Fighting Against Greenwashing: a mobile app for product transparency

Master's in Digital Marketing

Project Work

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Porto – December 2018

THE PORTO ACCOUNTING AND BUSINESS SCHOOL
POLYTECHNIC INSTITUTE OF PORTO

Fighting Against Greenwashing: a mobile app for product transparency

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Project Work

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ABSTRACT

Technology development changed the way people interact with their surroundings. Customers have access to much more information than they used to and they want to know more and more about the products they purchase. People are willing to pay more for environmentally friendly products from companies they trust. However, trust is difficult to build, it takes real commitment to the cause, so most companies start to use manipulations that lead to greenwashing and mistrust.

This project is about developing a solution that brings transparency to the supply chain. People have the right to know where exactly the product they are purchasing was produced, in which conditions, if people were well treated, how many natural resources were spent until it gets to the retailers' shop, in order to be sure if that's exactly what they want.

The proposed solution is a mobile app, which is the most effective way to interact with consumers. Using IoT (Internet of Things) and Blockchain technologies people will have access to all the information about the specific product on their mobile app. Through products' QR Code scanning, the app will show registered info at companies' and its stakeholder's blockchain (common registered information visible to all intervenient regarding a specific product).

A survey was developed to ensure the viability of the project. Using Google Forms platform, 154 answers were achieved. 95,4% of respondents are interested, 69,5% would use the app for sure, 25,3% would try it and maybe use it also. A profile of ideal user was developed with SPSS software.

Besides the solution for greenwashing and mistrust. For companies, it enables improved visibility of all activities and reveals where a product is at any point in time, who owns it, and what condition it's in. In this way, transparency is achieved within the company and its easily communicated to the consumer.

KEYWORDS

Greenwashing, Companies' Transparency, Blockchain for supply chain, Mobile app

RESUMO

O desenvolvimento tecnológico mudou a forma como as pessoas interagem com o ambiente que os rodeia. Atualmente os consumidores têm acesso a muito mais informação e querem saber cada vez mais sobre os produtos que compram. As pessoas estão dispostas a pagar mais por produtos sustentáveis de empresas nas quais confiam. No entanto, a confiança é difícil de construir, é preciso um compromisso autêntico com a causa, logo, a maioria das empresas começa a recorrer a manipulações que provocam a desconfiança e *Greenwashing*.

Este projeto procura desenvolver uma solução que promove a transparência da cadeia de abastecimento. As pessoas têm o direito de saber exatamente onde o produto que estão a comprar foi produzido, em que condições, se as pessoas foram bem tratadas no processo, quantos recursos naturais foram gastos até chegar às lojas, para poderem tomar uma decisão consciente com base nas informações fidedignas.

A solução proposta é uma App para dispositivos móveis, o meio mais eficaz de interagir com os consumidores. Recorrendo às tecnologias de IoT ("Internet das Coisas") e *Blockchain*, as pessoas terão acesso a todas as informações sobre o produto específico. Através do *QR Code* no rótulo do produto, a aplicação mostra as informações registadas na *Blockchain* comum entre a empresa e os seus *stakeholders*. O registo comum das informações sobre o produto é visível a todos os intervenientes no seu ciclo de vida.

Desenvolveu-se um inquérito para garantir a viabilidade do projeto. Através do Google Forms registaram-se 154 respostas ao questionário. 95,4% dos entrevistados estão interessados na solução, 69,5% utilizariam a aplicação, 25,3% talvez utilizariam. O perfil do utilizador ideal foi desenvolvido através do software SPSS.

Além da solução para o *Greenwashing* e desconfiança. As empresas terão melhor visibilidade de todos os processos que revelam, em qualquer momento, onde se encontra exatamente um produto, quem é o proprietário e em que condições está. Desta forma a transparência é conseguida dentro da empresa e é facilmente comunicada ao consumidor.

PALAVRAS-CHAVE

Greenwashing, Transparência corporativa, Blockchain para a cadeia de abastecimento, Aplicação móvel

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1. INTRODUCTION

1.1 Framework

Problem: Supply chain transparency holds a prominent position in concerns for consumer and business. Starting with branding, organizational strategy and relationship with stakeholders, the lack of supply chain transparency causes fraud, dishonesty and low traceability of incident sources. It leads to desperate measures such as greenwashing strategies that result in mistrust between companies and customers.

Solution: In a world of technological abundance, it is imperative to take advantage of supply chain management, using IoT applications to track the products along with all their lifecycle. Nowadays, we trust in the information that financial, governmental and other external entities provide us. But can we be sure that such information has not been altered/falsified in any way (Reyna, Martín, Chen, Soler, & Díaz, 2018)?

Authors suggest that one way to provide trustworthiness to IoT applications is to distribute the data through all the participants at the process. With a system that guarantees data reliability. Every member can verify if the data remains immutable with since the first definition. That's when blockchain technology emerges. Imagine one simple product purchased at the supermarket, let's say an apple. It is imperative that all the participants in the supply chain have access to apple's data/records since growing stage (for example if there were used pesticides, amount of water spent, duration of transportation…) until reaching supermarket's shelves, to achieve trustworthiness and guarantee product quality.

1.2 Motivation

The main motivation for this research is the personal concern regarding the lack of transparency in products and companies. Moreover, a strong reliance on digital media in solving global problems.

Therefore, simplifying the customers' purchase decisions and increasing their confidence in brands is the strongest aspect of this research. Consumers' positive perception of a company's environmental performance would positively influence willingness to purchase, consumers demand more effective communication, transparency of the

company's intentions and real actions that add value to a brand image (Grimmer & Bingham, 2013).

Environmental responsibility of a company can achieve multiple benefits, such as cost reduction (lower natural resource consumption, essentially water, and energy), profit increase (recycling and residuals reusing) and brand image improvement as a competitive advantage (Simão & Lisboa, 2017). This study intends to demonstrate how companies can achieve a brand improvement advantage and customer loyalty through their actions' transparency.

Government and non-government entities are working hard to standardize businesses and society to sustainable economic, environmental and social development (International Organization for Standards, 2011). An emerging number of different eco-labels show the increase of concern with environmental advantages of products, although some consumers can identify labelled quality products, they would like to receive more information about the labels since only pieces of data are available to the consumer (Nilsson, Tunçer, & Thidell, 2004).

In Global Green Economy Index, 80 countries are evaluated for their performance in the green economy and its perception in the eyes of the population (Tamanini & Valenciano, 2016). The key conclusion is that society perceives that their countries have a greater performance than they actually have, it reveals that the expectations are high and need to be satisfied since the number of people sensitive to this matter is growing (The Nielsen Company, 2015).

1.3 Objectives

The main objective of this study is to provide a possible solution for Greenwashing. In the customers' perspective, it is to have all the trustworthy information about purchasing goods just a click away, in businesses' perspective, it is an opportunity to create a trustful relationship with their clients over a path of transparency, proving environmental responsibility through actual actions and, for government entities, the easiest way to control company performance regarding the environment.

Specific objectives are:

- ✓ Understanding whether customers value the environmental advantages of products such as certifications or brand responsibility during purchase decision;
- ✓ Comprehending the connection between environmental company responsibility and customers' loyalty;
- ✓ Understanding major barriers regarding sustainable purchase decision;
- ✓ Analysing company performance, according to market and environmental changes;
- ✓ Analysing government performance, according to market and environmental changes;
- ✓ Studying the effects of greenwashing on consumers' attitudes;
- ✓ Creating a possible digital solution to solve trust issues between customers and companies;
- ✓ Evaluate the viability of the solution. If people would use it or not and create a Persona user;
- ✓ Creating the prototype and simulate the operation.

1.4 Methodology

Once identified the problem, the first step is to gather information from secondary external sources such as electronic libraries: Google Scholar, B-On, Science Direct, Elsevier, and EBSCO, also data published by governments, company reports, and statistics from independent specialized entities. The most important keywords used during the study were: "Greenwashing", "Green purchase behaviour", "Green marketing", "Corporate sustainability strategy", "Blockchain", "Supply chain", "Blockchain for supply chain", "Products' lifecycle", "Eco-label credibility", "Customer brand trust", "Company environmental performance", "Environmental certification", "Digital platform", "Mobile application usage", etc., subsequently 123 articles were read though not all relevant enough, however, they were all important to understand the current panorama.

After completing the analysis and organization of the data, a gap has been identified between consumers and firms. The lack of customers' confidence in the environmental company communication is a major barrier to purchase (Joshi & Rahman, 2015), the product information and the firm's claims about sustainability do not fulfil the customers' expectations (Taufique, Vocino, & Polonsky, 2017). The popularity of greenwash is the

main challenge for the companies which want to gain customers' green trust (Y. S. Chen & Chang, 2013). This evidence gives rise to a need for primary data research about a solution to the lack of company and product transparency, an independent mobile application to provide consumers with all the relevant info about the products they purchase.

Collecting data from the primary source is the second phase of the methodology. The chosen technique is the application of an online survey to Portuguese consumers, to understand their concerns with environmentally friendly products and, above all, to realize if the mobile application, where they can find information about the product's lifecycle from production to sale, would be useful and curious in their opinion. The survey will be divided into two sections: socio-demographic questions and subject related questions, essentially according to Likert's scale format.

The third phase is the analysis of a specific real product commercialized in Portugal by Nutural company to demonstrate all the information required from enterprises, to exemplify the platforms' performance.

Finally, the creation of the app layout prototype in InVision platform also using Adobe Photoshop and Adobe Illustrator to design all the navigation screens.

1.5 Structure

This dissertation contains nine chapters. It begins with an introductory chapter which includes a theoretical framework, motivation for the study, general and specific objectives and methodology. Second, third and fourth chapters include all the literature review about the research subject investigated through secondary sources such as independent studies and online libraries. The second contains literature about sustainable consumption and analyses behaviours of customers, companies and government entities. The third chapter embraces greenwashing impacts on customers and companies. Fourth part includes blockchain technology explanation and application.

The fifth chapter comprehends specifically all the development of the survey, since the formulation of the questions, the sample definition, the platforms used in the application stage and findings analysis.

Afterwards, the sixth chapter refers to the creation of the mobile application. Explanation of all the information regarding the product and the user experience is presented in this section. Likewise, the demonstration of the performance of a real product, almond butter from a Portuguese brand Nutural.

The seventh chapter presents the conclusion and recommendations for future research are included in the eight chapter. Ninth section includes all the bibliography and last, tenth chapter is dedicated to attachments, here can be found App's prototype screens, paper draft and digital version including a flowchart.

Since the environment is the topic of great importance in this project, the original document template was slightly changed. All the chapter titles joined the content on the same page to use less paper for printing. All the A4 paper used is recycled.

2. SUSTAINABLE CONSUMPTION

People listen from many sources that environment is changing and what could happen if certain behaviours continued for much longer (consumption, pollution, overpopulation). All these concerns influence customer's behaviour and habits.

2.1 Customers' behaviour

Buying behaviour has been changing gradually since consumers started to add environmental aspects to criteria such as price and performance. By increasing environmental concerns, consumers' willingness to buy green products also increases (Mobrezi & Khoshtinat, 2016). Green products are related to sustainable manufacturing and supply chain management, which involves environment-friendly, people friendly and animal-friendly standards, technologies and practices (Palevich, 2012).

Joshi & Rahman (2015) reviewed 53 empirical articles on green purchase behaviour from 2000 to 2014. This review identified a gap reported by many studies: most of the consumers might have the intention of buying green products but only a small number actually buys them. In order to explain this discrepancy, individual and situational motives that encourage or discourage product purchase was identified.

Major barriers (Table 1) during the decision process are higher prices, availability, and difficulty in accessing environmentally sustainable products, customers' habits, especially if they don't worry about the environment and key barriers such as mistrust in ethical claims and in the green characteristics of a product (Joshi & Rahman, 2015).

	FACTORS AFFECTING GREEN PURCHASE INTENTION	**Influence**
Individual Factors	Emotions (environmental concern)	+
	Habits	-
	Perceived consumer' usefulness (their consumption can make a difference)	+
	Perceived behavioural control (perceived control one has over one's actions)	+
	Values and personal norms (altruism, universalism goodwill, health, and safety)	+
	Trust (belief or expectation about the environmental performance of products)	-
	Knowledge of environmental benefits	+

Situational Factors	Price (high price sensitivity)	-
	Product availability (barrier between a positive attitude and actual behaviour)	-
	Social norm and reference group	+
	Product attributes and quality (functionality, sustainability and high quality)	+
	Store related attributes (sustainability)	+
	Brand image (correlated in customers' memory as sustainable)	+
	Eco-labelling and certification (if the information is not trustful)	-

Table 1 - Factors Affecting Green Purchase Intention (Joshi & Rahman, 2015)

Worldwide company Nielsen, specialized in studying consumer habits, confirmed the same results. The Global Sustainability Report (2015) reveals that the market for sustainable goods continues to expand. Despite variations by region, demographics, and category, on a global scale, it is the opportunity for significant brand growth. The report also reveals that consumers want on the market newer products that are affordable, healthy, convenient, and environmentally friendly. In fact, there is a notable gap between the percentage of consumers demanding for more eco-friendly products (26%) than those who say they had purchased them (10%) (The Nielsen Company, 2015).

KEY PURCHASING DRIVERS	**Influence**
The products are made by a brand/company that I trust	62%
The product is known for its health & wellness benefits	59%
The product is made from fresh, natural and/or organic ingredients	57%
The product is from a company known for being environmentally friendly	45%
The product is from a company known for its commitment to social value	43%
The product's packaging is environmentally friendly	41%
The product is from a company known for its commitment to my community	41%
I saw an ad on television about the social and/or environmental good the product's company is doing	34%

Table 2 - Key Purchasing Drivers (The Nielsen Company, 2015)

Brands need to increase customers' trust by demonstrating a commitment to social and environmental sustainability. More than half (62%) of the consumers are influenced to purchase if they trust the company and 66% of the consumers (the majority under the age of 35) are willing to pay more for brands committed to a positive social and environmental impact (The Nielsen Company, 2015).

2.2 Company performance

According to a change in consumption habits, companies aim at integrating environmental sustainability into their marketing mix and strategy. The Green Marketing Mix comprehends the main characteristics of green products, identifying factors affecting their price and consumers willing to pay more for them, sales channels and promotional tools. The Green Marketing Strategy focuses on targeting green products for green consumers through customer segmentation ("greenness level"), positioning and differentiating the company as truthful (Dangelico & Vocalelli, 2017).

Companies are looking forward to taking advantage of the green trend, consequently, green marketing becomes a common feature of advertising messages such as "eco", "environmentally friendly", "green", "earth friendly", and "sustainability" (Y. S. Chen & Chang, 2013). The strong green purchase forces corporations to prove current and potential clients that they are ecologically conscious and environmentally correct. Greenwash is defined **as "the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service"** (Parguel, Benoît-Moreau, & Larceneux, 2011).

Using greenwash on marketing campaigns increases green consumer confusion and green perceived risk, but also reduces green trust. If companies want to enhance their consumers' trust, they should decrease their consumers' greenwash (Y. S. Chen & Chang, 2013).

Grimmer & Bingham (2013) research predicts that consumers' positive perception of a company's environmental performance will positively influence the willingness to purchase. Companies with high perceived environmental performance tend to have high purchase intentions, regardless of consumers' degree of environmental involvement. Consumers are desperate for more effective communication, transparency of the company's intentions and real actions that add value to brand image. In order to enhance consumer's intention to purchase green products, brand communication should specify benefits that make them feel good while doing good (Hartmann & Apaolaza-Ibáñez, 2012).

