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**INSECTS AS A LEGITIMATE FOOD INGREDIENT: BARRIERS &
STRATEGIES**

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Dedicated to my parents and my sister

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“The greater our knowledge increases, the greater our
ignorance unfolds.”

John F. Kennedy, September 12th, 1962

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LIST OF SYMBOLS, ABBREVIATIONS & ACRONYMS

ANVISA	National Health Surveillance Agency (<i>Agência Nacional de Vigilância Sanitária</i>)
ASBRACI	Brazilian Association of Insect Breeders (<i>Associação Brasileira dos Criadores de Insetos</i>)
Ca	Calcium
CH ₄	Methane
CO ₂	Carbon Dioxide
COP21	The 21 st annual Conference of the Parties
Cu	Copper
FAO	United Nations Food and Agriculture Organization
FDA	U.S. Food and Drug Administration
Fe	Iron
GHG	Greenhouse Gases
GPES	Grupo de Pesquisa, Educação e Saúde
IEIC	International Entomophagous Insects Conference
IEIC5	The 5th International Entomophagous Insects Conference
IFC	Federal Institute of Catarinense
IFRJ	Federal Institute of Rio de Janeiro
K	Potassium
Kg	Kilograms
MAPA	Ministry of Agriculture, Livestock and Food Supply (<i>Ministério da Agricultura, Pecuária e Abastecimento</i>)
Mg	Magnesium
Mn	Manganese
Na	Sodium
N ₂ O	Nitrous Oxide
P	Phosphorus
R&D	Research and Development
SC	Santa Catarina
UEFS	State University of Feira de Santana
UESC	State University of Santa Cruz
UNEB	Bahia State University
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USA or U.S.	United States of America
WUR	Wageningen University and Research Centre
Zn	Zinc

ABSTRACT

The very idea of eating insects is the greatest booster of the revulsion feeling towards entomophagy. An inappropriate cultural categorisation of this eating habit has been cultivated by Western societies. The various approaches on promoting invertebrates as a legitimate food habit have been misapplied. Educational efforts have been made unsuccessfully. To address cognitive aversion toward insects, a complete change in the strategic plan must be established. This qualitative explanatory research aims at a full theoretical, and methodologically sustained, understanding of the psychological and cultural drivers that lead to the negative assumptions of the population. The demystification of prejudices and imaginations by promoting normalcy of entomophagy it will stamp the harmful and incoherent disgust image out of the Westerners' psyche. This study underpins the psycho-cultural strategies along with gastronomic science that must be carried out when this product is introduced in a market where the insect is a culturally unacceptable food.

ABSTRATO

A simples ideia de comer insetos é o maior impulsionador de repulsa em relação à entomofagia. Uma categorização cultural inadequada deste hábito alimentar tem vindo a ser cultivada pelas sociedades ocidentais. As diversas abordagens sobre a promoção de invertebrados como um legítimo hábito alimentar têm sido mal aplicadas. Os esforços educacionais não alcançaram nenhum êxito. Para enfrentar a aversão cognitiva em relação aos insetos, uma mudança completa no plano estratégico deve ser estabelecida. Esta pesquisa qualitativa explicativa tem como objetivo uma plena compreensão teórica, e metodologicamente sustentada, dos impulsores psicológicos e culturais que levam às suposições negativas da população. Desmistificando os preconceitos e as imaginações promovendo a normalidade da entomofagia, esta eliminará a imagem nociva e incoerente de repulsa que se encontra na mente dos ocidentais. Estratégias psico-culturais juntamente com a ciência gastronómica devem ser levadas a cabo quando este produto é introduzido num mercado onde o inseto é um alimento culturalmente inaceitável.

1. INTRODUCTION

1.1 Presentation of the Main Theme

1.1.1 Brief Explanation on the Importance of the Matter

Food and Agriculture Organization of the United Nations (FAO) claims that there is an upcoming problem which will affect the general global population – how to cope with strong demand growth considering resources and land have been becoming increasingly scarce (Gerber, et al., 2013). The big challenge basically is how to maintain a productive agriculture without undermine the food security (Dobermann, et al., 2013). Therefore, investing in innovative agriculture and food systems is vital to meet the needs of would-be 9.6 billion people who will probably populate our planet within forty years (Huis, Gurr, & Dicke, 2015). New techniques and state-of-the-art technologies have been used to save resources especially water and energy (Winpenny, Burke, Faurès, Hoogeveen, & Steduto, 2012), maximise the existing pasture and crop land, make agricultural waste treatments more efficient (Burton & Turner, 2003) and reduce drastically the food waste (Smithers, 2016; Jackson, 2016). Nevertheless, livestock is still the greater responsible of agricultural greenhouse gas (GHG) and methane emissions (Gerber, et al., 2013; Oonincx, et al., 2010).

In the meantime, climate changes constitute a top-list global issue in the world leaders' agenda (Clark, 2014), and agriculture (particularly animal rearing) is one of main drivers of this reality (Vrbicek, 2015). Due to these strong trends in climate change, the average global temperature has increased exponentially over the last years (Chavaillaz, Joussaume, Dehecq, Braconnot, & Vautard, 2016). Consequently, the impacts have been visible: global sea levels are rising, species and their habitats are becoming scarce, natural catastrophes have been more frequent, droughts and floods have been daily for many populations, erratic weather patterns, thus the adaptive capacity of ecosystems given these negative changes is getting weaker and weaker (Constance I. Millar, 2007). These events, therefore, are neither a short-run problem (Pacala & Socolow, 2004) nor affecting a minority, but rather a concern of the entire human race (Houghton, Change, & Callander, 1992).

The food sector has been pointed out by several organisations and institutions as a major actor of the climate changes. In fact, livestock rearing

1.1.2 Presentation of the Main Theme

Diverse “animal-friendly” lifestyles have been gathering more followers throughout the ages, such as vegetarians or vegans, aiming to curb the intake of meat, nonetheless there are still room for other sources of proteins as a meat substitute or complement. Over the past years, a new market has been emerged among Westerners. A future and sustainable dietary habit has been instilled and encouraged in Western society¹ - entomophagy. In fact, for some authors, the most correct (new) term for human consumption of insects is called as anthropo-entomophagy (Neto & Ramos-Elorduy, 2006). Daniella Martin (2014) has mentioned once, entomophagy is a habit that our ancestors, dwellers of neighbouring nations, and even we ourselves (Westerners) do constantly without realising it. Areas as Mexico, Thailand, Japan, numerous indigenous groups worldwide, or even in several regions in Brazil edible insects² belong to their daily eating habits (Vane-Wright, 1991; Costa Neto & Ramos-Elorduy, 2006; Costa Neto, 2004). Usually, in the first instance, we tend to reject insects, however, we do not realise that we often eat a certain amount of insect matter that is found in our common foods. For instance, U.S. Food and Drug Administration (FDA) has listed out numerous sort of product with ‘maximum levels of natural or unavoidable defects in foods for human use that present no health hazard’, such as a tomato paste or peanut butter are authorised to contain on average 30 or more fly eggs (among other insect fragments) per 100 grams³. Furthermore, even though the insects’ consumption could be creepy and a reason of revulsion for many, in several Western dietaries animals as lobster, mussels or shrimps are closely related to bugs (Ramos-Elorduy, 1998). Indeed, they belong to the same phylum, and the taste and texture as well as the visual features are quite familiar (Ramos-Elorduy, 1998; Costa Neto & Ramos-Elorduy, 2006).

Entomophagy is the human consumption of insects, arachnids, or invertebrates practised by roughly two billion of people (Shockley & Dossey, 2013). Julieta Ramos-Elorduy has defended throughout her publications that using insects as food occurs since “Plio-Pleistocene” times.

¹ Plenty of nations and cultural groups have European influence. The term “Western” and its family of words refer the all countries where language, eating habits, values and beliefs, or culture itself comes from the regions considered Westerns, at the first place (Harris, 2013). Brazil will be referred as a Western society as well due to its historical and cultural heritage (De Holanda, Summ, & Monteiro, 2012; Skidmore, 2010). Furthermore, once the present author comes from a Western society, eventually other words will be used such as “we” or “our” throughout this paper as reference to the Western people.

² It depends on the author and how the estimation process was carried out, nevertheless it is estimated almost two thousand species of edible insects worldwide (Costa Neto, 2013; Huis, et al., 2013). Then, throughout this paper in the term “insects” has been used by the author as form to generalise the all insect species alongside other edible invertebrates such as arthropods. Therefore, the term “insects” includes different specie groups as true bugs, beetles, and termites as well as life forms such as grubs, caterpillars, and maggots (Looy, Dunkel, & Wood, 2014).

³<http://www.fda.gov/food/guidanceregulation/guidancedocumentsregulatoryinformation/sanitationtransportation/ucm056174.htm> - **Defect Levels Handbook** - The Food Defect Action Levels: Levels of natural or unavoidable defects in foods that present no health hazards for humans; *U.S. Food and Drug Administration (FDA)*

Currently, approximately one thousand and nine hundred species of insects were adopted as edible food by around three thousand ethnic groups and other thousands of citizens in more than one hundred and twenty countries (Ramos-Elorduy, 2004). As previously mentioned, Asia, Africa, Australia and Latin America are the most common regions where these mini-livestock are used as food in the daily diets of the population (Costa Neto & Ramos-Elorduy, 2006; Vane-Wright, 1991; Gahukar, 2011). Even so, a few countries in Europe have added in their regular diets some types of invertebrates as for example sea and land snails in France and Portugal (Eatwell, 2014; Sobral & Rodrigues, 2013). This food diet has gained more attention from Westerners since FAO published in 2013 the book *Edible Insects: Future Prospects for Food and Feed Security*, where it is profoundly discussed the potential of edible insects as food and feed. Since then, in addition to diverse authors and professionals involved in this sector, the public in general have been demonstrated an even stronger interest with this new cuisine (Costa Neto, 2013). In fact, insect's consumption is not new theme among Westerners. One of the first pioneering works was "*Why Not Eat Insects*", in 1885. A small book whereby the English entomologist Vincent M. Holt stressed the fact that entomophagy could be an adequate dietary for the malnutrition worker, among other advantages (Holt, 1885). The gastronomy of insects has been developed practically in the last half century by insect's cookbooks (Taylor & Carter, 1976; Gordon, 1998; Huis, Gurr, & Dicke, 2015) and scientifically deepened by journals, magazines, and so on (Lindroth, 1993). Such events as TED conferences (Dicke, 2010), documentaries (Monroe, 2016) or TV shows (Linassi & Bernardes, 2015) have been broadcasting to the general public. Furthermore, some of the most influences organisations as United Nations have urged people to adapt this new food habit (BBC, 2013).

The trend of investing more and more in the insect sector as food and feed in the Western regions have been noticeably increasing (Lander, 2016; Moodie, 2016). Since the beginning of XXI century, a rising number of new start-ups have been setting up and specialising on this area (Hayley, 2016; Brickman, 2014). From across the world innumerable enterprises have been coming up with innovative food science processes to integrate insects into human food items (Huis, et al., 2013). In the past few years, a few of the plentiful companies as Ronzo (Poland), C-Fu (Canada), Bugs World Solution Food (Belgium), Q-Biofábrica, Hakkuna and Nutrinsecta (Brazil), Nordic Food Lab (Denmark), Entomo Farms and All Things Bugs (USA), Bugzz (Netherlands), Jungle Bar (Iceland), Steak Tzar Tzar (Israel), Earth & Me (UK), Tastebugs (Australia), Gryö Bars (France) or Edible Bug (South Korean) have been increasingly gaining market share in food sector and garnering mainstream appeal from the modern societies

(Tarkan, 2015; Engström, 2016; Fleming, 2016). Besides those business organisations, within the catering sector many others have been exploring insects as human food. With the purpose to wide the boundaries of the current market, and gain market share, competitive advantages have been created through a significantly investment in R&D (Research and Development), communication, and technology expertise. Notwithstanding, further development and investment has been required for the insects industry (Huis, et al., 2013).

The entomophagy has been considering as an efficient method to address the food and nutrition needs. A wide range of edible insect species is available in the “human diet menu” and varies conforming to the metamorphic stage, habitats, or diets (Finke, 2002; Conconi & Rodríguez, 1977). This novel food has attracted the interest of the Westerners, because the insect as food is considered highly nutritive, rich in proteins, fibres, vitamins, minerals, and fat (Bukkens, 1997; Resh & Cardé, 2003), and environmentally friendly comparing to other sources of animal protein as mammals or birds (Huis, 2013; Oonincx & Boer, 2012). Nowadays we are witnessed for a much more mindful and careful generation regards to their lifestyle and well-being, not only due to their greater purchasing power but also because we live in a period in which access to information is reachable and easy access to most citizens. Due to these and many other reasons, insects have been gaining prominence among Westerners. So, why do most Western people do not eat insects? Numerous approaches to entomophagy have focused on the nutritional and sustainability values of insects and other terrestrial invertebrates as a source of human food (Deroy, Reade, & Spence, 2015). Rational approaches have been used face to the negative attitudes of Westerners with insect consumption (Looy, Dunkel, & Wood, 2014). On the other hand, psychological and cultural dimensions have been neglected or disregarded as possible strategies on changing culture tastes, behaviours, and beliefs (Tan, et al., 2015; DeFoliart, 1992). According various researchers, such as Rozin & Fallon (1987), Tybur, Lieberman, Kurzban and DeScioli (2013), or Mignon (2002), the rejection is culturally relative, and thus the individual’s disgust is triggered by cognitive components and irrational feelings, which in part follow magic rules – law of contagion and law of similarity (Frazer, 1890/1922/1959; Mauss, 1902/1972). Furthermore, in addition to the important role of visual features on the people’s expectations, an “environmental confound”, driven by misleading associations with insects as negative or risky source of food, leads to an inner and illogical repulsion toward entomophagy (Deroy, Reade, & Spence, 2015; Yen, 2009). Given this, it might be only sensorial and irrational strategies such as communication, marketing, or gastronomic approaches capable to surpass those irrational sociocultural barriers (Shiv,

Carmon, & Ariely, 2005; Mignon, 2002; Martins & Pliner, 2006; Evans, et al., 2015; Rozin & Fallon, 1980; Kellert, 1993).

Apart from those sociocultural barriers, sundry literatures have mentioned other external obstacles that hamper the growth of this market such as framework implications for trade, e.g. unclear regulations and legislation on farming and selling insects for human consumption, lack of infrastructures, little networking among producers, inexistence or barely developed clusters, and a poor demand for a large quantities for human consumption (Menezes, 2016; Halloran, Münke, Vantomme, Reade, & Evans, 2015; Huis, et al., 2013; Costa Neto, 2013; House, 2016), but it will not be delved deeper into detail.

