it is perceived that there is a fast emerging market in the east and several potential strategies to operate in this regions and explore this culture in other markets (Ferreira and Ferreira 2018). The increasing incomes and the globalization, allowing all the individuals to connect with the Western lifestyles, make these individuals highly interested in purchasing choices as indications of both aspirations and status. This type of consumers has created a high interest in imported brands and trends, presenting opportunities for internationalization of coffee businesses and culture.

2.1.3.2. Coffee production

Coffee production system can take different approaches: Forest coffee, semi-forest coffee, semi-forest plantation coffee, plantation coffee or home-garden coffee (Teketay 1999).

Forest coffee production can have a role in biodiversity preservation and is mainly produced by small-holders, who harvest coffee from undomesticated coffee shrubs in more or less managed forests (Aerts et al. 2011). In semi-forest production, farmers do not plant the coffee plants but, instead, transplant semi-wild coffee plants that regenerate spontaneously inside the forest to fill open spaces. In coffee plantation, the most common form of coffee production and the one that brings the most value added to the production chain, is usually done is large commercial operations and the final bean is used for export.

In the last years, climate change is a growing concern on coffee production. Coffee plantations have a lifespan of about thirty-years (Bunn et al. 2015), meaning, the current climatic situation will begin to show its effects on the product.

Although climate change can start to affect coffee production, there are still coffee production chain behind the coffee consumed in the world, that needs to be explained. The first step is planting the seed for the coffee plant to grow and generate new beans. Then, the workers need to harvest and pick the cherries, leading into a sorting and selection process to evaluate the cherries and separate the good ones from the ones who present any kind of problem. After this process, the cherries move into the pulping process, meaning that the coffee beans will be extracted from inside the coffee cherry and the red skin and fruit pulp will be removed. There are different types of coffee processing methods to separate the coffee cherry from the bean:

- Wet process – The coffee cherries are placed in substantial quantities of water and are sorted by immersion. Bad fruit will float, and good fruit will sink. The cherry skin is removed by pressing the fruit by machine in water through a screen.

- Dry process – The oldest process. The cherries are first sorted and cleaned to separate the good from the damaged. Then, the cherries are placed in the sun to dry on tables or in thin layers on patios.
- Semi-dry process – In this process the cherries skin is first removed mechanically. After this process, the beans are still coated with mucilage[1], being then stored for a day. After this day, the mucilage is washed out and the beans are placed to dry out in the sun.

The different processes described above include both the "Pulping the cherries", "Fermenting" and "Drying" steps presented in Figure 1. After these processes, the beans need to be stored before exportation for the consuming countries.

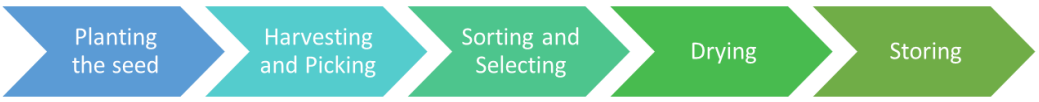

Figure 1 Coffee production chain

1 A gelatinous substance of various plants that contains protein and polysaccharides and is like plant gums.

2.1.3.3. Coffee types

Around the world there are four main types of coffee beans produced, however, some play a more significant role in production and market than the others. Having species more produced than the remaining has to do with the conditions at which they are produced, mainly altitude and temperature. However, to get truly familiarized with all the existing types of coffee beans and, to know what distinguishes one from the other there are also some other classification factors such as the berries' size, density, and crushing strength that need to be evaluated (Ismail, Sapari, and Abdul Wahab 2014). Color, aroma, and textures of coffee also play an important role in classification (Arboleda 2019).

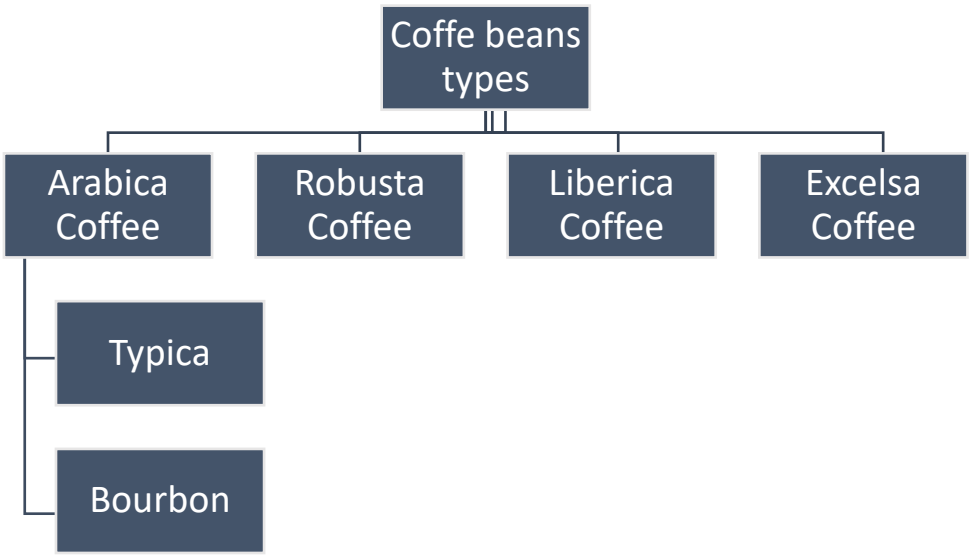

Figure 2 Coffee Bean Types Explained

2.1.3.4. Arabica

Arabica coffee was originated in Ethiopia, where it was discovered in the 6th century. Then, it started to be spread around the world, mainly to the Islamic world (Smith 1985), however, Ethiopia is known as the center of diversity for this type of coffee.

Currently arabica coffee is produced all around the world, from Africa to South and Central America and Asia and is known for being a more vulnerable coffee been. This type of coffee is cultivated at higher altitudes (900 to 2000m high) and has an aromatic/fruity taste, being more popular among consumers. Its acidity varies according to the production altitude. Besides the altitude, temperature also influences Arabica coffee production. This coffee needs to be produced between 15 and 24 degrees Celsius, preferably at highlands or volcanic slopes, areas that receive steady rainfall and have a plentiful amount of shade.

It also has a lower caffeine content when compared with Robusta (0,8 to 1,5%). Arabica presents two different varieties: typica and bourbon.

All the factors mentioned above define the quality of the coffee consumed by the end user, however, areas of Arabica coffee production are shrinking due to climatic change. According to a recent study on the climate change impact on Arabica yield in southeast Brazil, projections indicate that there will be a reduction of about 20 to 60% of the areas currently suitable for coffee cultivation. Also, it is predicted that at the end of the century, coffee cultivation will only be suitable at elevated mountain areas, posing difficulties to the farming management (da Silva Tavares et al. 2018).

Figure 3 Arabica Bean

2.1.3.5. Robusta

Coffee canephora, mostly known as robusta coffee, varies from Arabica, as the bean is smaller and has a harsher, strong, and persistent taste, meaning it is less aromatic. However, this type of coffee is generally easier to grow (more resistant) and adapts better to hot, humid regions. It is cultivated in flat lands, from 400 to 900m high, with temperatures varying from 24 to 30 degrees Celsius. Robusta presents a high caffeine content, ranging from 1,7 to 3,5%.

Recent study suggests that robusta coffee is way more sensitive to temperature than previously thought. It is demonstrated that this type of bean as an optimal temperature below 20.5 degrees Celsius, or a minimum/maximum of ≤ 16.2/24.1 degrees Celsius. This means that, if this coffee as an optimal temperature range over 22 degrees Celsius, it is likely to be decreasing the ability of supplying robusta to the market, as temperatures tend to continue increasing under climate change (Kath et al. 2020).

Figure 4 Robusta Bean

2.1.3.6. Liberica

Liberica coffee is very rare. The bean grows in very specific climates, with the production being far too scarce to allow producers to scale their operations to satisfy a global market. Liberica is the most important coffee specie grown in Malaysia and presents the biggest bean size as well as mass and true density, when compared with robusta and arabica. Also, its colour differentiates as it was found to tend to orange and yellow (Ismail, Sapari, and Abdul Wahab 2014).

2.1.3.7. Excelsa

As Liberica coffee, Excelsa is also very rare and is produced in small scale and few countries. It is a low-land coffee produced in Indonesia and has characteristics like Liberica.

2.1.3.8. Coffee processing and distribution channels

Until coffee reaches the final consumer it goes through a whole set of transformations that make coffee what we know today. However, for coffee to reach those transformations, it needs to go through a distribution channel (Figure 5) that reach all the necessary intermediaries, and after that, the distribution channel is utilized to reach the final consumer.

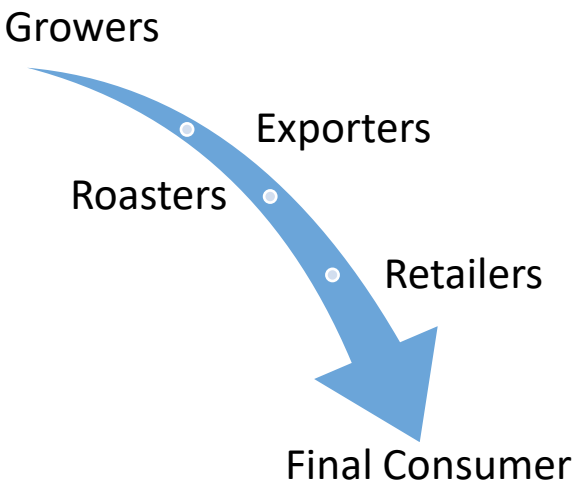

Figure 5 Coffee Distribution Channels

In the roasting companies, the beans besides being roasted, they need to be packaged. The beans go through a treadmill until the packaging machines. There are several types of used packaging that can influence the quality of the coffee. Let us take as an example the types of packaging used in Delta, a Portuguese roasting company:

- Package the coffee with total absence of air. This is the best packaging conservation method, as normally, the packaging has exhaust gas valve, allowing good protection against external influences.
- Reduce the oxygen content inside the package and replace the oxygen with an inert gas. In general, oxygen percentages below 0,5% are sufficient to stabilize the product's intrinsic qualities for 18 months.

In the market, we can find other widely used packaging methods, such as cans, much used for vacuum packaging and glass containers, particularly used in instant coffee.

As an example, Delta also controls all the packaging, making sure it complies with all the necessary characteristics of the coffee (corps, flavor, aroma) and is ready to be sold at the market. The net weight of the coffee is controlled, as well as the packaging integrity and the residual oxygen inside the package.

After processed and packaged coffee is ready to be distributed. In the majority of the times, coffee roasting companies are the ones distributing coffee to the retailers. Roasting companies have the right knowledge and expertise to deliver coffee in the best conditions and quality as possible.

2.1.3.9. Coffee quality and hygiene

According to the International Organization for Standardization (ISO, 2000), there is a definition for quality, "The extent to which a group of intrinsic features (physical, sensorial, behavioural, temporal, ergonomic, functional, etc.) satisfies the requirements, where requirement means need or expectation which may be explicit, generally implicit or binding".

ICO implemented the Coffee Quality Improvement Programme (CQP) that defines the target standards that exporting members shall strive to achieve. Coffee presenting characteristics like the ones described below should not be exported:

- Arabica, more than 86 defects per 300g sample and for Robusta, more than 150 defects per 300g.
- For both Arabica and Robusta, moisture content below 8% or more than 12.5%, measured using the ISO 6673 method.

In Figure 6, we can observe what coffee beans with a good quality standard should look like and what the appearance should not be.

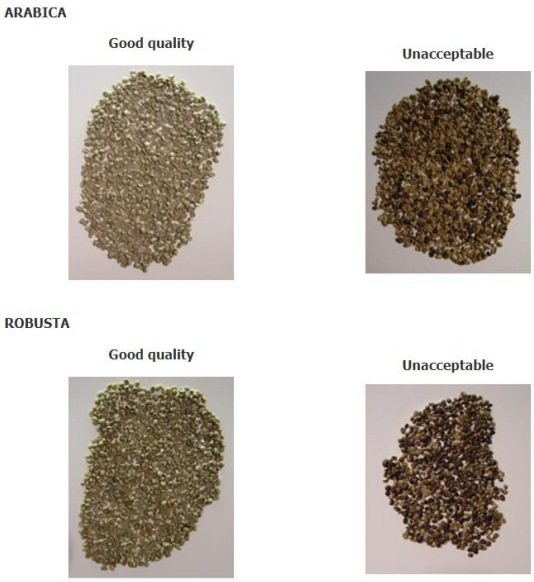

Figure 6 Source: ICO-International Coffee Organization

According to the producer's point of view, the consumer is receiving the products in conformity with their needs. However, from the point of view of the costumer, it is necessary to distinguish between various types of quality (Illy and Viani 2005):

1) Expected quality, meaning the customers expectation towards the product.

2) Promised quality, meaning that the customer gains awareness of the quality of the product when confronted. Also, the consumer can compare the quality of the product against the same product of another brand.

3) Effective quality is the effective measurable quality of the product.

4) Perceived quality is the sum of both the promised quality and the effective quality. It is considered to be the most important quality measure as it regulates consumer satisfaction.

5) Potential quality measures how the product can be further improved.

Coffee beans quality are influenced by an extensive list of characteristics and conditions. Not only the operations taken post-harvest (selection, drying, storing) but also the chemical composition of coffee is influenced by genetic, environmental, nutritional factors, crop management, harvesting and preparation. All these factors might be controlled by a good management of the process and the crop, configuring peoples minds to coffee quality and hygiene (Pimenta et al. 2018).

2.2. AGRICULTURAL SOCIOECONOMICS

2.2.1. Economic classification of countries

Developed countries are characterized by a mature economy, advanced technological infrastructure, and high level of services. Population have access to a quality health care system and a higher level of education. The HDI in developed countries is much higher when compared to developing regions. This index quantifies the data between 0 and 1 and, most developed countries have HDI figures above 0.8. According to 2019 Human Development Index (HDI) ranking from the United Nations, Norway was the country with the highest HDI index (0.954) after evaluating variables like life expectancy at birth, expected years of schooling, mean years of schooling and Gross National Income (GNI) per capita.

Developing countries are considered to have a lower GDP than developed countries, which translated into a less mature economy, population have a lower average income per resident and access to health care and education is very limited. The HDI of this type of countries is low, when compared to more developed countries. HDI aggregates indexes of life expectancy, education, and per capita income used to rank countries according to human development.

Usually, developing countries present the following characteristics: majority of the population work in the agricultural sector and jobs in the cities are usually rare and under paid; poor access to drinking water, sanitation and hygiene and high levels of people with infectious diseases; high levels of pollution and lack of infrastructures; a government which is not capable of providing basic necessity care to the poorer.

2.2.2. Migrants/Seasonal workers

Agriculture production is becoming more dynamic and changed from small-scale farming to an industrialized complex, which has changed consumer patterns and behaviors. The ease and speed with that products flow from production to supermarkets are very buyer-driven, making supermarkets a dominant marker leader, able to set quality standards (Gertel et al. 2014). The current competitive agricultural sector, brings increased competitiveness, introduces new forms of flexibility, precariousness, and social insecurity (Mésini 2010). For producers to compete in this market and reduce its production costs, it is necessary to resort to all form's recruitment, being them legal or illegal.

Migrants are a big part of the agricultural workforce, coming from all over the world, to the developed countries, looking for better life conditions. Migrants in the United States come from several countries like Mexico, Guatemala, Haiti and from Southeast Asia (Culp and Umbarger 2004). In Europe, people from Eastern European countries go to the Northern countries. Besides, coming from all over the world, they all carry a common problem. Farmers are looking for cheap and obedient Labour, making these workers subject to low-wages and poor Labour conditions (Rye and Andrzejewska 2010).

There is already evidence that unauthorized immigrants are more likely to be selected to low-skill and low-wage agricultural jobs, when compared to legal workers. This trend is consistent with the profit maximization and reduction of production costs by farm employers. Some legislation to protect migrants' workers and to legalize them already exist, however, illegal workers legalization is not likely to increase farmers profits (Taylor 1992).

These types of workers are likely to perform arduous tasks and are very exposed to health risks. Having a low social status, language and cultural barrier and poor access to health care contributes immensely to existing health problems in the population (Mobed et al. 1992). They face some specific health problems like infectious diseases and chemical-and pesticide-related illnesses, dental diseases, and mental health problems (Hansen and Donohoe 2003).

Focusing on coffee plantations, these types of workers are also usually present in the plantations. The workforce is cheap, and they need a work to provide for their livelihoods, meaning that they accept jobs that put in risk their health and lives.

2.2.3. Child labour

Child Labour continues to represent a huge problem in development countries, with higher poverty levels. It is the work that by its nature, harms, abuses, and exploits the child, deprives them from an education and a future livelihood (Edet and Etim 2013). The worst form of child Labour involves children being separated from their families, enslaved, and exposed to serious hazards and illnesses (International Labour Organization 2017).

In 2016, 152 million children were estimated to be in child Labour. Analyzing the numbers, agriculture is the economic activity employing 70.9% of the children (International Labour Organization 2017). Children carrying this type of work endangers their safety, health and can even put at risk their own lives. Children are exploited, performing dangerous works and are hardly payed. Important it is to mention that child Labour is not only restricted to developing countries but also to developed countries (Hurst 2007).

Agriculture is one of the most dangerous sectors in terms of work-related fatalities, non-fatal accidents, and occupational diseases (Edet and Etim 2013).

There are several factors influencing the entry of children into agriculture, beyond poverty, like lack of accessible, quality, and affordable education, cultural traditions, and HIV/AIDS. According to the literature and research taken, many coffee producing countries use child labour in agriculture and industry.

2.2.4. Norms, standards and conventions on food

As we live in an increasingly globalized world, food and agricultural products move at high speed through the food chain to reach the final consumer. Many actors are involved in what concerns the safety of the product, being them farmers, processors, retailers, consumers, and governments. Having that in mind, it became important to create internationally harmonized standards that control the product and protect the consumers (Alimentarius and Measures n.d.).