From the perspective of many companies, the central barrier to the implementation of sustainable practices is the lack of knowledge of how it can be done profitably. Several

businesses have tried and failed with “green” or “eco-friendly” products, and they’ve given up because they assume that “green doesn’t sell”. Successful ecological business leaders view sustainability and social good not just as where businesses spend their money but how they earn it (Williams, 2015).

An example of a brand committed to sustainability that has positively applied green marketing strategies is Toyota, more specifically, one of the brand's models, Toyota Prius, considered one of the nine green giants that exemplify how companies are shifting sustainability into profitable businesses (Williams, 2015). Currently, the company is perceived as a benchmark due to its values, principles, and performance. In 2015 Toyota established important environmental goals to be reached until 2050, this type of commitment leads the brand to a respectful position as a global green brand (Simão & Lisboa, 2017; Williams, 2015).

Other global brands like Nike or IKEA, considered “Green Giants” by Williams (2015), have also adopted ecological practices. Nike has created a new model of shoes “Flyknit”, a technology that combines high performance and reduces up to 80% less waste than conventional athletics shoes during manufacture, instead of gathering the pieces the solution is to knit. IKEA has created a line of “products for a more sustainable life at home” whose aim is to help customers to use energy more efficiently, produce renewable energy, reduce waste, recycle and save, reuse, or purify water.

Coca-Cola, a multinational brand, revealed in 2016 a sustainability report. Its main aspects include sugar reduction, packaging improvement, beverage evolution (other flavours and drinks – organic tea, juices, coconut water, etc.), more sustainably sourced ingredients, reduction of carbon footprint, contribution to renewable energy projects, support and donation to environmental and commentary organizations and finally, encouragement of informed choices through data clarity on packaging (The Coca-Cola Company, 2016).

There are several other instances of multinational companies focused on their sustainability performance. The pressure from customers, competitors, legal regulation, the company’s existing level of expertise and also pressure from shareholders/stockholders affects the organisation’s decision on environmentally responsible investment, its success depends on its size, marketing, technological capacity and managers’ ethicality (Li, McMurray, Xue, Liu, & Sy, 2017). The last, but not least

aspect, ethicality, can greatly influence a company's decision. Volkswagen, for instance, did not respect this factor and, consequently, was found to falsify the test records of selected air pollutants by up to 40%, this resulted in worldwide investigations of company fraud, and even worse, triggered breach of customers' trust (Li et al., 2017).

Given the high price of greenwashing, the success depends on authenticity, legitimacy, and transparency of company actions. The main challenge for companies that remains is: how can people know for sure if the company is authentic about their practices or if it's just a marketing strategy.

2.3 Government and non-government entities' approach

The fundamental role in environmental sustainability is played by governments. In order to conserve natural resources and quality of life, the establishment of environmental norms and regulatory frameworks is indispensable, such actions may be regarded as cost enhancing and disadvantageous to industrial competitiveness (Wilkinson, Hill, & Gollan, 2001).

Generally, all the governments around the world show concern about green marketing activities that they have attempted to regulate (Rais Ahmad Itoo & Naik, 2015).

In November 2017, 194 states and the European Union signed the Paris Agreement, approved in 2015 at the United Nations Climate Change Conference (COP 21). A global agreement on the reduction of greenhouse gas emissions from 2020. The aim of the agreement is to keep global temperature rise below 2 degrees Celsius and increase the ability to adapt to the climate change impact through financial flows consistent with a pathway towards low greenhouse gas emissions (United Nations, 2017).

In 1992, the European Union developed an Ecolabel that includes a wide range of product groups, from major areas of manufacturing to tourist accommodation. The main focus when developing criteria is the product lifecycle stages where the highest environmental impact occurs. It begins with extraction (cultivation of materials such as cotton for textiles or wood for paper), it continues with manufacturing and packaging, distribution, usage and finally recycling or disposing of (European Parliament & Council of the European Union, 2009). Since 1992 the number of EU Ecolabels increased significantly, currently, the number is 2.130 licenses.

In an international context, an independent, non-government organization ISO (International Organization for Standardization) has published, since 1947, 21.975 international standards which provide practical tools for measurement of three dimensions of sustainable development: economic, environmental and social (International Organization for Standards, 2011). Regarding environmental standards, ISO 14000 series of standards, certifies that companies are not misleading their customers with "environmentally friendly", "green", "nature's friend" or similar claims, also ensuring that companies with ISO are actually improving their environmental performance and accurately pass this information to the consumers without confusing them (International Organization for Standards, 2012).

Regulations and governments count on ISO standards to help develop better regulation and standardization which is the major step to global communication. This way government and non-government entities contribute to environmental protection. The problem is the lack of clear information regarding certification, which leads to customers' credibility issues (Nilsson et al., 2004).

Yenipazarli (2015), identifies primary barriers for eco-labelling. For reasons of market growth and customers' willingness to pay higher prices for certified products, the cost and the requirements to obtain eco-labelling are increasing. The author finds that higher prices for eco-labelled products do not guarantee that a company will derive a higher profit from eco-labelling. Also, auditing fees paid per product unit may dissuade a firm from participating in eco-labelling.

This government strategy is expensive and doesn't guarantee a higher profit for the company. The solution proposed in this study focuses on helping companies to achieve transparency, government and non-government entities to facilitate regulations and customers to learn which products and companies can be trusted based on their actions.

3. GREENWASHING

Public concern that companies are disseminating untruthful environmental information, has increased the number of sceptical customers about sustainable performance and benefits of green products (Goh & Balaji, 2016). The consequence is a lower ecological concern and knowledge and, in addition, lower purchase intention as well.

3.1 Customers' trust due to greenwashing popularity

Some businesses are genuinely committed to making the world a better place nonetheless, to many others, environmentalism is just a convenient slogan that may help increase sales. The main challenge for companies is how to increase green trust in the popularity of greenwash (Y. S. Chen & Chang, 2013).

Companies are aware that consumers need relevant environmental product information in order to purchase, therefore they are integrating details like eco-labels in their offer. Taufique, Vocino, & Polonsky (2017) concluded that knowledge of eco-labels influences negatively pro-environmental consumer behaviour, but on the other hand confidence in eco-labels has a positive influence, this can be explained by consumers' scepticism on eco-label information when the sources are not perceived as credible, in other words, when consumers believe that the information presented is greenwashing (Taufique et al., 2017).

Eco-labels are a strategic communication tool, consumers need to be educated about the environment and specifics of eco-labels. Rubik & Frankl (2017), found that eco-labels need to be better interlinked and also connected to national and international policies. Thøgersen (2000) emphasised the importance of consumer recognition, understanding and trust in eco-labels. Even so, most consumers do not have access to information about the environmental or social impacts of the products they purchase or do not trust the facts provided by companies (O'Rourke, 2008).

Besides eco-labelling, consumers' expectations about environmentally friendly products are not fulfilled when compared to their perception as they expect higher environmental, functional and quality performance than that provided (Tseng & Hung, 2013). Gleim, Smith, Andrews, & Cronin (2013) identified price and lack of expertise as major barriers to purchase behaviour, although, if knowledge increased, individuals would understand

the impact on a single purchase, what makes products environmentally friendly and why prices are higher.

3.2 Company reputation

Customer perception of greenwashing is real and its impact on brand attitude and purchase intention is significant. Companies that have adopted green advertising in their strategy without decreasing environmental impact, do not only take ethical consequences, but also consumer perception and ultimately financial ones (Nyilasy, Gangadharbatla, & Paladino, 2013).

Company reputation today is made of actions, not advertising. It's imperative to rethink the business model in order to focus on a purpose beyond profit like many business leaders such as Nike, Unilever, IKEA, Tesla Motors, etc. have already done (Williams, 2015).

The increase of regulations concerning environmental sustainability emphasizes the significance of ecological strategies as a competitive advantage. Strong company competition, in order to satisfy customer needs, led to quality and performance improvement, price reduction, product innovation and extra effort to achieve customers' loyalty (Marakanon & Panjakajornsak, 2017).

The problem lies in the transparency of company actions and intentions. The Bureau for the Appraisal of Societal Impacts for Citizen information & Multinationals' Observatory (2015), French independent organizations that investigate company responsibility and transparency, analysed the performance of major French sponsors of the 21st Conference of the Parties (COP21) held in Paris. The main goal was to reduce greenhouse gas emissions across the entire value chain; the ten companies analysed were Accor, BNP Paribas, Carrefour, EDF, Engie, Kering, LVMH, L'Oréal, Michelin and Renault. Three key areas were analysed: transparency and coherency of greenhouse gas emission declarations, ability to think and act on a global scale and across their entire value chain and, finally, the level of their emissions in relation to the French and the EU official GHG reduction targets (-20% by 2020, -40% by 2030, -80% by 2050).

The results illustrate that none of the companies meets the criteria, only four presented data transparency, none of them accounted for the exact emissions across the value chain and only one seems to reach the EU targets. Among the majority of the companies

analysed no type of strategy to reduce carbon footprint was found and unlike financial information, companies' emission statements weren't standardized or easily comparable (Bureau for the Appraisal of Societal Impacts for Citizen information & Multinationals' Observatory, 2015).

The companies mentioned above, or Volkswagen fraud case, are only a few examples of a reality we are living in, disinformation, misleading data and lack of customers' trust. They can be solved if people are correctly and subtly educated to search and evaluate authentic product information.

4. BLOCKCHAIN

Blockchain technology received initial attention for its association with Bitcoin (Nakamoto, 2008) though it only provided the means to record and store Bitcoin transactions, however, blockchain has many other purposes (Gupta, 2017). It is characterized as an "open-source, decentralized, distributed database for storing transaction information" in any single location, meaning the records it saves are truly public and easily verifiable (Francisco & Swanson, 2018).

Following to Don and Alex Tapscott: "The blockchain is an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions, but virtually everything of value" (Tapscott & Tapscott, 2016).

Gupta (2017), director and distinguished engineer - cloud-native competency at IBM, presents an approach for blockchain applicability for the car leasing process (Figure 1 and Figure 2).

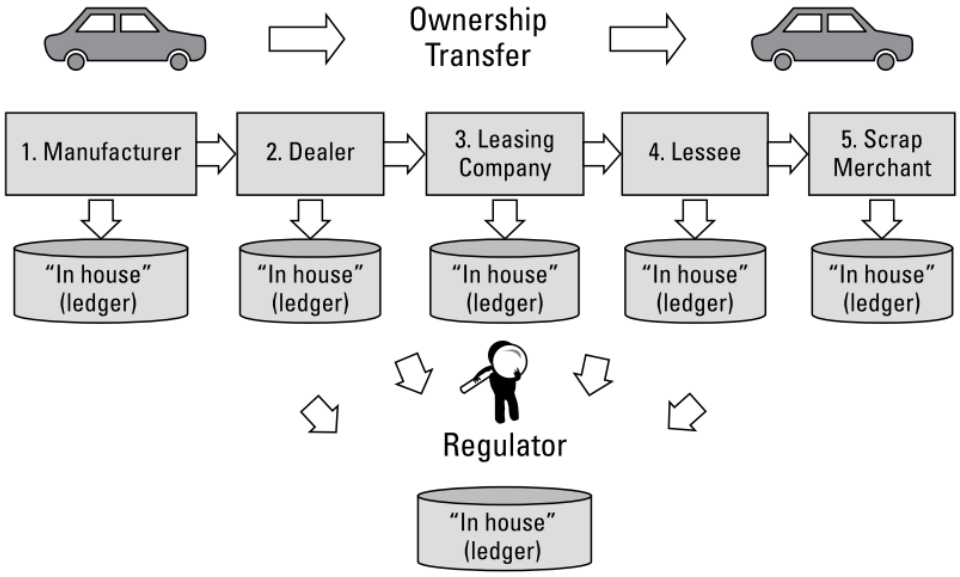


Figure 1 - Tracking vehicle ownership without blockchain (Gupta, 2017)

A significant challenge faced by today's car leasing networks is the fragmentation of support systems. Each participant in the network keeps their own records (ledger), what may take days or even weeks to synchronize (Gupta, 2017).

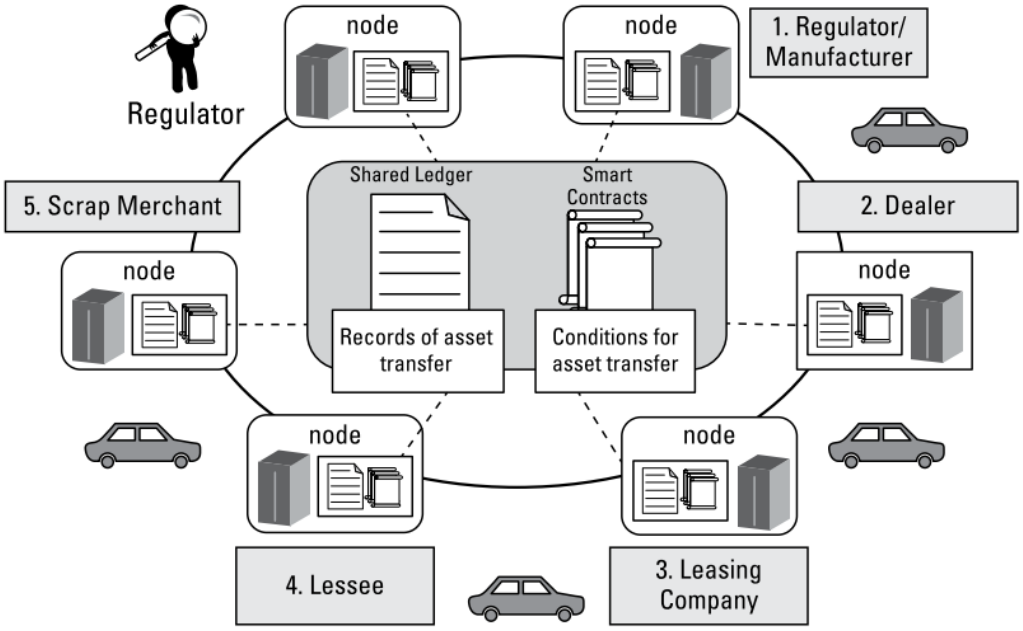


Figure 2 - Tracking vehicle ownership with blockchain (Gupta, 2017)

By using a shared ledger on a blockchain network, every authorized participant can access, monitor, and analyse the vehicle conditions regardless of its position within its lifecycle.

4.1 Blockchain for supply chain

After disrupting the finance industry, blockchain next implementations are supply chain, power and food/agriculture areas (Bünger, 2017). Supply chain activities are among others, the ones that are most likely to be transformed by blockchain. The first direct benefit is the solution to identity management (Alam, 2016). It's a foolproof method to detect who is doing what actions, information that couldn't be proven until now, even with all the Internet-of-things (IoT) applications. An increasing reliance on the use of IoT applications which has allowed real-time tracking of goods since their origin. The development of IoT solutions, conventional devices have become smart, connected and autonomous, such as Radio-frequency identifications (RFID) tags, sensors, barcodes, GPS tags and chips (Kshetri, 2018). Even so, challenges in the domain of security or data reliability have persisted so the blockchain has emerged as a key technology that will transform the way we share information. (Reyna et al., 2018).

The valid and effective measurement of supply chain management (SCM) key processes' performance and outcomes is simplified by blockchain technology. Once the inputs

tracking data are registered on a blockchain ledger, they are unchallengeable. Other suppliers in the chain can also track shipments, delivers and progress. Consequently, it increases trust among suppliers. Also, middlemen auditors are eliminated from the equation, so that costs can be lowered and efficiency improved (Owyang & Groopman, 2018).