In this paper, the sociocultural aspects related to insects as an edible food, and its consumption will be in-depth discussed and analysed. Hereafter, strategies and approaches to overcome those barriers will be highlighted based on secondary information. Information that comes from numerous literatures related to the potentialities of entomophagy as a sustainable diet; and the consumers eating behaviours toward this novelty. In the light of interviews conducted with several professionals in the area, primary data will be gathered and compared with theoretical information. Finally, the prepositions made by the relation between primary and secondary information will be the building blocks of the last conclusions. This exploratory research aims to identify the conceivable strategies on turning the insect-based food not only acceptable but also appealing to Westerners consumers by highlighting the core elements that trigger the rooted distaste towards intake of insects.

1.2 Objectives

1.2.1 General

The Westerner's attitudes towards insects as a novel source of human food is the core research topic of enquiry. The present study outlines empirical work, theoretically informed and methodologically verified by a detailed appraisal, with experts of insect-based convenience foods in the Brazil.

This paper does not have as final objective to convince the reader that edible insects are the only way out to save our planet from the climate changes. The goal is neither force people switch completely their based-protein diets nor other types of alimentation. Here the core interest is giving to the Western public, more concretely to the Brazilian people, a different outlook about their food choices.

The goals of this research are to delve deeper mainly into two dimensions:

- *On what grounds do the Westerners reject insects as a legitimate food source? In what ways and forms do these barriers present themselves?*
- *Which kind of approach strategies should be carried out to surpass those "insect-phobic" barriers of human entomophagy?*

1.2.2 Specific Ones

Understanding the psychological and cultural factors are undoubtedly necessary to run strategies on the right track and persuade positively the consumer decision-making towards edible insects as a source of food.

An extensive literature review will be engaged, and thereafter this secondary information will be verified and eventually enriched by primary data obtained from interviews. The main objective here is whether there is a link between theory and reality. In addition, if those methods may be applied in Western society, having Brazil as sample.

The present thesis lies on two general objectives: Barriers and Strategies dimensions.

- **Barriers towards insect consumption**
 - *How to understand and explain rejection of insect eating?*
 - *What are the main factors related to this phenomenon?*
 - *In what ways do psychological arguments explain rejection to eating insects?*
 - *Can insects be dismissed as something "natural" by humans?*
 - *How do cultural factors act on this phenomenon?*

- *Is it possible to link the barriers to this rejection? In what way?*
- **Strategies to promote normalisation and acceptance of edible insects in Western dietary habits**
- *What legal and structural barriers exist today in the western market for the production and human consumption of insects?*
- *What kind of efforts are most effective in raising the consciousness of Westerners to a genuine interest in edible insects as a daily food ingredient?*
- *What kind of marketing and psychological dynamics are more likely to reverse consumer aversions and preferences?*

1.3 Justification of the Theme

A thorough consumer behaviour awareness is fundamental to every business project (Solomon, Russell-Bennett, & Previte, *Consumer Behaviour*, 2012). The significance on comprehending eating behaviours is essential when it comes to introduce a novelty into the food market (Goldberg, 2015). Here, bearing Westerners as the core target, the complete understanding about what influences the most their food choices is mainly required in order to lead those *eaters* to adopt a whole new category of food into their own diet (Deroy, Reade, & Spence, 2015).

Anthropo-entomophagy is acknowledged as “the future diet” (Megido, et al., 2013; DeFoliart, 1999), not least for its considerable high nourish content, reliable food security, and its little environmental footprint ⁴ (Huis, et al., 2013). Sensory properties such as palatability may also be a benefit for this novel dietary pattern (Shelomi, 2015; Costa Neto, 2013).

The relevance of this very theme will be pinpointed among three dimensions: *Academic Relevance*, *Market Landscape*, and finally *Personal Motivation*.

1.3.1 Academic Relevance

Westerns' eating behaviours and attitudes towards anthropo-entomophagy habits is a hitherto little-known or at least little-developed theme. The weak presence of insect on agriculture research has been jeopardised by the peoples' neglect cultivated by many food institutions (Deroy, Reade, & Spence, 2015). Nonetheless, academic- and agricultural-speaking, this theme has recently started to be in-depth explored in diverse regions (Costa Neto, 2013; Yen, 2009; Gahukar, 2011). Costa Neto (2013) in his papers has underlined the fact that in traditionally non-entomophagy societies, Europe or United States of America for instance, have been noticing a greater exposure of this phenomenon through numerous types of media such as journal articles, films, media interviews, lectures, gastronomic festivals, and the like. The International Entomophagous Insects Conference (IEIC) is one of the greatest examples. Since 2009 a biennially conference has enabled researchers and experts on the arthropod and entomophagy area from around the world have been able to meet and exchange up-to-date information. Indeed, the fifth IEIC (IEIC5) will be held in Kyoto, Japan, from October 16th to 20th, 2017 (The 5th International Entomophagous Insects Conference, 2016). In addition to the

⁴ According to the book *Edible Insects - Future Prospects for Food and Feed Security* (2013), further documentation and investigation is required with the objective to instigate the insects' consumption promotion through most trustworthy and irrefutable avenues.

latter one, many other international scientific events and conferences have been held over the last decade. In 2000, a forum aiming to address the entomophagy theme was held in Paris, France, named by “*Les Insectes Dans La Tradition Orale*” (Huis, et al., 2013). Numerous experts from anthropology, entomology, among other areas, have gathered in another consultation to discuss the topic of insects as a food in USA. This conference called by “*Eating Insects*” took place at Wayne State University in Detroit, USA, on May 26th to 28th, 2016 (Eating Insects Detroit: Exploring the Culture of Insects as Food and Feed, 2016). A couple of international meetings were also jointly set up by the United Nations Food and Agriculture Organization (FAO) and Wageningen University and Research Centre (WUR) such as:

- In January 2012, the “*Expert Consultation Meeting on Assessing the Potential of Insects as Food and Feed in Assuring Food Security*” at FAO in Rome, Italy (Huis, et al., 2013);
- Between 14th to 17th May 2014, the conference “*Insects to Feed the World*” at conference centre De Reehorst in Ede (Wageningen), The Netherlands (Vantomme, Münke, Huis, Itterbeeck, & Hakman, 2014);

However, in spite of all these international meetings, plus the substantial amount of literatures and the strong media attention towards this subject (Costa Neto, 2013; Looy, Dunkel, & Wood, 2014; Huis, et al., 2013; Shelomi, 2016; DeFoliart, 1999), it has not been enough to get people familiarised with this novel food habit. Those conferences and international meetings have had an academic, scientific, and educational relevance, in terms of creating public awareness, in a way that it will break down fake facts, and clarify diverse assumptions about entomophagy (Verneau, et al., 2016; UNESCO, 2005; Dovey, Staples, Gibson, & Halford, 2008). Nevertheless, psychological and cultural perspectives should be also taken into consideration when it comes to set up strategies to promote in Western societies. Those dimensions will be further discussed in the following chapters.

1.3.2 Market Landscape

Anthropo-entomophagy is a regular diet of a large part of Earth’s population, accounting roughly 2 million *eaters* across the six countries (excluding Antarctica). Although it is seemed solely as a primitive behaviour by many, recently there has been a trend among Western’s societies to adopt edible insects in their daily diets (Halloran, Münke, Vantomme, Reade, & Evans, 2015; Costa Neto, 2003).

Practically in all Western countries, besides the existence of diverse insect-product businesses, entomophagy is still an underdeveloped market. According to International Monetary Fund’s

World Economic Outlook Database (cited by Daniel Workman, 2017), such countries as Brazil where agriculture and livestock are in the top ten of export sectors, and one of the biggest markets in Latin America (Shepherdson, 2015). However, edible insects are still an unknown area for most (Costa Neto & Ramos-Elorduy, 2006). Then, there are still a large room to be explored. Various environmental opportunities, likelihood improvements, or economic developments have been promoted by embracing this novelty. Factors such as the livelihood and economic opportunities that insect's production offer to for both poor and rich sections of society due to its low-tech and low-capital investment, the nutritious and healthy properties of the insect's body, the low environmental footprints comparing with other traditional sources of proteins, the little requirement of land portion and land-clearing to expand production, and adding to the prediction of an exponential increase in demand for new sources of animal protein due to climate change are what make this market so appealing (Huis, et al., 2013; Durst, Johnson, Leslie, & Shono, 2010; Gahukar, 2011; Godfray, et al., 2010). The entry barriers are low because the few competitor, nevertheless the risk is high due to lack of reliable information and frameworks in this sector (Huis, et al., 2013).

Therefore, a major turn-around from production-based thinking to a sustainable industry driven by individual consumer needs and conservation of the environment is demanded to face the upcoming environmental and societal challenges. In addition, other aspects such as a more efficient and equitable food security to the general population as well as a considerable reduction on the food wastage might be conducted in the food sector.

Concluding, being the "big-first" in the area could means a competitive advantage in terms of gain market share and branding, however, being the solely the pioneer implies to be the one take the first risk and error, i.e., it is subject to be easily replicated by its rivals. Nowadays, a more health-conscious eating as well as an increasingly environmental-awareness has been trended especially by the youth generation (Watson, 2015). Plus, the people needs have become more demanding and sophisticated. Therefore, bearing in mind the willingness to shift radically an eating-habit is unlikely to happen overnight (Goldenberg, 2011; Goldenberg, 2010), Huis et. al (2013) amongst other experts advocate a tailored media communication strategies and educational programmes to reach the consumers' positioning as a sustainable and palatable food. Plus, investors and policymakers are needed with a view to giving credibility and validating the arguments in favour of insects' consumption.

1.3.3 Personal Motivation

Numerous natural catastrophes, terrible wars, epidemics, economic crashes, and whole kind of humanitarian crises have happened throughout our history. Today, we are facing one of the greatest calamities, which humanity has ever witnessed – environmental crisis. A myriad of reasons and theories have been pointed out to this very situation. Nonetheless, one of the most often mentioned is from agriculture sector. This industry is one of the most important, oldest, and timeless ones due to the human's dependency of it for their own survival. Within this same area, there are several sub-industries, and animal rearing, more specifically intensive industrial livestock production, is one of the biggest players in terms of environmental impacts. Factors, which will be explained in a greater detail in the further chapters, are mainly come from cattle. A society that increasingly seeks more animal protein, new alternatives are relentlessly sought to respond to consumers' needs in a more sustainable way. The most reliable and prosperous solution that I myself believe is human-entomophagy. That is, according my perspective about this ongoing issue, people worldwide adopting insects in their own diets as an alternative or supplement to traditional sources of protein will greatly reduce the environmental crisis that humanity is currently experiencing, and certainly, it will worsen in the next decades.

Two of my passions are biology and gastronomy, and I have been mesmerised by the way these two subjects perfectly complimented each other. I have enriched the biological knowledge by theoretical tools whereas gastronomic sense has been matured largely by individual experiences. Travelling has been the best way to wide my “taste buds”. One of most rewarding travels were a backpacker around Southeastern Asia. I have had the fortuity to explore more than a dozen of countries, over half a year. During these months, different types of cuisines were explored and diverse sensory properties were unveiled. Among those was entomophagy. Insects' consumption is a standard diet pattern for a large part of Southeast Asian dwellers. Growing up under a neophilic education, I have been always eager to explore new palates. Thus, it was during a bus-trip in a remote area, located in the countryside of Cambodia, where I was exposed to my first insect-intake's experience. From that moment on, my awareness about this new cuisine has been steadily increasing. Innumerable documentaries, films and journal articles have been contributing for my “interest-boost” towards this novel food. Furthermore, having a background in business management, it has likewise drawn my attention to the potentialities of this new market.

At a Westerner's outlook, anthro-entomophagy is surely a polemic and controversy subject. Nevertheless, it is because this very reason I have chosen entomophagy as my thesis' theme.

Besides my profound concern about climate changes, I see insect consumption as one of the most potential longstanding businesses within the food sector. With an unstoppable population growth, gradually civilisations espousing Western eating habits (focus on animal-protein), scarcities of basic resources, overexploitation of fisheries, and greater land competition, edible insects are possibly the gateway of this food's dilemma.

2. GLOBAL CONTEXTUALISATION OF ANTHROPO-ENTOMOPHAGY

As aforementioned, the global livestock sector is one of the most environmentally damaging industries (Gerber, et al., 2013; Winpenny, Burke, Faurès, Hoogeveen, & Steduto, 2012). Being climate change an issue of utmost importance, actions have been taken worldwide. One of the most remarkable achievements of the century was the Paris Agreement. According to its official website, in December 2015, Paris headed a climate conference (COP21), where all Parties to the *United Nations Framework Convention on Climate Change* (UNFCCC) have come together into a common cause: combat the climate changes. An historical legally binding climate deal was carried out by dozens of countries in which the major goal is to mitigate the greenhouse gases emissions to the atmosphere. By limiting global warming to well below 2 degrees Celsius with an aspiration of 1.5 degrees Celsius (Harvey, 2015), the current one hundred and twenty-five Parties that have ratified the Agreement aim to: “[...] *increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG [Greenhouse Gases] emissions and climate-resilient pathway*” (The Paris Agreement, 2016). Undoubtedly, COP21 represents a political success in climate negotiations and traditional state diplomacy (Dimitrov, 2016).

Experts in the area have been defending that one of the possible alternatives on diminishing the environmental footprint and sector’s emissions is people change their eating habits to a more sustainable and environmental friendly diet. For instance, in the paper “*Diet and the Environment: Does What You Eat Matter?*”, Marlow, et. al (2009) have concluded in an environmental perspective non-vegetarian diets have a much higher negative impact than vegetarian diets. Nonetheless, over the last decades, numerous articles, documents, scientific reports have been focused on other dietary alternatives such as seaweed or other type of animals. A potential alternative is entomophagy. It is a sustainable dietary consumption based on insects, arachnids and invertebrates (Ramos-Elorduy, 2009). These mini-livestock are acknowledged as a rich source of proteins and vitamins for human being (Clegg, 2015), and it requires less resources, reducing adverse environmental impacts of livestock production (Yen, 2009). Therefore, in this present paper, the discussion will have a greater focus on human entomophagy.

In this section, with the view to contextualise arthropod-entomophagy in the market, it will be highlighted the nutritional, environmental, and socioeconomic benefits on adopting insects as food habit.

2.1 Potential of Eating Insects

Human entomophagy, or known as anthropo-entomophagy, is recurrent in diverse cultures scattered around the World (Ramos-Elorduy, 2009), including Brazil (Costa Neto, 2014). Lots of specialists consider insects as the animal protein source of the future (Huis, Gulp, & Dicke, 2015; Huis, 2013; DeFoliart, 1999; Dicke, 2010; Schösler, Boer, & Boersema, 2012; Müller, Evans, Payne, & Roberts, 2016; Verbeke, 2015) mostly due to its nutritional properties and low environmental impacts comparing with other traditional sources of proteins (Martin, 2014). Particularly, in Brazil the entomophagy culture has Indigenous origin (Costa Neto, 2000). More specifically, the first records about the practise of entomophagy by indigenous peoples was around the sixteenth century (Costa Neto, 2013).