The norms created by the international regulatory institutions aim to ensure the quality and safety of the food, a fair market trade as well as facilitate it, maintain animal, and plant health and provide for the future natural resources. Currently, there are three main standards used by the global market (Alimentarius and Measures n.d.):

- The Codex Alimentarius.
- The International Plant Protection Convention for plants.
- The World Organisation for Animal Health for animals.

The Codex Alimentarius was established by FAO and World Health Organization (WHO) in 1963. Its goal is to promote fair practices in food trade as well as protect the consumer health. The standards, guidelines, and conventions, all put together ensure the products arriving at consumers houses is safe. Codex also aims to promote coordination of all the food standards work undertaken by international governmental and non-governmental organizations (FAO and WTO 2017).

Additionally, the International Plant Protection Convention (IPPC; https://www.ippc.int/), aims to protect the world's plants resources from the spread and introduction of pests and promoting safe trade.

Besides the norms, standards and conventions defined by the regulatory institutions, there are also social norms by which the society operates. Social norms have a powerful effect on food choice and the amount consumed. They are a code of conduct that provide a guide to appropriate consumption (Higgs 2015). People tend to follow social norms because it increases their ability to be part of a social group and be liked, meaning it increases the peer's social acceptance.

2.3. FOOD SECURITY IN COFFEE REGIONS

"Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. - 1996 World Food Summit"

According to (FAO, 2008) there are four dimensions of food security:

- Availability of physical food, meaning if there are sufficient stock levels and net trade and, if there is enough food production available.
- Economic and physical access to food, because according to household income, expenditure, markets, and prices, not everyone is able to accomplish food security objectives.
- Food utilization understands that, according to the way food is prepared, the diet variety and the access to food, every individual should have sufficient energy and a good nutritional status.
- Stability of the other three dimensions over time is perceived as having a good food intake daily, not harming your nutritional status.

Small-scale farmers, coffee harvesters, processors, and industry workers livelihoods depend on the crop and these coffee growing communities seem to be suffering from seasonal food insecurity. Areas where coffee is grown are prone to face food insecurity risk factors such as, environmental degradation, impacts like natural disasters and conflicts and seasonal changes in food production and prices (Caswell, Méndez, and Bacon 2012). Food insecurity denotes hunger however, it is necessary to distinguish between chronic food insecurity, which stands for long-term or persistent insecurity and transitory food insecurity, which is short-term and temporary (FAO 2008).

3. METHODOLOGY

The present methodology is an adaptation and extension of the methodology created by Miguel Freitas Cardoso in the Master dissertation "Desenvolvimento de *Scores* Sociopolíticos para a caracterização de artigos produzidos em diferentes países. Uma aplicação a artigos de vestuário vendidos em Portugal" (Cardoso, 2016). This work is an adaptation of this dissertation because the previous author proposed an application to clothing products, which we are adapting to coffee products. Also, the present study extends the existing methodology because additional indicators are used in this study (e.g., environmental performance, migration policy, and food security). Additionally, the final product of this dissertation, and its main contribution to the society is a software prototype demonstrating the developed methodology application to real cases.

This chapter explains the data collection procedure and characterizes the coffee products. The sociopolitical, environmental and food security indicators considered are also detailed. Figure 7 summarizes the methodological framework.

It is important to understand the differences between an index, and indicator and a score. An index is defined as a statistical measure that tracks the performance of something that is being studied. In statistics an indicator is a sign of the presence or absence of the concept being studied (Babbie 2020). In this dissertation, we are using open data from indexes created by other institutions, however, sometimes, those indexes need to be adapted to our necessities. When those transformations are done, we are calling to the proposed measure, an indicator. If no transformations are carried out, the index itself will be used for the calculation of our proposed score.

Section 3.1. describes the target population of the study, i.e. coffee products, as well as the coffee categories gathered for the analysis. All the categories are analyzed and described in detail to give a better perception of what the dissertation is covering. Among the wide range of variables presented in the products, not all of them are relevant for the final result, thus this section depicts the interest variables for the study.

Section 3.2. explains the methodology used to gather the data. The research methods that might be used to collect the necessary data are explained, as well as the difference between primary and secondary data. This section also details the list of coffee producing countries.

Section 3.3 will define in detail the survey questions and how it will be conducted to the consumers in order to get a better overview of the thesis value proposition and how individual perceptions are accounted nowadays.

Section 3.4 explains the three indexes and the indicator used to create the proposed scores, namely the Global food security index, the Environmental performance index, the Child labour indicator, and the Migrant Integration Policy index.

Finally, Section 3.5 details the construction of the scores that are proposed to compute the final Awareness score, which evaluates the security, ethics, and environmental sustainability performance of a coffee product. In Figure 7 the methodology process is shown.

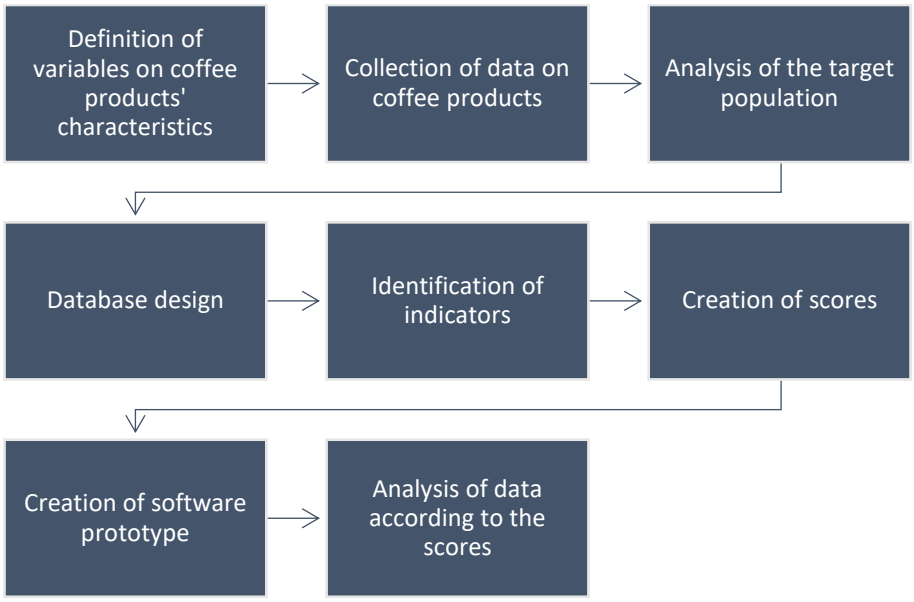

Figure 7 Methodology Process

3.1. TARGET POPULATION OF COFFEE PRODUCTS

The target population of this study are all the coffee products being sold in grocery stores previously identified and which belong to the categories: capsule, soluble (instant), bean, ground, and tablet coffee. The choice of these categories is related with the size of the study population. If we would limit the study to only capsule coffee or bean coffee, there would not be enough data for a good result. In several products we could observe that the same product was repeated, only changing the size of the packaging or the units inside. The repetition of the same product would not bring additional benefits to the study and, for that reason it was decided to go with only one unit of observation of each product, promoting the diversity between all the gathered data.

3.1.1. Coffee categories

Capsule

Capsule coffee is a single-serve coffee container, that prepares coffee for one single portion. The use of capsules can have several benefits like the elimination of measurement of portions, keep the product fresher because it is individually packaged and is not exposed to air and light before being used. It is commonly used in Nespresso and Dolce Gusto machines. The creation of capsule coffee became generalized and several brands create capsules that can be used by Nespresso and Dolce Gusto machines.

Soluble

Soluble or instant coffee is derived from brewed coffee beans. This type of coffee is available in powder or granulated form. Instant coffee is produced by adding hot water of milk to the solution and the intensity of the final beverage can be controlled by the amount of powder the consumer adds to the water or milk. The beverage is prepared very quickly.

Bean

Whole bean coffee is often considered to have a better quality then the other types of coffee categories. The coffee beans tend to come from better crops because it is harder to hide the negative qualities of the beans, whereas it is easier to hide the imperfections on grounded coffee, as an example. This type of product is usually more utilized in coffee shops, although there are consumers who prefer to use this product at home.

Ground

Ground coffee can present different types of brewing methods: Extra coarse, coarse, medium coarse, medium, medium fine, fine, and extra fine. The different types of brewing methods create different types of coffee. Ground coffee, when compared with whole beans lose its freshness faster because its surface is faster exposed to air.

Coffee tablets make coffee very easy to prepare as there are no need to special devices or right dosage. They appeal to consumers as it is easy to use and produce no mess, they are practical and efficient, they provide a precise and regular dosing and have no additives. Its preparation is also very easy. The consumer adds the tablet to a cup, pours hot water, stirs and the coffee is ready.

3.1.2. Study variables

Coffee Products present several attributes which distinguishes one from the other, like, the brand, the price, the size, the category (capsule, bean, soluble…), the type of coffee bean, the country of origin. Considering what is trying to be studied in this thesis, the variables of interest for this study are the country of origin, the bean type, the price, the size of the product, the brand, and the categories of coffee.

3.1.3. Country listing

Considering the dissertation goal of evaluating the security, ethics and sustainability performance of coffee producing countries, the focus of the study will only be on the coffee producing countries (Table 1). For this reason, it was considered the list of countries present in the International Coffee Organization (ICO) as coffee exporting countries. According to ICO, on 4 January 2021, there were 49 member countries. However, from these 49 member countries, 42 are considered as exporting member countries (Table 1), while 7 are considered importing member countries (Countries inside the European Union count as just one).

Country	Continent
Angola	Africa
Bolivia	South America
Brazil	South America
Burundi	Africa
Cameroon	Africa
Central African Republic	Africa
Colombia	South America
Costa Rica	Central America
Côte d'Ivoire	Africa
Cuba	North America
Democratic Republic of the Congo	Africa
Ecuador	South America
El Salvador	Central America
Ethiopia	Africa
Gabon	Africa
Ghana	Africa
Honduras	Central America
India	Asia
Indonesia	Asia
Kenya	Africa
Liberia	Africa
Madagascar	Africa
Malawi	Africa
Mexico	North America
Nepal	Asia
Nicaragua	Central America

Country	Continent
Panama	Central America
Papua New Guinea	Asia Pacific
Peru	South America
Philippines	Asia Pacific
Rwanda	Africa
Sierra Leone	Africa
Tanzania	Africa
Thailand	Asia
Timor-Leste	Africa
Togo	Africa
Uganda	Africa
Venezuela	South America
Vietnam	Asia
Yemen	Asia
Zambia	Africa
Zimbabwe	Africa

Table 1 List of coffee exporting countries (Source: International Coffee Organization (ICO))

Even though for this dissertation we are mainly focusing on the coffee exporting countries, it was felt important to also describe the importing members of ICO (Table 2).

Country	Continent
Austria	Europe
Belgium	Europe
Bulgaria	Europe
Croatia	Europe
Cyprus	Europe
Czech Republic	Europe
Denmark	Europe
Estonia	Europe
Finland	Europe
France	Europe
Germany	Europe
Greece	Europe

Country	Continent
Hungary	Europe
Ireland	Europe
Italy	Europe
Latvia	Europe
Lithuania	Europe
Luxembourg	Europe
Malta	Europe
Netherlands	Europe
Norway	Europe
Poland	Europe
Portugal	Europe
Romania	Europe
Slovakia	Europe
Slovenia	Europe
Spain	Europe
Sweden	Europe
Switzerland	Europe
United Kingdom	Europe
Russian Federation	Europe/Asia
Japan	Asia
Tunisia	Africa

Table 2 List of coffee importing countries (Source: International Coffee Organization (ICO))

3.2. DATA COLLECTION OF COFFEE PRODUCTS

Primary data are collected for the specific research problem at hand, using procedures that best fit the research problem. When primary data is made available by the researcher and is added to the existing body of social knowledge so that it can be used for further research, it is then called secondary data (Hox and Boeije 2004). There are several ways to gather primary information and this information gathering can go from solicited to spontaneous data (Hox and Boeije 2004):

- Experiments (solicited data), the research as full control over who can participate in the experiment. The independent variable(s) is/are manipulated and the effects the independent variable has on the dependent variable are studied.

- Social surveys are carried out when the researchers are interested in gathering data on the observations, attitudes, feelings, experiences, or opinions of the defined target population to be interviewed. It can be on the form of interview surveys, mail surveys, structured diaries, or web surveys.

- Qualitative research can be used as a type of interview that is flexible and sensitive to the social context. The interviewees are guided by the researcher's need for information. Qualitative research can be an open interview, a focus group, an unstructured diary, or a participant observation (Spontaneous).

In this work, the collected observations will be analyzed as primary data.

As a starting point, supermarkets in Portugal were selected to capture the largest number and diversity of coffee products, from different brands, that vary from store to store. Having in consideration the data that was intended to be collected for the creation of the data model, a first definition of the variables for its creation was done. Considering the type of food product being studied, it was decided to collect information on brand, type of product, product name, coffee state, type of coffee, type of coffee bean, country of origin and price.

Considering that the data gathering process was done mainly online, and some products information was collected in person, it was decided to start by coffee category. First, a category was chosen and all the brands having products inside the category were evaluated. The same process was considered for the other coffee categories. To have population diversity, the gathered products presented slightly differences between themselves (e.g., country of origin). If two products did not present significant differences, they were not considered in the gathering process (e.g., same product, same brand, different sizes).

Having the above into consideration, the following exclusion criteria were considered:

- Products that did not presented information on the main variables of interest.
- Products from the same brand, presenting the exact same characteristics, only differing on size and price (in these cases, the first product gathered is the one considered and the next ones are not considered).

Below, Figure 8 illustrates the data collecting process, both for the online gathering method, as well as for the products gathered in person. Even though most of the products were gathered in the supermarket websites, the tabs on the website pretend to recreate the supermarket aisles. With the following method, data on 166 different products was gathered.

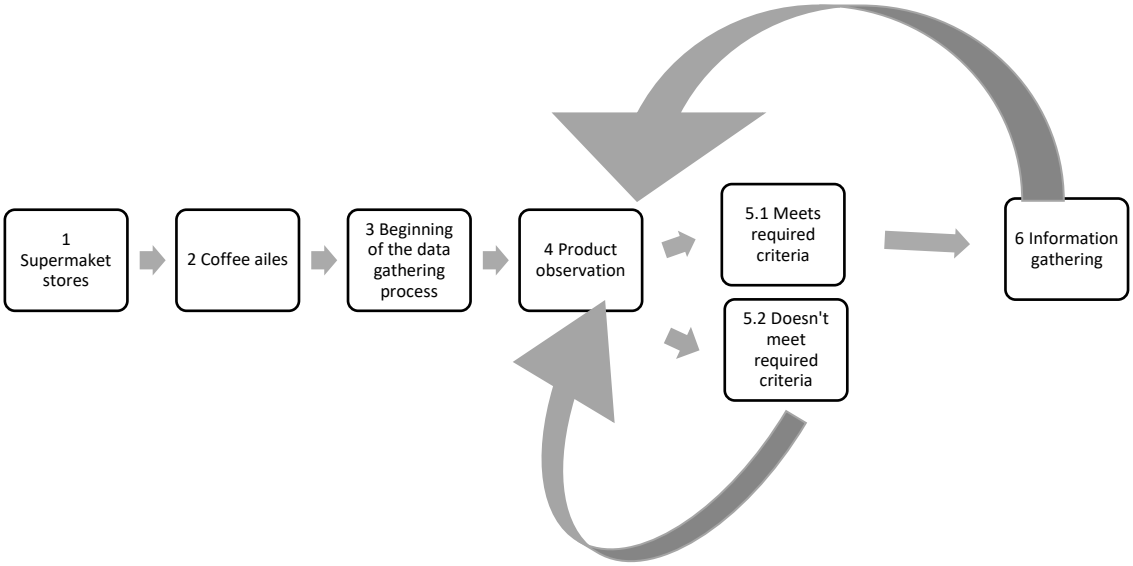

Figura 8 Data Gathering Process

3.3. CONSUMERS SURVEY

A survey was conducted to understand consumers opinion regarding the study conducted and the value of the scores for a specific product. The following questionnaire was made available to the portuguese population via internet, allowing for an easier way to reach coffee consumers. The questionnaire was built in Google Forms, and requested to be filled through social media and email. The main goal is to access the population who consumes coffee, their age, sex, what types of coffee they consume and if the security with which coffee is produced is a variable that they take into account upon the buying process. Also, the last question aims to understand if the software application is made available if it would help consumers evaluating what they are buying and make them more aware in their shopping decisions.

The questionnaire can be seen below:

1. What is your age?
2. What is your sex (Male/ Female/ Other)
3. Are you a regular coffee consumer? (Yes/ No)

4. How often do you consume the following coffee products?

Product	1- Daily	2- Weekly	3- Occasionally	4- Never
4A- Capsules				
4B- Soluble				
4C- Bean				
4D- Ground				
4E- Tablet				

5. If you answered daily, how many times a day do you consume coffee (1, 2, 3, …, 6 or more; NA- Not applicable)?

Product	1	2	3	4	5	6 or more	NA
5A- Capsules							
5B- Soluble							
5C- Bean							
5D- Ground							
5E- Tablet							

6. When at the supermarket/store (physical or online), how long on average does it take to choose your coffee?

Product	Time (minutes)	NA
6A- Capsules		
6B- Soluble		
6C- Bean		
6D- Ground		
6E- Tablet		

7. Do you know the difference between Arabica beans and Robusta beans? (Yes/No)

8. Do you consider the type of coffee bean when purchasing each of the following products?

Product	Yes	No	NA
8A- Capsules			
8B- Soluble			
8C- Bean			
8D- Ground			
8E- Tablet			

In the following questions, consider the coffee product that you consume most frequently (capsules, soluble, beans, ground or in tablets).

9. When you buy the product, what is your degree of concern regarding the **country of origin of the coffee beans**… (1- No concern; …; 10- Much concern)

Indicator	1	2	3	4	5	6	7	8	9	10
9A) In terms of food security?										
9B) In terms of Environmental ethics?										
9C) In terms of social ethics (e.g., existence of child labour)?										
9D) In terms of political ethics (e.g., no policies to integrate migrants)?										