There is a severe lack of transparency and accountability across complex supply chains. For example, an American chain of fast casual restaurants, Chipotle, to secure their supply chain and guarantee fresh and locally sourced ingredients without blockchain methods, required manual verification and massive record keeping which was expensive and arduous. However, companies like Chipotle are not in the position to monitor their suppliers in real-time, so it is almost impossible to prevent food contamination or stop it after it is discovered. Unfortunately, E. Coli infection affected 55 customers and the company's share price dropped by 42% (Casey & Wong, 2017). This example can be generalized to all kinds of industries. The blockchain increases supply chain transparency (O'Marah, 2017).

Besides traceability, blockchain provides an accurate way of measuring product quality during transportation, by analysing data on the journey and its duration which is important for refrigerated goods. Also, reducing labour costs and food waste are huge benefits to all parties involved (Kshetri, 2018). For instance, stores know all the details of the arrival of a shipment so they can be prepared to receive it (Groenfeldt, 2017). In what concerns food products supply chain, when confirmed that a shipment, say, apples, will arrive at the juice factory, a code is generated and stored remotely, being available for verification at any time. The information about the apples and the factory that received them is connected with this code that can be represented on maps of inputs or any other user-friendly outputs (O'Marah, 2017). Trust and security can thus be improved with blockchain, although the full potential of this technology can only be recognised after the improvement of the supply chain members' participation (Kshetri, 2018).

4.2 Blockchain application

Since 2016, some of the main companies such as Maersk, Alibaba, Modum, Walmart, and Intel started to apply blockchain technology.

Figure 3 - Maersk, largest container ship and supply vessel operator in the world

Maersk is the world's largest container carrier (Groenfeldt, 2017). For many years, they had been looking for a better way to trace the goods they shipped worldwide. They already used IoT apps like GPS location, temperature, and other conditions (Jackson, 2017).

The key problem was the huge amount of paperwork required for each container due to the number of entities involved. Containers can be loaded on a ship in a few minutes, however, they can be held up in the port for many days due to missing paperwork. The goods inside the containers may get spoiled.

Maersk started to work with IBM's top blockchain expert on a software version that would be open to everyone involved with every container. When the customs authorities signed off a document, they could immediately upload its copy using a digital signature, so Maersk and the government authorities could see that it was complete. The cryptography involved makes it really hard for a digital signature to be forged (Popper & Lohr, 2017).

Pilot projects developed after the establishment of this partnership were a complete success. Before blockchain, paperwork may have cost as much as physically moving the containers. Thereafter, the shipping cost was 2000$ and the estimated paperwork cost of about 300$ (Groenfeldt, 2017).

Figure 4 - Walmart, American multinational retail corporation

Walmart started to work with IBM in late 2016. The project involved moving pork products from farms to stores, first in the U.S. and then in China. A few months later, Walmart reported being confident that a finished version could be ready "within a few years" (Popper & Lohr, 2017).

In the past, to track individual pork products would take a few days, but blockchain has enabled this process to be complete in a few minutes. Additionally, details about the farm,

batch number, storage temperature and shipping can be viewed on the blockchain. These details help assess the authenticity of products and their expiry date (Yiannas, 2017).

Regardless of the store where the product is being sold, if an item is found to be spoiled, it is possible to identify the source of contamination and to engage strategical removals of the affected products instead of recalling the entire product line (Galvin, 2017).

Walmart reported that blockchain helped to reduce the time taken to track food from days to minutes, which is an important cost-saving implication (The Linux Foundation, 2018).

Figure 5 - Modum, improve supply chain processes by combining blockchain and IoT

Modum's aim is to design a system to ensure the safe delivery of pharmaceutical products. Most medicines need to be transported under exact temperature, humidity and light conditions. This process involves many people and a huge amount of paperwork (Allen, 2017). A recent regulatory change in the EU requires companies to report any temperature variation or other conditions to the distributor. Currently, the only way to comply with this regulation would be to use refrigerated trucks, which are four to eight times more expensive than the others. Since only 40% of the drugs transported in the EU require refrigeration, 3$ billion is wasted annually in unnecessary cooling (Campbell, 2016). The pilot project was a success.

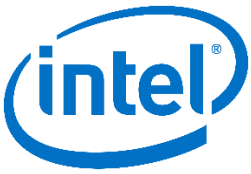


Figure 6 - Intel, American multinational corporation and technology company

In April 2017, Intel has revealed a solution to track seafood supply chain. "The ocean-to-table movement" aims to increase the precision of recordkeeping since the fish is caught (Castillo, 2017a). Sustainable tracking systems are based on papers and reports. The quality control of the fishing industry is a challenging task since the source comes from hundreds of boats and there is a lack of supervision. Therefore, in six months of testing, the blockchain tracked correctly all the fish information. This might be helpful to solve industry problems such as overfishing, illegal fishing and human rights abuse (Hannam, 2016).

5. SURVEY DEVELOPMENT

5.1 Conception and implementation of the questionnaire

Lack of corporate transparency and greenwashing popularity decreases customers' trust and loyalty and promotes corporate fraud. After secondary data analysis, the problem is defined. As the study is experimental, the primary data must be collected directly from the source. The chosen method for data collection is through an online survey.

The main goal is to analyse customer behaviour towards conscious product purchase. Also, evaluate the viability of the project by investigating customers interested to know more about companies/products. As a result, define the potential customers' profile.

Using Google Forms in the Portuguese language, a questionnaire was designed. Following to Wilson (2013), "a questionnaire is a written, online, or verbal tool for collecting data from individuals or groups that can be analysed using qualitative and quantitative techniques".

The sample type for this research is not probable one as the questionnaire was communicated through social media networks. The selection was unguided, although it wasn't random, respondents were motivated by convenience.

Each question was developed with a specific purpose shown in the following matrix.

Goal	Type of Question	Question
Evaluate the level of customer involvement during the purchase process	Multiple choice	1. Do you consult the information on product labels (durable and non-durable goods) before purchase? **Yes, No, Sometimes**
	Likert scale (frequency: never, rarely, sometimes, often, always)	1.1. What kind of information you are looking to find on labels? ✓ **Nutritional information (fat, salt, sugar)** ✓ **Ingredients** ✓ **Instructions** ✓ **Certification (environmental, quality, energy)** ✓ **Product origin (environmental, quality, energy)**

		✓ Specific logos (vegetarian, biological, gluten-free, etc.)
	Multiple choice	1.2. Why don't you consult the information on product's label? **1. The information isn't clear** **2. The information isn't relevant** **3. I have no interest** 4. **Other**
Analyse the use of digital media to find information about products	Multiple choice	2. Have you ever used digital media to check product/company information? **Yes, No**
	Likert scale (frequency: never, rarely, sometimes, often, always)	2.1. What kind of information did you seek? ✓ **Reviews (ratings/opinions/comments)** ✓ **Policies (production/ethics/sustainability)** ✓ **Prices and promotions** ✓ **Customer Service** ✓ **Certifications (quality/sustainability/ energy efficiency…)**
	Likert Scale (effort level)	2.2. Did you easily find all the information you would like to know on social media or brand's website? **1. Easy** **2. Not that easy** **3. Hard** **4. Really Hard** 5. **Didn't find at all**
Explore customer's trust	Likert Scale (importance: not important, less important, neutral, important, very important)	3. Rate the level of importance of the following factors in your purchase decision: ✓ **Brand trust** ✓ **Brand awareness;** ✓ **Origin and production (recyclable/biological/natural/fair trade)** ✓ **Environmental and social responsibility**
	Multiple choice	4. Is brand trust a determining factor in your purchase decision? **Yes, No, Don't know**
Fraud/Greenwashing experience	Likert Scale (frequency)	5. Have you ever felt that the information provided by the company about the product or its practices was not true?

		1. **Almost never** 2. **Rarely** 3. **Sometimes** 4. **Often** 5. **Almost always**
	Multiple choice	6. In the practical case of food fraud that occurred in several European countries, the sale of beef that was horse meat. Do you agree that an independent system that allows the consumer to check all the steps from production, middlemen and even to the point of sale would prevent such adulterations and promote transparency? **Yes, No**
Opinion about the suggested solution	Likert scale (interest)	7. If it were possible to know the impact on the environment and society that a product originated from its production to the moment of purchase, at the speed of a click, would you be interested? 1. **Very interested** 2. **Interested** 3. **Neutral** 4. **Slightly interested** 5. **Not interested**
	Multiple choice	8. Would you use an independent mobile application in which you could consult all the information about each product you consume? (Such as production process, the logistics up to your hand, the product life cycle and how you can recycle it, nutritional information, specific logos and certificates, the working conditions of the people who produced the product, the ecological footprint and opinions of other users on product performance): **Yes, No, Maybe**
The viability of app usage	Multiple choice	9. Select the applications you use. Leave blank if you do not use any: **Vivino (wine scanner); The Fork (restaurant finder); QR Code Reader; Picture This (plant identification)**
Demographic/personal characterization	Multiple choice	10. Gender: **Male; Female**
	Short answer	11. Age
	Multiple choice	12. Professional situation: **student; employed; unemployed; retired**

	Multiple choice	13. Marital status: **single; married; divorced; widower**
	Ordinal Scale	14. Academic education **1. Less than middle school** **2. Middle school** **3. High school** **4. Bachelor's** **5. Master's** **6. Doctorates**
	Multiple choice	15. Personal restrictions/options when purchasing products (health, religious, cultural, etc.): **Vegan/Vegetarian; Allergic (Gluten, lactose, etc.); Paleo/Raw Food Diet (or others); Kosher/Halal; Sustainable products (organic cotton, bio, fair trade); None; Other**

Table 3 – Connecting survey questions with project goals

Types of questions

Multiple choice and Likert Scale are types of questions most used in the survey due to the facility of their implementation and analysis.

- Likert Scale

The Likert scale was invented in 1930 by Rensis Likert, this scale is normally used to respond big amount of questions (items) on surveys. Likert scale in the most common format was composed by 5 horizontal options, where the extreme option (first left or first right) is positive (higher qualification) and the other one is the negative (lower qualification) witch the middle has a neutral qualification. Using this scale is possible to measure any type of event, evaluating the senses, attitudes and concerns (Hartley, 2014).

The original Likert scale proposed that the distance between the answers, or the interval of masseurs (for example "Totally Agree" and "Agree"), in a statistical point of view, is the same between all the options. Consequently, this scale is ideal to perform parametric tests (Harpe, 2015).

- Multiple choice

Multiple choice questions are most frequently used in educational evaluations but also used in market research surveys and elections. Their structure consists of the question

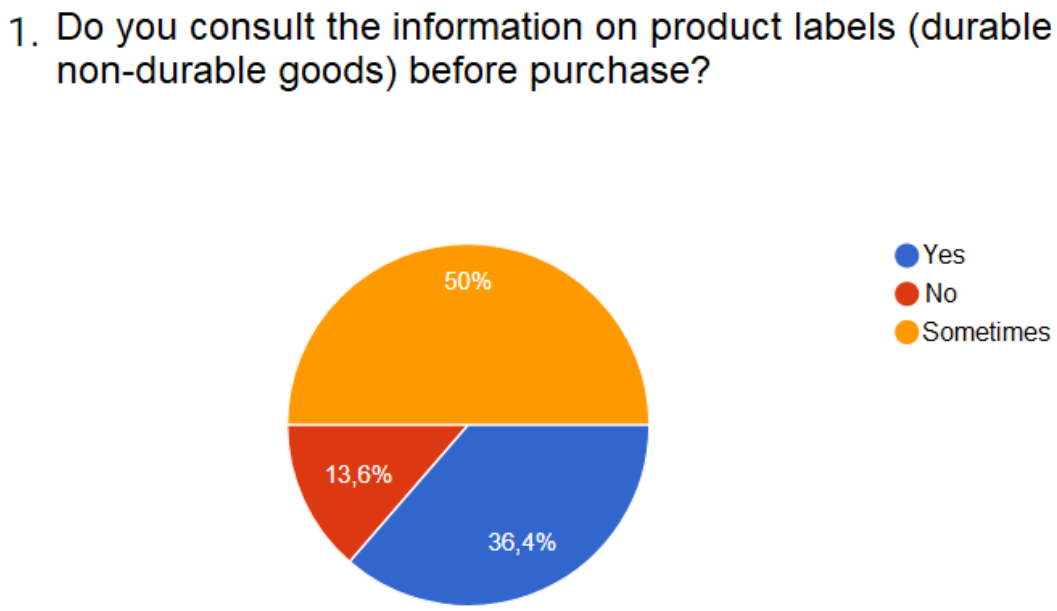
statement, followed by serval alternative answers to with only one response or multiple response items (Bergner, Filzen, & Simkin, 2016; Liu, 2017).

When people can choose more than one option between a set of options, the type of multiple choice used is the checkbox. Checkboxes are easy to administer and use, requires less training and the output produced is immediately useful (Wilson, 2013a).

5.2 Result analysis

5.2.1 Univariate analysis

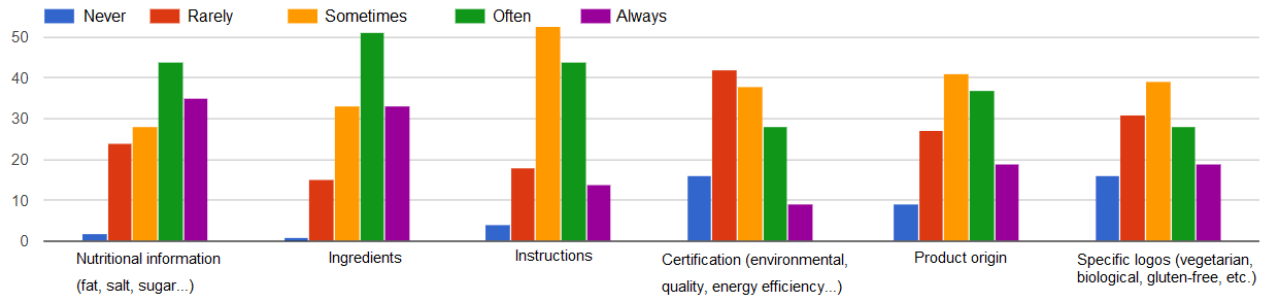
Univariate data analysis involves describing the distribution of a single variable (Meloun & Militký, 2011). Each variable was analysed when all 154 responses were collected with Google Forms.



Graph 1 – Label consulting before purchase

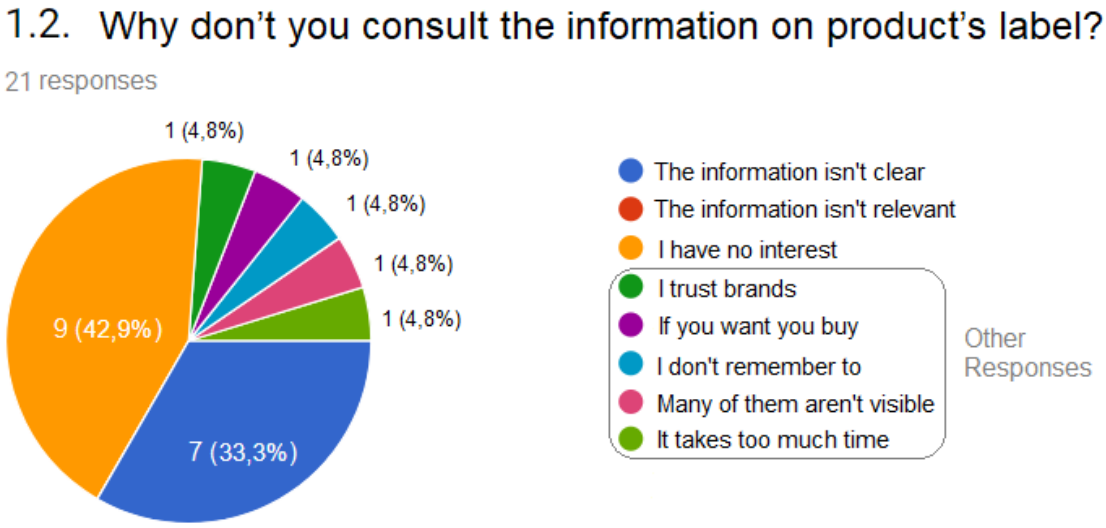
Almost all respondents consult label information before buying a product. 36,4% consult always every product and 50% confer sometimes.