FAO has been one major players on reigniting the hitherto comatose discussion of insects' consumption by humans. Sustainability has been used as a fundamental argument to entomophagy. So-called "food of the future" has increasingly gathered new *eaters* worldwide (Shelomi, 2016). Bearing in mind there are roughly 1,900 species of edible insects, the nutritional value varies on a large scale as well as the rearing methods, depending on each species (Gahukar, 2011). Notwithstanding, it is still considered as a higher environmental safety production comparing to conventional livestock (Megido, et al., 2013).

2.1.1 Overall View of the Insects' Profile

Although, it has been described insects as a nutritious food, there are other valuable products or utilities whereby we can obtain from (Huis, et al., 2013). From the bees, it is extracted the honey, and the silk is retained from the silkworms. The red dye carmine is derived from a type of scale insects, called cochineal. It is used to colour foods, textiles, manufacture of artificial flowers and paints, and pharmaceuticals (Greenhawt, McMorris, & Baldwin, 2009). However, insects are also medically useful and the substance extruded from them are vital for some end (Costa Neto, Ramos-Elorduy, & Pino, 2006). It is recurrent in agricultural activities to use certain species as natural pesticides and protectors of the biodiversity of the plantations, among many other functions. Therefore, insects are not only essential to maintain the balance of the ecosystem, but likewise a precious value for the human being.

Among a range of hundreds of species of insect insects, the most common edible insects consumed by humans⁵ (see *Table 1*) are beetles (*Coleoptera*); the second most is the caterpillar (*Lepidoptera*) with 18 percent; bees, wasps, and ants (*Hymenoptera*) occupies the third place (14 percent); Coming in forth at 13 percent are the grasshoppers, locusts and crickets (*Orthoptera*); then cicadas, leafhoppers, planthoppers, scale insects and true bugs (*Hemiptera*) at 10 percent are the fifth species of insects plus food.; termites (*Isoptera*) (3 percent); dragonflies (*Odonata*) (3 percent); flies (*Diptera*) (2 percent); and other orders (5 percent) (Huis, et al., 2013) (Cerritos, 2009). Sometimes, the values tend to vary according to each author, due to the small number of studies in this area, however, based on the most recent data, Latin America houses about 735 edible insects scientifically identified and Brazil is the second responsible for this number, with 122 insects (Jongema, 2014; Costa Neto, 2015).

2.1.2 Nutritional Value

Insects are known for being a nutritious food. It is an important source not only of proteins, but also of vitamins, fat, minerals, and fibre for many ethnic groups and regions throughout the world (Bukkens, 1997). Nevertheless, the nutritional values could differ from species to species. In addition, within the same species, many other aspects likewise influence the nutritional richness of the product. The metamorphic stage and the diet as well as the surrounding habitat are great nutritional influencers (Cox & Willis, 1985; Resh & Cardé, 2003). Another fact that influences the most nutritional level of the food is the processing methods, and preparation, i.e. depends whether it is a drying or fresh insect, and if it is boiling, frying, grilled, and so forth (Huis, et al., 2013).

Entomophagy has been considered a sustainable diet, not least because of the low environmental impacts, but also due to their high-energy values, with levels comparable to traditional sources of animal protein, such as dairy products, eggs, or beef (Dossey, 2013). DeFoliart (1988) and other authors have shown that we can find the same substances that compose the meat of the vertebrate animals, such as pork, ox, chicken, and fish, on the "meat" content that is inside of the most of insects. A large part of the insects are notable sources of proteins and lipids, and contain in abundance micronutrients, such as Na, K, Zn, P, Mn, Mg, Fe, Cu, and Ca (Conconi & Rodríguez, 1977). For instance, the ant of the specie *Atta cephalotes*

⁵ In addition to being values from 2013, these are global values (total values), in other words, it may vary according some tribes, groups, or countries. In addition, the frequency at which insects are eaten in certain regions is not related with those values (Huis, et al., 2013).

L., is made of 42,59% of proteins against 23% in chicken and 20% in beef (Conconi & Rodríguez, 1977).

In the book, *Edible insects - Future prospects for food and feed security*, we can find a table through which Xiaoming et al. (2010) analysed the raw protein and amino acids content of about 100 insects. The range varies according to the stage of life (egg, larva, pupa, or adult stages) and it is a percentage based on the dry matter. The following Table 2 describes the range of crude protein and amino acids found in insect's bodies and sort by descending order the most consumed worldwide by humans.

Table 1 - Crude protein and amino acid content of edible insects, by insect category most consumed worldwide (% dry weight)

Category of Insects	Stage	Range of Proteins (%)	Range of Amino Acids (%)
<i>Coleoptera</i>	Adults and Larvae	66.20 – 23.20	62.97 – 13.27
<i>Lepidoptera</i>	Pupae and Larvae	68.30 – 14.05	61.84 – 13.27
<i>Hymenoptera</i>	Adults, Larvae, Pupae, and Eggs	76.69 – 12.65	81.27 – 21.0
<i>Orthoptera</i>	Adults and Nymph	65.39 – 22.80	57.51 – 20.23
<i>Hemiptera</i>	Adults and Larvae	73.52 – 42.49	59.68 – 38.09
<i>Isoptera</i>	N/A	N/A	58.27 – 33.96
<i>Odonata</i>	Adults and Naiad	65.45 – 46.37	51.70 – 36.10
<i>Diptera</i>	N/A	59.39 (Average)	N/A
<i>Ephemeroptera</i>	N/A	66.26 (Average)	65.97 (Average)

Source: (Xiaoming, Ying, Hong, & Zhiyong, 2010); (Huis, et al., 2013); Yang (1998); Hu (1996); Mitsuhashi (1992); DeFoliart (1991); Comby (1990); Ramos-Elorduy and Pino (1989)

As we can see, the variation is quite ample, both among the different species and in each stages of life within the same species.

Moreover, (Huis, et al., 2013) compared the different protein values (on average) among mammals, fish, and some types of edible insects (*Table 2*).

Table 2 - The protein content average of each animal group and its species (% dry weight)

Animal Group	Species	Stage or Animal Name	Protein Content (g/100g of fresh weight)
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<i>Insect (raw)</i>	Locusts and grasshoppers: <i>Locusta migratoria</i> , <i>Acridium melanorhodon</i> , <i>Ruspolia differens</i>	Larva	14 – 18
	Locusts and grasshoppers: <i>Locusta migratoria</i> , <i>Acridium melanorhodon</i> , <i>Ruspolia differens</i>	Adult	13 – 28
	<i>Sphenarium purpurascens</i> (chapulines – Mexico)	Adult	35 – 48
	Silkworm (<i>Bombyx mori</i>)	Caterpillar	10 – 17
	Palmworm beetles: <i>Rhynchophorus palmarum</i> , <i>R.</i> <i>phoenicis</i> , <i>Callipogon barbatus</i>	Larva	7 – 36
	Yellow mealworm (<i>Tenebrio molitor</i>)	Larva	14 – 25
	Crickets	Adult	8 – 25
	Termites	Adult	13 – 28
<i>Cattle</i>		Beef (raw)	19 – 26
<i>Fish (raw)</i>	Finfish	Mackerel	16 – 28
		Catfish	17 – 28
	Crustaceans	Lobster	17 – 19
		Shrimp	13 – 27
		Molluscs	Cuttlefish & Squid

Source: (Huis, et al., 2013)

Therefore, as we can see, there are edible insects with a higher protein content than other traditional sources of proteins, as cattle or fish. Nonetheless, first of bearing in mind this is a small sample, comparing with 1909 species of edible insets and other many species of mammals, fish, and birds around the world. An example of another edible insect equally nutritious is "Ahuautle", a mixture of *Hemiptera* eggs that constitutes the "axayacatl", in which it is considered as the richness animal in terms of cysteine (amino acid) (Conconi & Rodríguez, 1977; Costa Neto, 2003). Secondly, the nutritional values are highly variable, even within the same species, and differ according its biotic conditions such as diet habits, stage of life, and habitat (Pino & Ramos-Elorduy, 1996). After harvesting, there are other factors that likewise influence the nutritional content such as whether the insect is offered fresh or dehydrated, and the method of how it is cooked (Huis, 2013).

2.1.3 Environmental Benefits

Numerous studies have stressed the idea that, in next decades, the humanity will undergo a crisis of nutritional resources (Megido, et al., 2013). However, this mini-livestock has been acknowledged as greater environmental safety source of animal proteins, among other nutrients,

when compared to other traditional animal sources, especially cattle (Oonincx, et al., 2010; Megido, et al., 2013).

The sustainability of an animal rearing is not least determined based on its outputs in terms of nutritional value, but also whether the amount of feed is proportional of the animal's weight. In other words, the feed-conversion efficiency is measure according to the weight that an animal gains for each gram consumed, that is, the higher the weight-gain/kilos-feed ratio the better the efficiency (Costa Neto, 2003). Several studies have pointed out the insects as one of the greatest on feed-conversion efficiency, being only chicken at the same level of efficiency (Costa Neto, 2003). Nonetheless, according with Krajick (1994), although a cricket is much smaller than the general cattle, poultry, and swine, this tiny animal is twelve, four and two times faster, respectively, on converting its feed into meat. This is owing the insects' physiological structure, which is cold-blooded, so they are capable to save energy from maintaining the body temperature stable (Mellanby, 1939). Considering the strongly variation on nutritional values among species and animals, for the same amount of live animal weight the insects are the less resource-consumers (Huis, et al., 2013). According Smil (2002), a beef requires 10kg of feed, pork needs 5kg, and for chicken is necessary 2.5kg, comparing with a much "balanced value" of 1,7kg of feed for 1kg of live animal weight of crickets, for example (Huis, et al., 2013; Collavo, et al., 2005).

Livestock is undoubtedly a largely responsible when it comes to the emission of harmful gases into the atmosphere (Gerber, et al., 2013). Overall, livestock production represents nearly 18% of global human-induced greenhouse gas (GHG) emissions, a greater impact than the transport sector (Steinfeld, et al., 2006; Huis, 2013). Many other gas emissions as Methane (CH₄) and Nitrous Oxide (N₂O) are originated by this activity through the production of enteric fermentation, feed crop fertilizer and manure (Huis, 2013).

In terms of water consumption, insects require expressively less than cattle rearing. Huis, et al. (2013) mentioned the concept virtual water, created by Chapagain and Hoekstra (2003), in which considers the whole water required in the rearing process, including for forage and grain production. Following this concept, it means that a simple production of 1 kg of chicken, pork and beef will have much stronger impacts on the environment, because of its extreme water consumption, requiring 2,300, 3,500 and 22,000 litres of virtual water, respectively. Actually, for some authors, such as Pimentel et al. (2004), the production of 1kg of beef is necessary approximately 43,000 litres. Due to the lack food and feed legislations, it will not give emphasis to the fact that edible insects could be reared sustainably on organic side streams and

consequently reducing environmental impacts as diminishing water usage and contamination (Huis, et al., 2013).

Relative to the area required for breeding, a large proportion of insect species need a significantly lower land portion compared to conventional livestock farming (Müller, Evans, Payne, & Roberts, 2016; Costa Neto, 2003). For instance, according Huis, et al. (2013), the land demanded to produce 1kg of mealworm protein is 2.5 times lower than milk production, 2-3.5 times lower than chicken and pork, and for the same amount of beef protein is necessary a land-area (measured in hectares) 10 times bigger compared to mealworm rearing.

Other benefits have been also emphasised in many literatures such as the low risk of transmitting zoonotic infections (Huis, et al., 2013), or the ease and speed of reproduction process and their short life-cycles (Costa Neto, 2013; Oonincx, et al., 2010).

2.1.4 Socio-Economic Impacts

Naturally, by introducing a new sector into Western food-market, there will be socio-economic impacts, even though it be little importance. First off, it will rise the competition against other food-markets, mainly the conventional livestock framing sector. Furthermore, while the biotic and abiotic barriers, the development and standardisation of a mass-rearing techniques on an industrial scale is asked to meet the would-be consumer needs, which leads to the origin of a new or unexplored economic sector (Huis, 2013).

The socio-economic factors should also to be taken into consideration, vis-à-vis job and wealth creation both in developed and developing countries (Huis, et al., 2013). Much of the evolved stakeholders could benefit from this novelty. The creation of new livelihood opportunities for the most needed people, once a large part of the edible insects is found in the poorest or less developed regions, it may contribute to a better job-conditions and welfare for those dwellers (Chen, et al., 1998). Through generate cash income and diminishing the malnutrition of the population, edible insects sector is likely to have important impacts in the whole society (Costa Neto, 2003).

3. LITERATURE REVIEW

Some authors have argued the strategies that have been implemented so far have been misused (Tan, et al., 2015). A psychological and sociological analysis based on the consumer's individual experiences as well as culture background have been missing or/and underestimated (Looy, Dunkel, & Wood, 2014). Thereby, the next chapter is primarily identifying the elements that hold the Westerners back from eating insects, or trying simply. Having a better understanding on what provokes the disgust toward the bugs, it will possible to elaborate techniques to overcome the prejudices, and get rid of this inner conflict that food institutions has rooted in the Western society (Deroy, Reade, & Spence, 2015). As Delaney and McCarthy (2009) have said once: *“A person’s socio-culturally determined life experiences may be brought to bear in food choices over the life course.”*

3.1 Why Westerns Do Not Eat Insects?

This sub-session aims to outline the sociologic behaviours towards the alimentation, in which it is considered as the greatest cultural barrier to the consumption of insects on the part of Westerners (Tan, et al., 2015; Costa Neto, 2013; Deroy, Reade, & Spence, 2015; Huis, 2013; Ramos-Elorduy, 2009). And after that, gathering possible strategies to surpass these barriers. Based on numerous theories and concepts from different authors, sociologists, managers, chefs, researchers, and so on, they will be discussed and analysed in order to give theoretical grounds to the propositions under research. Firstly, this explanatory investigation will give emphasis to the global eating behaviour, particularly from the Western consumers. Thereto, the cultural and individual control will be related and explained how it affects the eating behaviour. Thereafter, other elements and theories will be highlighted and in-depth explained as possible barriers to entomophagy.