10. When you buy the product, what is your degree of concern regarding the **country of origin of the product**… (1- No concern; …; 10- Very concerned)

Indicador	1	2	3	4	5	6	7	8	9	10
10A) In terms of food security?										
10B) In terms of environmental ethics?										
10C) In terms of social ethics (e.g., existence of child labour)?										
10D) In terms of political ethics (e.g., no policies to integrate migrants)?										

Suppose an App is made available free of charge that allows you to obtain product scores in terms of food safety and environmental, social and political ethics, as well as a global summary indicator.

11. When buying coffee, how likely would you use the App to compare the offer available at the supermarket/store (physical or online)? (1- No probability; …; 10- Very likely)

12. Would the score provided by the app for a certain product influence your product choice? (1- No probability; …; 10- Very likely)

13. Would the app influence your perception on how coffee is produced? (1- No probability; …; 10- Very likely)

3.4. INDEXES

The scores developed in the study are based on the literature review (sections 2.2. and 2.3.) where it is presented the socio-political, environmental and food security indexes that led to their construction. As this study also aims to evaluate the conditions under which coffee is produced in each country of origin, the first score that needs to be considered is the Country of Origin Score. For its construction, the following indexes were considered:

- Global food security index.
- Environmental performance index.
- Migrant integration policy index.
- Child labour index.

All these indexes will be fully explained in the next sections.

3.4.1. Global food security index

The Global food security index (The Economist Group; https://foodsecurityindex.eiu.com) accounts for three core issues, namely affordability, availability, quality and safety, and it examines comprehensively food security across 113 countries. Constructed from 34 indicators, the index measures the drivers of food security across developing and developed countries. Moreover, the index comprises a risk adjustment factor, natural resources, and resilience, that evaluates the impact of the changing climate on a country, its susceptibility to natural resources risk and how the country is adapting to these risks. Those 34 indicators characterize three major charachteristics:

- **Affordability**. When safe and nutritious food is not made available at a price affordable to all, the well-being of some people is threatened. Although this problem has been improving throughout the years, it is not guaranteed that it is always like this. There are factors that influence food prices to rise, such as, an increase in oil price, meaning that food distribution costs will be higher, resulting in increased food costs.

- **Availability**. Food availability is defined as sufficient quantities of food of appropriate quality, supplied through domestic production or imports, including food aid (FAO, 2011: http://www.fao.org/fileadmin/user_upload/suistainability/Presentations/Availability.pdf)
  Food availability highly depends on the conditions at which food is produced, meaning that it depends on healthy cultivates and natural land systems (Caiafa and Wrabel 2019).

- **Quality and Safety**. According to FAO, food safety refers to all those hazards, whether chronic or acute, that may make food injurious to the health of the consumer. Food hazards can come from pesticide residues, chemical contaminations, including biological toxins or adulteration. Food safety includes all the attributes that influence the product value to the

consumer. These attributes can be either negative, such as discoloration or off-odours, or positive, such as colour, flavour, texture, and processing method of food.

The countries are scored in a normalized scale of 0-100, where 100 corresponds to most favourable, for all the indicators. Affordability comprises 10 different questions, availability 16 different questions and quality and safety 14 different questions, each scoring from 0-100, where 100 is most favourable. Different weights are given to the questions to build the 34 indicators, meaning that if a question has a higher/lower weight, more/less importance should be given to that aspect in the overall assessment.

The category scores are calculated from the weighted mean of the underlying index scores. The overall score is a weighted mean of the categories scores. When applied, a Natural Resources & Resilience category score acts as an adjustment factor on countries' food security scores.

We will use the Global food security index without transformation, meaning that countries presenting high levels of food security are evaluated with a punctuation close or equal to 100, whereas countries with low food security levels are evaluated with a punctuation close or equal to 0 points.

3.4.2. Environmental performance index

The Environmental performance index (EPI; https://epi.yale.edu/) created by the Yale Center for Environmental Law & Policy, Yale University, Center for International Earth Science Information Network, Columbia University, ranks 180 countries according to environmental health and ecosystem vitality. It comprises 32 performance indexes, across 11 issue categories. EPI allows to set targets, spot problems, and identify the best policy practices. This is a powerful index to support countries in their effort to meet the targets of the SDGs of the United Nations and move the society towards a sustainable future. The EPI offers a scorecard that highlights leaders and laggards in environmental performance and provides practical guidance for countries that aspire to move toward a sustainable future.

The index evaluates the countries across 11 issue categories, which are divided into two main areas: Health, comprising air quality, sanitation and drinking water, heavy metals and waste management; and Ecosystem Vitality, which comprises categories such as biodiversity, ecosystem services, fisheries, climate change, pollution emissions, agriculture, and water resources.

The indicators are constructed on a 0–100 scale, from worst to best performance. For each country, the scores of indexes are weighted and aggregated into issue categories' indicators, then into policy objectives, and then, finally, into an EPI score.

In our Scores construction, we are going to use this index without further transformation. In this way, countries who present a good environmental performance are scored with a punctuation close or equal to 100, whereas countries with a bad environmental performance present a punctuation close or equal to 0.

3.4.3. Child labour indicator

According to the International Labour Organization (ILO) and as discussed in the literature review, child labour is perceived as the employment that limits or damages the physical, mental, moral, social or psychological development of children. The minimum age set to work is 15 years old, however, in some developing countries, due to their economic conditions, poverty and lack of educational resources the minimum age is lowered to 14 years old. All forms of hazardous work are prohibited to children below the age of 18 and, slavery, prostitution and trafficking are considered the worst forms of child labour.

The Child labour index (Verisk Maplecroft; https://www.maplecroft.com/risk-indices/child-labour-index), indicates the risk of business association with the employment of children by state and non-state actors in violation of international law. This index is built upon 32 indices accessing key elements of human rights and development environment, across 198 countries. The indices cover subjects such as labour rights, civil and political rights, human security, poverty, education and health.

This index evaluates countries according to the severity and frequency of violations, the adoption of laws and international treaties and their ability and will to enforce these laws through government agencies. Countries are evaluated in a scale of low to extreme risk. Extreme risk meaning that the country does not take any actions to implement and adopt laws that prevent child labour, whereas low risk means that the country enforces and take actions to prevent all forms of child labour.

The Child labour index is measured in four qualitative levels. Since the other indexes considered in this study have a quantitative scale, 0 to 100 points, it was necessary to apply a quantitative classification measure to this index. Trying to follow the same scale as the other indicators, it was given 0 points to the countries with Low Risk, 30 points to countries with medium risk, 70 points to countries with high risk and 100 points to countries with extreme risk of presenting child labour (Table 3).

Child labour index categories	Child labour indicator points
Low Risk	0 Points
Medium Risk	30 Points
High Risk	70 Points
Extreme Risk	100 Points

Table 3 Transformation of the Child labour index (source: Verisk Maplecroft) into the Child labour indicator

3.4.4. Migrant integration policy index

The MIPEX – Migrant integration policy index (Migration Integration Policy Index; https://www.mipex.eu/methodology) was first published in 2004 as the European Civic Citizenship and Inclusion Index, for EU-15 countries. Through the years, more editions have been launched, adding more international countries in every edition. Today, it covers 5 continents and 52 countries. This index measures countries policies to integrate migrants and covers 8 policy areas: labour market mobility, family reunification, education, political participation, permanent residence, access to nationality, anti-discrimination and health. The index scores the policies in a scale of 0 to 100, where 100 means that policies meet the highest standards for equal treatment. The overall country score is calculated averaging together the 8 policy areas (Table 4).

MIPEX Scale	
0	Critically unfavourable
1-20	Unfavourable
21-40	Slightly unfavourable
41-59	Halfway favourable
60-79	Sightly favourable
80-100	Favourable

Table 4 MIPEX index scale from 0 to 100 points

The proposed coffee scores are going to be constructed based on the Migrant Integration Policy Index. Countries are going to be measured on a scale of 0 to 100. If a country scores 0 points, it means that it is critically unfavorable to the integration of migrants, whereas, if it scores close or equal to 100, it means that the country is very favorable to the integration of migrants.

3.5. COFFEE PRODUCTS SCORES

This section describes how the three indexes and the Child labour indicator described in the previous section are used in the construction of the proposed scores. To be able to create the coffee products final score (i.e. the Awareness score), first it is necessary to create the Country of origin score and the Coffee score. The former will allow us to measure at which level of security, ethics, and envirnomental sustainability the coffee producing country is. Similarly, the latter will characterize the bean composition of the coffee product. These two scores together will generate the Awareness score that will characterize the coffee product being sold. The final score will be normalized on a scale from 0 to 100, not only for being presented to the "final consumer" taking part in the survey that will be carried out, but also on the software prototype.

3.5.1. Country of origin score

The Country of origin score aggregates in an additive way the three indexes and the one indicator. The data which creates the Country of origin score is the following:

- 2019 Global food security index
- 2020 Environmental performance index
- 2020 Migrant integration policy index
- Child labour indicator

These indicators are all measured on a scale from 0 to 100 points, 0 being the least favorable score and, 100 the most favorable score. The Country of origin score of each producing country is calculated by adding the points of those four indicators for each country of origin of the coffee product (Figure 9). Therefore, it can take values between 0 to 400 points. The highest the score, the better the classification of the product.

Figure 9 Construction of the Country of origin score

The scales of the original scores (zi) will be transformed to a scale from 0 to 100 points (Zi) for a better understanding. The following normalization formula was used:

Zi = 100*zi/400, where zi represents the Country of origin score in the scale 0 to 400, and Zi denotes this score in the scale 0 to 100.

Country of origin score normalization example:

Zi = 100*140/400

Zi = 35

Now, the values for all scores are between 0 and 100 points.

Finally, the Coutry of origin score of the coffee product is equal to the sum of the Coutry of origin scores of its producing countries (normalized to the 0 - 100 scale).

3.5.2. Coffee score

The Coffee score intends to classify the coffee products according to its bean composition, considering the proportion of its appearance in the product. The products might be composed by only one bean type or more than one, meaning that the percentage of each bean type needs to be considered. Moreover, the beans can come from more than one country, so the market share of the exporting country of the corresponding bean type also needs to be accounted for, similarly to the methodology proposed by Cardoso (2016).

The main goal is that, independently of the type of bean used to create the product, a classification according to global food security, environmental performance, child labour and migration policy of the countries is achieved for the beans composition (Figure 10). For each coffee producing country, a weighted sum of the Country of origin score (in the scale 0 to 100 points) is computed considering the countries' market share of each bean type (differs for each country). After assigning a pontuation to each bean type (Bean score), the Coffee score is the sum of these points weighted by the percentage of the composition of each bean type in the coffee product.

Score of bean type *i* = (1st Country of origin score)*(Market share of bean type *i* in the 1st country) + … + (*L*-th Country of origin score)*(Market share of bean type *i* in the *L*-th country),

where ***i***=1,…,k (*k* is the number of bean types of the coffee product), and *L* is the number of countries producing the product.

Figure 10 illustrates how Coffee Score is built.

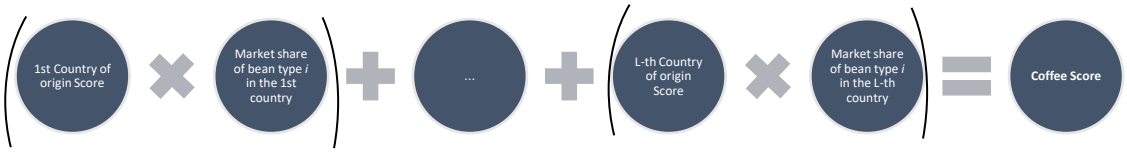

Figure 10 Construction of the Coffee score

3.5.3. Awareness score

The Awareness score corresponds to the sum of both Country of origin score and Coffee score. The Country of origin score can take values between 0 and 100 points, while the Coffee score can also take values between 0 and 100 points. This means that the Awareness score can take values between 0 and 200 points. The lower the Awareness score value, the biggest the evidence of the product composition and manufacturing come from a country with child labour manufacturing, poor environmental performance, poor food security, and low level of migrant's integration.

The scales of this score will be transformed to a scale from 0 to 100 points for a better understanding. The following normalization formula was used:

Wi = 100*wi/200, where wi represents the Awarenes score in the scale 0 to 200, and Wi denotes this score in the scale 0 to 100.

Now the values for the Awareness score are also normalized and can take values between 0 and 100 points.

3.5.4. Example of scores calculation

The sections above described how the scores were developed and how they should be calculated. In this section we exemplify how a score is calculated, using a product randomly chosen from the database. The characteristics of this product are shown in (Figure 11).

Figure 11 Chosen database product

Below, it is exemplified how the calculation for the Country of origin score and the calculation for the Coffee score are performed for this product. Then, the Awareness score is the sum of both the Country of origin score and the Coffee score.

3.5.4.1. Country of origin score

As stated above, a random product was chosen from the database. In this case, the product chosen presents as country of origin India and Brazil. The calculation for the India's Country of origin score is the following (Figure 12):

Figure 12 India's Country of origin score

The calculation for the Brazil's Country of origin score is the following (Figure 13):

Figure 13 Brazil's Country of origin score

Finally, the two scores for each country need to be added (Figure 14). Since the Country of origin score is normalized for each country on a scale of 0 – 100 points, the sum of the country of origin score can take a value in the scale of 0 – 200 points.

Figure 14 Country of origin score for product ID 135

3.5.4.2. Coffee score

The Coffee score takes into account the indexes and indicator already presented before (Global food security index, Environmental performance index, Child labour indicator and Migration integration policy index) through the Coutry of origin score. It also considers the market share of the country for each bean type used in the product being accessed, and the percentage of each bean type in the final product.

First, the composition of the product is accessed. In the case being considered, the product is composed by 20% Arabica bean type and 80% Robusta bean type. Then, it is considered the producing country of the beans, in our example, India and Brazil. Hence, the India's Country of origin score needs to be weighted according to the market share of Arabica, which was 2,00% on November 2021, according to the Coffee Board, Government of India, Ministry of Commerce & Industry (Figure 14). Similarly, the Brazil's Country of origin score needs to be weighted according to its market share regarding the Arabica bean, which was 10,2% in February 2021, according to https://www.comunicaffe.com/arabica-coffee-prices-rose-a-staggering-10-2-in-the-brazilian-market-in-february/ (Figure 15).

Figure 15 Arabica score calculation

Likewise, the Robusta score is the weighted sum of the Country of origin scores with their respective market shares regarding the Robusta bean (Figure 16).

Figure 16 Robusta score calculation

Then, those beans' scores are summed up and weighted according to the proportion of each bean type present in the product to obtain the Coffee score (Figure 17).

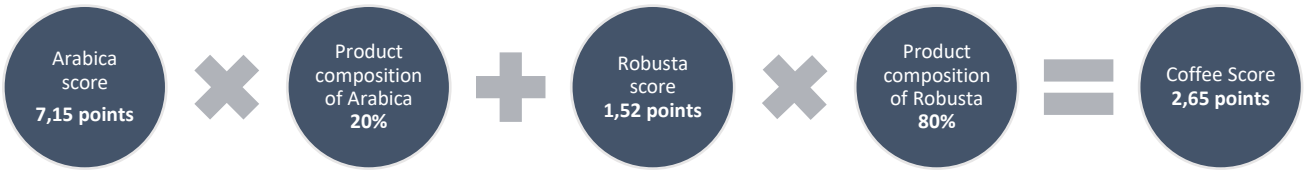

Figure 17 Coffee score calculation

3.5.4.3. Awareness score

The Awareness score corresponds to the sum of the Country of origin score with the Coffee score (Figure 18).

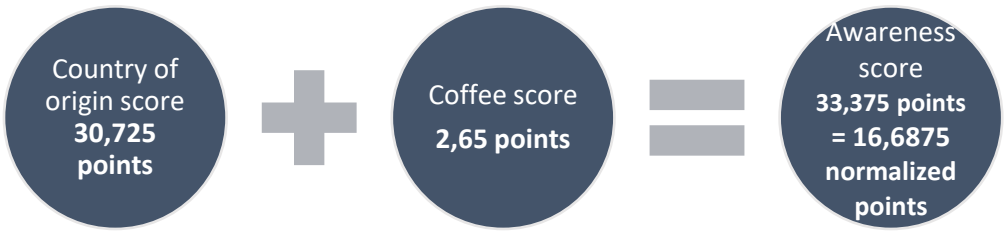

Figure 18 Awareness score calculation

4. RESULTS AND DISCUSSION

In this section, the results of the dissertation will be presented. A software design will be presented. This design, when implemented will allow to compute the necessary scores for each different gathered product and, with this, characterize the products according to each sample. In this case, then, the consumer would have access to the score for each product and evaluate with kind of coffee they would like to buy.

Also, in this section, it is presented a consumers survey, conducted to perceive the consumers opinions regarding the conducted work and the value the software would add to their dauily lifes. With this survey it was allowed to understand how consumers perceive coffee and the way it is produced. It also allowed to undertand if having a fully operational software would allow them in their daily lifes and most important add value to both personal lifes as well as life of the people in the coffee plantations.

4.1 SOFTWARE TO CROSSCHECK COFFEE SECURITY

As referred in the methodology, in the data gathering process, information on 173 products were collected, considering all the necessary interest variables to perform the proposed analysis in this dissertation. In this chapter the prototype will be described.

Below (in section 4.1) it is the detailed description on how the prototype design was made. Sections 4.1.1, 4.1.2, 4.1.3 and 4.1.4 describe namely the prototypw design, software architecture, database conceptual model and interface design.

Section 4.1.5 focuses on the prototype implementation and all the important features for its implementation, such as the software implementation in section 4.1.5.1 and database physical model in section 4.1.5.2.

In section 4.2 the sample coffee products gathered are analyzed in regards to the study variables.

Finally, in section 4.3, the results from the consumers survey are presented and analyzed.