1.1. What kind of information you are looking to find on labels?



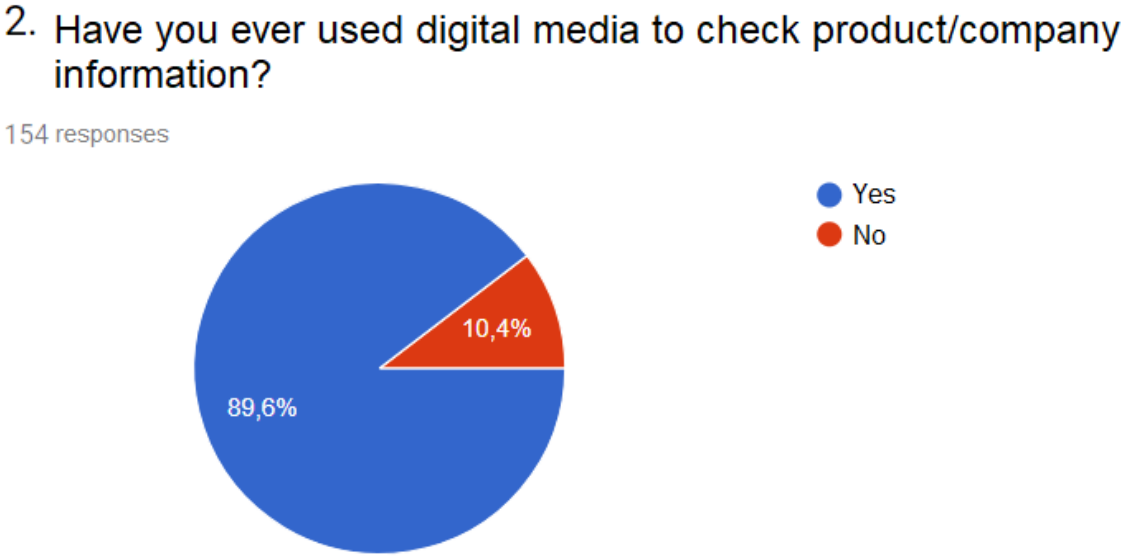
Graph 2 – Information of interest on product labels

People who usually check on products' labels, mostly want to find nutritional information and to know the ingredients. Although information about instructions, certifications, product origin and specific logos is also relevant, and people do check them frequently. Certification is the least consulted feature.



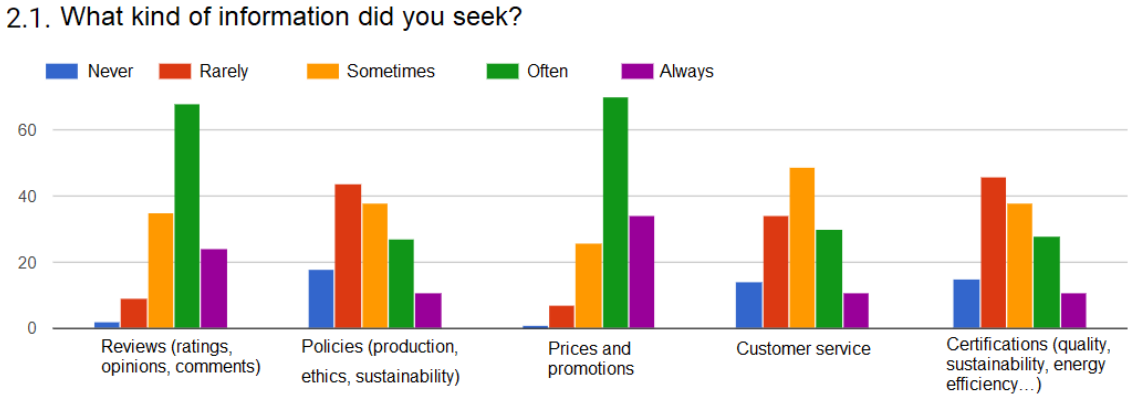
Graph 3 – Why do not consult the labels

13,6% of respondents who don't consult any labels, 42,9% of them claim to have no interest in the information. 33,3% think the information is unclear. 5 respondents have some other reasons like taking too much time to do so, or the labels aren't visible enough. The main interesting aspect is that no one thinks that the information isn't relevant. Only one person trusts the brands that he/she don't check any information.



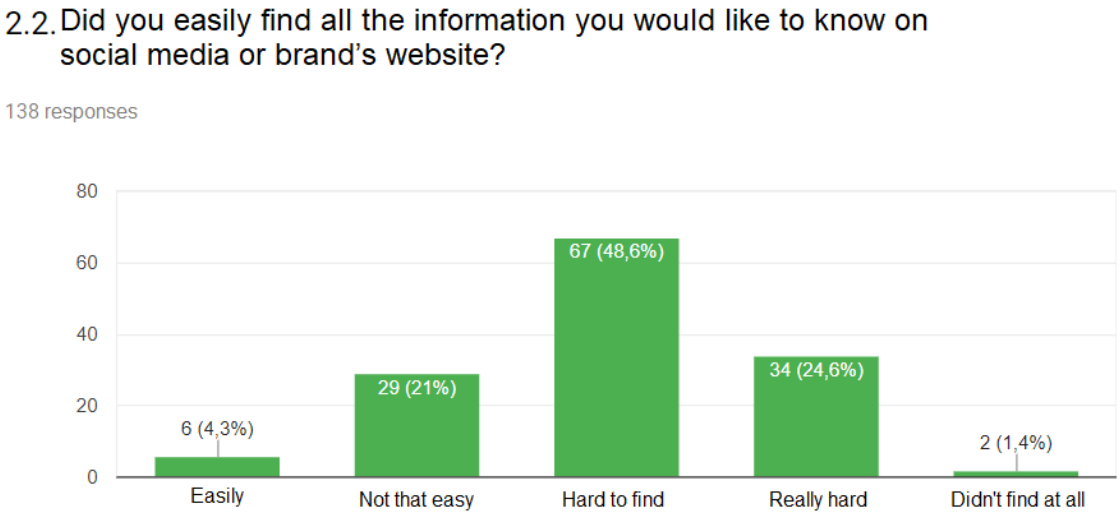
Graph 4 – Information consult about product/company on digital media

Most respondents used digital media to check information about companies and their products (89,6%). Consumers are influenced by their social interactions before making purchase decisions (Y. Chen, Wang, & Xie, 2011). It is crucial for a company to have all the information, easily accessible in all its digital channels.



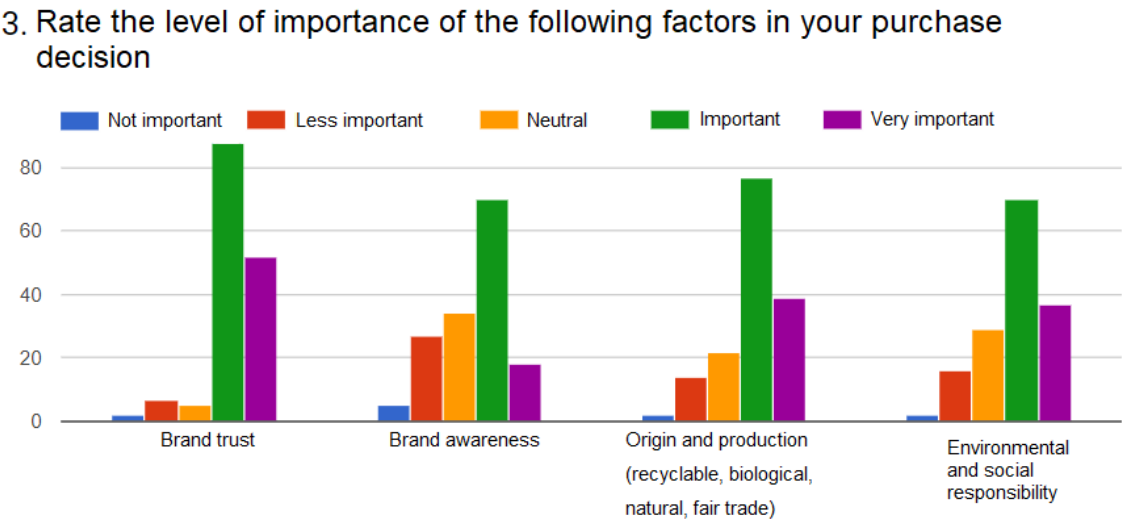
Graph 5 – Types of information searched on digital media regarding brands/products

Reviews and prices are the most wanted topics. Consumers' purchase decisions can be influenced by others' opinions and actions (Y. Chen et al., 2011). Ratings, comments, opinions and previous experiences can influence all the connection of the potential customer with a brand. It is also shown at the Graph 5 that production, ethics and sustainability policies, together with certificates, are the topics most rarely searched, even so, people have interest in knowing this information even if it's not the priority for some.



Graph 6 – How easy is to find the required information

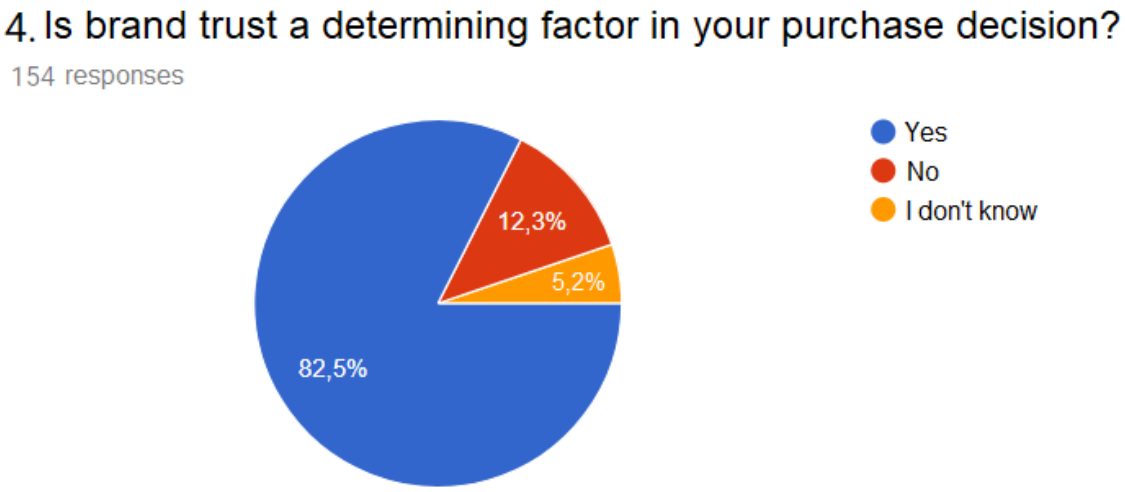
Only 4.3% of respondents could find the information they were looking for easily. 48,6% considered it hard to find and 24,6% found it really hard to find. This lack of information causes mistrust and affects the relationship with potential/active customers.



Graph 7 – Purchase decision-influencing factors

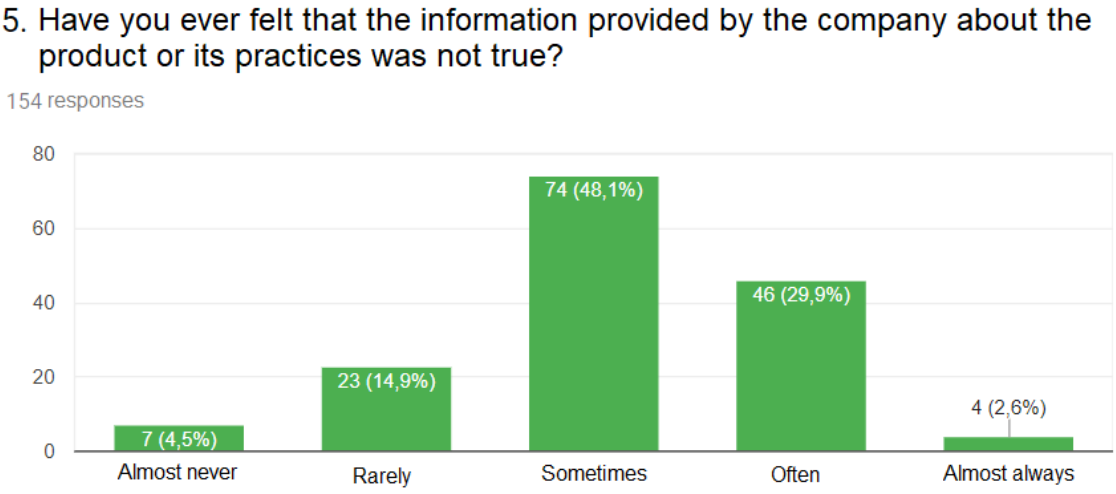
The purchase decision involves many aspects, for the analysis was considered "Important" and "Very Important" rates. The trust in a brand is considered by most respondents (91%) as the most important factor. Following by origin and production (75%). Environmental and social responsibility at the third level (70%) and the last aspect is brand awareness (57%). It means that even if the brand is well known and intensively advertised if the customer doesn't trust the brand or doesn't know the origin and

production of a product and the responsibility isn't clear, the notoriety doesn't have the most important role on the purchase decision.



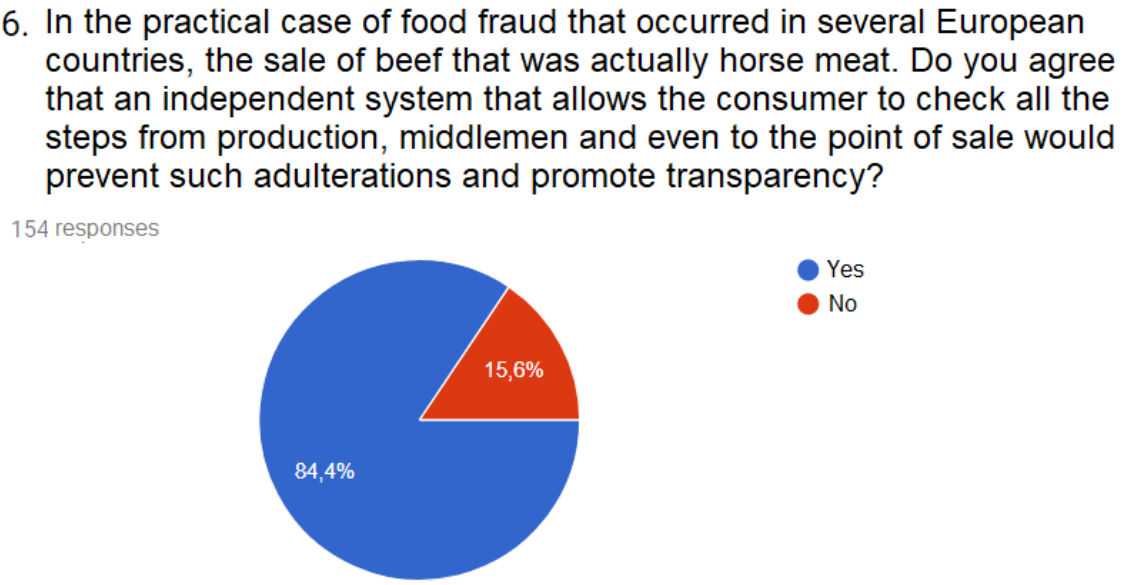
Graph 8 – Is brand trust a determining factor in a purchase decision?