3.1.1 Eating Behaviours

Despite what one may think, besides sensory and pleasure factors, food choices are not only relying on the nutritional value, such as proteins, vitamins, and so on (Lau, Kronl, & Coleman, 1984). Claude Fischler (2010) advocates there are implicit rules that are intrinsic to our eating behaviours. Irrationally, people follow standardised manners established by their own culture: what types of food are more suitable to intake according to the involved culture, what are the

most acceptable eating schedule, how many daily meals shall we intake, with whom or/and in which occasion we could have certain meals, which customary code of polite behaviour in society must we address, and so forth. These innate set of rules, depending on each culture, are blindly followed by the majority, which demonstrates the strong influence that culture has upon the dietary behaviours of the population (Goldenberg, 2010).

Besides Fischler, many other authors defending the eating habits are mainly shaped by the culture exposer and individual experiences (Tan, et al., 2015), taking into account of any other factors which may influence our food choices such as the visual features, or the smell and flavour itself (Deroy, Reade, & Spence, 2015). Depending on the society, each citizen is under individual and social control in his eating habits. Although we often do not realise that our decisions are strongly influenced by the culture that surrounds us, this is the main responsible for our daily behaviours (Goldenberg, 2010). According Fischler (2010) is easier to control our diet when our culture and society play a controlling role, a good example is what Guiliano (2007) stated in her book “*French Women Don't Get Fat*”, whereby she defends the reason about French women, comparing with other societies, as USA, do not get fat so easily is because those are culturally controlled.

Today, to be a competent *eater* requires great individual skills to understand which is the most adequate food to prepare and eat (Goldenberg, 2010). This is owing to the information overload that we are subjugate with (Goldenberg, 2011). People is constantly exposed to multiple and contradicted information and/or conflicting concepts about what ought they consume or not, in which led to the origin of an anomie in the gastronomy, designated as “gastro-anomie” – a concept created and developed by the sociologist Claude Fischler (1979). Moreover, with a rapid development and facilitation on the acquisition of mass-produced goods throughout the last years, which has led to a greater diversity and expansion in the consumer market, it has instigated a considerable range of different lifestyle’s opportunities (MacDonald, 2014). Each lifestyle is associated with a specific moral code (Wilk, 2001) and the food consumption, i.e. eating behaviour, has been used as a mean to assert membership to a moral and ethical framework, such as vegetarianism as part of an animal rights ethical framework (MacDonald, 2014). Consequently, people are dragging out to a complex and confused dilemma, where society pressure has an important role on the individual’s decision-making when he or she must decide which food is the rightest or more acceptable to intake. This uncomfortable and incompetence feeling faced, in the view of what and how should we eat, as a consequence of an excess of contradictory information it is somehow a form of "gastro-anomie" (Goldenberg,

2011), or “food normlessness” (MacDonald, 2014). The lack of reliable and accurately information is, therefore, one of the main causes of this phenomenon defended by Fischler. In a way, it is a paradoxical argument if we compare with the current reality, since nowadays we live in the era of globalisation where exchange of information has never been so accessible for the great majority of the terrestrial population. However, it is for this very reason that Claude Fischler has come up with this new concept. He advocates for the existence of a “psychopathology of daily alimentation”, in which the sense of uncertainty and anxiety in food choices are driven by a proliferation of contradictory discourses and arguments of experts about dietary habits (Goldenberg, 2011). Particularly in Western societies, more and more people have a special care in their own body image and subsequently healthy lifestyle (Grogan & Richards, 2002; Watson, 2015). Also, there is a clear increased environmental awareness on the part of the Western population (Kollmuss & Agyeman, 2010). The level of self-efficacy of an individual in relation to their ability to make healthy choices in certain situations is culturally relative (Toral & Slater, 2007; Deroy, Reade, & Spence, 2015). Societies have very complex and elaborate codes about food and the act of eating, and due to that, it turns out gastronomy as a set of culinary customs and styles composed by rules and laws that are implicit in each culture about what one should or should not eat. In fact, this argument had been already brought up by the entomologist Joseph Charles Bequaert in which he used to defend that what we eat is, after all, more a matter of custom and fashion than anything else (Bequaert, 1921). Therefore, it is evident that food choices are extremely varied and “culturally-determined” (Deroy, Reade, & Spence, 2015).

Not only is the culture exposure a fundamental factor on food choice, the individual experience has an important role when it is about food likes and dislikes (Rozin & Vollmecke, 1986). From a qualitative study conducted by Tan, et al. (2015), it is suggested those elements complement each other, in a way that culture exposure is a building block of our ideals, and a source of our expectations of which types and ways to consume and prepare food are most socially acceptable. On the other hand, individual experiences are a sort of “food-guides” in which decisions are made based on memories of past eating experiences, or visual features and product familiarities itself.

The physiological dimension is a vital element on the individual experiences. The cultural dimensions are not the only driver on eating behaviours (Martins & Pliner, 2005). An individual who comes from a culture whose ideology is sceptical to new cuisines, or scarce in terms of richness of food variety, a priori *the eater* will be someone with a limited range of food options

(Martins & Pliner, 2005; Bennett, 1988) and/or little willingness on expanding his or her palate to, or reluctant to take, new experiences and flavours (Dovey, Staples, Gibson, & Halford, 2008), i.e. the likelihood of an individual becomes neophobic will be higher (Tan, et al., 2015). Nevertheless, the education and individual experiences throughout the individual's life, and the respective personality of each one have also a significant role (Verneau, et al., 2016; Dovey, Staples, Gibson, & Halford, 2008). Furthermore, other factors have impacts on the people's psychological character (Dovey, Staples, Gibson, & Halford, 2008).

Closing, the consumer behaviour study is a complex universe. In addition to the culture exposure and individual experience dimensions, other theories and facts lie on the people's natural behaviour (Solomon, Russell-Bennett, & Previte, 2012). Marketing speaking, dimensions as price or promotion have a significant impact on the individual's beliefs, desires, and expectations, and consequently it shapes a reality on the perceiver's minds (Lee, Frederick, & Ariely, 2006). Anyhow, those dimensions will be further analysed on the following chapters.

3.1.2 Disgusting

To better understanding the Western attitudes towards eating insects it is indispensable to study not only the cultural dimension, but also the psychological and biological dimension (Looy, Dunkel, & Wood, 2014; Deroy, Reade, & Spence, 2015).

Disgust is a strong word used many times by various authors to describe a negative food-related emotion and a feeling revulsion aroused by something considered unpleasant or unpalatable (Rozin & Fallon, 1987). Broadly speaking, disgusting food is an organism's function that helps to diminish the risk of infection and contamination (Tan, et al., 2015). In several literatures, it is possible to find an implicit association between disgusting and food neophobia (Martins & Pliner, 2005; Martins & Pliner, 2006; Pliner & Salvy, 2006), and it will be assumed the same connection in this paper. As reported by several experts there is a clear distinction among distaste, disgust, and danger (Deroy, Reade, & Spence, 2015; Martins & Pliner, 2005). Despite those being relatively similar, they have distinctive definitions. The three emotions are natural defence-mechanisms that aim to deal with an expanding set of threats to the human's organism (Rozin & Haidt, 2013). Distaste is an innate function of the human being aiming to protect himself from intaking toxic compounds (Rozin & Fallon, 1987). Sensory properties alert the presence of toxins, essentially through bitterness. Pursuant to Martins and Pliner (2005) as opposed to disgust, distaste is a negative behavioural response to toxic substances, usually along with facial expressions, which is triggered by certain sensory properties. So, once the negative

sensory characteristic is not sensed, the very item is not rejected. Plus, the refusal of the same object does not mean that it is a component of danger. In turn, disgust requires a cognitive assessment, which could lead to incoherent and precipitate presumptions about the tastiness and riskiness of the object, and consequently its rejection, even if the toxic substances are undetectable. In terms of food-related disgust, this is characterised as *core disgust* (Martins & Pliner, 2006; Rozin & Fallon, 1987). The main elicitors of this disgust dimension are body waste products, non-edible food, and animals and their potential by-products (Harrison, Gray, Gianaros, & Critchley, 2010; Rozin, Lowery, & Ebert, 1994). The cognitive people's attitudes to a specific food occasionally could come down as an irrational disgust (Deroy, Reade, & Spence, 2015). As stated by the several authors, when it comes food choices, the disgust underlying *eater's* attitudes is culturally relative (Tan, et al., 2015). Considered by many as acquired distaste, the very idea of disgust is the reflection of the culture, in which we are (over) exposed, and a knowledge (or lack thereof) and experiences that people develop throughout their lives (Martins & Pliner, 2005; Martins & Pliner, 2006; Rozin & Fallon, 1987). Considering exposure and culture values as a core building block to everyone's behavioural responses, it is justifiable the different dietary patterns between societies (Martins & Pliner, 2005; Rozin & Haidt, 2013). The edible insects, for instance, are seemed as desirable food in diverse cultures such as Mexico or Thailand, however, entomophagy evokes a repulsion and disgust response from many Westernised cultures (Martins & Pliner, 2005; Tan, et al., 2015; Ramos-Elorduy, 2009; Huis, 2013; Costa Neto, 2013). As reported by Deroy, et. al (2015), whereas the all sensory properties are involved in other objects of disgusting such as vomit, faeces, or rotten food, the insects, generally-speaking, are not smelly, nor visually unappealing, but it is the simple fact of eating them that generates this *core disgust* on the part of Westerners.

As it has been mentioned, the food acceptance varies according numerous situational and affective factors as well as the cultural exposure and individual experiences of each person (Martins & Pliner, 2005). Pursuant to Einstein & Hornstein (1970), in addition to physical features such as appearance, smell and palate satisfaction, sensory preferences are also constituted by prior experiences. Nevertheless, once this pre-requisite is inexistent, it is more likely the level of disgust (or interest) influences the individual's willingness to try than the very expected experience of the sensory properties (Martins & Pliner, 2005). Indeed, when it comes to the food item to be intaken, the individual's eating behaviours tend to ley on their beliefs overlapping the actual sensory experience (Steenkamp, 1990). Subsequently, in many instances an *eater* tends to reject food items based on inaccurate presumptions of bad taste

(Rozin & Fallon, 1987) by virtue of a pre-acquired incoherent disgust before it is even tasted (Tan, et al., 2015; Deroy, Reade, & Spence, 2015). This unconscious disgust is a core barrier of entomophagy whereby unpleasant food-related emotion is intrinsic on Westerns' minds (Deroy, Reade, & Spence, 2015).

3.1.3 Theoretical Barriers of Entomophagy

Entomophagy is a dietary habit adopted by more than one-third of the world's population (Huis, et al., 2013), however, it is still seen as "primitive" habits in the eyes of modern societies (Chen, et al., 1998; Costa Neto, 2003; DeFoliart, 1999). Although a wide range of edible-insects is available worldwide, its consumption broadly-diverge according the society, history (background) and tradition (Costa Neto, 2013). Western countries as Brazil, entomophagy is mainly a traditional food habit by indigenous groups (Costa Neto, 2013), in which besides being a fundamental diet for the survival of these ethnic groups, it is also a source of income (Ramos-Elorduy, 2011). Indeed, presently in Brazil, species as *tanajura*, a flying leaf-cutter ant (fertile females, ants of the genus *Atta*), are behold as a scrumptious food by many people (Costa Neto, 2000; Costa Neto, 2003; Rose, 1993; Costa Neto, 2004).

Despite the previously mentioned facts, it is discernible the intrinsic revulsion from the Western *eaters* toward entomophagy (Verneau, et al., 2016). Although in various societies insects are valued as a delightful food (Costa Neto, 2004; Costa Neto, 2000; Huis, et al., 2013; DeFoliart, 1999; Gahukar, 2011), the consumption of this mini-livestock is a disgusting ideal for the most of Western societies (Costa Neto, 2013; Huis, 2013). The individual's neophobia towards edible insects comes from the "knowledge" (or lack thereof) of insect habits and origins, in which repulsion is originated by anticipating "negative post-ingestional consequences" (Rozin & Vollmecke, 1986; Rozin & Fallon, 1987; Megido, et al., 2013). Even though observation is a core element of (de)motivation (Tan, et al., 2015), insects are rejected even before any visual domain (Costa Neto, 2003). The insect's positioning in those consumer's minds is represented as pathogen risk, disgusting, disease-transmitters, plagues, or unpalatable food (Tybur, Lieberman, Kurzban, & DeScioli, 2013; Tan, et al., 2015). It is understandable, given the fact that over the last centuries the education systems, social media, historical background, and others, have been the building blocks of this Western mind-set about insects and other terrestrial arthropod relatives (Looy & Wood, 2006; Shelomi, 2015; Vane-Wright, 1991). Bearing in mind all the possible barriers mentioned so far, the culture bias against entomophagy is still an ambiguous and inexact fact (DeFoliart, 1999; Holt, 1885; Gahukar, 2011). Eating insects is a

contemptible habit for many Westerners due in large to lack exposure and easily-obtainable information existent in their societies (Looy, Dunkel, & Wood, 2014). The barely absence of tailor communications approaches and educational programmes raises stereotypes and innate disgust because, by rule, there is a food neophobia by the majority, when it comes to novel and unfamiliar foods (Al-Shawaf, Lewis, Alley, & Buss, 2015; Birch, 1999; Martins & Pliner, 2006; Huis, 2013). Therefore, educational could be an essential tool for creating public awareness, in a way that it will break down the myths and unveil the mysteries about entomophagy (Verneau, et al., 2016; UNESCO, 2005). Notwithstanding, it is no longer validate provide educational programmes if it is not creating the right conditions to generate a genuine interest for edible insects as a food (Deroy, Reade, & Spence, 2015).

The very idea of eating insects is the greatest booster of the feeling of revulsion (Tan, et al., 2015), rather than a basic physiological reaction based on the visual features as well as other sensory properties (Rozin & Fallon, 1987; Huis, 2013; Menezes, 2016). According several literatures, the disgust towards anthro-entomophagy comes from something deeply rooted in people's psyche, and unconsciously related with the individual's cultural (Costa Neto, 2003; Costa Neto, 2000; Costa Neto, 2013; Tan, et al., 2015; Shelomi, 2016; Looy, Dunkel, & Wood, 2014). One of the studies where this reality it is well-portrayed is the article carried out by Paul Rozin, Linda Millman and Carol Nemeroff (1986). As stated by the authors, the diverse behaviours in response to disgusting, dangerous or feared objects are driven by two *laws of sympathetic magic*. These laws were first brought up by the anthropologists Sir James Frazer (1890/1922/1959) in "The New Golden Bough" and Marcel Mauss (1902/1972) in "The General Theory of Magic" on traditional cultures. The first one is called by *law of contagion*, and it refers to the fact that "once in contact, always in contact". This theory comes under empirical experiments and it is based on the contact between something apparently disgusting (animal, person, faeces and alike) and a neutral object. The very idea of a food be in contact with a disgusting substance, even if there is no perceivable vestige of the item in question, it is also called as a *principle of contamination*. The individuals' repulsive reactions would be instigated from both objects, i.e. once an exchange of a disgusting "essence" is made between two items, the "essence" may remain in some form of nonphysical contact. The "magical" idea on this situation comes from the permanent feeling about the object being still considered as dangerous or contaminating, even though it is known that the previously contact it has been erased and the risk is no longer existing. Therefore, following this line of reasoning, considering

insects as a disgusting object, the food that has been in contact with it, automatically it will be rejected, even if this same very contact has been eliminated.