4.1.1. Prototype design

The process to construct the database that will store all the collected data. The database helps in the construction of the software prototype, which will illustrate the applicability of the proposed methodology. First, important concepts regarding the database design are described, namely primary keys, SQL, data integrity, among others. Followed by the database definitions, the conceptual model that was first designed to understand the relationships between the different necessary tables. Then, it is outlined how the physical model is generated. All the tables composing the database model are also described in detail, so it is fully understandable why they were created and what they comprise.

4.1.2. Software architecture

The software architecture of an application, according to Franchitti on Application Servers G22. 3033-011, is a set of artifacts (that is, principles, guidelines, policies, models, standards, and processes) and the relationships between these artifacts, that guide the selection creation, and implementation of solutions aligned with business goals. It is the structure of structures of an information system consisting of entities and their externally visible properties, and the relationships among them.

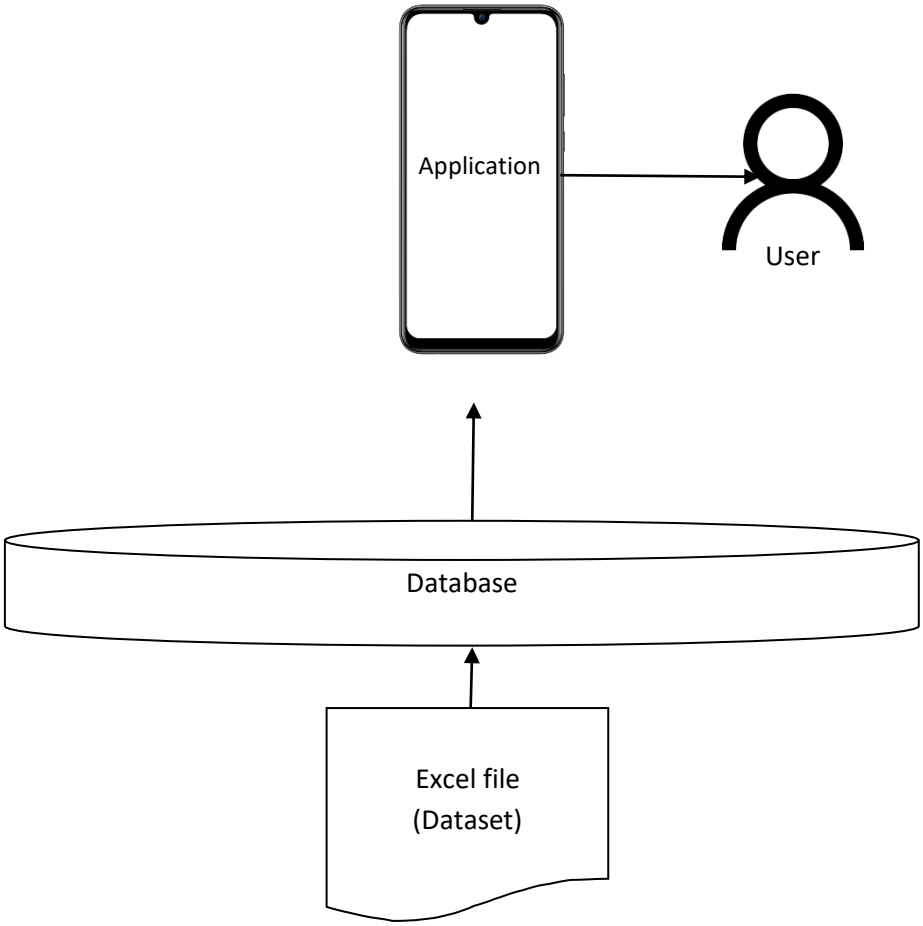

Figure 19 Software architecture design

In Figure 19, we can see the main blocks of the software architecture. First, the dataset, in excel format needs to be fed to the data warehouse staging area. In the staging area is where the necessary transformations and calculations to the data will be done. After this stage is completed, the data is fed into the data warehouse that receives the cleaned data. The data in the warehouse is ready to the used by the application and finally by the end user.

4.1.3. Database conceptual model

To fulfill the proposed research and the Scores creation, a database of coffee products needs to be created to support the storage of the data gathered. This chapter describes the methodology used to create the database that will support the analysis of the coffee products. A database will be used to store the data in an organized manner and, since it is stored, it should be easy to retrieve its information. The design of the database highly influences how the data is stored and it determines the ease to search for the relevant information based on multiple criteria (Stephens and Plew 2000).

In the database, each product must have a unique identifier, guaranteeing that each product is unique in the database. A unique identifier in the database is called a primary key. To easily identify a product, the following information should be stored: brand (Sical, Nescafé, Boundi, Delta…), type of bean (Arabica, Robusta), the category of the product (soluble, capsule, bean…), the price (in euros), the size of the product and the information on the country where the beans derive of. Having information on the country producer of the beans utilized to produce a product allow at a later stage to classify products according to its sociopolitical information.

The database design should follow some database design principles that will allow for a better storage of the data:

- Multiple views of the data should be supported, meaning that if multiple users need to access the database, they can and, they can view only the data of their interest.
- There should be a control of data redundancy, meaning that each item should be stored in only one place in the database.
- Data can be accessed through SQL.
- Data integrity should be always maintained, meaning that only valid information should be entered.

Below it is represented the conceptual model designed to represent the problem at study. It is composed of entities connected by relations. An entity is a business object that represents a group or a category of data. They are used to logically separate data. Since data is divided into several entities, data needs to be accessed and, for that reason, relationships are created between tables, representing the interconnection of the data (Stephens and Plew 2000).

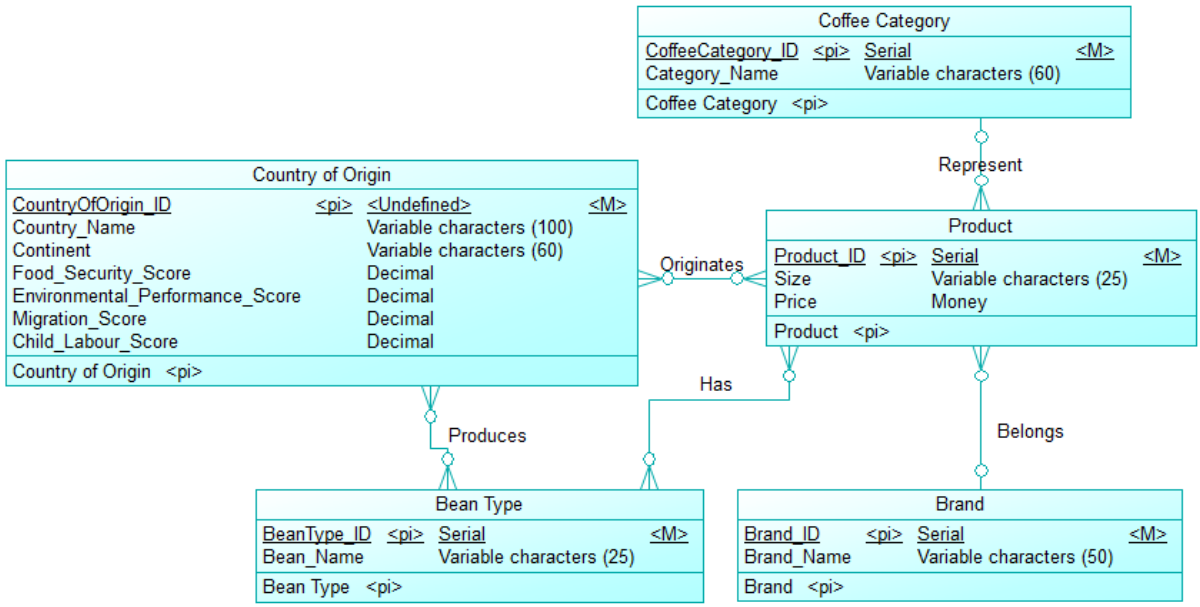

Figure 20 Database conceptual model

In Figure 20 the represented entities refer to the necessary information that needs to be stored to fully characterize the product at study. We identified the entities product, coffee category, brand, bean type and country of origin. The entities are described below for a better understanding of what they represent:

- Product – Characterizes each coffee product and contain information regarding the size and price.
- Coffee Category – Describe the coffee category to which the product belongs. Categories can be capsule, soluble, bean, ground, or tablet.
- Brand – Describe the brand of the coffee product.
- Bean Type - Contain the information regarding the type of bean used for the product creation.
- Country of Origin – Encloses the information regarding the country where the beans are produced.

4.1.4. Interface design

For the application software, it was decided that a mobile application would be built, to facilitate the end user interaction at any place, mainly, supermarket stores. Interface design is a big part of a software application, because the interaction of the user with the end result needs to be the most comfortable as possible. There are several studies on usability principles and interface design, but Wang and Huang in 2015 survey results states that the user's behaviour of operating an interactive interface is related to the user prior experience, the users' rating of the visibility principle is related to user's subjective perception but not related to user prior experience, however, the rating on ease, efficiency and enjoyment are related to prior experience. The final takeaway is that the key attributes affecting the users' behaviour of operating an interface include aesthetics, achievement, and friendliness.

For the interface design Balsamiq Wireframes tool was used for a good understanding of the possible end result.

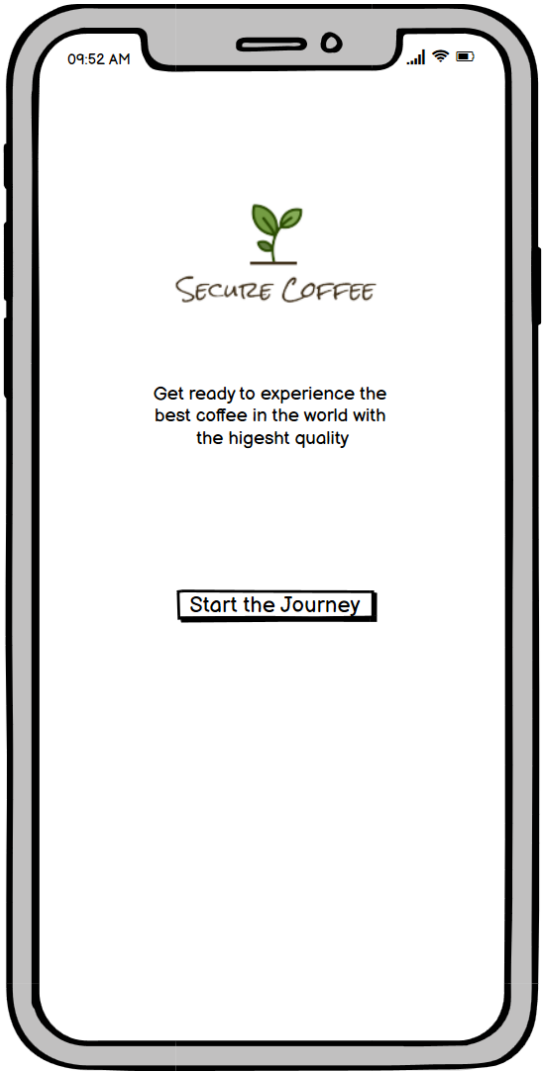

Figure 21 Prototype 1st screen

The software aims to inform the consumer on which kinds of coffee there are and the difference between them before moving into the analysis of the product the consumer is thinking about buying.

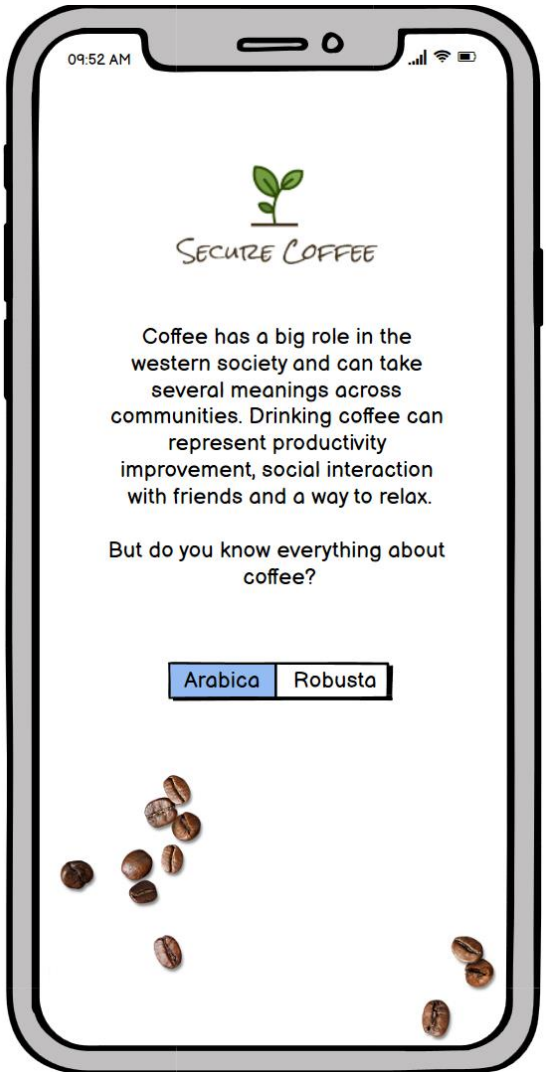

Figure 22 Prototype 2nd screen

The user will always have their profile to check at which level they stand in. There are three existing levels according to the awareness of the consumer and according to his reserachs, meaning that what the consumer checks for is saved in the database for a period of 2 years in order to allow the level calculations. As soon as a user uninstalls the application, all the data will be automatically deleted from the database.

Figure 23 Prototype 3rd screen

The most important part of the project is what is shown on figure XX. This screen will allow the user to choose the type of beans the constitute the product (Arabica, Robusta, or both), as well as the country or countries that the beans are coming from.

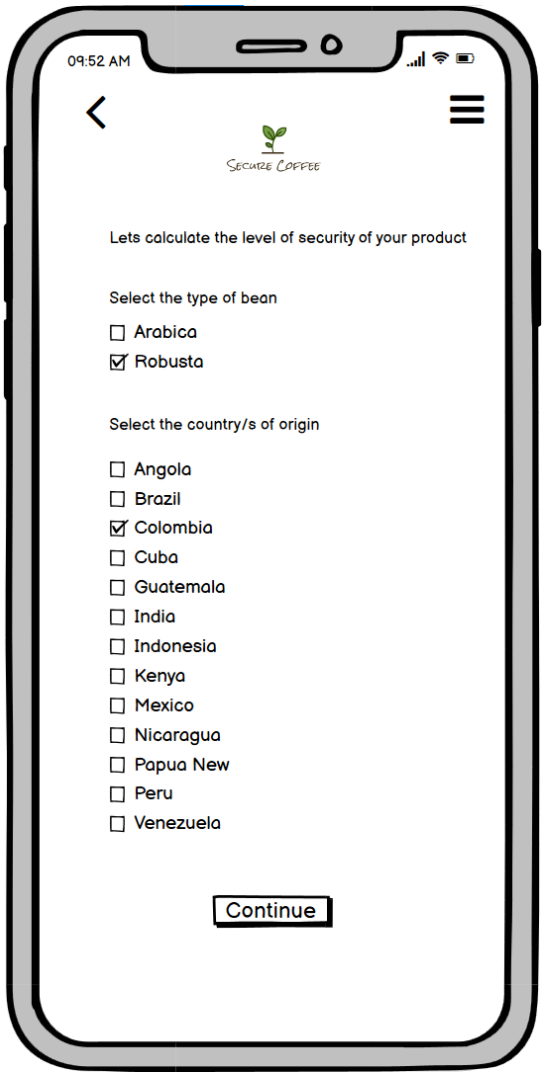

Figure 24 Prototype 4th screen

Then, based on the indexes and the calculations showned before, the calculation will be started for the specified product.

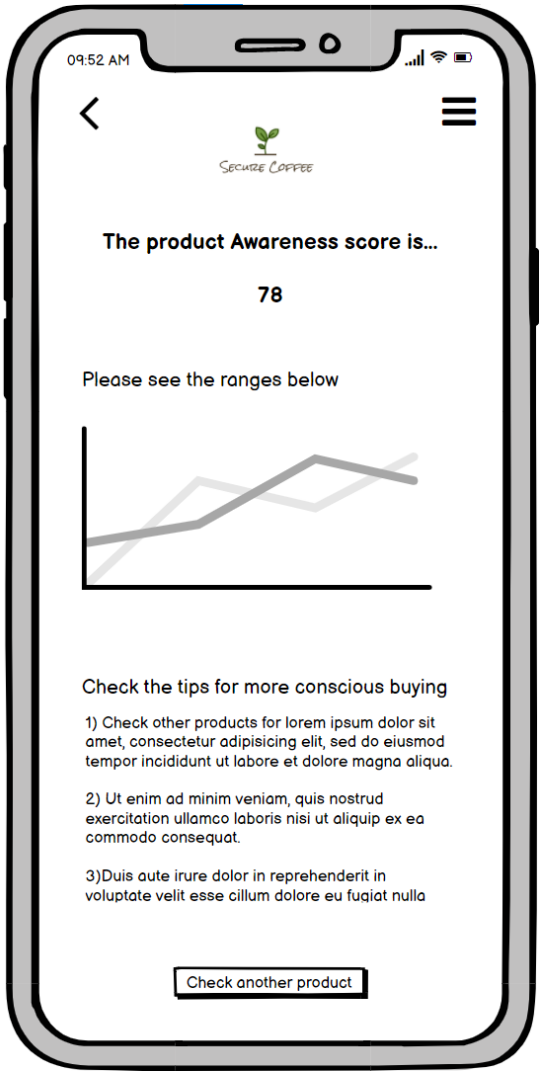

Figure 25 Prototype 5th screen

The Awareness score is calculated and the consumer can see if that specific coffee product is performing well according to the indexes discussed above. Mainly they are able to see where the product stands in terms of social and political responsibility. The lower the Awareness score value, the biggest the evidence of the product composition and manufacturing come from a country with child labour manufacturing, poor environmental performance, poor food security, and low level of migrant's integration. So, in this case, the consumer will want to see a high Awareness score. If, upon calculation the value is not what the consumer has thought, they can always check another product and see if the Awareness score drop or gets higher.

A range of tips are also given to the consumer for a more concious buying once at the supermarket.