As Graph 8 indicates, 82,5% of respondents found trust as a determining factor in their purchase decisions. Maybe for some (12,3%) the price or promotion is a more important factor. And they are respondents that don't know, it could be explained by low evolvement during the purchase process. Companies must earn trust by communicating and demonstrating that they share the same values and beliefs as their customers, shareholders and employees.



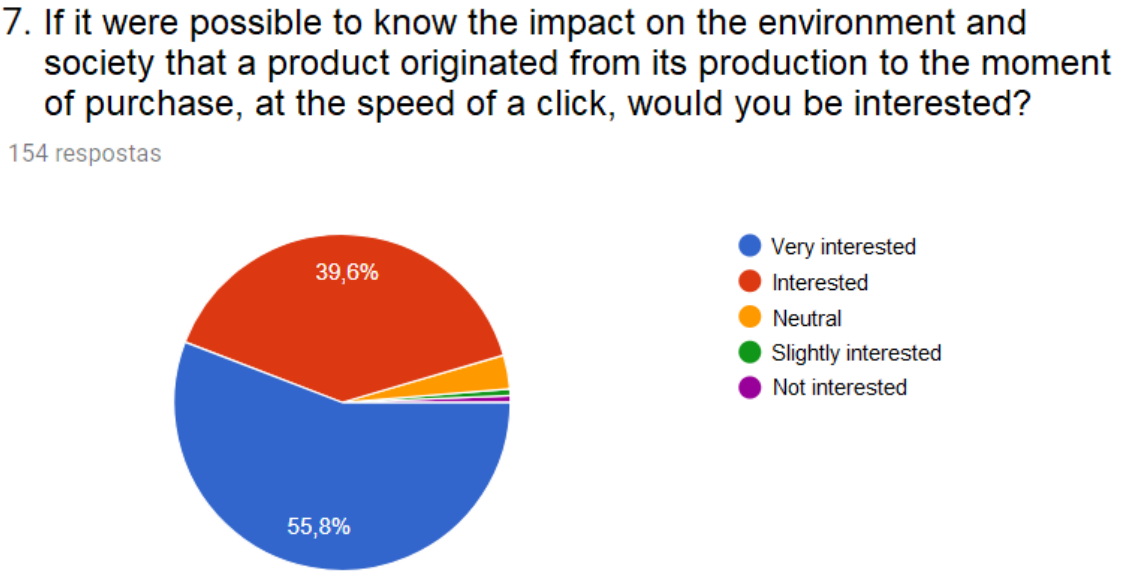
Graph 9 – Mistrust in company's practices/products

Only 4,5% of respondents almost never felt deceived by companies. At some point, every one of the rest of the respondents (95,5%) felt the opposite. As demonstrated previously, according to the Nielsen Company Report, brand trust is a key purchasing driver.



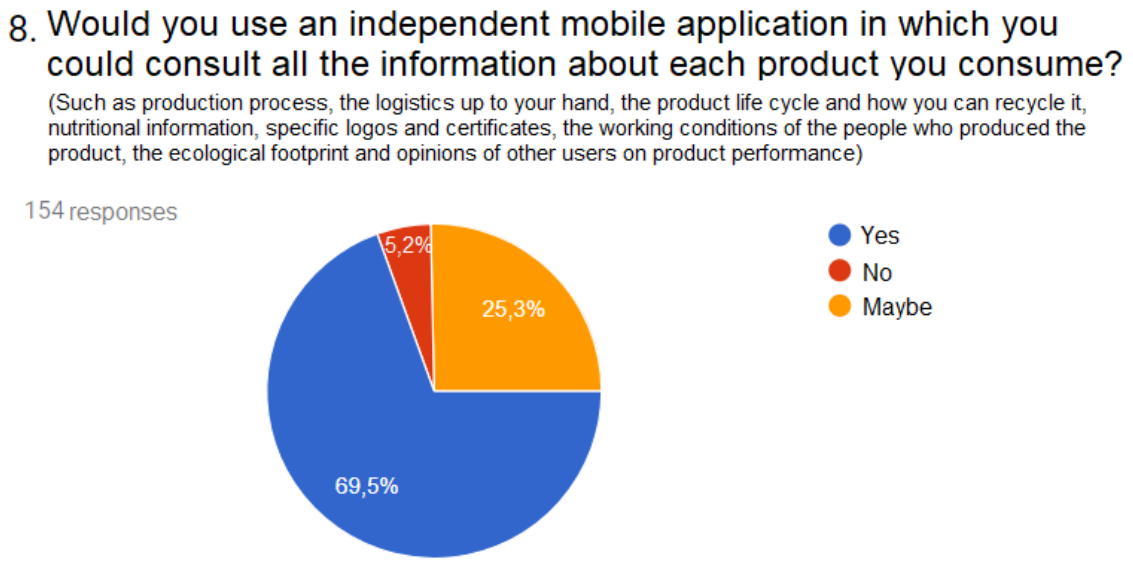
Graph 10 – Food fraud example

This strong example was chosen by purpose. This situation was disturbing in Portugal, the country of survey implementation. The aim was for all respondents to recognise the problem. 84,4% agree that an independent system proposed in this project could solve this type of problems. It's a determining factor for the development of this project.



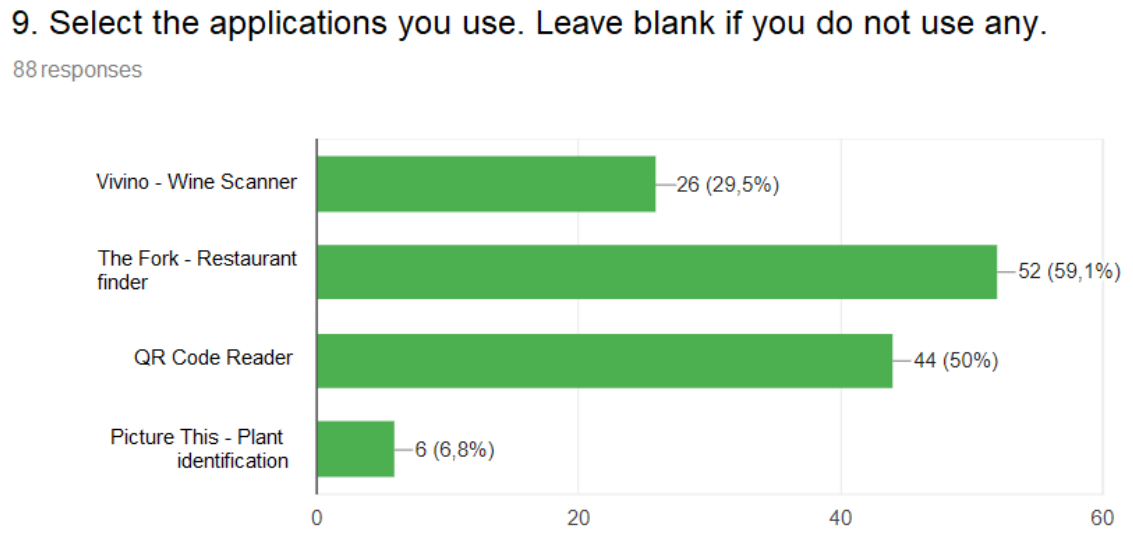
Graph 11 – Interest in knowing the environmental impact of the products

Most respondents are interested in the solution proposed in this project (95,4%). At further bivariate analysis, all the interested people are more precisely studied depending on their demographic characteristics.



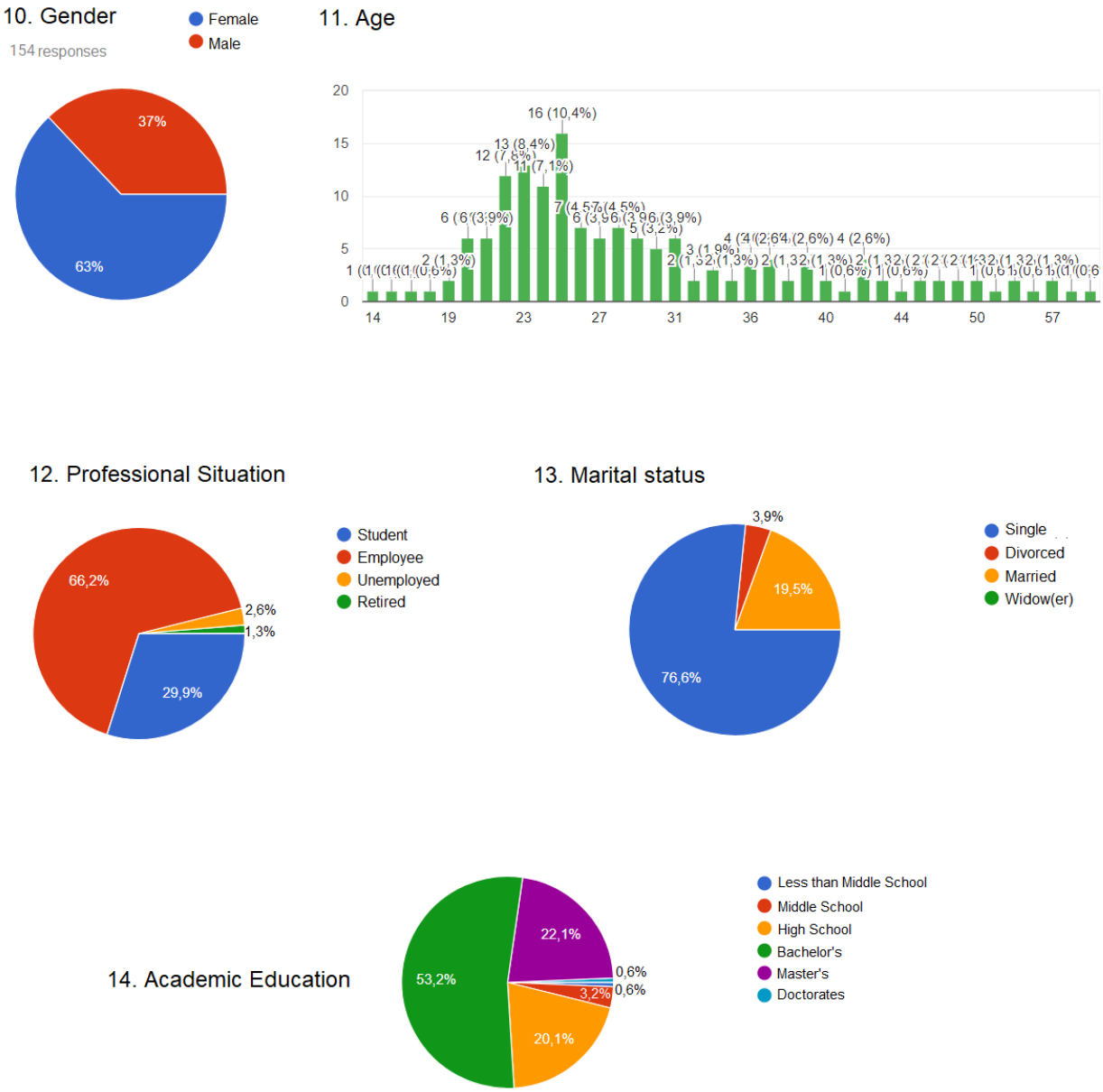
Graph 12 -Mobile App possible usage

It is verified that 69,5% of respondents would use the presented app for sure, 25,3% would try it and maybe use it also. Only 5,2% aren't interested in using the app. Probably these respondents are not used to apps or don't even have a smartphone.



Graph 13 – Some Apps people usually use

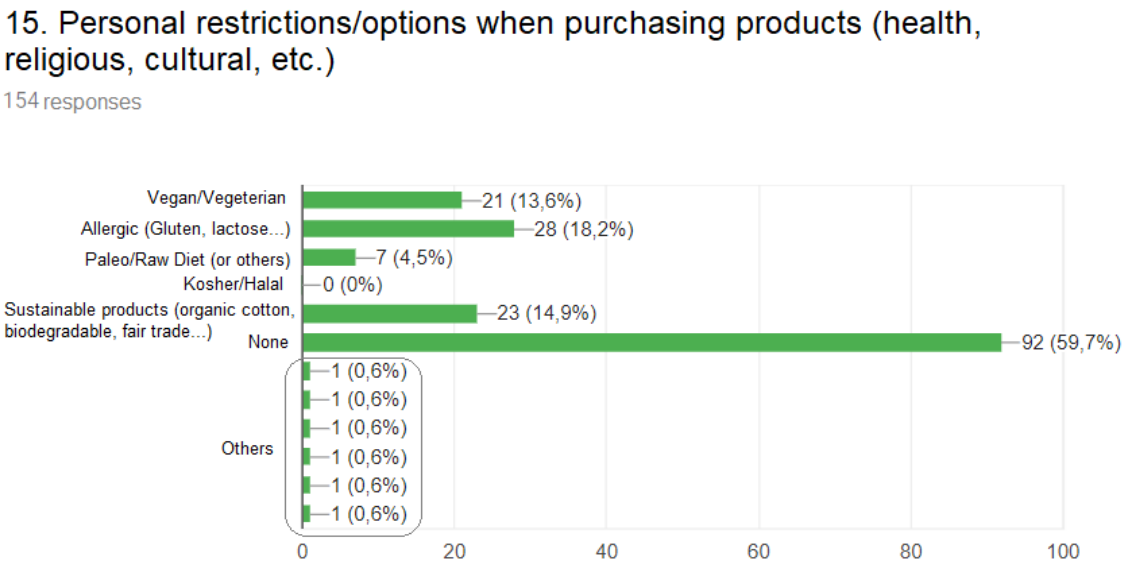
88 respondents (57%) use one of the apps presented above. These apps were specifically selected due to their scanning feature. This is the key feature of the app presented in this project. People are getting used to this convenient app attribute, which is simple to use and easy to implement.



Graph 14 – Demographics of respondents

63% of respondents are female, 37% are male. Most popular ages are between 19 and 31 years old. 66,2% are employed, 28,9 are student, 2,6% unemployed and 1,3% retired. The majority is single (76,6%), 19,5% are married and 3,9% divorced. 53,2% have a bachelor's degree, 22,1% master's degree, 20,1% finished high school, 3,2% only finished the middle school, 0,6% are doctorates and 0,6% didn't finish middle school.

The univariate analysis summarizes the collected data into one main conclusion: the development of an app which can solve trust, safety and greenwashing problems, is a valid, effective and interesting strategy.



Graph 15 – Personal restrictions of respondents

This question was included so to verify if people who have any restriction in their purchase habits are more likely to use the app. Almost half of the respondents have any restrictions which influence their purchase decisions.

5.2.2 Bivariate and multivariate analysis

For more interactive statistical analysis, to create the potential consumer profile were used SPSS Statistics software. First, collected data needs to be classified into a specific data type. Depending on the data types, different statistical techniques can be used for data analysis.