This cognitive reaction towards to edible insects leads us to *law of similarity* as the second *law of sympathetic magic*. Basically, the *law of similarity* holds that “image equals to the object”, i.e., the shape or image has a direct impact on the nature of the object. The object’s content, therefore, is defined by the item that it resembles the most – “it is what it looks like”. Hence, a food that bears resemblance to an insect and yet is known to be palatable would still be a target of repulse (Deroy, Reade, & Spence, 2015).

Assuming these two laws previously discussed, it is proper to consider the reason why Westerns repulse the entomophagy is owing to a negative and unconscious connotation of insects to contaminated, unclean and unhygienic environments (Deroy, Reade, & Spence, 2015; Shelomi, 2015; DeFoliart, 1999). To this very fact, another categorisation was made-up by the authors Deroy, Reade and Spence (2015), named as “*Environmental Confound*”. As mentioned above, the folk-entomophagy results on an illogical and incoherent behaviour responses to insects. The mere image or physical presence of an insect is an enough reason for revulsion. There is an obvious environmental misleading among the diverse insect and invertebrate species. The Westerns’ unaware behaviour toward “bugs” is aroused by the generalised-association of insects to filth and contaminated habitats, or threats in case of invertebrates such as spiders or scorpions. So, why do the *eaters* consider arthropods or invertebrates such as lobsters, prawns, and oysters as delicious and fantasy foods, if dirt is basically the food-source of their dietary habits (Deroy, Reade, & Spence, 2015; Costa Neto, 2013; Townsend, 2011)? How do these dietary habits that used to be food-sources for the poorer-social-class in the Western societies turn out to become a delightful and expensive food ingredient in most of developed countries (Huis, et al., 2013; Townsend, 2011)? In the light of dietary patterns, it is interesting to see how seafood or even pork can be considered as part of regular diet, whereas edible insects (e.g. crickets or grasshoppers), which their alimentation is essentially similar to goats or lambs, are constantly rejected and neglected from the Western diets (Costa Neto, 2013; Shelomi, 2015; Deroy, Reade, & Spence, 2015; Costa Neto, 2000). In a social experience between Dutch and Thai culture, carried out by Tan, et al. (2015), the results were clear: what it is consider as proper food in one culture can evoke a repulsion reaction in another one, especially when the sensory properties and nature of the object resembles inappropriate characteristics in the food context. Even within the same group of insects, there are species more likely to be accepted than others are. A cockroach, for instance, due to its association to sewage, or maggots related

to death or body violation are automatically linked to contaminated environments (Deroy, Reade, & Spence, 2015). On the other hand, bees are recalled as a sweet thing, or ant is seemed like a tiny animal, which resides in our houses and feeds on crumbs (Huis, 2013). Restricting to culturally-agreeable insects, there are the ones who are inedible but also useless to human-benefit, e.g. butterflies (Costa Neto, 2013), the inedible but functional to human activities, such as ladybugs (Looy & Wood, 2006), the edible ones not only themselves, but also their by-products, honey bee for instance (Huis, 2013), and the edible insects that are neutral, like grasshoppers or locusts (Deroy, Reade, & Spence, 2015). Nonetheless, a fundamental perception barrier, occasionally forgotten by some authors, is related to the Western broad-awareness towards insects as a unique category of “bugs” (Shelomi, 2015; Looy, Dunkel, & Wood, 2014). That is, as previously stressed, the public has the tendency to generalise the insects’ idea in a way that homogenises their diversity (Kellert, 1993; Müller, Evans, Payne, & Roberts, 2016). While the thousands of different edible invertebrate and insect species existing on Earth, Western societies have taken as granted that those would have similar palate. The Western’s naïve idea regarding these animals results on an incapacity to distinguish between insect’s varieties. Some insects (e.g. carrion beetle, houseflies, or maggots) cause the general negative associations because of living in direct contact with rotting flesh, faeces, or decaying matter such as carcasses and corses. Given that, mistakenly similarities are made as loathsome and contaminated objects, albeit a large part is clean-living and -feeding insects (DeFoliart, 1999). The same applies to some invertible animals as spiders, which they are related to dangerousness and hazardousness but the majority are harmless to humankind (Halloran, Münke, Vantomme, Reade, & Evans, 2015).

The appearance could be a major factor that would provoke this similarity, however, there is another aspect that equally influences the object's categorisation: the naming of the item (Evans, et al., 2015). About this latter aspect, as stated by the author, the name given to the food “contains the object’s essence”. The name itself could be consider as an elicitor of disgusting (Martins & Pliner, 2006). In several studies, it has been shown that the name encompasses a strong influence on consumer’s expectations, influencing the taste-satisfaction of the final consumer (Rozin, Millman, & Nemeroff, 1986; Holt, 1885; Looy, Dunkel, & Wood, 2014; Tuorila, Meiselman, Cardello, & Leshner, 1998). As stated by Shelomi (2015): “*The words “entomophagy” and even “insects” also add a clinical artificiality that other, more successfully diffused diets never needed*”.

Likewise, the ignorance attitude leads to a miscategorisation of the insects as a novel food. Edible insects have been stated as the “future source of animal protein” (Megido, et al., 2013), or even “future food” (DeFoliart, 1992). The very reason of being categorised on these terms is owing to its high protein value (Xiaoming, Ying, Hong, & Zhiyong, 2010; Shockley & Dossey, 2013), and so this novel food has been mentioned as the new and sustainable “meat substitute” (Holt, 1885; Verbeke, 2015; Müller, Evans, Payne, & Roberts, 2016; DeFoliart, 1999; Schösler, Boer, & Boersema, 2012; Huis, Gurr, & Dicke, 2015; Dicke, 2010). Consequently, *eaters*’ expectations towards the new food would be all related and compared with meat such as consistency, palate, or visual appearance (Deroy, Reade, & Spence, 2015). Such demands are unlikely to be addressed through edible insects, ergo other alternatives shall be thorough further tested.

Usually, a drastic revolution or significant modifications on people’s eating behaviours are not so common, but such changes have been made since we are *homo sapiens sapiens* (Goldenberg, 2010; Halloran, Münke, Vantomme, Reade, & Evans, 2015; Vane-Wright, 1991). In addition to lobsters, other foods have undergone radical shifting on the individuals’ mind-set, changing from repulsion to desirable positioning (Townsend, 2011; Shelomi, 2015; Lenko & Papavero, 1979). The global sushi boom over the past decades is a remarkable example of a cultural-taste-change, in which eating raw fish went from peculiar to fashionable (Shelomi, 2015; Johnson, 2010). The negative impressions associated with certain cheeses, due to its strong odour and palate, were also surpassed by the *eaters* (Johnson, 2010). The same applies, yet on the opposite way, to the cockroach as a savoury food. Regarding the latter one, in the last centuries, this animal was used to be cooked with butter, flour, and salt to form a paste. This mixture, spread on buttered bread, was seemed as delicacies for lovers of exotic products, in London and Ireland (Lenko & Papavero, 1979).

In this sense, the inner conflict with these food choices extends beyond the realm of insects *per se*. The people’s imagination and visual similarities must be considered as driven not just by negative cultural representations that food institutions have cultivated in us but primarily by an acquired distaste (Martins & Pliner, 2005; Rozin & Fallon, 1987; Deroy, Reade, & Spence, 2015). The lack or inexistence exposures to the all novel sensory properties leads the Westerns to unknown dimensions, submitted by naïve and misleading connotations, also known as *Environmental Confound*.

3.2 Potential Strategies to Overcome the Western Food Prejudice

Besides the large number of literatures and experimental sciences about eating behaviours and how to modify a consumer's food habit, entomophagy is something never before thought, nor even put up as a hypothesis by many of Westerners (Huis, 2013). For the most part of developed countries, looking at entomophagy as an attractive cuisine composed by clean-living insect is an unlikely-reality (Resh & Cardé, 2003). Rather, it is considered as unfamiliar or disgusting food (Deroy, Reade, & Spence, 2015). To address this issue, it is required diverse expertise due to its complexity and variety, even within the same culture (Bequaert, 1921; Holt, 1885; Menezes, 2016).

In one of the interviews where Fischler has participated, he has stated that regardless the "race", new-borns have similar tastes, emphasising the general trend to prefer sweet flavours. So, why do we not owe the same food preferences? The answer comes basically from two aspects: individual experiences and culture exposure. Adopting this point of view, the food choices are shaped according to the knowledge and experiences that an individual has passed through. Keeping this line of thought, our eating behaviours are, wherefore, driven by inherently cognitive components. So, the repulsion towards eating insects is a mere negative picture drawn by our own culture.

If what was said before was the truth, *instrumental reasons* based on academic and scientific dimensions would be sufficient to change negative culture representations. That is, through pedagogical manners, scientific papers, public lectures, or even educational programmes, the cognitive repulsion could be fully eradicated from the consumers' mind (Looy & Wood, 2006). However, this is not the case in reality. Based on a study carried out by Rozin, Millman, and Nemeroff (1986) and Looy, Dunkel & Wood (2014), rational approaches are likely to fail, because people's repulsion is also triggered by an acquired distaste. The simple idea of eating insects, as previously stressed, is one of the main drivers of their repulsion. Hence, the individual's rejection towards insects as human food evolves in part cultural and emotional dimensions (Looy & Wood, 2006), which means it is largely immune to reason (Rozin P. , 1984; Rozin P. , 2002).

In the light of these issues, marketing tools and sensorial-driven strategy should to be taken into consideration in order to better meet the Westerners' needs and demands (Shelomi, 2015). The main goal here is changing the consumers' mind-set, so psycho-cultural strategies might to be implemented. Consumer behaviour and gastronomic dimensions should be merged, and reach

the inner motivation of the public target. Among those psychological and cultural approaches, the present author has formulated three elements based on the Deroy et. al (2015)'s paper: *sensory properties, availability, and communication and categorisation.*

3.2.1 Sensory Properties

Starting from *sensory strategies*, it is important to understand that for an individual to change his regular food diet, it is crucial that the food is palatable and visual appealing (Halloran, Münke, Vantomme, Reade, & Evans, 2015). As stated by Paul Rozin (2002), “*Human food choices is richly multidetermined*”, so again multisensory strategies should be carried out (Spence & Piqueras-Fiszman, 2014). Like high gastronomy, the flavour of each insect might be explored. That is, by mixing or incorporating with other ingredients such as species, herbs, sauces, vegetables, or even animal products, will bring out the best taste of insects. As cited by Huis, et al. (2013): “[...] *explore the vast range of delicious flavours in order to incorporate an increasingly wide array of foods into the sphere of the edible*”. Yet, to reach the greatest exponent of taste satisfaction other four senses should bear in those strategies. Indeed, besides prior experiences and knowledge, the oral texture, auditory properties, odour, and visual features are the key drivers of people’s expectations toward insects as a food source (Trobe, Liberman, & Wakslak, 2007). Furthermore, the geographic variable should be also included in this equation. Evan et. al (2015) defend the taste preferences vary with the history, culture, demography (e.g. gender or age), or place where the individual comes from. Thereby, the palate properties should fulfil the *eater’s* expectations considering the place-based taste in order to avoid their disappointment.

Another sensory strategy that could be complemented with the previous one is related the food preparation. As stated by Tan, et al. (2015) being palatable and provide the benefits that consumers are interested in could be not enough to motivate consumers to adopt insects in their own diet. Along with other authors, Tan, et al. showed that the willingness to try a novel food is strongly influence by the familiarity with other already-known food products (Pliner & Salvy, 2006; Martins & Pliner, 2006; Martins & Pliner, 2005). Following this line of reasoning, the association of existence sensory properties and preparation in familiar manners could be a fileable way to diminish the prejudices. In fact, Loo and Sellbach (2013) go further on defending a personal involvement on this activity. That is, according to them and cited by Deroy, et. al (2015), it is the consumer himself who should prepare the insect. In the light of

getting rid from social improper associations, a strategy aiming individual homes might be the solution to drag this novelty out to the “*centre of cultural culinary practice*” (Deroy, Reade, & Spence, 2015).

3.2.2 *Availability*

Maintaining on the same track, the second element comes out – *availability*. It is not enough to simply plan sensory strategies, it is necessary someone capable to implement it (Looy, Dunkel, & Wood, 2014). One of the first steps to make an unknown product into a reality is its market availability. To this very end, chefs and other gastronomic leaders should collaborate with each other, and create the best techniques and approaches to reach the public target (Halloran, Münke, Vantomme, Reade, & Evans, 2015). Chefs should start to include insects on to their menus in restaurants and snacks in bars, and provide both cooking workshops and cooking shows to the public (Deroy, Reade, & Spence, 2015; Huis, et al., 2013; Shelomi, 2015). Whereas experts of the area might set up cultural and gastronomic public-events such as festivals, expos, or scientific exhibitions to not only to raise awareness on this topic but also to offer an insect tasting (Huis, et al., 2013; Megido, et al., 2013). Moreover, for the purpose of reducing the difficult access to insects for human consumption in the most modern societies similar techniques could be used in supermarket and other facilities shelving them side by side with other everyday food ingredients, even if be characterised with an exotic label (Looy, Dunkel, & Wood, 2014; Shelomi, 2015). It is useless educate the population about a new product without providing the right conditions to reach and try them first.

Product availability does not rely solely on product placement or stocking levels but also if it is pricing reachable (Conlon & Mortimer, 2010). Price constitutes one of key elements of marketing mix, and it is often used as a tool in marketing and product strategies (Borden, 1964). Taking into account segment size and the categorisation of the product, numerous researchers have argued about different pricing strategies but none in particular. Whether is for instance penetration or skimming pricing the authors defend that depends on the market segmentation (Bolles, 1910). Nonetheless, the high prices charged in the most of the countries, especially the less traditional-entomophagy ones, is a reality (Ramos-Elorduy, 2011; Müller, Evans, Payne, & Roberts, 2016; Fleming, 2016). In various places, the most popular insects are significantly more expensive than regular animal sources as swine, beef, or fish (Huis, et al., 2013). Although usually people’s purchase-decision bases on the maximization of a price-quality correlation,

having the wines sector as an example (Hollebeek, Jaeger, Brodie, & Balemi, 2007; Erickson & Johansson, 1985), the same reasoning could not be applied in the case under discussion. Asking for average prices far higher than the regular animal-protein products and by-products shrink the market segment, not least because of the increase of the opportunity cost. Unfordable price practises might lead to an exclusion of the majority of the global population from access to this product (Müller, Evans, Payne, & Roberts, 2016). The current Western market landscape is characterised by a poor demand alongside with premium prices (Shelomi, 2016). The lack of economies of scope and scale, and poor investment of the production sector as well as a scarce supply lead to prices which reflecting the ongoing costs (Huis, et al., 2013). In addition, because the low-demand, lack of policies, and bureaucratic and inflexible trade chains, an easy obtainability of edible insects is practically inexistence (Müller, Evans, Payne, & Roberts, 2016; Looy, Dunkel, & Wood, 2014). Regardless of the long-run pricing strategies, the focus should be on creating the right conditions as infrastructures and frameworks in which insects could be developed as an edible product (Costa Neto, 2013). Huis et. al (2013) suggest the usage of innovation technologies, laying down the most accurate approaches towards changing the consumer food habits, an insect-encompassing food legislation, and more sustainable food production in order to create a more efficient and effective insect industry.