4.1.5. Guidelines for the Prototype implementation

In this section, the tools and ways used to develop and implement the prototype will be discussed. In section 4.2.1 it is described the software development, mainly which tools were used and how it was implemented and in section 4.2.2. it is described the database physical model, what it is, and how it is applied to the solution aimed to construct.

4.1.5.1. Software development

During the software development, programming language python was used. The IDE used was Django. Python was chosen as programming language due to its high usage nowadays. It is an interpreted high-level general-purpose programming language. It has high code redability which is very good when more than one person is working at the same code simultaneously. Its oriented approach aims to help programmers to write clear and logical code, either for small or large scale projects.

4.1.5.2. Database physical model

The physical data model (Figure 26) is the representation of the actual structure of a database, the existing tables and the columns that will take the collected data. In this type of model, the entity types usually represent tables, and the relationship type lines represent the foreign keys that are shared between tables. It is usual that the model's structure is tuned to the needs of the processes operating on the data to ensure an adequate performance. Typically, it includes (West 2011):

- Restrictions on the data that can be held by the model.
- Denormalization to improve performance of specific queries.
- Referential integrity rules to implement relationship types.
- Rules and derived data that are relevant to the processes of the application the physical model is serving.

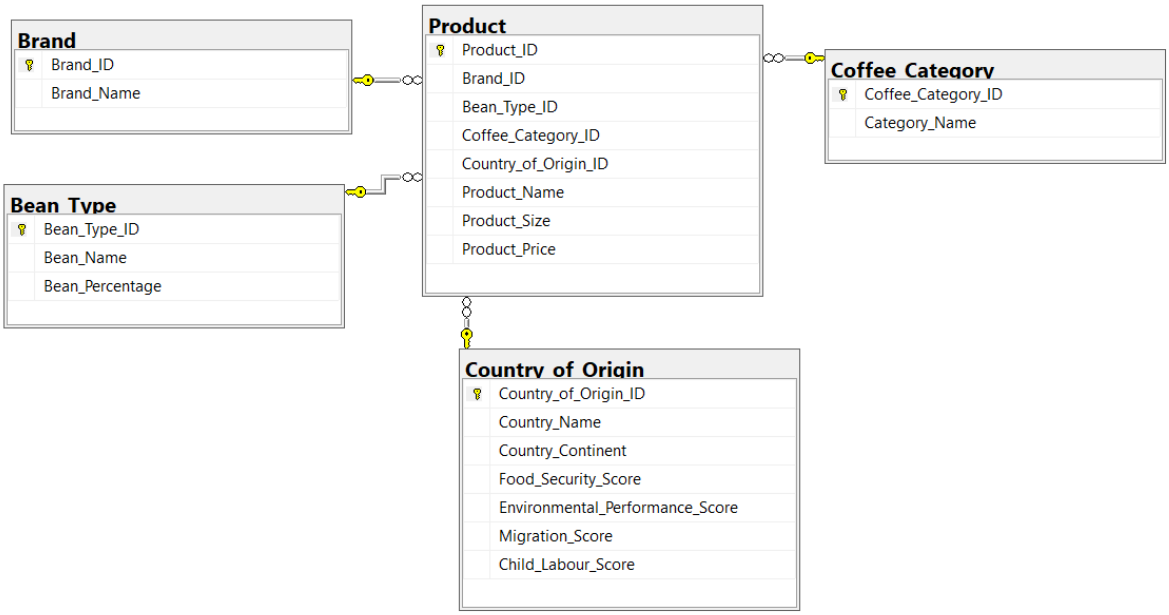

Figure 26 Physical data model

Description of the relationship between the tables

The tables identified in the physical model relate between themselves as described below.

- Product: The Product ID relates with the Country of Origin table, because the beans who form the product are coming from a specific country of origin. This way, the Country_of_Origin_ID is received by the Product table. A product cam be composed by beans from more than one country of origin.

  A product can also be part of a specific coffee category. However, a product can only be part of one category, but one category can have more than one product. Product table also receives the Coffee_Category_ID key in its table.

  A Product, besides belonging to a coffee category is produced by a specific brand, meaning that the Product table also needs to be connected to the Brand table. A Brand may have more than one product; however, a specific product only belongs to a brand. The Brand_ID is also received by the Product table.

  The Product table also has a relationship with the Bean Type table because a product is composed by bean types. It can be composed by only one type of bean (e.g., Arabica), or composed by more than one type of bean. Also, the bean types are in more than one coffee product. In this way, the Bean_Type_ID is also received by the Product table.

- Country of Origin: This table receives the coffee producing countries, because those are the countries producing the bean types. The Country of Origin and Bean Type can be related

from the Product table. However, besides needing to relate with the type of bean produced, the Country of Origin table also encloses the information regarding the indicators necessary to evaluate the socioeconomic and sociopolitical situation of a coffee producing country and the situation in which coffee beans are being produced.

Tables description

The Data Type can be of the type INT, NVARCHAR or Money. INT data type represent integer values. NVARCHAR data type represent characters, that can be digits, letters or other, with indefinite length. Money data type stores values with two decimal places and the values are rounded to the corresponding currency unit.

Primary Key (PK) – Represents a key in the database that is unique for each record. Primary key is a unique identifier.

Foreign Key (FK) – The foreign key is the key used to link two tables together. The foreign key value matches a primary key value in a different table.

The tables below describe in detail the fields that belong to each table, its meaning, the data type, the length if applicable and if it corresponds to a primary key or foreign key.

Product				
Column Name	Description	Data Type	Length	PK or FK
Product_ID	Product Identifier Number	INT	N/A	PK
Brand_ID	Brand Identifier Number	INT	N/A	FK
Bean_Type_ID	Bean Type Identifier Number	INT	N/A	FK
Coffee_Category_ID	Coffee Category Identifier Number	INT	N/A	FK
Country_of_Origin_ID	Country of Origin Identifier Number	INT	N/A	FK
Product_Name	Name of the product	NVARCHAR	50	PK
Product_Size	Size of the product	NVARCHAR	50	PK
Product_Price	Price of the product	Money	N/A	PK

Table 5 Product table description

Brand				
Column Name	Description	Data Type	Length	PK or FK
Brand_ID	Brand Identifier Number	INT	N/A	PK
Brand_Name	Name of the product brand	NVARCHAR	50	PK

Table 6 Brand table description

Bean_Type				
Column Name	Description	Data Type	Length	PK or FK
Bean_Type_ID	Bean Type Identifier Number	INT	N/A	PK
Bean_Name	Name of the type of bean	NVARCHAR	10	PK
Bean_Percentage	Percentage of bean type present in the product	INT	N/A	PK

Table 7 Bean_Type table description

Coffee_Category				
Column Name	Description	Data Type	Length	PK or FK
Coffee_Category_ID	Coffee Category Identifier Number	INT	N/A	PK
Category_Name	Name of the coffee category to which the product belongs	NVARCHAR	50	PK

Table 8 Coffee_Category table description

Country_of_Origin				
Column Name	Description	Data Type	Length	PK or FK
Country_of_Origin_ID	Country of Origin Identifier Number	INT	N/A	PK
Country_Name	Name of the country from which the beans come	NVARCHAR	100	PK
Country_Continent	Continent to which the country belongs	NVARCHAR	60	PK
Food_Security_Score	Food Security Score	INT	N/A	-
Environmental_Performance_Score	Environmental Performance Score	INT	N/A	-
Migration_Score	Migration Score	INT	N/A	-
Child_Labour_Score	Child Labour Score	INT	N/A	-

Table 9 Country_of_Origin table description

Attributes description

The following tables describe the main attributes for our analysis: Bean_Name, Category_Name, Brand_Name, Country_Name and Country_Continent.

Bean_Name
Arabica
Robusta

Table 10 Bean_Name attribute description

Category_Name
Capsule
Soluble
Bean
Ground
Tablet

Table 11 Category_Name atttribute description

Country_Name
Vietnam
Uganda
Brazil
Honduras
Kenya
Colombia
India
Cuba
Timor
Angola
Jamaica
Ethiopia
Nicaragua
Peru
Indonesia
Guatemala
Papua New Guinea
Cameroon
Costa Rica
El Salvador
Australia
Mexico

Table 12 Country_Name attribute description

Country_Continent
Asia
Africa
South America
Central America
Oceania

Table 13 Country_Continent attribute description

Brand_Name
Sical
Delta
Boundi
Nicola
Starbucks
Nescafé
L'or
Illy
Pilão
Bicafé
Compagnia Dell'Arabica
Segafredo
Mount Hagen
Alternativa 3
Ginga Café - Grupo Nabeiro
Café O
Cartwright & Butler
Fábrica
Malongo
Sonnentor
El Corte Inglés Brand
Continente Brand
Pingo Doce Brand
Auchan Brand
Intermarché Brand
E.Leclerc Brand
Coffee by weight

Table 14 Brand_Name attribute description

4.2. SAMPLE OF COFFEE PRODUCTS

As presented in the work methodology used, data from 173 different products were gathered, considering all the necessary charactheristics defined as being necessary for identifying a coffee product. The gathered data will be presented in the following sections, focusing in each characteristic of the product. The characterization of the products from the sample according to the developed scores is presented in section 4.2.5.

4.2.1. Category type

At first, an analysis on the category types of the data gathered was conducted. From Figure 25 it is understandable that Ground coffee is the category more observed among the data points, with 72%. Bean type is the second category most observed, accounting for 27% of the observations of the dataset. Tablets and Soluble coffee are the ones with the least observations, Tablets with 2 and Soluble coffe type with 1 observation.

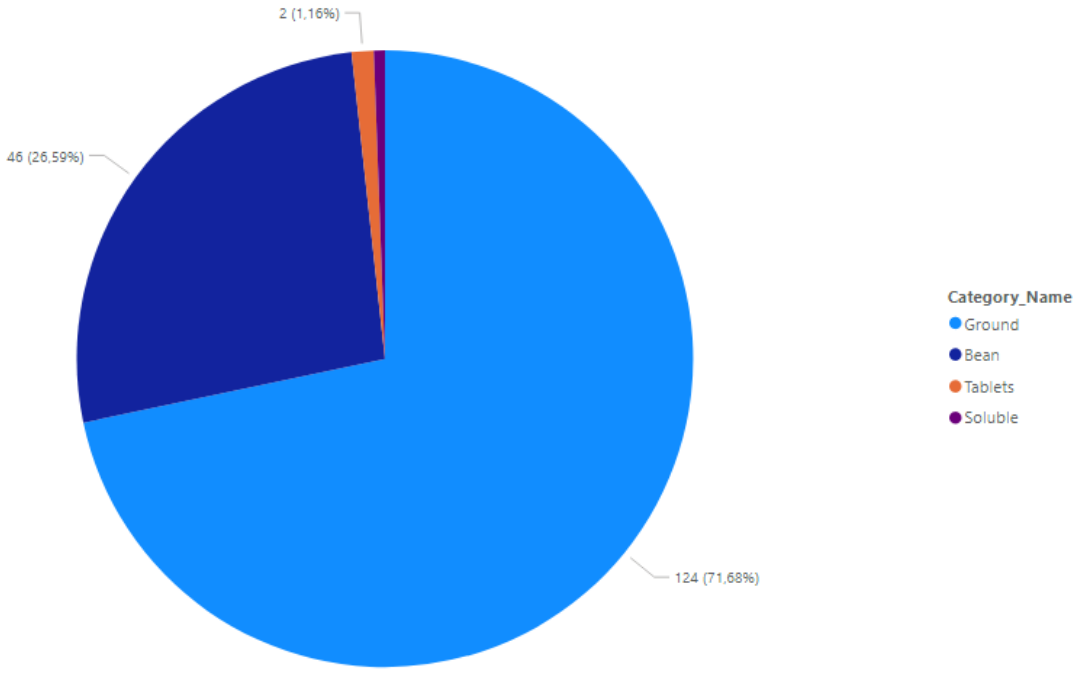

Figure 27 Beans category type pie chart

4.2.2. Type of bean

The next step to analyze was the most common type of bean on the analyzed products. As stated in the literature review, the most common types of beans in the world market are Arabica and Robusta. Liberica and Excelsa are very uncommon and mostly used for family markets. Hence, when evaluating the results it is understandable that the common types, Arabica and Robusta are the common ones that appear as product constitution. It is highly perceptible that products composed only by Arabica bean type is the most common, leading in front. It is then followed by 100% Robusta type, although with a lower significance. The other products are always a mix between Arabica beans and Robusta beans, with not a very significant difference between them.

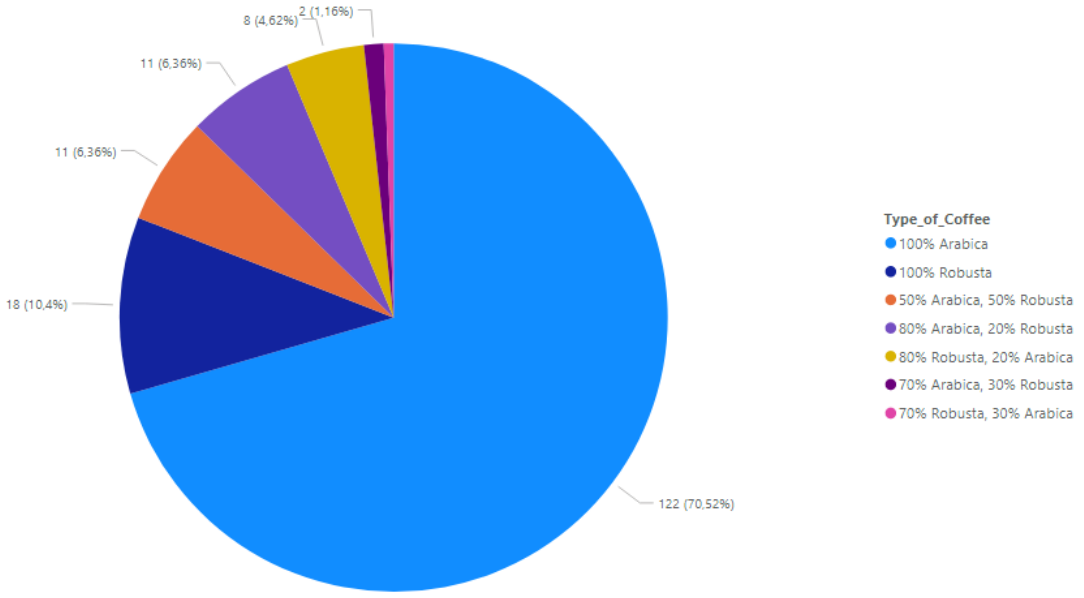

Figure 28 Products beans types pie chart

4.2.3. Price of product

Analyzing the products prices, we can understand which products, grouped, are the most expensive. Even though Ground coffee represent the highest amount of observations, as seen on table 15, with 72%, Bean coffee is the most expensive with a sum of 835,77€. This happens because on the dataset there are observations from beans from Jamaica, which costs 195€/kg, while ground coffee observations represent the "general" coffee which is sold in the usual supermarkets.

Category Name	Sum of Unitary Price
Bean	835,77 €
Ground	612,75 €
Soluble	5,29 €
Tablets	5,08 €
Total	**1 458,89 €**

Table 15 Price per product

Figure 29 Word cloud for products unitary prices

4.2.4. Size of product

The size of the product means the quantity of product in grams from the products gathered in the dataset (e.g., 1000g of Beans from Jamaica, costs to a consumer, 195€). As perceived by the bar chart the majority of the gathered products weigthed 55 grams.

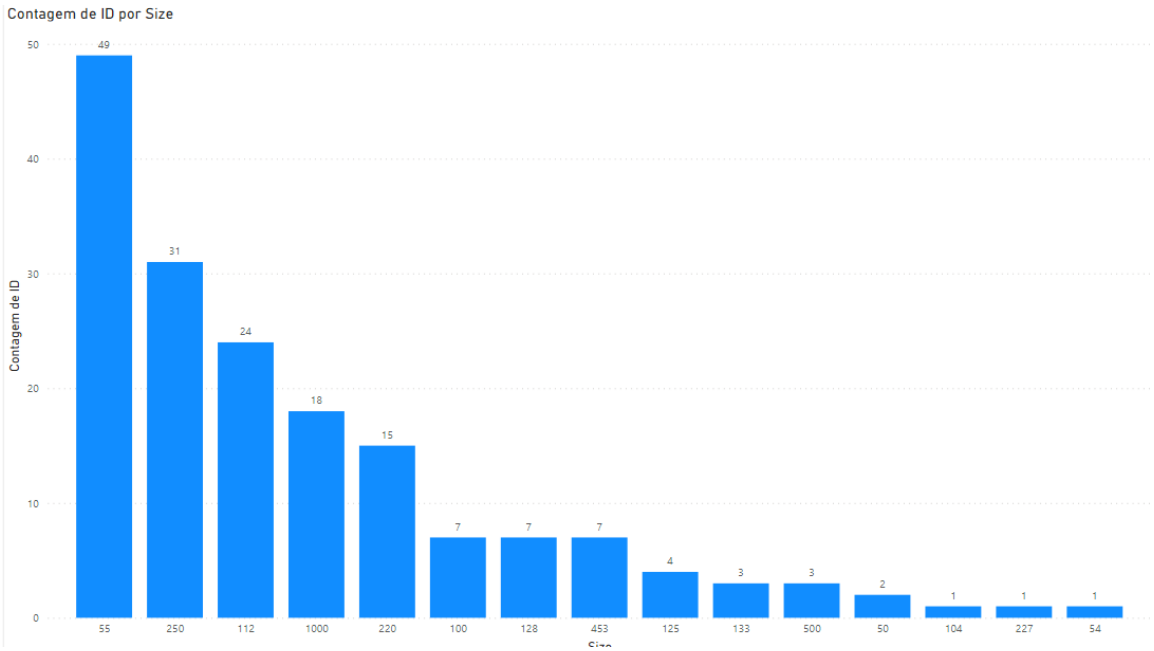

Figure 30 Bar chart for products sizes

4.2.5. Sample products characterization according to the developed scores

On the annexes, the table with the 173 products gathered can be found (Table 16). This table also comprises the country of origin score, coffe score and awareness score of each product.