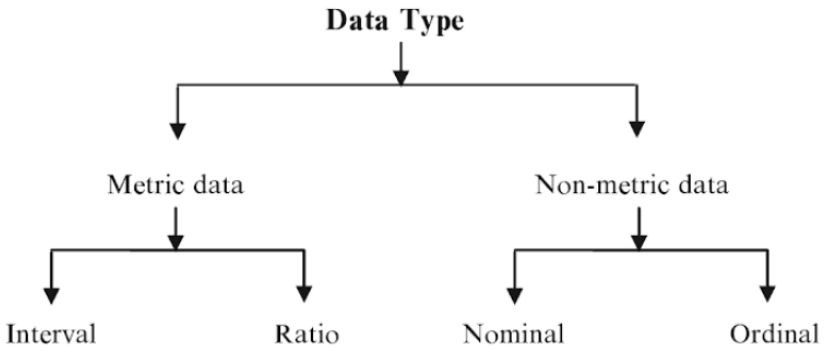


Figure 7 - Types of data and their classification (Verma, 2012)

Metric data is always associated with a scale measure. It is also known as quantitative data. Interval data is measured along a scale where the distance between two pairs is

equivalent. Ratio scale starts from zero and includes the observations that can be measured or count, such as age, height, weight, etc. (Verma, 2012).

Nonmetric data is expressed not in numbers but rather by means of a natural language description. It is also known as qualitative data. Nominal data is a categorical variable obtained in terms of frequency. For example, demographic data such as gender, professional situation, etc. On the other hand, ordinal data is also categorical variable. The main difference is that the categories are ordered. Likert Scale is the prime example (Verma, 2012).

Types of data used in this research are Ratio, Nominal and Ordinal. Based on Table 3 at chapter 5.1 the definition of data types is:

Type of data	Questions
Ratio	11 (Age)
Nominal	1; 1.2; 2; 4; 6; 8; 9; 10; 12; 14; 15
Ordinal	1.1; 2.1; 2.2; 3; 5; 7; 13

Table 4 – Data type per question

After defining and introducing all the variables into the software, the data may be analysed for testing different hypotheses.

Would you use an independent mobile application in which you could consult all the information about each product you consume?						
			Yes	No	Maybe	Total
Gender	Female	Count	70	6	21	97
		% within Gender	**72,2%**	6,2%	**21,6%**	100,0%
		% within Would you..	65,4%	75,0%	53,8%	63,0%
	Male	Count	37	2	18	57
		% within Gender	**64,9%**	3,5%	**31,6%**	100,0%
		% within Would you…	34,6%	25,0%	46,2%	37,0%
Total		Count	107	8	39	154
		% within Gender	69,5%	5,2%	25,3%	100,0%
		% within Would you…	100,0%	100,0%	100,0%	100,0%

Table 5 – App Usage & Gender

Women are more likely to use the proposed mobile app than men, 72% will use and 22% maybe will. Even so, 65% of men will use it as well and 32% aren't sure.

			Yes	No	Maybe	Total
Professional situation	Student	Count	28	2	16	46
		% within Professional	**60,9%**	4,3%	34,8%	100,0%
		% within Would you...	26,2%	25,0%	41,0%	29,9%
	Employee	Count	75	6	21	102
		% within Professional	**73,5%**	5,9%	20,6%	100,0%
		% within Would you...	**70,1%**	75,0%	53,8%	66,2%
	Unemployed	Count	3	0	1	4
		% within Professional	**75,0%**	0,0%	25,0%	100,0%
		% within Would you...	2,8%	0,0%	2,6%	2,6%
	Retired	Count	1	0	1	2
		% within Professional	50,0%	0,0%	50,0%	100,0%
		% within Would you...	0,9%	0,0%	2,6%	1,3%
Total		Count	107	8	39	154
		% within Professional	69,5%	5,2%	25,3%	100,0%
		% within Would you...	100,0%	100,0%	100,0%	100,0%

Table 6 - App Usage & Professional situation

Regarding the professional situation, the people who are employed are the ones who would mostly use the app (70%). 61% of students, 73,5% of employed people and 75% of unemployed will use the app. There are only two retired respondents, one of them will use and another maybe will too.

			Yes	No	Maybe	Total
Marital status	Single	Count	84	4	30	118
		% within Marital status	**71,2%**	3,4%	25,4%	100,0%
		% within Would you…	78,5%	50,0%	76,9%	76,6%
	Married	Count	22	3	5	30
		% within Marital status	**73,3%**	10,0%	16,7%	100,0%
		% within Would you...	20,6%	37,5%	12,8%	19,5%
	Divorced	Count	1	1	4	6
		% within Marital status	16,7%	16,7%	**66,7%**	100,0%
		% within Would you...	0,9%	12,5%	10,3%	3,9%
Total		Count	107	8	39	154
		% within Marital status	69,5%	5,2%	25,3%	100,0%
		% within Would you...	100,0%	100,0%	100,0%	100,0%

Table 7 - App Usage & Marital status

Married people are the ones who are most likely to use the app (73%). Most single people will also use it (71%). On the other hand, most divorced people aren't sure if they will use it, 67% answered "Maybe".

			Yes	No	Maybe	Total
Academic education	Less than middle school	Count	1	0	0	1
		% within Education	**100,0%**	0,0%	0,0%	100,0%
		% within Would you...	0,9%	0,0%	0,0%	0,6%
	Middle school	Count	3	0	2	5
		% within Education	**60,0%**	0,0%	40,0%	100,0%
		% within Would you...	2,8%	0,0%	5,1%	3,2%
	High school	Count	22	2	7	31
		% within Education	**71,0%**	6,5%	22,6%	100,0%
		% within Would you...	20,6%	25,0%	17,9%	20,1%
	Bachelor's	Count	57	4	20	81
		% within Education	**70,4%**	4,9%	24,7%	100,0%
		% within Would you...	**53,3%**	50,0%	51,3%	52,6%
	Master's	Count	23	1	10	34
		% within Education	**67,6%**	2,9%	29,4%	100,0%
		% within Would you...	21,5%	12,5%	25,6%	22,1%
	Doctorates	Count	1	1	0	2
		% within Education	**50,0%**	50,0%	0,0%	100,0%
		% within Would you...	0,9%	12,5%	0,0%	1,3%
Total		Count	107	8	39	154
		% within Education	69,5%	5,2%	25,3%	100,0%
		% within Would you...	100,0%	100,0%	100,0%	100,0%

Table 8 - App Usage & Academic education

Regardless of the academic degree, most people would use the app. Only 5,2% of respondents wouldn't use it, mostly with a bachelor's degree.

			Yes	No	Maybe	Total
Age Groups	<17	Count	2	0	1	3
		% within Age Groups	**66,7%**	0,0%	33,3%	100,0%
	18-25	Count	48	4	15	67
		% within Age Groups	**71,6%**	6,0%	22,4%	100,0%
	26-56	Count	56	4	22	82
		% within Age Groups	**68,3%**	4,9%	26,8%	100,0%
	>60	Count	1	0	1	2
		% within Age Groups	**50,0%**	0,0%	50,0%	100,0%

Total	Count	107	8	39	154
	% within Age Groups	69,5%	5,2%	25,3%	100,0%

Table 9 - App Usage & Age

Respondents between 18 and 25 years' old are the main group most interested in using the app (71,6%). It probably shows that the future generation is more concerned and attentive.

			Yes	No	Maybe	Total
Personal restrictions (options) when purchasing products (health, religious, cultural, etc.)	Vegan/Vegetarian	Count	18	0	3	21
		% within Personal restrictions	**85,7%**	0,0%	14,3%	100,0%
	Allergic (Gluten, lactose, etc.)	Count	13	2	7	22
		% within Personal restrictions	**59,1%**	9,1%	31,8%	100,0%
	Paleo/Raw Food Diet (or others)	Count	3	0	1	4
		% within Personal restrictions	**75,0%**	0,0%	25,0%	100,0%
	Sustainable products (organic cotton, fair trade, etc.)	Count	11	0	1	12
		% within Personal restrictions	**91,7%**	0,0%	8,3%	100,0%
	None	Count	60	6	25	91
		% within Personal restrictions	**65,9%**	6,6%	27,5%	100,0%
	Other	Count	2	0	2	4
		% within Personal restrictions	**50,0%**	0,0%	**50,0%**	100,0%
Total		Count	107	8	39	154
		% within Personal restrictions	69,5%	5,2%	25,3%	100,0%

Table 10 - App Usage & Personal restrictions

As shown in the table above, 59% of respondents (91) have no restrictions in their product purchase, even so, 66% of them would use the app to know more about what they are buying. People who have any restrictions would most likely to use the app, especially people who consume sustainable products or have a vegan/vegetarian lifestyle.

It is also clear that people who wouldn't use the app have no personal options/restrictions (6,6%) or their restriction are allergic ones, in which case the information about allergies is explicit on the labels so it might be enough for 9% of respondents.

			Yes	No	Maybe	Total
Do you consult the information on product labels	Yes	Count	46	3	7	56
		% within Do you consult…	**82,1%**	5,4%	12,5%	100,0%
	No	Count	17	0	4	21

(durable and non-durable goods) before purchase?		% within Do you consult…	**81,0%**	0,0%	19,0%	100,0%
	Sometimes	Count	44	5	28	77
		% within Do you consult…	**57,1%**	6,5%	36,4%	100,0%
Total		Count	107	8	39	154
		% within Do you consult…	69,5%	5,2%	25,3%	100,0%

Table 11 - App Usage & Label consulting

Everyone in this category would use the app or at least try it. Only 5,2% of respondents aren't interested. People who consult product's labels are most likely to use the app (82%), and people who don't consult any labels will use it too (81%). It can be explained by the simplicity of using an app instead of reading unclear labels.

			Yes	No	Maybe	Total
Have you ever felt that the information provided by the company about the product or its practices was not true?	Almost never	Count	4	1	2	7
		% within Have you	**57,1%**	14,3%	28,6%	100,0%
	Rarely	Count	17	0	6	23
		% within Have you	**73,9%**	0,0%	26,1%	100,0%
	Sometimes	Count	52	5	17	74
		% within Have you	**70,3%**	6,8%	23,0%	100,0%
	Often	Count	31	2	13	46
		% within Have you	**67,4%**	4,3%	28,3%	100,0%
	Almost always	Count	3	0	1	4
		% within Have you	**75,0%**	0,0%	25,0%	100,0%
Total		Count	107	8	39	154
		% within Have you	69,5%	5,2%	25,3%	100,0%

Table 12 - App Usage & Mistrust in companies

People who almost always feel deceived by brands are the ones who will mostly use the app (75%). Although everyone in this category is more likely to use that not to use. Even people who almost never felt deceived would like to use the suggested app (57%). So, it means that people who don't trust the brands will use the app and even people who do trust will use the app to find more information.

			Yes	No	Maybe	Total
If it were possible to know the impact on the environment and society that a product originated from its production	Very interested	Count	72	1	13	86
		% within If it were…	**83,7%**	1,2%	15,1%	100,0%
	Interested	Count	34	4	23	61
		% within If it were…	**55,7%**	6,6%	37,7%	100,0%
	Neutral	Count	1	2	2	5

to the moment of purchase, at the speed of a click, would you be interested?		% within If it were…	20,0%	**40,0%**	**40,0%**	100,0%
	Not interested	Count	0	1	1	2
		% within If it were…	0,0%	**50,0%**	**50,0%**	100,0%
Total		Count	107	8	39	154
		% within If it were…	69,5%	5,2%	25,3%	100,0%

Table 13 - App Usage & Knowledge about the environmental impact

People become more concerned with the impact of their consumption habits on society and the environment. The one who show awareness is very interested in the presented solution (84%). People who don't show ant interest or are neutral about the subject are most likely not to use the app.

			<17	18-25	26-59	>60	Total
If it were possible to know the impact on the environment and society that a product originated from its production to the moment of purchase, at the speed of a click, would you be interested?	Very interested	Count	3	41	41	1	86
		% within If	3,5%	**47,7%**	**47,7%**	1,2%	100,0%
	Interested	Count	0	22	39	0	61
		% within If	0,0%	**36,1%**	**63,9%**	0,0%	100,0%
	Neutral	Count	0	2	2	1	5
		% within If	0,0%	40,0%	40,0%	20,0%	100,0%
	Not interested	Count	0	2	0	0	2
		% within If	0,0%	100,0%	0,0%	0,0%	100,0%
Total		Count	3	67	82	2	154
		% within If	1,9%	43,5%	53,2%	1,3%	100,0%

Table 14 – Interest in using the App & Age

The groups of people most interested in environmental impact are between 18 and 59 years old. Means that people with the highest purchasing influence are the most concerned ones. This is a great outcome considering that the possible future users are the ones who represent the majority of the population.

After the analysis, it is possible to create a profile of a potential user. To represent the Persona were created her profile using Xtensio platform: http://www.xtensio.com. Barbara, 25 years old, single, is a teacher in a Middle School. Her goal in life is to inspire kids to make a difference in the world, travel around the world and make a positive impact by changing her consumption habits to more environmentally friendly ones. Her personality and preferences are described in the next figure.

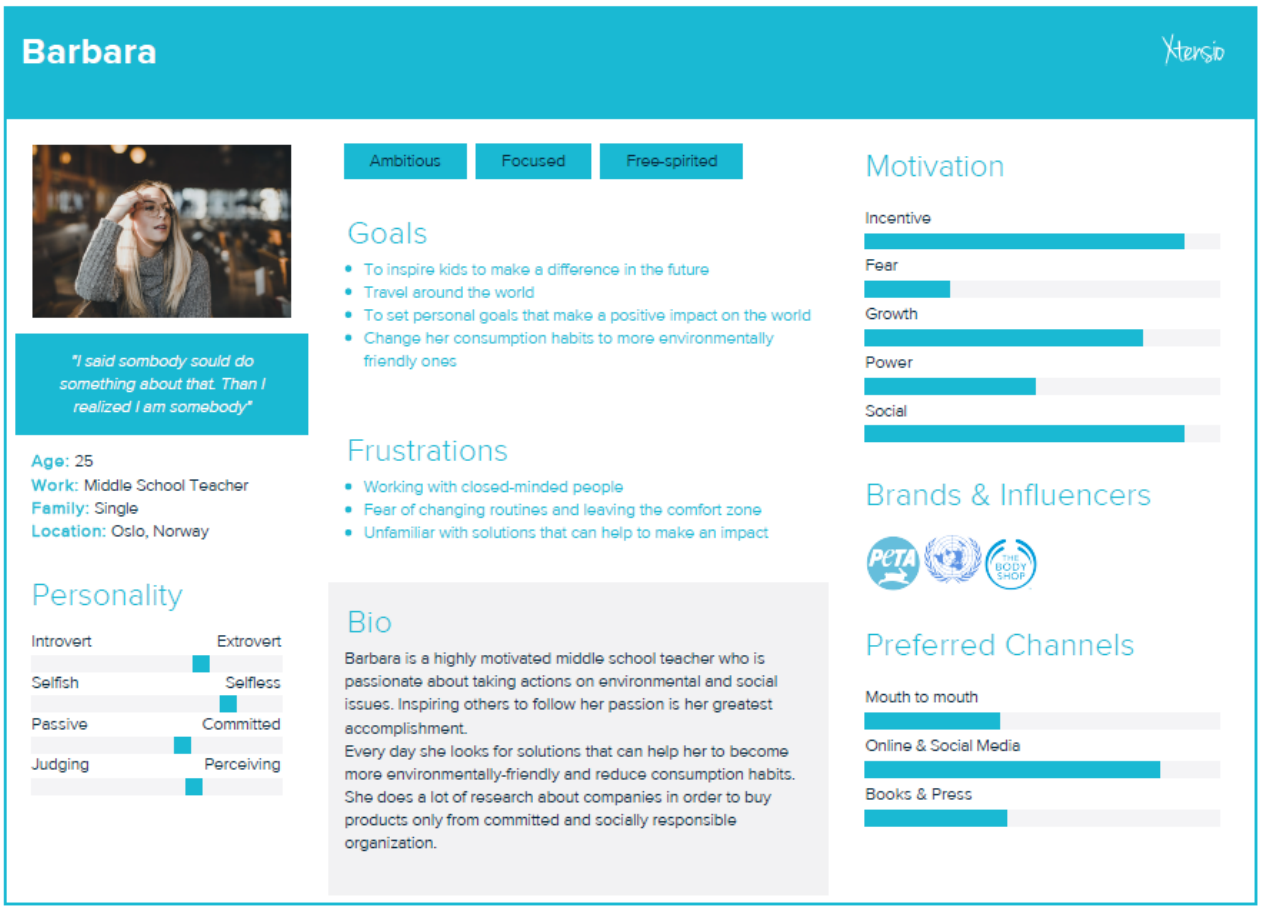


Figure 8 – Persona's profile using Xtensio Platform

6. LUMBA APP

Due to the global proportion of this project, the name for the App should be easy to pronounce in multiple languages. "Lumba" was inspired at dolphins and their ability of echolocation. Dolphins are able to determine the distance, speed, shape and size of objects around them to find food and navigate. They are natural scanners, which is the most important feature of the App, scanning products. Dolphin in Malay means Lumba-lumba.