Deroy et. al claim the causes of acquired distaste is from a combination of lack of past experiences and culture components, which hampers the development of appropriate approaches of the product. Hence, a more often availability and exposition of the edible insects, considering which species of insects to offer as well as in which circumstances, could reduce neophobia among developed populations and stamp out their negative perception of insects as a human food (Megido, et al., 2013).

3.2.3 *Communication & Categorisation*

Finally, the next and last element is correlated with the previous two above-mentioned. The third pole of this “strategic triangle” is *communication & categorisation*. Essentially, this approach has already been present in “visual communication” (*sensory properties*) and “social placement” (*availability*) cases.

The main goals here are categorising the insects into different classes, and placing insects at the epicentre of the gastronomic universe through communication. As explained before, culture representations are driven by both cognitive disgust and acquired distaste, which leads to an

environmental confound about insects. The folk-category of insects extends to other organisms as anthropoids and invertebrates, and the distinction between edible and inedible insects is barely existence. Then, a well-thought-out and reliable categorisation supported by an accurate communication framework might be the key drivers to stamp out the negative image of insects as a source of diseases or dangerousness (Shockley & Dossey, 2013; Looy, Dunkel, & Wood, 2014; House, 2016; Verneau, et al., 2016).

Regarding to the aforementioned sensory strategies, several conditions may be considered in compliance with an accurate categorisation of insects. Confirmed by diverse authors, preparing insects in familiar ways is strategically viable (Megido, et al., 2013; Shelomi, 2015; Loo & Sellbach, 2013). The familiarity with other existent products reduces negative associations. Nonetheless, Deroy et. al argue the visual characteristics should remain perceptible. Nowadays, quite a few companies worldwide such as Bitty Foods (USA), Bugeater Food (USA), CrikNutrition (Canada), or Ronzo (Poland) offer for sale insects as a food supplement. At the first sign, it might seem the ideal strategy to sell powder products made by insects to overcome the exposure issues. However, it misses a weak-spot of insects: categorisation. If an insect product is visually and sensorial hidden, how would insects be able to differentiate from the other products, or even other insect species? Without a sensorial identity, the labels would be the motivational-drivers of the insect's consumption, which means being strongly depended on educational efforts. Relying exclusively on reasoning will not be a sustainable solution, since the general disgusting is deeply rooted in people's psyche as form of irrational thinking (Rozin & Fallon, 1987; Martins & Pliner, 2006). Hence, the best solution could be cooking insects without be hidden, and prepare it as a core ingredient of the dish. Based on traditional or innovative recipes, and mixed together with other familiar ingredients could be a form to completely erase the background negative attitudes, and bring out the best of this novel food ingredient (Looy & Wood, 2006; Menzel & D'Aluisio, 1998; Gordon, 1998; Halloran, Münke, Vantomme, Reade, & Evans, 2015).

Lamentably, many authors have been positioning insects in a few inappropriate categories. Such as "future meat" or going further with "meat alternative" have prejudiced insects on being introduced into the market (Huis, Gulp, & Dicke, 2015; Huis, 2013; DeFoliart, 1999; Dicke, 2010; Schösler, Boer, & Boersema, 2012; Müller, Evans, Payne, & Roberts, 2016; Verbeke, 2015). The real strategy here, stated by Deroy et. al's paper, is to distinguish insects from other traditional sources of animal protein rather than to extend an existing food category. However, considering insect as a substitute of chicken or beef could lead to irrational and inaccurate

expectations towards the insect's sensory properties. Categorisation is fundamental for insects to find their own position and get rid from misrepresentations. So, the new categories of insects should be defined as a rich nourishment source but also for being a distinct and pleasant food in all sensory levels.

As pointed out by Shelomi in his studies (2015 & 2016), an insects *sensu lato*s must be replaced by specifying them into different categories. There is no impact on categorising insects only between non-edible and edible whatsoever. A more detailed division into classes based on food habits or habitats could be a decent way to do so. Nevertheless, the level of acceptance, the diverse associations with specific environments, or even visual and gustatory characteristics should be also considered as crucial variables on the definition of a single category. Deroy et. al believe on the potentiality to create other categories of insect as an opportunity to originate new outlooks from the Westerners. Based on the readings, besides sensory properties, appealing categories should involve the most familiar and popular insects according to the market segmentation (Evans, Flore, Pedersen, & Frøst, 2015; Smith, 1956). Also, another relevant factor mentioned by the authors that should be involved in is the name. Regardless of whether is a familiar or novel product, the name of dishes has been considered as appropriate prerequisites to promote greater consumer's expectations about insects, and consequently to influence final taste at all sensory levels (Spence & Piqueras-Fiszman, 2014; Martins & Pliner, 2006; Evans, et al., 2015). Even Vincent M. Hold (1885) in his book "*Why Not Eat Insects?*" had argued that the ordinary entomological terms should be moved to more exotic scientific or indigenous names, instead. Some examples as eating crustaceans or banana are not called as decapophagy or musaphagy respectively (Evans, et al., 2015), so Matan Shelomi (2015) suggested normalising the name of eating insects rather than presenting them as a non-natural and "lab-name" – entomophagy. Another remarkable example is sushi, as it manages to move from a peculiar raw fish to a fashionable food, and the name was one of the drivers of this categorisation (Johnson, 2010). Naming strategies should then lie on evoking status, deliciousness, glamour, or pleasantness with clever euphemisms. Depending on the public target, some descriptive strategies could be more suitable than others. Deroy et. al recommends that different names should be compared with different cultures. For the same food, distinctive names should be displayed for the purpose of checking which one is the most adequate and attractive for the dish.

The communication is another dimension whereby vital push-tactics can be implemented to trigger people's interests of insects as an everyday food. To increase the likelihood of

acceptance of this novelty, insects should be presented within a safe and trustworthy environment (Gahukar, 2011). Various researchers recommend methods of tracing goods using traceability techniques throughout the rearing to cooking process (Shelomi, 2015; Ruby, Rozin, & Chan, 2015; Deroy, Reade, & Spence, 2015). The transparency of the entire process should be cautiously and wisely displayed to the final consumer as a prior experience. Both word-power or visual presentation might be the drivers of this very process. In Deroy et. al paper it is possible to find examples of this last approach. One of the examples mentioned in the paper took place in Melbourne Museum, Australia. Basically, a degustation event was conducted with children and their parents, and they were complemented with diverse menus of insect dishes. However, numerous visual presentations beforehand were displayed. The participants were confronted not only with verbal information from reliable sources but also with diverse images and videos of people consuming insects. In addition, it was provided the access to the recipes of each dish and the whole tracking of the cooking process. Other similar social experiences were brought to public elsewhere, and the results of each one speak for themselves: positive feedback and little resistance in tasting insects.

In the latter event, it is possible to understand the integral role of communication on the people's decisions. Aside from visual and olfactory properties, pre-communication evokes both negative and positive expectations about food satisfaction. With a visual presentation, it has raised the participants' eagerness to taste insects. Notwithstanding, pursuant to Shelomi (2015) what has happened today is an abnormal publicity. The consumption of insects has been positioning as something weird and odd, and only a brave, adventurer, open-minded, or even weird person is keen on to taste it (Huis, Gurp, & Dicke, 2015). Television programmes have been jeopardising the insects image as an edible food by constantly putting it together with peculiar situations. Such survival contests or bizarre reality shows where people are forced or challenged to intake insects should be replaced by regular cooking shows. Also, recipes and cookbooks focusing on insects should be freely available to everyone. Via digital or paper, a wide range of different insects should be alongside with standard foods in those recipes presented in cookbooks and cooking shows (Shelomi, 2015). Another approach to promote the normalcy of eating insects comes from an availability strategy above-mentioned. The fact of placing insect products next to regular food at groceries and alike implies the edibility of this exotic food (Looy, Dunkel, & Wood, 2014; Shelomi, 2015). The latter author contends therefore communication should focus on normalising this eating habit rather than marketing it as a novelty, or "animal" and "barbarian" behaviour (Ramos-Elorduy, 2009).

Still on the subject about insect's broadcasting, researchers as Pitt and Shockley (2014), Tan, et al. (2015), Matan Shelomi (2015), Heather Looy (2014) or Everett M. Rogers (2010) advocate that an individual is more likely to be influenced by his peers of a homophilous group than through via digital. That is, the impact is stronger when someone similar and close to us embraces entomophagy, at the first place. Plus, the channels and means that are used to spread the word have lesser influences rather if made by personal. Through contemporary media, e.g. television or social media, entomophagy could be plausible, yet the genuine acceptance comes from interpersonal motivations and observations.

Then, besides all psychological strategies above-suggested, reason instruments are an important tool. Once the right conditions in which consumers can develop a genuine interest for insects as a palatable food have been established, such educational programmes could be applied with the view to cement the relationship between the *eater* and edible insect (Deroy, Reade, & Spence, 2015; Looy, Dunkel, & Wood, 2014; Looy & Wood, 2006).

Concluding, when it comes to categorisation as well as communication, this should diversify considering the target market (Evans, Flore, Pedersen, & Frøst, 2015). Entomophagy might need tailor-made communication approaches, while categorisation should mark an exclusive identity, and a strong brand awareness in the Western societies due to the characteristics and positive distinctions of the diverse insects. Once again, what motivates the acceptance or rejection of a food item is roughly a question of culture and inner emotions (Huis, et al., 2013; Martins & Pliner, 2005; Rozin P. , 2002; Looy, Dunkel, & Wood, 2014), and thus what might be considered disgusting and hazardous in some social groups could be culturally accepted in others (Martins & Pliner, 2006; Martin, 2014; Douglas, 2003). As already stated, different insects undergo distinct approaches. While a spider, broadly-speaking, is feared by a large part of Western population because of its poison content (Davey, 1994), butterfly is a beauty symbol even though is consider inedible for human diet (Allen, 2012; Ramos-Elorduy, 2009; Haynes, 2013). Therefore, before define any strategy or tactic to introduce a product into the market it is fundamental a profound analysis of the market segment. Pursuant to Deroy et. al (2015), in addition to an in-depth analysis of the micro- and macro-environmental factors (e.g. SWOT and PESTLE analyses respectively), a strategy management to change the consumer behaviour, in this case a food habit, should compile three dimensions: cognitive neuroscience; consumer behaviour; and gastronomic science (Deroy, Reade, & Spence, 2015).

4. METHODOLOGY

The present paper follows a qualitative methodology aiming to inductively explore the human-eating behaviours towards edible insects with an especial attention to Western societies. Due to the limitation of information and the complexity of phenomena under study, a qualitative and exploratory research supports the content analyses. Such in-depth investigation throughout numerous theoretical and scientific papers were carried out in order to get clear insights and perceptions about the research topic of enquiry. In the follow-up and complementation of this theme, semi-structure interviews were conducted via Skype to specialists of the area. The purpose of such approach it was enriching the data content through the participant's perspectives about the new dietary pattern – arthropod-entomophagy.

4.1 Research Strategy

A research strategy was previously settled to meet the questions about the topic in probing. Thoughtful research design and precise wording were used to engage this research paper as well as on the analysis of the data collection.

The starting point of the research process stems from three fieldworks: the potential of insects in terms of nutritional, environmental and livelihood universes; the broad-overlook about the Westerners eating-behaviours; and the limitations and strategies to boost the entomophagy habit into modern societies. In the light of the information collected, the research questions for the interviews were realised, based on semi-structured interviewing. Furthermore, underpinning the qualitative method is the inductive exploration of both primary and secondary information (Vergara, 2005). Through set of mechanisms and techniques were used to analyse the data, and finally obtain the foremost conclusions.

4.2 Research Approach

Within the universe of scientific papers, the data collection is pursued from various approaches. According to Ghauri and Grønhaug (2010) the most usual ones are qualitative and quantitative methods. In regards to quantitative method, when it comes to numerical interpretations quantitative techniques are the most recommended to deal with. Relying on a quantitative data collection, mathematical, statistical, and numerical analysis are used to thereafter plot conclusions based on results obtained through polls, questionnaires, and surveys.

In contrast, qualitative research consists in data collection difficult to measure, or even unmeasurable. Therefore, the latter research method is ideal for sociocultural inquiries (Bryman & Bell, 2007). Once human behaviours are difficult to measure on numbers and statistics, personal and flexible approaches are required to manage such complex issues (Liamputtong & Ezzy, 2005). Unlike quantitative research, qualitative methods, by rule, does not demand a significant quantity of studying numbers (Bryman & Bell, 2007). Qualitative enquiries allow to acquire intangible data through natural settings, and give the opportunity of the research participants to express their feelings and experiences in their own words (Ghauri & Grønhaug, 2010; Liamputtong & Ezzy, 2005).

Therefore, it is on the basis of objectives and structures of the study under enquiry that defines which method is the most suitable. Regarding on the present case and taking into account what was aforementioned discussed, a qualitative research is the most appropriate method to be pursued. The objectives of this paper are based on identifying sociocultural barriers and psychocultural strategies to surpass them, so beliefs, feelings, opinions, perceptions, experiences, thoughts, and so forth, are unlikely to be assessed by quantitative methods. By using this research method enables the researcher to cover “the overall picture” and reach the internal insights from the specialists of the area.

4.3 Scientific Approach

The linkage between theory and research is probed under either inductive or deductive theory. As stated by Bryman & Bell (2007), the purpose of an investigation either is to build theories or test thereof. In regards to the deductive theory, the whole process of analysing the data collected aims to test a hypothesis(es), statement or general theory, and hereafter reach a conclusion about the reliability of the subject of enquiry (Ghauri & Grønhaug, 2010).

On the contrary, on the basis of various empirical observations, the investigator set up his own hypotheses and theories (Ghauri & Grønhaug, 2010). Notwithstanding, regardless the number of observation carried out by an inductive reasoning approach, the researcher is unlikely to achieve an indubitableness conclusion in the end (Ghauri & Grønhaug, 2010).