A descriptive analysis per category type, meaning the minimum, maximum, median, average and then a histogram of Awareness score will be shown.

4.3. CONSUMERS SURVEY

A consumers survey was conducted to understand the perception of the consumers related to the developed study. It was intended to perceive how coffee and non coffee consumers discern the producing of beans that are consumed. In this section, the results of the survey will be presented in order to get a better overview of the answers gathered.

During the gathering process, 68 different answers were recorded. From the 68 answers, it is necessary to distinguish the completely valid answers and the ones that are not considered valid because the survey was not answered until the end and gaps of information are perceived. From the 68 received answers, 9 were considered invalid. In the end, 61 answers will be considered.

Question 1: What is your age?

By analyzing the results of this question, we are able to understand that the consumers answering the survey are between 20 and 63 years old of age.

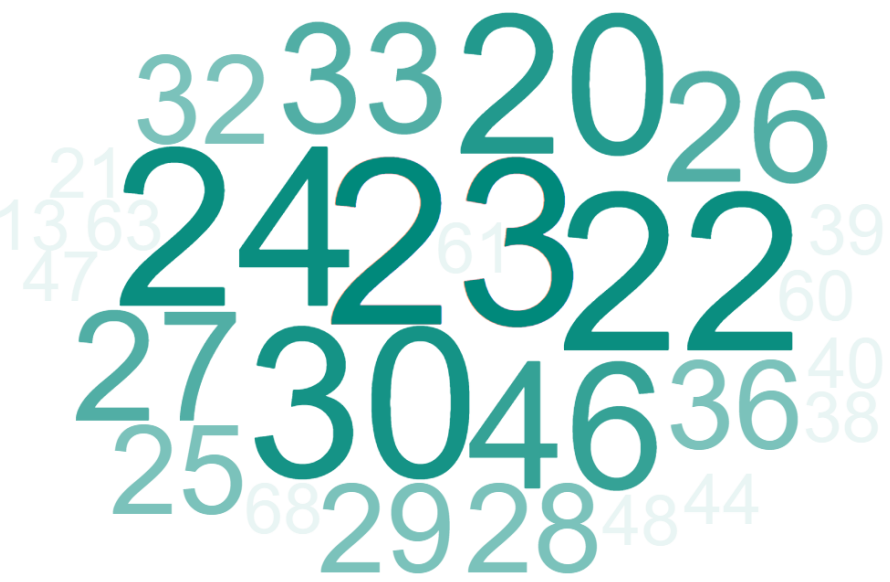

Figure 31 Word cloud for consumers age

Using a word cloud, we were able to distinguish the ages who contributed the most for the reply of the survey. The ages 24, 23 and 22 are the ones with most significance. Right after, 20, 30 and 46 years old, were the ages more significant in the survey.

Question 2: What is your sex (Male/ Female/ Other)

In question 2 the aim was to access which sex replied the most to the survey. There were 3 different options, male, female and other. In the results, we had 39 male answers, 22 female and 0 other.

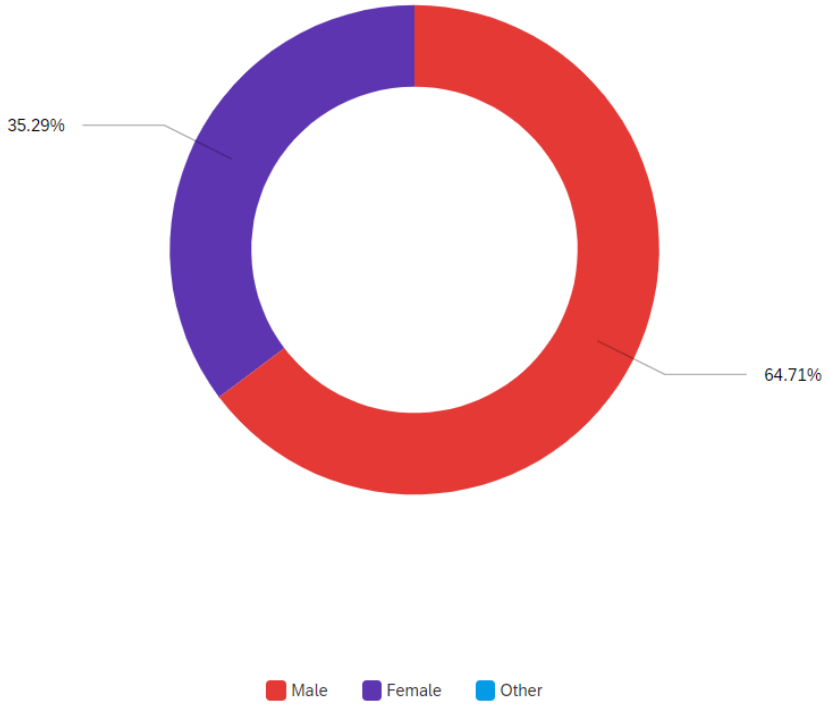

Figure 32 Consumer's sex

Question 3: Are you a regular coffee consumer? (Yes/ No)

As told in the literature review, we live in a coffee culture, so, in order to access if the inquiries were coffee consumers or not, question 3 aimed to underatand if consumers drunk coffee on a regular basis or not. By analyzing the results, it is obvious by Figure 32 that the most of the people who answered to the survey were definitely coffee consumers. With only 8 people answering that they are not regular coffee consumers, it is perceived that 53 of the inquiries drink coffee on a regular basis.

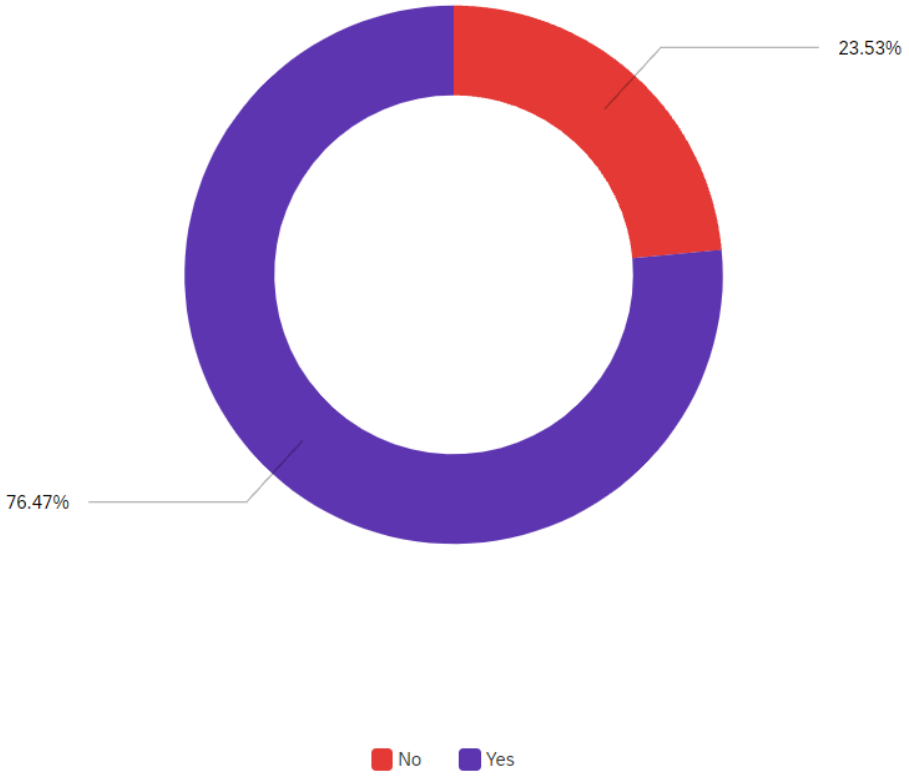

Figure 33 Consumers regularity in coffee consumption

Question 4: How often do you consume the following coffee products?

After checking if the the consumers consume coffee regularly, it was accessed the kind of products that they consume, on a daily, weekly, occassionaly or never basis. The products accessed were capsules, soluble, bean, ground and tablet coffee, as these were the products identified above in the methodology.

It is very easily perceived that capsules are the most common product to be consumed on a daily basis by consumers (38 people, corresponding to 61,29%). On the other hand, it is easily seens that tablet coffee products are the ones that least people consume, 40 people replying never (32,26%). On a daily basis, the most consumed product are beans, following with 14,52%. The pattern perceived between daily and weekly consumption is that capsules are always the most consumed product. On an occasionaly comsumption, beans and soluble coffee take the same percentage with 30,91%.

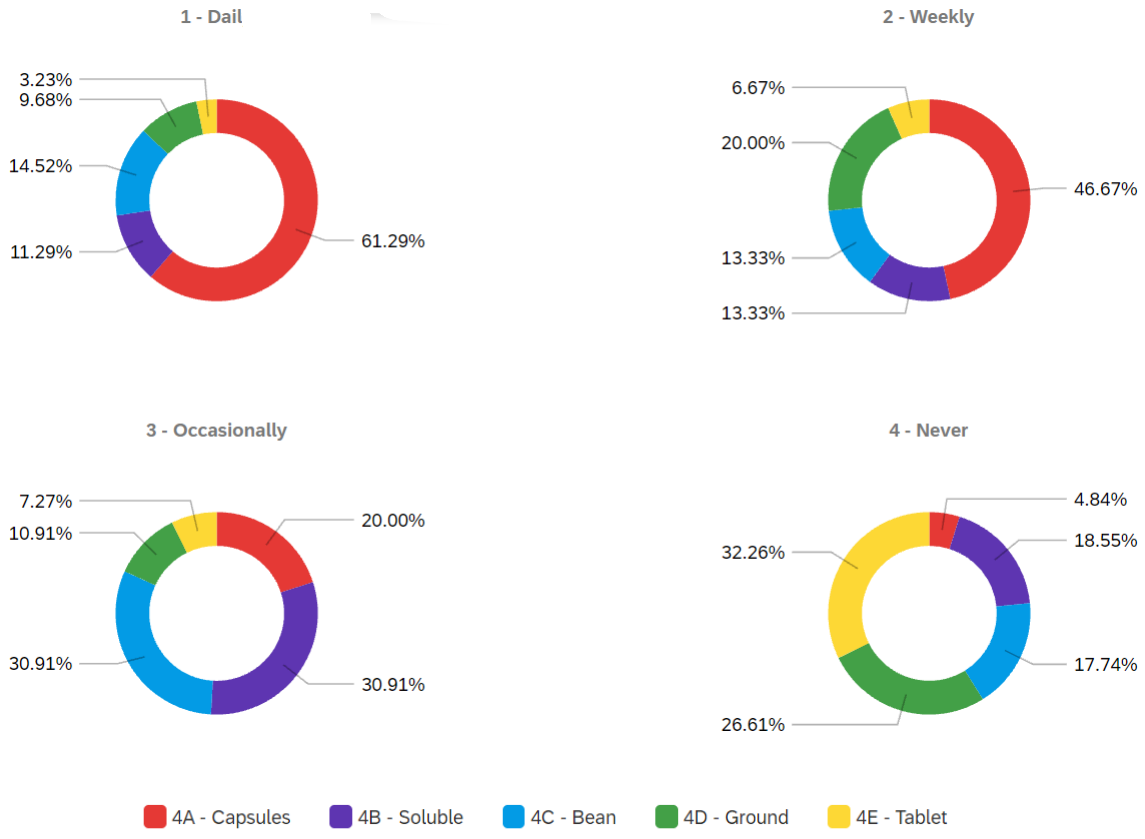

Figure 34 Type of products most consumed by the inquiries

Question 5: If you answered daily, how many times a day do you consume coffee (1, 2, 3, …, 6 or more; NA- Not applicable)?

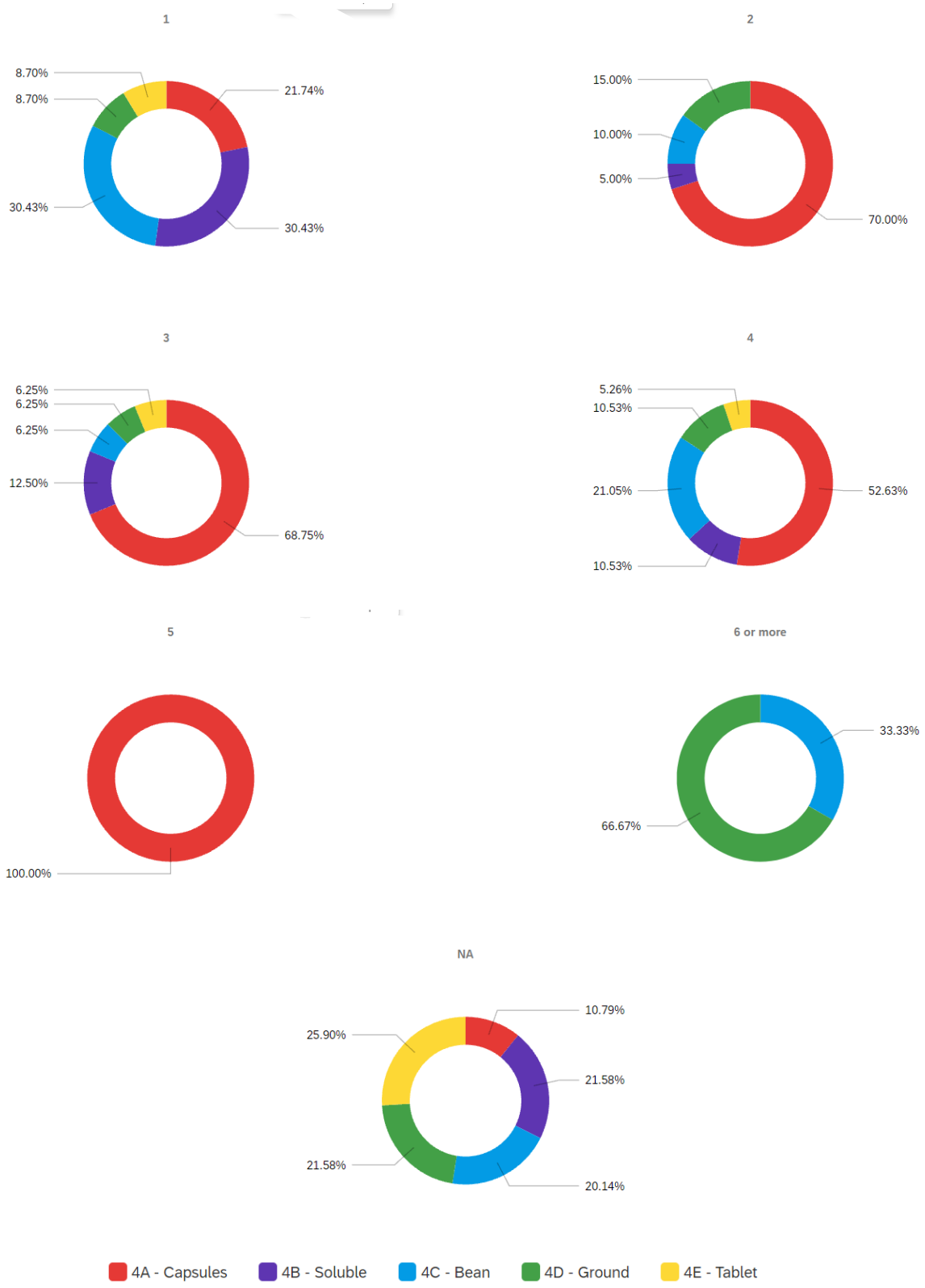

Figure 35 Regularity of type of product consumption

Question 6: When at the supermarket/store (physical or online), how long on average does it take to choose your coffee?

Another aspect of the analysis was the amount of time a consumer takes to choose the product they are going to by, whether it is on a physical or online store. Most of the consumers take only 0-5 minutes while making their choice, with 83,33%, followed by 5–10 minutes with 10,61%, 10-15 minutes with 4,55% and 15-20 minutes, with very low significance, 1,52%. No of the survey respondants sid that they take more than 20 minutes to choose the product they are going to buy.

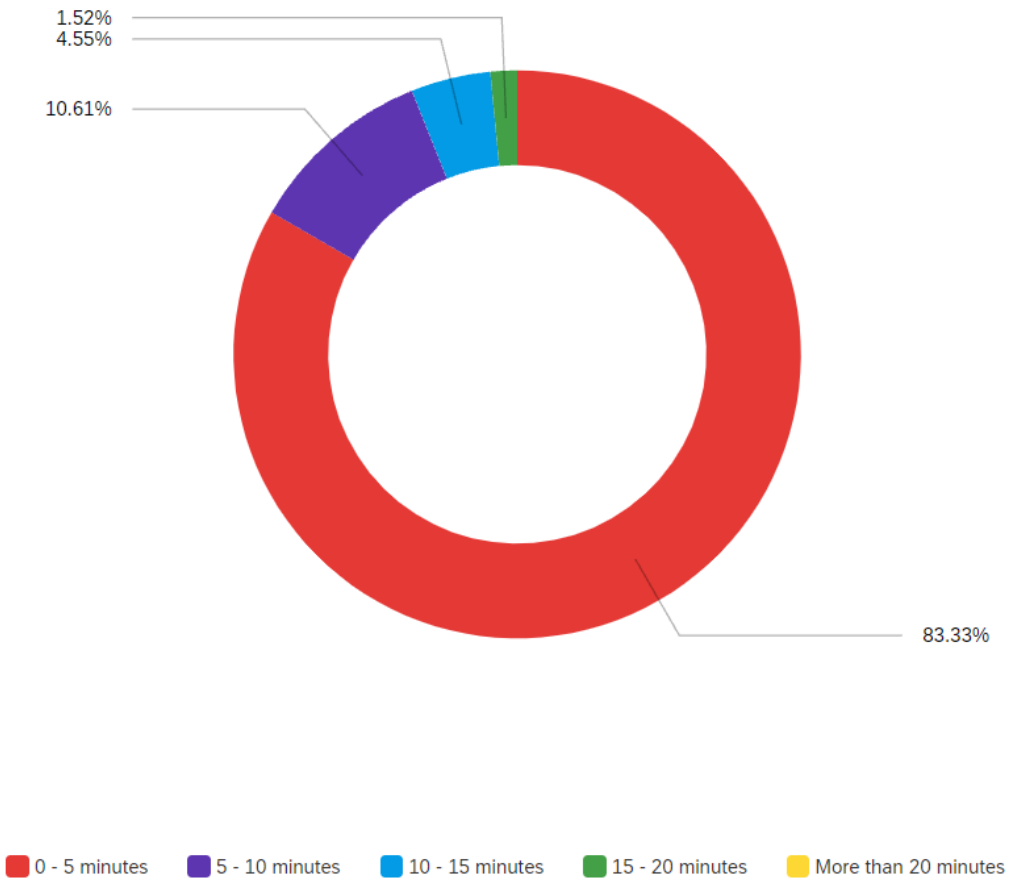

Figure 36 Average time to choose coffee product

Question 7: Do you know the difference between Arabica beans and Robusta beans?