6.1 Concept

The concept for Lumba App was structured using Simon Sinek's "Golden Circle" theory. Author defends that some people and organizations are more inventive, pioneering and successful than the others because they start with why. Everyone knows "In business, doesn't matter what you do, it matters why you do it. Steve Jobs, the Wright brothers and Martin Luther King have one thing in common: They started with why. The WHY is the

purpose, cause, or belief that drives every organization and every person's individual career." (Sinek, 2011).

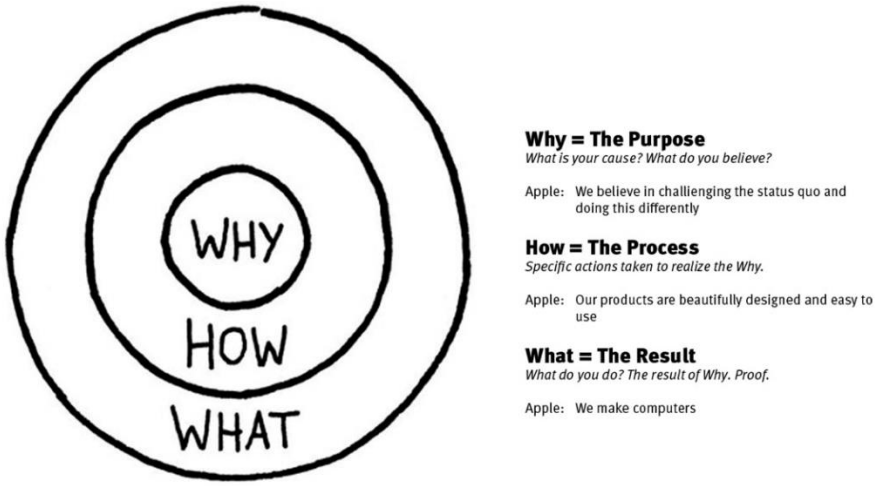


Figure 9 – Golden Circle by Simon Sinek (Sinek, 2011)

Why?

Transparency is the key to a strong, equal and fair society. It begins with citizens, goes to the companies all the way to the governments. Every person is a valuable piece of society's chain. Their decision making shall be knowledgeable, conscious and confident, regarding every aspect of their life. The purpose is to give people the opportunity to choose with certainty, avoiding manipulation, misleading and greenwashing.

How?

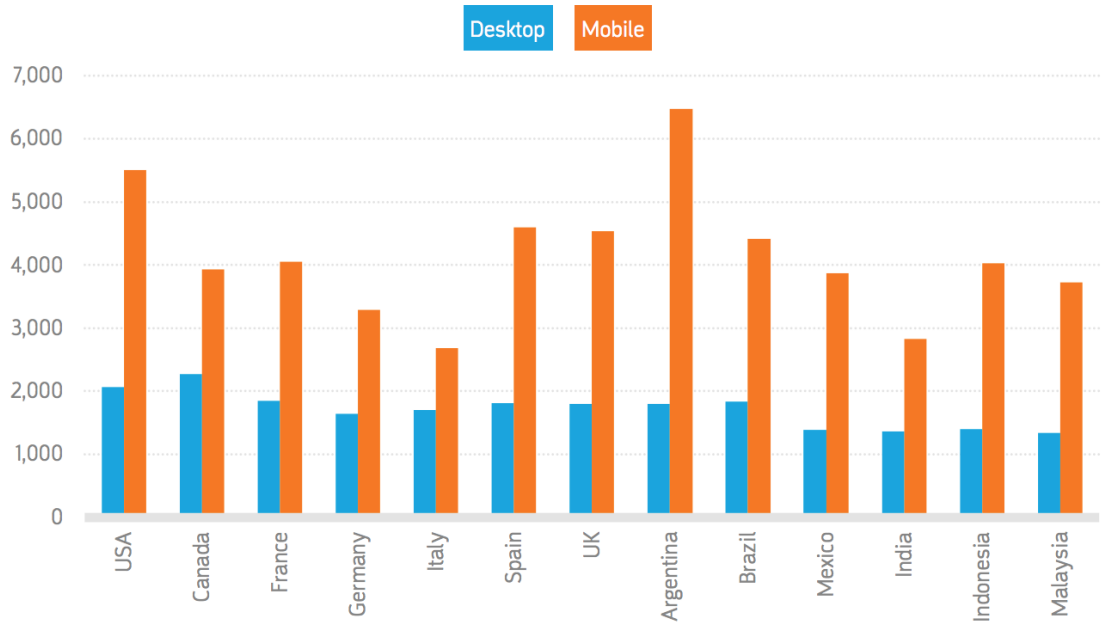
Technology connects people, industries and governments around the world. Marketers have the power to guide companies in the direction that would simultaneously grow their business, educate people and achieve the WHY. With so many different technological resources it becomes much easier, faster and effective.

What?

A mobile app it's a powerful resource to which most of the population have access to and the numbers are constantly growing. That's the main reason why the solution to transparency and trust has to be a mobile app. Relying on blockchain technology, distributed data recording system which cannot be forged or altered.

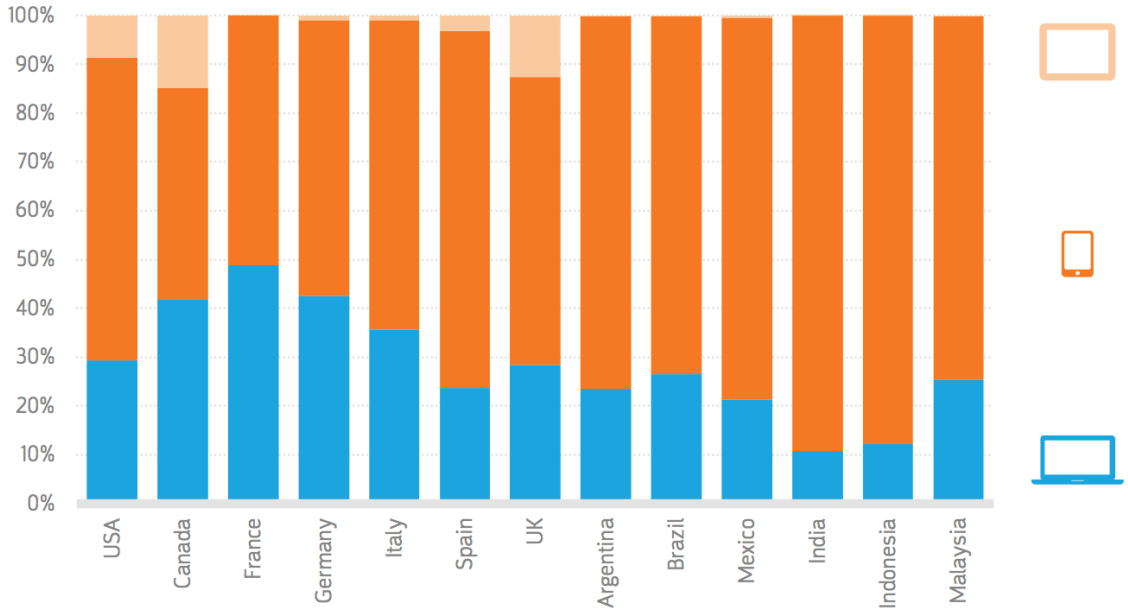
The suggested platform will include all the information about the products' life cycle. From production, transportation, processing and packaging, until the sailing point. Relying on blockchain technology, all the records from each supply chain stakeholder are stored in a single location (shared ledger) that's updated and validated in real time with each network participant. This results in one truth across the supply chain network, an equal visibility of activities revealing where assets are at any point in time.

According to We Are Social, more than half of the world uses a smartphone (Kemp, We Are Social, & Hootsuite, 2017).



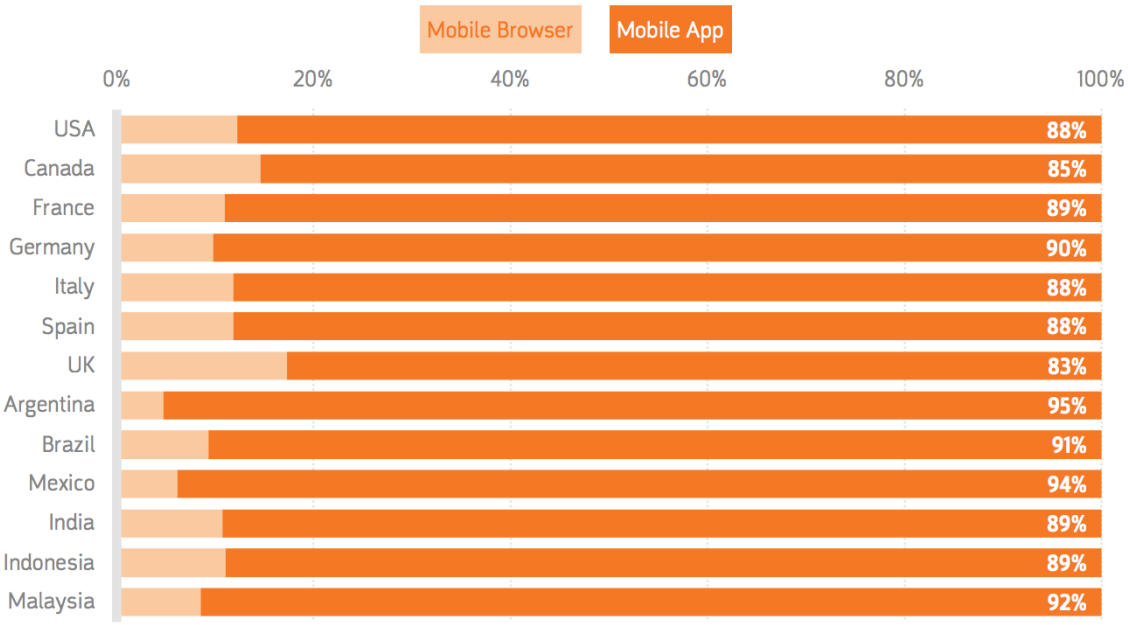
Graph 16 – ComScore report – Navigation time spent on Mobile VS Desktop

Comscore (2018) report at 13 global digital markets in 2018, shows that mobile users spent twice as much time navigating on their smartphone than on their desktop (Graph 16).



Graph 17 - ComScore report –Time spent on Mobile VS Desktop VS Tablet

According to the same report, smartphones are now the dominant platform considering the time of usage vs tablet or desktop in different continents (Graph 17). From 2016 to 2017 the time spent on smartphones increased 7,4%, against desktop and tablet (Comscore, 2018).



Graph 18 - ComScore report – Mobile navigation Browser VS App

More specifically at mobile atmosphere, apps are used during 80% of the time against 20% of time spent on browsing on the internet (Graph 18) (Comscore, 2018).

These worldwide statistics only prove that the most efficient way to connect with the population is through mobile apps. This is the main reason why this project is focused on an app.

6.2 Product Prototyping "Nutural"

To apply the theory, a tangible example will be demonstrated. A Portuguese brand of almond butter, Nutural, is the subject of the demo. Just one specific product was chosen for this project. The goal is to explain how the app will work based on the actual information about the life cycle of this product.

http://nutural.pt/

Figure 10 – Nutural's Almond Butter

Nutural is a small company based in Algarve, committed to creating products with only natural ingredients, minimal processing in order to preserve to the maximum all their qualities. Nutural's mission is to provide healthy and tasty products for better eating habits in peoples' daily life.

6.2.1 Essential information input

A possible solution presented in this project, it's a mobile application that promotes transparency in supply chains. The application is designed to identify through QR code the specific product chosen by the customer and to reveal all the information regarding this product. All the products will be divided into six different categories:

Food Industry	✓ Product name ✓ Brand ✓ Image and description ✓ Life Cycle (Raw materials, Production, Distribution and Recycle/Reuse and Decomposing time)
Cosmetics and Household	
Fashion Industry	

Technology **Vehicles** **Furniture and Decoration**	✓ Ecological Footprint (natural resources consumed) ✓ Product Certificates ✓ Technical Information ✓ Nutritional Information ✓ Selling Points (or online store link) ✓ Other relevant information ✓ Reviews

Table 15 - Product Categories on the APP

The main goal is to provide as much information as possible to answer all the questions that customers may have. To guarantee the transparency and accuracy of provided information, companies must implement blockchain technology in their management to integrate their data and be available on the app.

To satisfy customers and answer their questions, extreme importance is given to their opinion. Every searched product within the app is possible to classify, comment, save into favourites and share. Therefore, consumers' opinion and feedback, generally exposed in social networks, blogs or communities, influence company decisions regarding their products, actions, and goals. Company's social media marketing platforms tend to affect digital word of mouth through customer engagement, post-purchase reviews and satisfaction ratings (Wu, Fan, & Zhao, 2017). It is expected that both, customer and company decisions, start to change. Then, consequently, the course of industries.

In the interest of users, a specific instructive section will be designed within the platform. Users will be able to find information regarding certificates and labels, what they stand for and why they are important; likewise, facts regarding production practices, fair-trade, sustainability and working conditions of the employees (if the product was made in a developing country what conditions are offered in that specific country). Furthermore, a statistical section, for example about the most polluting industries and the role of every single person to help the environment.

6.2.2 Blockchain implementation

Traceability and transparency are some of the most important foundations of logistics. Using blockchain technology, fraud and errors are reduced or eliminated, becomes much faster to identify issues, the inventory management is enhanced, paperwork delays are reduced, shipping costs are possible to minimize and most important, it brings trust to the consumer and stakeholders involved.

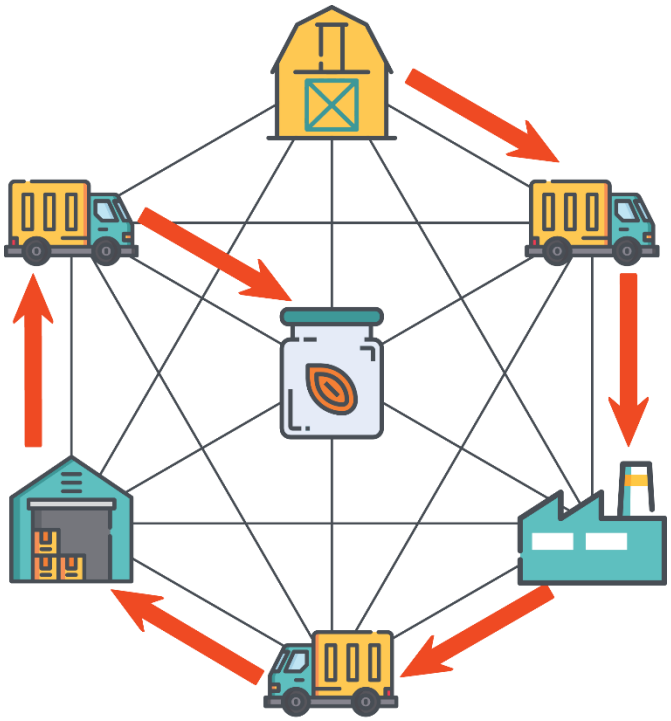


Figure 11 – Nutural's Supply Chain with blockchain implementation

Supply Chain Order

Manufacturer → Transportation - almond in the shell → Partition unit (peeling process) → Transportation – peeled almonds → Processing and packaging unit → Shipping of the final product to retailers.