Considering what was aforesaid about adopting an interpretivist stance, it might prompt the author to use inductive theory to evaluate the primary data collection (Lehman, 2008). Furthermore, taking into account the novelty and complexity of the phenomenon, new hypothesis and prepositions may be emerged towards better insights of the very case. Therefore, an inductive approach was used to cover the theme under investigation.

4.4 Data Collection

Pursuant to Tashakkori & Teddlie (2003), the primary and secondary information are the two sources of qualitative data. As explained by Bryman & Bell (2007), the primary data is gathered through a first-hand investigation, whereby the researcher explores directly their own questions using surveys, interviews, experiments or focus groups as research means. In contrast, the data collected from common sources is titled as secondary data. Someone other than the researcher himself collects this information, and it can be found out in literatures, articles, documents, and so on (Ghauri & Grønhaug, 2010).

This empirical research was carried out under a qualitative research dimension. Within an exploratory approach the two types of data were collected: primary and secondary. The primary data was gathered through semi-structured interviews, and open-ended questions. The interviewee-target were specialists in the entomophagy area, in which their experiments with edible insects in public were tested in part in Brazil. With the purpose to obtain a more trustworthy information, qualitative interviews were employed face-to-face with these professionals. Bearing in mind that each participant has a different outlook about this particular phenomenon given his individual experience, an interpretivist position was assumed in this very research (Lehman, 2008). That is, with the view of getting a better comprehending about the theme, the author has investigated those diverse realities within the context in which they occur.

The secondary data was conducted and collected from numerous scientific journal articles and documents, books, newspapers interviews and alike. To achieve a better understanding on the entomophagy area, other dimensions were studied to support the theoretical part such as consumer-behaviour, social, ecological, nutritional, cultural, economic and gastronomy subjects (Rozin P. , 2002).

4.5 Interview Structure

As abovementioned this exploratory research has followed a semi-structured interviewing as the sole source of primary information. Wherefore, the respondents were addressed with open-ended questions, which prompted them into a further discussion. Giving to the interviewees the opportunity and free-will to inductively explore specific subjects, it has enabled the research to get a richness of data and deeper insight into the phenomena under study.

The questions were split into five subjects (excluding the topic “Further Comments”):

Table 3 - The Five Dimensions of the Qualitative Interviewing

<i>Affair</i>	<i>Topic Content</i>	<i>Objective Aimed</i>	<i>Key Words</i>
<i>Background</i>	Overview of the respondent	Thorough understanding of how, why and what it has led to the intervenient to end up in this sector.	Professional and Personal Background; New Cuisine
<i>Consumer's Profile</i>	Analysis of the surrounding environment, both internal and external; Sociocultural barriers.	Characterisation of the consumer target; Reactions of the <i>eaters</i> when faced with edible-insects' dishes; Individual's motivations to consume or reject an insect as human food.	Market Segment; Consumer Behaviour; Sociocultural Barriers; Environmental Confound; Law of Contamination; Lack of Reachable Information
<i>Product & Place</i>	Methods to persuade a specific target	Current approaches towards the consumer; Which and why the choice of a specie of insect to be served.	Familiarly Products; Acceptable Insects; Insect vs Invertible; Visual Features; Sensory Properties; Contextualisation of the Product
<i>Price & Promotion</i>	Potential strategies to overcome the current Western food prejudice	Possible approaches to face the current barriers; Long-standing market strategies to be implemented.	Communication Strategies; Haute Cuisine; Affordable Price; Poor Food
<i>Legislation</i>	Legislation in the Health & Safety area	Situations when edible insects are legal for human consumption; Current legal process.	MAPA; ANVISA; Government; "Grey-Zone"

Source: Author's Table

In consideration of the nature and complexity of the issue, a flexible method was required. As it was adopted a semi-structured qualitative methodology, the interviews have tended to last between one to two hours. The qualitative interviewing was employed via Skype with the purpose to get a more natural and flowed conversation (Patton, 2005; Longhurst, 2003).

4.6 Interview Procedure

In addition to anthro-entomophagy has been becoming more popular within the modern societies over the last years, this phenomenon is still rejected as edible food by the Brazilian society. For this very reason, the insect consumption has been poorly widespread and explored as a regular diet. Consequently, the number of experts and professionals in the entomophagy area are currently scarce owed to their low-demand. Therefore, the lack of information and potential interviewees have been relevant limitations of the present paper.

Primarily, qualitative interviews were procedure due to the nature of the topic. As above-mentioned, few studies are required when it comes qualitative interviews (Bryman & Bell, 2007). Although quantitative interviewing hinges on statistics or numbers, qualitative interviewing bases on open-ended and free-flowing questions so that diverse pinpoints can be explored effectively (Tashakkori & Teddlie, 2003). Moreover, this method allows the researcher to achieve a greater clarity and detail about the information needed rather than through surveys or questionnaires (Tashakkori & Teddlie, 2003).

Here, the research method to collect primary data was conducted via semi-structured interviewing. It is important bear in mind that there are other approaches in addition the latter one. The different qualitative interviewing lie on a continuum composed by structured, semi-structured and unstructured interviewing (Longhurst, 2003). At the beginning of this continuum, structured interviews are composed by a predetermined list of questions, which normally pursue a specific order. On the other hand, in an unstructured interview, there is a wide room where the interviewee can freely speak and explore their thoughts and experiences. During a semi-structured one the participant is submitted to follow a set of pre-required issues and questions the interviewer aims to cover throughout the session (Longhurst, 2003; Fylan, 2005). Unlike other sorts of interviews (structured and unstructured), the functionality of a semi-structured interview is meeting the “why”. Pursuant to Fiona Fylan (2005), due to the versatility of this type of interviews, it allows explore contradictions among the involved participants. Thus, considering the sensitiveness of the topic of enquiry, semi-structured is the most suitable format.

Regarding to the investigator behaviour, several authors argue that the interviewer should always maintain a neutral position regards to the interviewee’s points of view in order to avoid the possibility of a bias effect of the researcher (Bryman & Bell, 2007; Ghauri & Grønhaug, 2010). Nonetheless, although the present author has tried to remain non-judgmental according

to respondents' responses, the follow-up questions have ranged depending on the interviewer's opinions.

Lastly, the interviews were conducted in Portuguese because of the interveners' nationality. To a more efficient and accurate inquiry, a smartphone was used to record those interviews⁶. Then, the transcribed material was analysed in detail, and subsequently the most relevant conclusions were highlighted into different categories.

4.7 The Overview of Respondents

As aforementioned before, a stronger and intensive promotion towards entomophagy should be persecuted with the purpose of gathering further followers to this novelty. Through theoretical documents and articles insects as a novel category of Westerner gastronomy has been explored and new strategies have been planned. Nonetheless, in this paper practical and personal experiences will be assessed with the view of adding value to it. To do so, a non-probability approach has been defined since it was running a non-random selection process (Bryman & Bell, 2007). That is, a niche of the population has been established from a specific area – anthropo-entomophagy.

Having as main objective the exploration and divulgation of insects' consumption within Western societies, Brazil was chosen the country where the qualitative research will be based on. Looking at the historical background of Brazil, it is possible to affirm that Brazil is a multicultural society whereas African, Indigenous, and European are the main culture's building blocks (Skidmore, 2010). Notwithstanding, the language and demographic ethnicity majorities are currently Europeans, special from the Portuguese culture (De Holanda, Summ, & Monteiro, 2012). Hence, the reason of Brazil has been selected as the main Westerner target is because the cultural pillars of Brazilian society are strongly influenced by the Occidental cultural. Furthermore, Brazil is one of the Earth's biologically richest countries, in terms of fauna and flora (Mittermeier, Myers, Mittermeier, & Robles Gil, 1999), so there are great natural conditions and opportunities on rearing edible insects.

The interviewees selection was mainly based on their individual experiences and backgrounds. One of the requisites is that respondent has had at least more than two personal involvement with edible insects both in private and public events. The main targets were chefs, biologists,

⁶ In the light of private policy, it was given the right to the interviewer claims the anonymity of the interview. Plus, the authorisation of recording the interview was asked beforehand by the interviewer.

nutritionists, entrepreneurs, and professors. Besides owing a comprehensive overview of the Brazilian society, all of them must witnessed those social experiences in Brazil.

The selection method used was a non-probability approach, and it has pursued in the following manner:

Step 1 – A sub-sample of professionals of the area were approached from a larger media search taking place in Brazil. All targets took part in a background screening session, and hereafter were contacted and invited for a private interview.

Step 2 – The media search was based on newspapers, journal articles, TV shows, amongst others. Nevertheless, due to the difficult access to their private or professional contact numbers and lack of feedbacks, only one was reached through this search – Chef Rossano Linassi. Thereafter, from his recommendations another expert was reached – Dr. Eraldo Medeiros Costa Neto. Likewise, Dr. Casé Oliveira was recommended by Dr. Costa Neto and so on and so forth. Hence, non-probability sampling techniques were used, such as the snowball method, where the participants already interviewed suggested others whose characteristics fit according to the interests of the research. This snowball sampling was therefore a main driver on the interviewees recruitment (Biernacki & Waldorf, 1981).

Step 3 – With all respondents the research got in touch through either e-mail or WhatsApp message. Once the contact was established, the interview was set up via Skype.

Step 4 – After each interview, the information was wrapped up and the transcript material was analysed in detail. After that, conclusions were pinpointed into specific categories.

It was of utmost importance having interviews with the right person who has a significant position within the entomophagy universe since it diminishes the risk of misrepresentations due to a lack of knowledge, and thus intensifies the reliability of the responses. The backgrounds of the interview participants are as following table:

Table 4 - The Professional Background of each Interviewee

<i>Respondents (Data Interview)</i>	<i>Background</i>
<i>Chef Rossano Linassi (December 13th, 2016)</i>	Chef, Professor of Gastronomy at Instituto Federal Catarinense (IFC) - Campus Camboriú (SC) - Vale do Itajaí University, member of the <i>Grupo de Pesquisa Educação e Saúde (GPES - IFC)</i> , member of the research group <i>Antropoentomofagia</i> :

<p><i>Dr. Eraldo Medeiros Costa Neto</i> (December 22nd, 2016)</p>	<p><i>Insetos como Recursos Alimentares</i>⁷ – UEFS (State University of Feira de Santana).</p>
<p><i>Casé Oliveira</i> (January 20th, 2017)</p>	<p>Professor in Ethnobiology at the Department of Biological Sciences of the State University of Feira de Santana, Teacher Advisor in the following postgraduate programs: Zoology (UEFS), Zoology (UESC) and Human Ecology (UNEB Campus VIII). He has experience in Ecology and Natural Resources, with emphasis in Applied Ecology, working mainly in the following subjects: ethno-entomology, ethnozooology, previous knowledge, edible insects, use and conservation of animals, environmental education, biocultural systems, zooterapia and traditional medicine.</p>
<p><i>Dr. Gilberto Schickler</i> (January 25th, 2017)</p>	<p>One of the founders and Biologist in ASBRACI (Associação Brasileira dos Criadores de Insectos)⁸, Teacher of Biology at the Public School Visconde de Itaúna – São Paulo, and Entrepreneur and owner of the company Q-Biofábrica.</p>
<p><i>Dra. Shaiene Gouvêa</i> (February 13th, 2017)</p>	<p>Zootechnist and Technical Manager of the start-up Hakkuna, and former partner and Technical Manager of the company Nutrinsecta.</p>
	<p>Entomologists, Professor of Entomology at the IFRJ - Federal Institute of Rio de Janeiro</p>

Source: Auhtor's Table

4.8 Limitations

Various literatures argue that qualitative research is the most accurate method to analyse a research topic in business and management administration as well as social behaviours (Bryman & Bell, 2007; Ghauri & Grønhaug, 2010; Lehman, 2008; Patton, 2005; Fylan, 2005).

Nevertheless, some limitations are underpinning to the use of this methodology. Firstly, the definition of data saturation is still ambiguous among some authors (Guest, Bunce, & Johnson, 2006; Hagaman & Wutich, 2016). In the present paper, due to the poor dissemination and development of this phenomenon in Brazil leads to a scarce of people to specialize in the entomophagy area. The major of the professionals are related to edible insects as animal feed. Given that, plus the difficult access to the contact numbers of the potential interviewees, the study was subjected to a few interviews. Nonetheless, by rule, qualitative method does not

⁷ “Anthropo-entomophagy: Insects as Food Resources”, translated in English.

⁸ Brazilian Association of Insect Breeders, translated in English.

require a large number of studies (Bryman & Bell, 2007). Also, the information collected during the research process was sufficient to conclude with feasible prepositions.

In regards to another limitation, the study of the legal situation of insects' consumption by human was compromised from the inexplicit and unclear Brazilian food regulations. The absence of policies ruling insects as human food at national level affects the market availability, and consequently it will affect directly the strategies to adopt insects as food diet (Halloran, Münke, Vantomme, Reade, & Evans, 2015).

Last but by no means least, the responses from the interviewees are subject to the researcher's interpretation. The analysis could be influence not only by the interviewer's background, but also by misinterpretations from both sides⁹. This is owing to the fact that this study is based on a semi-structured qualitative research, which does not allow for a more objective analysis.

⁹ Although both parts speak fluent Portuguese, the articulation, vocabulary, and construction of sentences slightly diverge from Portuguese of Portugal to Portuguese of Brazil (and each Brazilian region inclusive).

5. ANALYSIS OF THE RESULTS OF THE INTERVIEWS

This chapter will present an overview of the interviews employed to Brazilian professionals with experience on the entomophagy area. Over seven hours of five interviews were thoroughly analysed. The first part of the chapter will be highlighted the foremost responses¹⁰ and outlooks related with the research questions. The second part of the chapter will relate and discuss the interview outputs with literature material collected in the previous chapters.

5.1 Overview of the Results

The overview of results will be pursued through the analysis of the two general objectives: psychological and sociocultural barriers that lead Westerners to refuse eating insects; strategies for changing food preferences and aversions.

5.1.1 Barriers of Insect Consumption

Here, the main interview testimonials will be gathered according with the theme rather than what each interviewee has responded about each topic. The present author has found therefore this manner of collecting and lay outing this type of data easier for the following analyses.

Table 5 - List of Barriers Divided into Different Categories

<i>Theme</i>	<i>Interview Testimonial</i>
	<i>Market & Product Dimensions</i>
<i>Weak Production Process</i>	<p>Economies of scale in production are another major challenge [...] the production processes in the industries are still handcrafted and manual. It requires a more efficient production process and a greater industrialization." – Chef Rossano Linassi</p> <p>"It is necessary to demonstrate the opportunities of this product so that there is a greater investment in this category of insects, as it exists in the other agricultural chains. It is needed more genetic research and nutrition research. There is still plenty of insect production without any genetic engineering, without any knowledge of what that insect really needs to eat, what are the</p>

¹⁰ All responses were made in Portuguese, and thereafter translated to English. Given this, certain words or sentences have undergone some alterations from the original one. Nonetheless, the core idea remains intact. In case of wishing to have the access to both the original written answers in Portuguese and the full audio of the interview, it will be possible to find it on the CD alongside with the present paper.