Another interesting analysis was to check wheter consumers knew the difference between Arabica and Robusta beans. As it was explained in the literature review, the two types of beans present differences and can make a product totally different depending on the amount of each bean that is used. By checking figure 36 we can understand that the majority of the consumers do not know the difference between the two type of beans that make the products they consume.

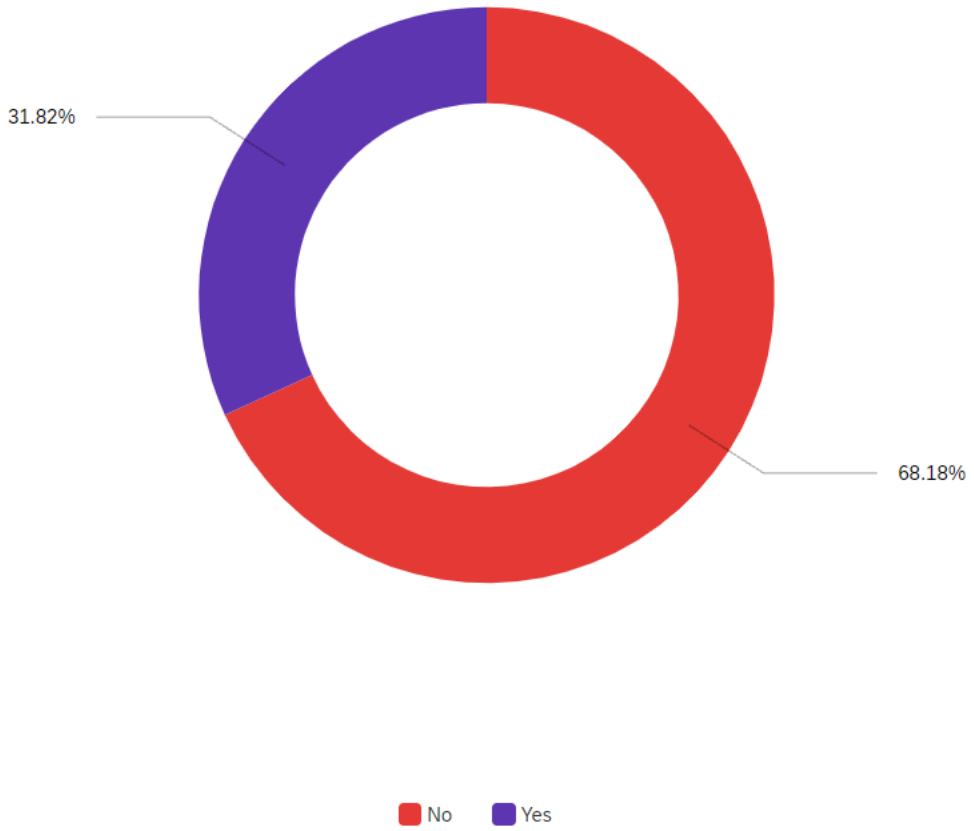

Figure 37 Knowledge about Arabica and Robusta beans

Question 8: Do you consider the type of coffee bean when purchasing each of the following products?

Then, it was also analyzed if consumers take into consideration the type of coffee bean that creates the product they are about to buy. Most of capsules consumers say they do consider the type of coffee bean when purchasing the product, however, this number might be a little bit biased since in question 7, when asked if consumers know the difference between arabica and robusta beans, 68.18% say that they don't know.

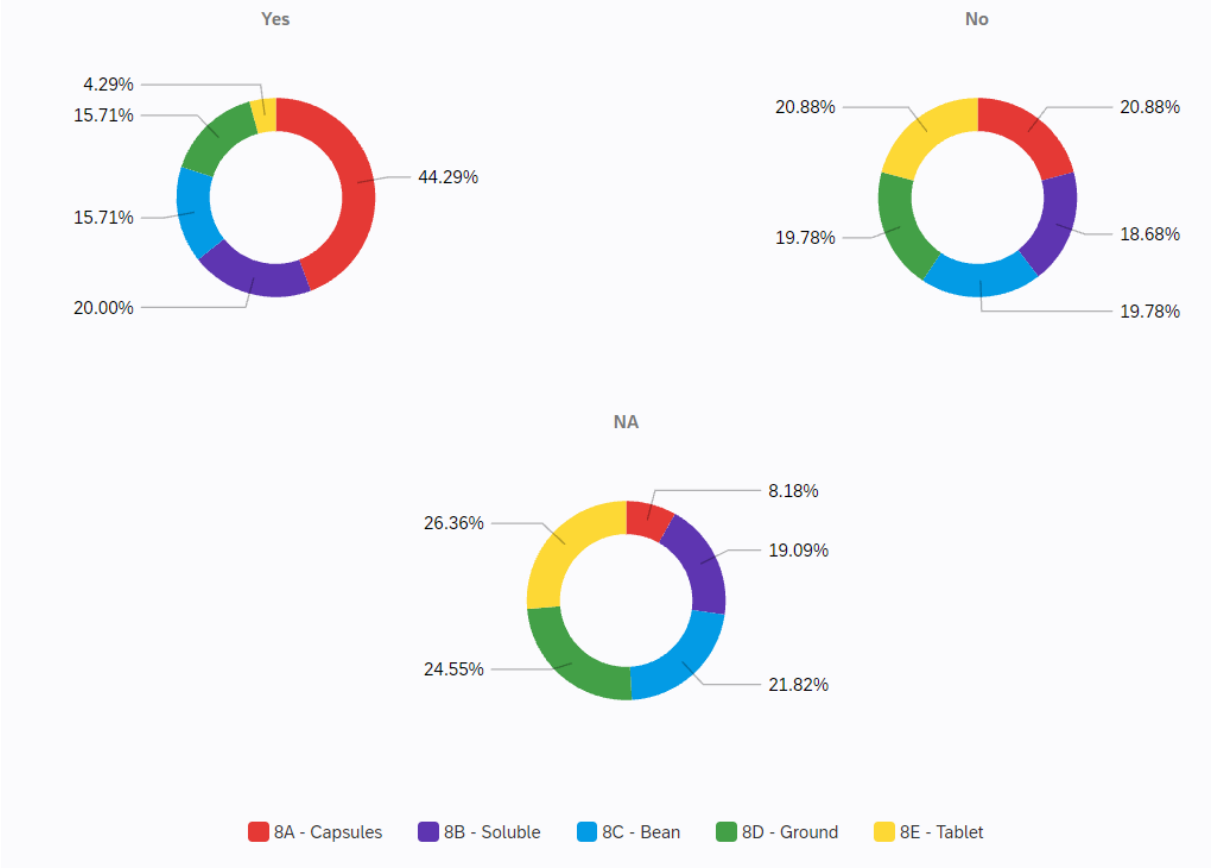

Figure 38 Coffee bean perception and concern during buying process

Question 9: When you buy the product, what is your degree of concern regarding the country of origin of the coffee beans… (1- No concern; …; 10- Much concern)

After accessing if the respondents were regular coffee consumers and which type of products they consume on a daily, weekly and occasionaly basis (never also included), the concern about the country of origin of the coffee beans was accessed against 4 different variables: food security, environmental ethics, social ethics and political ethics.

The results can be seen below and interpreted as following. Since all questions range between 1, no concern, and 10, much concern, it is perceived that for all variables the degree of concern stays below 5, considered the mean value.

Social ethics, for example, the existence of child labour involved in the coffee beans production was the variable scoring higher between the remaining. Food security is the variable that does not create a very high concern when comparing with the 3 other variables, scoring 4.39 out of 10.

Figure 39 Degree of concern with origin of coffee beans

Question 10: When buying coffee, how likely would you use the App to compare the offer available at the supermarket/store (physical or online)? (1- No probability; …; 10- Very likely)

Succeeding all the previous analysis, we decided to analyze what would be the adherence in case an application for comparing supermarket coffee products offer. Also ranging from 1 to 10, while 1 is no probability of using the application and 10 is a very likely probability of using the application, the results showed an average value of 5.04 for the application usage intention.

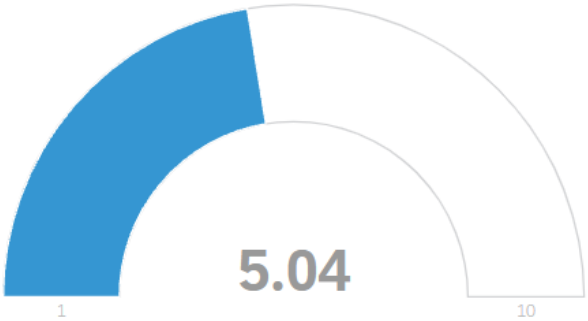

Figure 40 Application usage intention

Question 11: Would the score provided by the app for a certain product influence your product choice? (1- No probability; …; 10- Very likely)

While analyzing if the score provided by the application would have an influence in the choice of the product by the consumer, the result was more favourable, showing 5.96, ranging between 1 and 10.

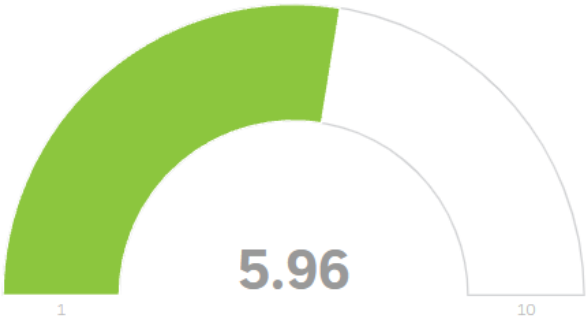

Figure 41 Score influence on product choice

Question 12: Would the app influence your perception on how coffee is produced? (1- No probability; …; 10- Very likely)

As the last question, it was asked if consumers would change their perception about coffee production. As a final result, consumers rated this question with an average of 5.86 regarding a change in their perception about coffee production.

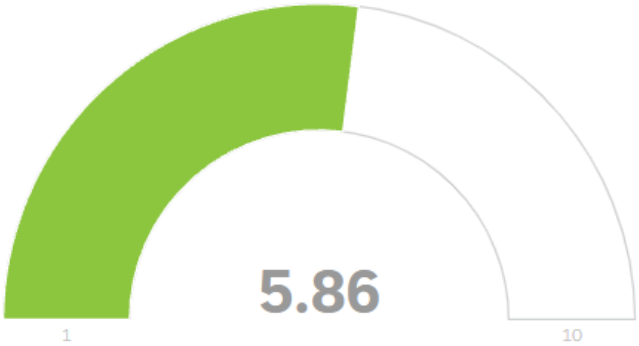

Figure 42 Application influence on coffee production perception

5. CONCLUSIONS

The following dissertation had as objective the development of scores able to characterize the production of coffee beans socially, ethically and politically. Besides the development of the scores, a software prototype was also designed to showcase the scores calculation and evalluate the consumers opinions in regards to the study. The proposed Scores are illustrated using a data sample from products commercialized in Portugal, sold in supermarkets from the entire country.

From the carried work, we are able to conclude that the majority of the consumers, drink coffee because it is an habit inherited by the society. Consumers do not have an active role in knowing what is happening during the production of the beans they are consuming in the end. Most of the consumers do not even know the difference between the two main coffee beans commercialized worldwide and in the country, Arabica and Robusta. What can be derived from this, is that consumers only buy because they want to consume coffee, despite the problems that can be inherited from it.

The Awareness score is a great value proposal when it comes to access the social and political responsibility of the countries that produce the coffee beans.

5.1. LIMITATIONS

One of the key limitation encountered was the availability of the indicators used in the dissertation. Besides the difficulty to find all the necessary indicators, it also comprise the problem of the data reliability, however, during the gathering process, trustworthy sources were always considered.

The collection of the coffee data was a big challenge. What was realized during this entire process was that the majority of the products do not say neither the product's composition in terms of beans and percentages, neither the countries from where the beans are coming from. Since, for the scores calculation both data needed to be available, this comprised a limitation to the work, with only 173 products being collected.

Another limitation is that it was not possible to develop a software prototype, which would might influence the results of the survey if the respondents could use it before answering the questions.

5.2. RECOMMENDATIONS FOR FUTURE WORKS

For future works it is recommended that, instead of a prototype, a real application is developed and made available into the market. Stakeholders such as coffee retailers, like Delta, could use this application for marketing purposes and expand furthermore their brand while having into consideration the ethical, social and political problems that coffee producing countries face.

It is also recommended to focus more on the application rather on the scores construction.

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ANNEX

Table 16 presented in the next pages shows the coffee products gathered during the collection of products step.

Brand	Type_of_Product	Product_Name	Category_Name	Type_of_Coffee	Country_of_Origin	Size	UnitaryPrice	Country Score	Coffee Score	Awareness Score
Sical	Roasted Coffee	Café Torrado em Grão 5 estrelas	Bean	80% Arabica, 20% Robusta	Brazil, Kenya	1000	10,94			
Sical	Roasted Coffee	Café Moaem Universal Dak Lak	Bean	100% Robusta	Vietnam	220	2,99			
Sical	Roasted Coffee	Café Moaem Universal Masaka	Bean	100% Robusta	Uganda	220	2,99			
Sical	Roasted Coffee	Café Masaka Uganda	Ground	100% Robusta	Uganda	220	2,99			
Sical	Roasted Coffee	Café Torrado Espírito Santo	Bean	100% Robusta	Brazil	220	2,99			
Sical	Roasted Coffee	Café Torrado Santa Bárbara	Bean	100% Arabica	Honduras	220	2,99			
Sical	Roasted Coffee	Café Torrado Dak Lak	Bean	100% Robusta	Vietnam	220	2,99			
Sical	Roasted Coffee	Café Torrado 5 Estrelas Nyeri	Tablets	100% Arabica	Kenya	104	3,09			
Sical	Roasted Coffee	Café Torrado Nyeri Quénia	Bean	100% Arabica	Kenya	220	2,99			
Sical	Roasted Coffee	Manizales	Ground	100% Arabica	Colombia	220	2,99			
Delta	Roasted Coffee	India	Ground	100% Robusta	India	220	3,09			
Delta	Roasted Coffee	Cuba	Ground	100% Arabica	Cuba	220	3,09			
Delta	Roasted Coffee	Vietnam	Ground	100% Robusta	Vietnam	220	3,09			
Delta	Roasted Coffee	Brasil	Ground	100% Arabica	Brazil	220	3,09			
Delta	Roasted Coffee	Timor	Ground	100% Arabica	Indonesia	220	3,09			
Delta	Roasted Coffee	Angola	Ground	100% Robusta	Angola	220	3,09			
Delta	Roasted Coffee	Colombia	Ground	100% Arabica	Colombia	220	3,09			
Delta	Roasted Coffee	Jamaica	Ground	100% Arabica	Jamaica	55	3,99			
Buondi	Roasted Coffee	Original	Ground	50% Arabica, 50% Robusta	Brazil, Ethiopia, Uganda, Nicaragua	55	3,59			

Buondi	Roasted Coffee	Encorpado	Ground	50% Arabica, 50% Robusta	Guatemala, Honduras, Uganda, Kenya	55	3,59			
Buondi	Roasted Coffee	Intenso	Ground	80% Arabica, 20% Robusta	Guatemala, Nicaragua, Honduras	55	3,59			
Nicola	Roasted Coffee	Alma Brasil	Ground	100% Arabica	Brazil	55	3,29			
Nicola	Roasted Coffee	Alma Perú	Ground	100% Arabica	Peru	55	3,29			
Nicola	Roasted Coffee	Alma Índia	Ground	50% Arabica, 50% Robusta	India	55	2,89			
Nicola	Roasted Coffee	Alma Colombia	Ground	50% Arabica, 50% Robusta	Colombia	55	3,29			
Nicola	Roasted Coffee	Alma Kenya	Ground	50% Arabica, 50% Robusta	Kenya	55	3,29			
Starbucks	Roasted Coffee	Single-Origin Colombia	Ground	100% Arabica	Colombia	55	3,59			
Starbucks	Roasted Coffee	Single-Origin Sumatra	Ground	100% Arabica	Indonesia	55	3,59			
Starbucks	Roasted Coffee	Medium Colombia	Bean	100% Arabica	Colombia	250	6,79			
Starbucks	Roasted Coffee	Medium Guatemala Antiua	Bean	100% Arabica	Guatemala	453	6,79			
Starbucks	Roasted Coffee	Medium Kenya	Bean	100% Arabica	Kenya	453	6,79			
Starbucks	Roasted Coffee	Blonde Veranda Blend	Bean	100% Arabica	Brazil, Colombia	453	6,79			
Starbucks	Roasted Coffee	Blonde Willow Blend	Bean	100% Arabica	Brazil, Colombia, Ethiopia	453	6,79			
Starbucks	Roasted Coffee	Medium Organic Ethiopia Yiracheffe	Bean	100% Arabica	Ethiopia	250	6,79			
Starbucks	Roasted Coffee	Dark Espresso Roast	Bean	100% Arabica	Brasil, Indonesia, Vietnam	453	6,79			
Starbucks	Roasted Coffee	Anniversary Blend	Bean	100% Arabica	Indonesia	250	6,79			