1. Manufacturer

The almond is produced in the Algarve region in traditional dryland orchards (containing: almond, olive and carob trees). Taking into account the natural conditions of development of the orchards, with the adoption of dry farming, producers guarantee that no chemicals are used. The dry almond is quite resistant to pests and other adverse conditions, so the use of chemicals in their production is not justified. The almond is purchased raw (in the shell).

2. Partition unit

The raw product is transported to a partition unit to be peeled.

3. Processing and packaging unit

After the partition unit, almond is transported to the processing and packaging unit. The transformation of the product passes through crushing the almond until it turns into a paste. Thereafter the almond paste is placed in a machine which will slowly grind without heating for a long period of time so the product remains raw. The cold temperature allows achieving a softer and creamy solution with the desired texture. This process results in almond butter.

Once the production is finished, the packaging process begins at the very same unit. The butter is poured into glass jars which are subsequently sealed in a vacuum. In this way, the nutritional values, as well as the validity, are preserved for a longer period.

4. Retail

Shipping of the final product to retailers or final customers.

All the records made by each member of the network regarding the product are shared between them in a common register (ledger).

6.3 Prototype development

First, the prototype is designed in the paper. Afterwards, the draft is implemented in Adobe Photoshop and Adobe Illustrator. Consult the flowchart at Attachments.

Once all App screens are finished, navigation is simulated using Invision Platform. The resulting video should be consulted on the attached CD.

7. CONCLUSION

Changes in consumption patterns have a substantial effect on business models, technology evolution and ultimately our society. To give people the opportunity to know more about their consumption habits than the information given by companies is the focus of this project. Their decision making shall be knowledgeable, conscious and confident.

The main objective of the study, provide a possible solution to Greenwashing has been achieved. The mobile app presents in the previous chapter is the opportunity to create a trustful relationship between businesses and their clients over a path of transparency. In the process, environmental and social improvements might be achieved as well.

Specific objectives presented at the beginning of the research were also achieved. It is clear that customers value the environmental advantages of the products during purchase decision, however, their knowledge about specific aspects as certifications or eco-labels is low and sceptical. The lack of information to educate consumers about these aspects has to be improved.

Customers' loyalty to a company is directly related to trust. 82,5% of respondents found trust as a determining factor in their purchase decisions. Environmental responsibility of a company is one of the aspects that helps to build trust when is genuine and not greenwashing. People are willing to pay more for products they believe and trust to help the environment.

The major barriers to sustainable purchase decision are higher prices, availability, and difficulty in accessing environmentally sustainable products. Habits, especially if people don't worry about the environment, are also barriers. Mistrust in ethical claims and green characteristics of a product, especially when the price is higher is the main barrier. All these aspects are improved with the suggested mobile app.

Environmental changes affect the performance of governments and companies. Most companies are looking forward to taking advantage of "green trend" and governments show concern about green marketing activities and attempt to regulate them. However, there are some companies working hard to achieve transparency in their actions and help the environment in the process.

On the other hand, some businesses consider the greenwashing path, the easiest one. They do not only take ethical consequences, but also consumer perception. Nowadays, companies' actions have a major role in advertising and achieve customer loyalty.

The presented solution not only solves the greenwashing problem and trust issues between customers and companies, as it brings transparency to the supply chain and creates trust also between the stakeholders. It also enables to guarantee product quality and almost instantaneity provide the source in case of fraud. According to the World Health Organization (WHO), every year, around 600 million people in the world suffer illness from eating contaminated food, of which 420 thousand dies (World Health Organization, 2017). These types of problems could be solved much faster and even avoided.

Specifically, in the Portuguese market, where the survey took place, the feedback about the suggested solution was quite positive. 95,4% are interested, 69,5% of respondents would use the app for sure, 25,3% would try it and maybe use it also. Only 5,2% aren't interested in using the app. Probably these respondents are not used to apps or don't even have a smartphone.

The Persona created for this project is Barbara, she is the potential user and ambassador for the solution. She believes what we believe and if she feels satisfied and fulfilled, she will recommend and inspire people to use the app as well. And this is the most genuine approach for start to spread the word.

The prototype presented it's a simple demonstration of what can become a huge change in peoples' lives, and this is the biggest motivation for this project development.

8. LIMITATIONS AND FUTURE RESEARCH

The most significant limitation in this project is the need to test and study the viability of latest Blockchain technology. Some of the companies, mentioned in chapter 4, are slowly introducing this technology into their management, however it will take some time until all the companies start to use it on their daily basis. Only after this shift on our society, the Lumba App will achieve its full potential.

Opportunities for further researches are abundant. This study is focused on environmental issues and suggests the following future research directions. First suggestion is to focus the study on an international scale, expand the survey implemented in Portugal to other countries. Second suggestion is to try to partner with a company that already has the blockchain implemented and create an app for transparency of their business. The third suggestion is to research the usage of blockchain in social media, how can it influence the use of fake content. If the posted content can be verified and traceable through blockchain technology, the ability to block fake data could be game-changing. Well informed people create more fair and transparent society.

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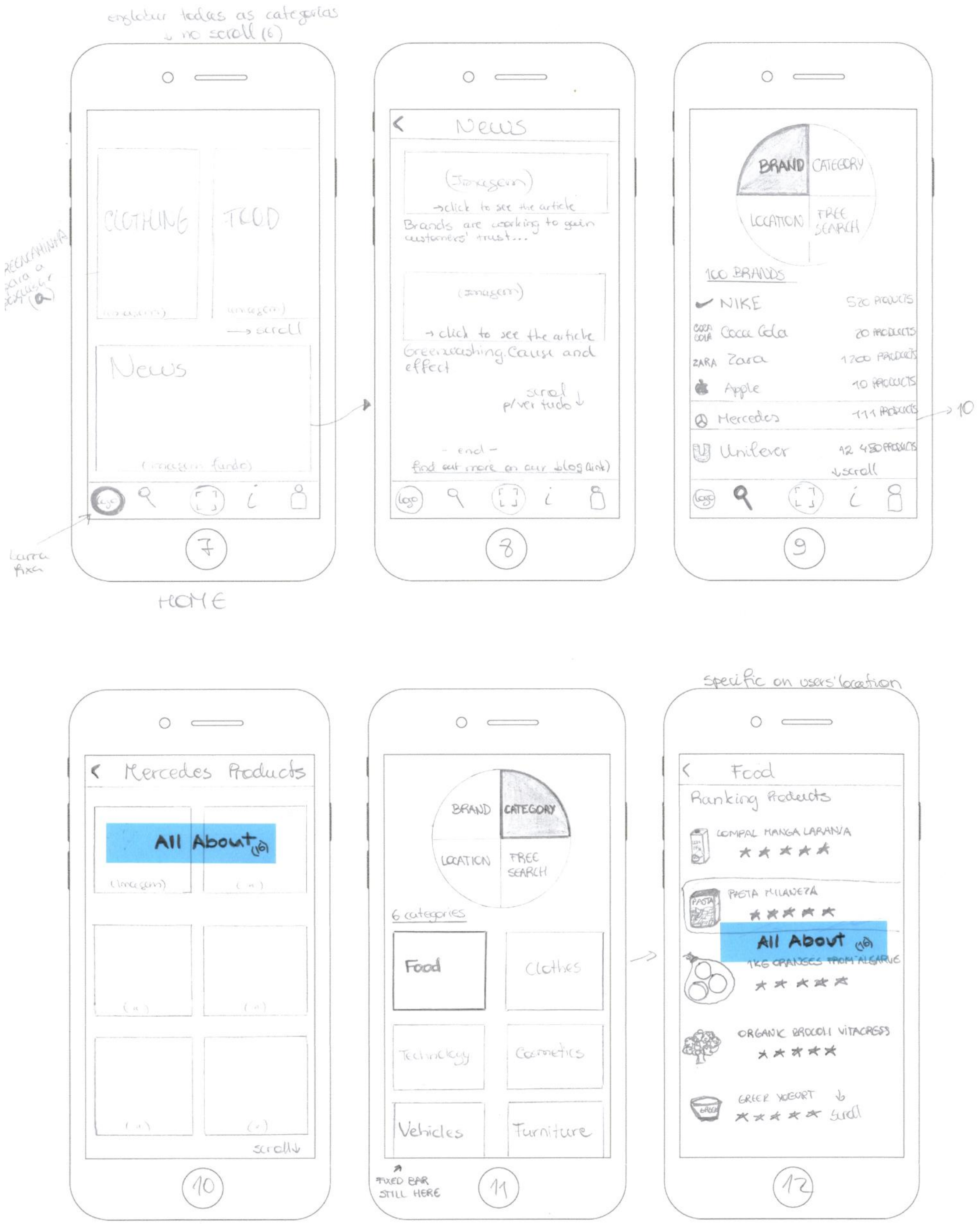
10. ATTACHMENTS

Paper draft flowchart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FOOD
(imagem)
→ scroll
News
(imagem fundo)
barra fixa
7
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News
(Imagem)
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(Imagem)
→ click to see the article
Greenwashing. Cause and effect
scroll p/ ver tudo ↓
- end -
find out more on our blog (link)
8
BRAND
CATEGORY
LOCATION
FREE SEARCH
100 BRANDS
NIKE 520 PRODUCTS
Coca Cola 20 PRODUCTS
ZARA Zara 1200 PRODUCTS
Apple 10 PRODUCTS
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↓ scroll
→ 10
9
Mercedes Products
All About (16)
(imagem)
scroll ↓
10
BRAND
CATEGORY
LOCATION
FREE SEARCH
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Food
Clothes
Technology
Cosmetics
Vehicles
Furniture
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11
specific on users' location
Food
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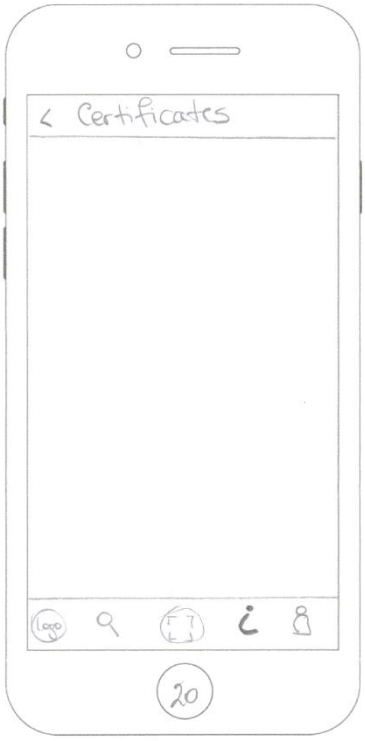
12


BRAND
CATEGORY
LOCATION
FREE SEARCH
CHOOSE A DIFFERENT LOCATION
Country
City
Category
Search...
13
Results: screen 12
BRAND
CATEGORY
LOCATION
FREE SEARCH
VEGAN (for example)
tofu
soy
potato
Results depend of location
14
(home)
(QR CODE IMAGE)
FIND THE QR CODE ON THE PRODUCT
15
All About "Manteiga de Amêndoa Natural"
16
This product doesn't exist on our database.
We will suggest this brand to enter our platform as soon as possible.
TRY AGAIN
17
Review
Comment
Save to favorites
18
ou


Certificates/Standards
Eco-labels
Sustainability
Fair Trade
Statistics
19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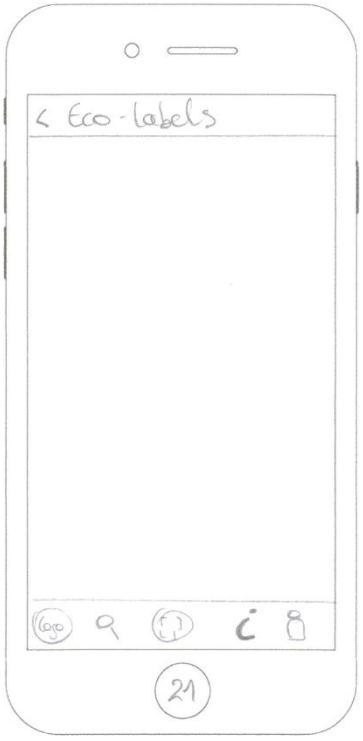
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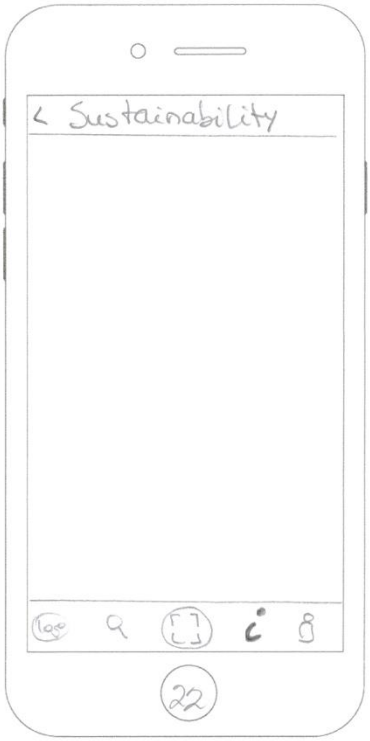
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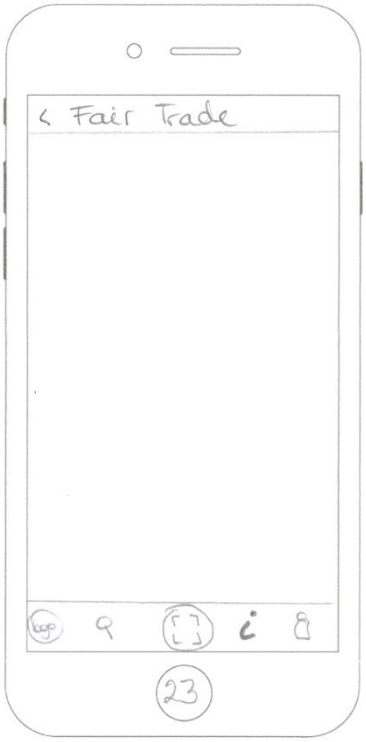
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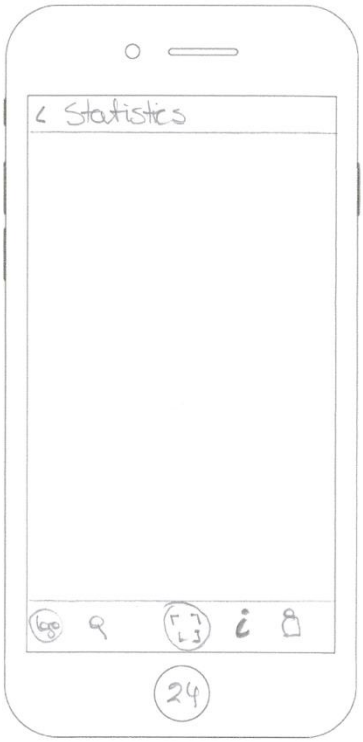
< Statistics
24

The next page is the representation of the final screens for the designed App.