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Starbucks	Roasted Coffee	Tribute	Bean	100% Arabica	Sumatra, Papua New Guinea, Ethiopia, Colombia	453	6,79			
Starbucks	Roasted Coffee	Christmas Blend Espresso Roast	Bean	100% Arabica	Colombia, Vietnam, Indonesia	453	6,79			
Nescafé	Roasted Coffee	Grande Intenso	Ground	100% Arabica	Kenya, Ethiopia	112	5,79			
Nescafé	Roasted Coffee	Galão Café au Lait	Ground	100% Robusta	Kenya, Uganda	112	5,79			
Nescafé	Roasted Coffee	CGold Brew	Ground	100% Arabica	Brazil	112	4,99			
Nescafé	Roasted Coffee	Ristretto Napoli	Ground	80% Arabica, 20% Robusta	Uganda, Brazil, Colombia	112	5,79			
Nescafé	Roasted Coffee	Espresso	Ground	100% Arabica	Colombia, Brazil	112	5,79			
Nescafé	Roasted Coffee	Espresso Intenso	Ground	70% Arabica, 30% Robusta	Colombia, Vietnam	112	5,79			
Nescafé	Roasted Coffee	Ristretto	Ground	80% Robusta, 20% Arabica	Brazil, Vietnam	112	5,79			
Nescafé	Roasted Coffee	Flat White	Ground	50% Arabica, 50% Robusta	Brazil, Vietnam	112	5,79			
Nescafé	Roasted Coffee	Espresso Descafeinado	Ground	100% Arabica	Colombia, Brazil	112	5,79			
Nescafé	Roasted Coffee	Ristretto Ardenza	Ground	80% Robusta, 20% Arabica	Ethiopia, Colombia, Vietnam	112	5,79			
Nescafé	Roasted Coffee	Ristretto Barista	Ground	80% Robusta, 20% Arabica	Ethiopia, Brazil, Vietnam	112	5,79			
Nescafé	Roasted Coffee	Buondi	Ground	80% Robusta, 20% Arabica	Cameroon, Uganda, Colombia, Vietnam	112	5,79			
Nescafé	Roasted Coffee	Sical	Ground	70% Arabica, 30% Robusta	Honduras, Colombia, Brazil, Vietnam	112	5,79			
Nescafé	Roasted Coffee	Latte Macchiato Caramel	Ground	50% Arabica, 50% Robusta	Colombia, Kenya, Vietnam	112	5,79			
Nescafé	Roasted Coffee	Essenza di Moka	Ground	80% Arabica, 20% Robusta	Colombia, Brazil, Vietnam	112	5,79			
Nescafé	Roasted Coffee	Cappuccino	Ground	80% Arabica, 20% Robusta	Colombia, Brazil, Vietnam	112	5,79			

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Nescafé	Roasted Coffee	Nescafé clássico	Ground	80% Arabica, 20% Robusta	Brazil, Colombia, Kenya	112	6,49			
Nescafé	Roasted Coffee	Grande	Ground	100% Arabica	Colombia, Brazil, Ethiopia	112	5,79			
Nescafé	Roasted Coffee	Peru	Ground	100% Arabica	Peru	112	4,79			
Nescafé	Roasted Coffee	Guatemala	Ground	100% Arabica	Guatemala	112	4,99			
Nescafé	Roasted Coffee	Colombia	Ground	100% Arabica	Colombia	112	4,99			
Nescafé	Roasted Coffee	Lungo Intenso	Ground	80% Arabica, 20% Robusta	Brazil	112	5,79			
Nescafé	Roasted Coffee	Lungo	Ground	100% Arabica	Ethiopia, Brazil, Colombia	112	5,79			
Nescafé	Roasted Coffee	Latte Macchiato	Ground	80% Arabica, 20% Robusta	Brazil, Colombia, Vietnam	112	5,79			
Nescafé	Soluble Coffee	Gold Origins Colombia	Ground	100% Arabica	Colombia	100	5,29			
Nescafé	Soluble Coffee	Gold Origins Uganda Kenya	Ground	100% Robusta	Uganda/Kenya	100	5,29			
Nescafé	Soluble Coffee	Gold Origins Indonesia Sumatra	Ground	100% Robusta	Indonesia	100	5,29			
Nescafé	Soluble Coffee	Gold Origins Alta Rica	Ground	100% Arabica	Colombia, Peru, Guatemala	100	5,29			
Nescafé	Soluble Coffee	Gold Origins Puro Colombia	Ground	100% Arabica	Colombia	100	5,29			
L'or	Roasted Coffee	L'or Colombia	Ground	100% Arabica	Colombia	55	3,99			
L'or	Roasted Coffee	L'or India	Ground	80% Robusta, 20% Arabica	India	55	3,99			
L'or	Roasted Coffee	L'or Papua	Ground	100% Arabica	Papua New Guinea	55	3,99			
L'or	Roasted Coffee	L'or Indonesia	Ground	100% Robusta	Indonesia	55	3,99			
L'or	Roasted Coffee	L'or Guatemala	Ground	100% Arabica	Guatemala	55	3,99			
Illy	Roasted Coffee	Brasil	Bean	100% Arabica	Brazil	250	12,44			
Illy	Roasted Coffee	Colombia	Bean	100% Arabica	Colombia	250	12,44			
Illy	Roasted Coffee	Costa Rica	Bean	100% Arabica	Costa Rica	250	12,44			
Illy	Roasted Coffee	Ethiopia	Bean	100% Arabica	Ethiopia	250	12,44			

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Illy	Roasted Coffee	Guatemala	Bean	100% Arabica	Guatemala	250	12,44			
Illy	Roasted Coffee	India	Bean	100% Arabica	India	250	12,44			
Illy	Roasted coffee	Espresso	Ground	100% Arabica	Guatemala	55	4,55			
Illy	Roasted coffee	Espresso Forte	Ground	100% Arabica	Costa Rica	55	4,55			
Illy	Roasted coffee	Espresso Intenso	Ground	100% Arabica	Honduras	55	4,55			
Illy	Roasted coffee	Espresso Luno	Ground	100% Arabica	Brazil	55	4,55			
Pilão	Roasted Coffee	Tradicional	Ground	100% Arabica	Brazil	250	4,75			
Bicafé	Roasted Coffee	Bio Colômbia	Ground	100% Arabica	Colombia	133	3,79			
Bicafé	Roasted Coffee	Bio Honduras	Ground	100% Arabica	Honduras	133	3,79			
Bicafé	Roasted Coffee	Bio Peru	Ground	100% Arabica	Peru	133	3,79			
Compagnia Dell'Arabica	Roasted Coffee	Agricultura Biologica	Ground	100% Arabica	Peru	55	3,99			
Compagnia Dell'Arabica	Roasted Coffee	Gayo Mountain	Ground	100% Arabica	Indonesia	55	3,99			
Compagnia Dell'Arabica	Roasted Coffee	Caffé Brasil Santos	Ground	100% Arabica	Brazil	55	2,99			
Compagnia Dell'Arabica	Roasted Coffee	Caffé Medellin Supremo	Ground	100% Arabica	Colombia	55	2,99			
Compagnia Dell'Arabica	Roasted Coffee	Caffé Costa Rica Tarrazu	Ground	100% Arabica	Costa Rica	55	2,99			
Compagnia Dell'Arabica	Roasted Coffee	Caffé El Salvador	Ground	100% Arabica	El Salvador	55	2,99			
Compagnia Dell'Arabica	Roasted Coffee	Caffé India Monsooned Malabar	Ground	100% Arabica	India	55	2,99			
Compagnia Dell'Arabica	Roasted Coffee	Caffé Kenya AA Washed	Ground	100% Arabica	Kenya	55	2,99			
Mount Hagen	Roasted Coffee	Organic Café	Soluble	100% Arabica	Papua New Guinea	100	5,29			
Alternativa 3	Roasted Coffee	Café Moído Colombia Biológico	Ground	100% Arabica	Colombia	250	5,49			
Alternativa 3	Roasted Coffee	Café Moído Nicaragua	Ground	100% Arabica	Nicaragua	250	5,49			

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		Biológico								
Alternativa 3	Roasted Coffee	Café Moído Peru Biológico	Ground	100% Arabica	Peru	250	5,89			
Alternativa 3	Roasted Coffee	Café Moído Guatemala Biológico	Ground	100% Arabica	Guatemala	250	6,95			
Alternativa 3	Roasted Coffee	Café Chiapas México	Ground	100% Arabica	Mexico	250	5,89			
Alternativa 3	Roasted Coffee	Café Solúvel Biológico	Ground	100% Arabica	Colombia	100	7,49			
Alternativa 3	Roasted Coffee	Café Descafeinado Moído Biológico	Ground	100% Arabica	Brazil, Colombia	250	5,99			
Alternativa 3	Roasted Coffee	Café Colombia	Ground	100% Arabica	Colombia	55	3,95			
Segafredo	Roasted Coffee	Le Origini Brasile	Ground	100% Arabica	Brazil	55	3,19			
Segafredo	Roasted Coffee	Le Origini Costa Rica	Ground	100% Arabica	Costa Rica	55	3,19			
Segafredo	Roasted Coffee	Le Origini Peru	Ground	100% Arabica	Peru	55	3,19			
Ginga Café	Roasted Coffee	Ginga Café Lote Lobito	Bean	100% Robusta	Angola	1000	4,99			
Café O	Roasted Coffee	Café aromatizado canela	Ground	100% Arabica	Brazil	125	5,45			
Café O	Roasted Coffee	Café aromatizado chocolate	Ground	100% Arabica	Brazil	125	5,45			
Café O	Roasted Coffee	Café aromatizado Grand marnier	Ground	100% Arabica	Brazil	125	5,45			
Café O	Roasted Coffee	Café Arábica	Ground	100% Arabica	Brazil, Colombia, Costa Rica, Kenya	250	6,4			
Café O	Roasted Coffee	Café Gourmet Arábica	Ground	100% Arabica	Brazil	250	7,85			
Café O	Roasted Coffee	Café Gourmet Colombia	Ground	100% Arabica	Colombia	250	7,6			

Café O	Roasted Coffee	Café Gourmet Costa Rica	Ground	100% Arabica	Costa Rica	250	7,75			
Café O	Roasted Coffee	Café Gourmet Kenya	Ground	100% Arabica	Kenya	250	8,7			
Cartwright & Butler	Roasted Coffee	Traditional York Coffee	Ground	100% Arabica	Jamaica	227	13,85			
Fábrica	Roasted Coffee	Espresso Blend	Bean	100% Arabica	Brazil, Ethiopia	250	7,5			
Fábrica	Roasted Coffee	Ato Tona	Bean	100% Arabica	Ethiopia	250	10,9			
Malongo	Roasted Coffee	Blue Mountain Jamaica	Ground	100% Arabica	Jamaica	250	58,9			
Malongo	Roasted Coffee	Pur Kenya	Ground	100% Arabica	Kenya	250	17,9			
Malongo	Roasted Coffee	La rande Reserve	Ground	100% Arabica	Nicaragua	250	13,9			
Sonnentor	reen Coffee	Café Verde	Ground	100% Arabica	Nicaragua	54	4,99			
El Corte Inglés Brand	Roasted Coffee	Café Colombia	Ground	100% Arabica	Colombia	55	2,39			
El Corte Inglés Brand	Roasted Coffee	Café Etiopia	Ground	100% Arabica	Ethiopia	55	2,39			
El Corte Inglés Brand	Roasted Coffee	Café Kenya	Ground	100% Arabica	Kenya	55	2,39			
El Corte Inglés Brand	Roasted Coffee	Café Brasil	Ground	100% Arabica	Brazil	55	2,39			
El Corte Inglés Brand	Roasted Coffee	Café tostado molido natural	Ground	100% Arabica	Colombia, Brazil	250	2,99			
El Corte Inglés Brand	Roasted Coffee	Café tostado molido natural	Ground	100% Arabica	Colombia	250	3,99			
Continente Brand	Roasted Coffee	Brasil	Ground	100% Arabica	Brazil	50	2,39			
Continente Brand	Roasted Coffee	Vietname	Ground	100% Robusta	Vietnam	50	2,39			
Continente Brand	Roasted Coffee	Angola	Ground	80% Robusta, 20% Arabica	India, Angola, Uganda, Brazil	55	2,39			
Pingo Doce Brand	Roasted Coffee	Ristretto Extra Forte	Ground	70% Robusta, 30% Arabica	Brazil, India, Vietnam	128	3,65			
Pingo Doce Brand	Roasted Coffee	Descobrimentos	Ground	50% Arabica, 50% Robusta	Brazil, Ethiopia, India	128	3,65			

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Pingo Doce Brand	Roasted Coffee	Invicta	Ground	50% Arabica, 50% Robusta	Brazil, Guatemala, Vietnam, India	128	3,65			
Pingo Doce Brand	Roasted Coffee	Corposo	Ground	80% Robusta, 20% Arabica	India, Brazil	128	3,65			
Pingo Doce Brand	Roasted Coffee	Aromático	Ground	80% Arabica, 20% Robusta	India, Brazil, Colombia	128	3,65			
Pingo Doce Brand	Roasted Coffee	Descafeinado	Ground	50% Arabica, 50% Robusta	India, Brazil	128	3,65			
Pingo Doce Brand	Roasted Coffee	Kaapi Royale	Ground	100% Robusta	India	128	3,65			
Pingo Doce Brand	Roasted Coffee	Comércio Justo	Ground	80% Arabica, 20% Robusta	Uganda, El Salvador, Brazil	55	2,49			
Pingo Doce Brand	Roasted Coffee	Vietnam	Ground	100% Robusta	Vietnam	55	2,49			
Pingo Doce Brand	Roasted Coffee	Aveludado	Ground	100% Arabica	Brazil, Colombia, Guatemala, Ethiopia	55	2,49			
Pingo Doce Brand	Roasted Coffee	Canela	Ground	80% Arabica, 20% Robusta	India, Brazil, Colombia	55	2,49			
Pingo Doce Brand	Roasted Coffee	Uganda	Ground	100% Robusta	Uganda	55	2,49			
Pingo Doce Brand	Roasted Coffee	Brasil	Ground	100% Arabica	Brazil	55	2,49			
Pingo Doce Brand	Roasted Coffee	Costa Rica	Ground	100% Arabica	Costa Rica	55	2,49			
Auchan Brand	Roasted Coffee	Sensation Brazil	Bean	100% Arabica	Brazil	500	4,59			
Auchan Brand	Roasted Coffee	Sensation Colombia	Bean	100% Arabica	Colombia	500	4,89			
Auchan Brand	Roasted Coffee	Sensation Ethiopia	Bean	100% Arabica	Ethiopia	500	4,59			
Intermarché Brand	Roasted Coffee	Colombia	Ground	100% Arabica	Colombia	55	2,39			
Intermarché Brand	Roasted Coffee	Quenia	Ground	100% Arabica	Kenya	55	2,39			
Intermarché Brand	Roasted Coffee	Brasil	Ground	100% Arabica	Brazil	55	2,39			
E.Leclerc	Roasted Coffee	Plantation Asia	Ground	80% Robusta,	Indonesia, Angola,	55	2,58			

Brand				20% Arabica	Uganda, Brazil					
E.Leclerc Brand	Roasted Coffee	Plantation Brasil	Ground	100% Arabica	Brazil	55	2,48			
E.Leclerc Brand	Roasted Coffee	Bio Village	Tablets	100% Arabica	Brazil, Colombia	125	1,99			
E.Leclerc Brand	Roasted Coffee	Bio Village en rains	Bean	100% Arabica	Brazil, Colombia	250	2,99			
E.Leclerc Brand	Roasted Coffee	Café Torrado	Ground	50% Arabica, 50% Robusta	Brazil, Kenya, Honduras	250	1,44			
E.Leclerc Brand	Roasted Coffee	Bio Village Café moulu	Ground	100% Arabica	Guatemala, Honduras, Costa Rica	250	2,99			
Coffee by weight	Roasted Coffee	Café da Austrália Skybu	Bean	100% Arabica	Australia	1000	55,45			
Coffee by weight	Roasted Coffee	Café da Colombia Descafeinado	Bean	100% Arabica	Colombia	1000	26,95			
Coffee by weight	Roasted Coffee	Café da Colombia Supremo	Bean	100% Arabica	Colombia	1000	21,5			
Coffee by weight	Roasted Coffee	Café da Costa Rica Tarrazu	Bean	100% Arabica	Costa Rica	1000	26,95			
Coffee by weight	Roasted Coffee	Café da Etiópia	Bean	100% Arabica	Ethiopia	1000	26,95			
Coffee by weight	Roasted Coffee	Café da Nova Guiné Papua	Bean	100% Arabica	Papua New Guinea	1000	26,95			
Coffee by weight	Roasted Coffee	Café da India	Bean	100% Arabica	India	1000	26,95			
Coffee by weight	Roasted Coffee	Café da Guatemala Vulcão	Bean	100% Arabica	Guatemala	1000	26,95			
Coffee by weight	Roasted Coffee	Café do Brasil Minas do Sul	Bean	100% Arabica	Brazil	1000	26,95			
Coffee by weight	Roasted Coffee	Café do Quénia	Bean	100% Arabica	Kenya	1000	32,5			
Coffee by weight	Roasted Coffee	Café da Jamaica	Bean	100% Arabica	Jamaica	1000	195			

Coffee by weight	Roasted Coffee	Café da Nicaráua	Bean	100% Arabica	Nicaraua	1000	26,95			
Coffee by weight	Roasted Coffee	Café Honduras Marcal	Bean	100% Arabica	Honduras	1000	26,95			
Coffee by weight	Roasted Coffee	Café Maraoype	Bean	100% Arabica	Brazil	1000	34,95			
Coffee by weight	Roasted Coffee	Café México	Bean	100% Arabica	Mexico	1000	24,5			
Coffee by weight	Roasted Coffee	Café de Uganda Buiso	Bean	100% Robusta	Uganda	1000	17,45			

Table 16 Gathered coffee products during collection step

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