	<p>cheapest and most efficient ways to produce these animals. I see that there is an increasingly incentive to exploit these businesses, but Government support continues to be practically nonexistent." – Dr. Gilberto Schickler</p>
<p><i>Lack of Research & Development</i></p>	<p>"Because of the lack of information and investigation, no one knows yet what is needed to produce insects safely. Who will tell you how to produce the insects safely is the research." – Dra. Shaiene Moreno</p> <p>"Generally speaking, farmers do not know whether the feed they use is the most adequate feed for each type of insect [...] the feed used is practically the same for insects of both human consumption and animal consumption. They never thought that dietary modifications could interfere positively in the palatability and acceptance of the product." – Dra. Shaiene Moreno</p> <p>"Here in Brazil, there is a lack of research into the various areas of insects. Nowadays, only seven to ten insects are being produced, which limits creativity in both the sales area and the gastronomic area." – Chef Rossano Linassi</p> <p>"[...] it is necessary great developments in knowledge of insects, and its rearing and production processes. There is great consumption in the world, but most of those animals are collected in nature. Therefore, there is still a large-scale production to be developed." – Dr. Gilberto Schickler</p>
<p><i>Production Costs & Logistic Issues</i></p>	<p>"When we started a laboratory for research purposes, buying directly from the producer costs 300 <i>reais</i> per kilo. Imagine how much it will cost the end consumer ... no matter how much the insect has three times more protein, one kilo of meat costs 30 <i>reais</i> [...] but today it is not a reality in Brazil to eat insects because it is still very expensive." – Dra. Shaiene Moreno</p> <p>"[...] I had to wait 40 days to receive a batch of live insects because there was no producer who had this product available to provide." – Dra. Shaiene Moreno</p> <p>"Fresh insects have a completely different flavour and texture than dehydrated ones. But for the sake of storage I end up having the most dehydrated. Yet the use of the fresh insect is much better for the palate of the dish. [...] the use of freezing may be an option, but to carry it will be more complicated. In addition, cost will be greater throughout the production process and logistic involved." – Chef Rossano Linassi</p>

	<p>"The ants, five years ago, were much cheaper. Nowadays they are around 250 <i>reais</i> a kilo. This is due to the fact that people have started to consume more, and have taken to the big centers from the cities of the interior, which caused the price increases exponentially. [...] and this is reflected in all the insects currently available on the market." – Chef Rossano Linassi</p> <p>"The second barrier for us is the price. These days, prices of insect products are quite high. [...] the cheapest I have ever sold so far was around 250 <i>reais</i> a kilo. If you buy <i>picanha</i> at 50 <i>reais</i> per kilo you will never buy a kilo of beans for 250 <i>reais</i>" – Dr. Casé Oliveira</p> <p>"Insects are a business that still offer good prices to the producer, but those will drop considering the development of new technologies." – Dr. Gilberto Schickler</p>
<p><i>Lobby & Inexistent Cluster</i></p>	<p>"In countries like Brazil, to create an industry of insects is very difficult, because the agricultural production is very strong." – Chef Rossano Linassi</p> <p>"We (group colleagues and experts in the field) have sent several proposals to the federal Government to allow a possible release of insects for human consumption. But this will take some time because of a strong Governmental lobby that exists for cattle raising." – Dr. Eraldo Medeiro Costa Neto</p> <p>"[...] since producers are not really so well organized, and even between them communication is difficult. Producers cannot be considered as a very closed group because the group is not well consolidated and the Producer Association has not yet been formalized. But the fact is that there is no strong cooperation between them. There is no strong group idea yet. Although this has been built and can be very positive in the future. However, the reality today is that as much as they are interested in increasing insect consumption so they can increase production, they do not want new people to produce insects. [...] they do not want more people to join in the insect production activity, fearing that the competition will increase and that they will be forced to lower the price." – Anonymous</p> <p>"If a new producer seeks help for any production process from the current producers, he or she is usually ignored. [...] Producers do not like it when they know that some other producer is selling live insect for someone to create because it will withdraw market share." – Anonymous</p>

Psychological Dynamics

<i>Culture Identity</i>	
<p><i>“The very idea of eating insects”</i> <i>(Unconscious Disgusting)</i></p>	<p>"Regarding to the few people who refused to experiment, they reported: they did not prove the insects because they did not have the courage. This was due to the association with something disgusting, and to the “fix idea” of not liking insects." – Dr. Shaiene Moreno</p> <p>"[...] motivation [of eating insects] is much more cultural, and because it is something that people are not used to. So, they always look on the negative side of eating insects. Never on the positive side" – Chef Rossano Linassi</p> <p>"The barrier is prior to looking at the dish." – Chef Rossano Linassi</p> <p>"The insect is not food because it is disgusting. From the moment that it stops being disgusting, the insect will be food." – Dr. Eraldo Medeiros Costa Neto</p> <p>"Normally the first reaction is of disgust, of not approaching; but after the product tasting the reaction is of positive surprise." – Dr. Eraldo Medeiros Costa Neto</p>
<p><i>Lack of Exposure</i> & <i>Unreachable Information</i></p>	<p>"[...] I have tried to do two things: to associate the mythical, ethnographic, cultural and symbolic part with the ecological, biological and taxonomic part. And that is what has been missing. There is a lack of basic research in Brazil." – Dr. Eraldo Medeiros Costa Neto</p> <p>"One of the great barriers is people's lack of knowledge. When we asked if we had ever thought to eat insects, the answers are always like: 'Eating insect? Are you crazy?!' This first reaction is due to the fact that they do not have a great knowledge about edible insects." – Dr. Casé Oliveira</p> <p>"There are few opportunities of a person seeing a well-made creation of insects. I think these types of experiences are missing a lot. People do not have much reliable information on this subject. Nowadays, people only have negative experiences with insects. A cockroach that has appeared from the kitchen coming from the sewer, or a dirty fly that is bothering. There is lack of information that confirms the animal is produced isolated from any contamination, and is not fed with other food, but rather with a careful diet." – Dr. Gilberto Schickler</p>
<p><i>Culturally Relative</i></p>	<p>"Insect rejection is culturally learned. Our parents have educated us since we are a child to not touch this or that because it is</p>

	<p>disgusting, because it is an "insect"! The word insect is semantically carried with a rather harmful prejudice that insect is something bad, dangerous, and it can kill. So, all these anthropocentric characteristics are passed on and reinforced for the children. And in this way the person grows with that feeling that the insect is something bad." – Dr. Eraldo Medeiros Costa Neto</p> <p>"Many people were curious to know if the cockroach was tasteful, and whether their repulsion was a cultural barrier or driven by a taboo. [...] when the person was willing to defy their fears and barriers, admitting the hypothesis of the insects as food, the person would face the cockroach in a very interesting way and end up eating. The rest of the other invertebrates, the resistance to eat were significantly smaller" – Dr. Gilberto Schickler</p>
<i>Categorisation</i>	
<i>Magical Laws & Environmental Confound</i>	<p>"[...] the idea that insects are dirty is always the first thing people talk about." – Dr. Shaiene Moreno</p> <p>"Most people know that the dish contains insects and it is because of this same idea that makes it difficult to eat the dish. The taste of the food is good, the presentation is good, the smell too. But once I tell the person that the dish contains cockroaches, even though he or she is not seeing anything and may not even have it, the person will have an instant reaction against this food." – Chef Rossano Linassi</p>
<i>Critical Commercialisation</i>	<p>"Although I think television shows are good for spreading insects as a human food, many of these programs feature insects in a very sensational way. In those programs the insect was always ridiculed and for that very reason I have rejected invitations from these same programs. I look for another program that has a scientific, cultural or environmental character [...] even in some programs I participated there was no agenda, everything was very messy and the insect was shown as disgust, almost forcing people to eat." – Dr. Casé Oliveira</p>
<i>Legislations & Regulations</i>	
<i>MAPA</i>	<p>"The fact that there is no specific legislation on this type of foodstuffs for human consumption has jeopardised several initiatives in introducing the insects in the menus of several restaurants." – Chef Rossano Linassi</p>

	<p>"There is an obstacle in our legislation. In Brazil, the word "Insect" was placed as "Prague". Therefore, I cannot transport it from one state to another, or even out of the country, because the insects have entered the category as a pest according to MAPA" – Dr. Casé Oliveira</p> <p>"Despite everything, there is already a breakthrough, because MAPA has already released the insects for animal consumption, but in the law, it is still considered 'plague'." – Dr. Casé Oliveira</p>
<i>ANVISA</i>	<p>"According to ANVISA and MAPA, the consumption of insects for being-human is released only in two conditions: for gastronomic experiences, that is, it is an experience that is not performed in a regular way; Or for the purpose of preserving indigenous culture." – Dr. Casé Oliveira</p> <p>"ANVISA may only add insects to the list of regulated food if MAPA legalise for human consumption" – Dr. Casé Oliveira</p>
<i>Government</i>	<p>"In some restaurants in Brazil they sell insects in a cultural way, on behalf preserving the indigenous culture and all legal organs know this" – Dr. Casé Oliveira</p> <p>"The legislations that the Government issued were solely towards creations of insects for animal consumption. Human consumption remains non-existent." – Dr. Eraldo Medeiro Costa Neto</p> <p>"[...] the recipe formulations are carried out without any supervision or supervision." – Anonymous</p>

Source: Author's Table

5.1.2 Strategies to Overcome the Western Rejection of Insects as Food Supply

In the next sub-chapter, the approaches to persuade an insect-phobia culture (in this case Brazilian society) to acquire a genuine appeal to insects and other terrestrial arthropod relatives as a legitimate food ingredient will be placed in accord with each topic that the best fits.

Table 6 - List of Strategies Divided into Different Categories

<i>Theme</i>	<i>Interview Testimonial</i>
	<i>Educational Efforts</i>
<i>Instrumental Reasons</i>	"Another interesting strategy bases on child education in relation to insect consumption. Because children are still forming their eating habits, so it is easier to persuade them, as they have not yet negative

connotations towards insects as the population already has." – **Dr. Shaiene Moreno**

"[...] for that reason the importance of making conferences, round tables, symposia, along with insect dishes provided to the public in a way to people be able to: listen on the presented subject, and thereafter be able to taste dishes based on insects. The greater the scientific dissemination on the subject, the greater the acceptance of the public. Hence, marketing strategies and advertising on the basis of education would remove the people's fear towards insects, enrich their knowledge, and increase their acceptance about this food."- **Dr. Eraldo Medeiro Costa Neto**

"What motivates most people to consume insects is their environmental awareness and curiosity." – **Dr. Casé Oliveira**

Sensory Properties

<i>Multisensory Strategies</i>	Chefs	"[...] before people experience insects, one of the things they do is evaluate the insect for both its appearance, texture and smell. And after smelling the insect they have a positive reaction because it smells like fish, like shrimp." – Dr. Casé Oliveira
		"It has to make insect more attractive. In our culture, there are still strong prejudices about insects. If you set up a stand on the street, and with the purpose of offering a meat degustation to the public, you do not have to tell whether is a cat or a frog, people will end up eating it. If you make a cricket on the spit, no one will want to eat." – Dr. Casé Oliveira
		"When we add the cockroach into cakes along with the dough, the answers were startling. People thought it was a cake with a more pronounced taste and better. We did not notice any repulsion when cockroaches were not visible on the cake, even if the participant had knowledge of the insect's existence." – Dr. Gilberto Schickler
	"[...] there is public for all forms of insects. They need to be tasty, not causing disgust on the palate. [...] Certain insects have to be worked with spices and other herbs to become the sensory properties of insects more appealing. For example, although I like the flavor of the cockroach, its odor is not the most appealing. However, the smell does not exactly identify the taste. Therefore, its smell should be modified through gastronomic tools, as it already happens with several Brazilian dishes, nowadays." – Dr. Gilberto Schickler	
Producer	"Many growers often use insect feeds for bone and fish meal. However, because we [producers] do not know the origin and	

	<p>contaminants that these products can bring and to ensure insect food safety, we are developing diets without these animal protein sources. Instead, we use algae flours in the composition of reason as it will add a fish flavor to the insects." – Dra. Shaiene Moreno</p> <p>"[...] once the use of essential nutritional requirements that each insect needs, the feed can vary according to the available ingredients, whether they are cheaper, or that can add a special sensory value to the insect with the purpose of increasing quality to the product." – Dra. Shaiene Moreno</p> <p>"Once this market starts growing, with a booming market, there is plenty of room to grow in insect production. One of the main sectors will be the industrialisation of this product, maintaining the nutritional values, but in a way to not undermine the people's acceptance." – Chef Rossano Linassi</p> <p>"The source of animal protein from insects always comes from fish-meal." – Dr. Casé Oliveira</p> <p>"A possible strategy to create an exclusive range of insects could be from the insect feed production process. By adding milk to larval feed, you could create a selected product with a different taste. But more research into introducing insects into burgers and nuggets, and changing the protein dominance of this type of food [...] will help to create more popular and familiar products." – Dr. Gilberto Schickler</p>
<p><i>Familiarity</i></p>	<p>"[...] the preparation of <i>brigadeiros</i> with insect [cockroach] had a much better note than the traditional brigadier without insects [...] and according to the people's reports, Brigadier recalled a gourmet <i>brigadeiro</i>, remembering a flavour that flour of cockroach has that it is almond." – Dra. Shaiene Moreno</p> <p>"[...] we put the whole insect into the food and mixed inside a risotto, a yakisoba or as stuffing of something dish in order to show the presence of the insect, it is possible to be consumed, and it is not harmful. These are the main intentions of doing this." – Chef Rossano Linassi</p> <p>"We gave it to try crickets covered with chocolate. Although the crickets were served whole, the format resembled a bonbon. The cricket served recalled a chocolate called 'Bis' and people associated the taste with chocolate waffles." – Dr. Gilberto Schickler</p> <p>"Usually the Yakisoba dishes are served with chunks of shrimp or bacon. Then, there are always certain kind of ingredients that are</p>

	<p>served in pieces along with noodles. Therefore, in this dish we find it interesting to serve the whole insects. On the other hand, the “<i>pé-de-moleque</i>”, for example, was served with fragmented insects, derived from the nature of the sweet. The giant caramelized tenebrio was served to the children. [...] Therefore, the format depends on both the characteristics of the product and who will be served.”- Dr. Gilberto Schickler</p>
<i>Availability</i>	
<i>Physical Availability</i>	<p>"[...] working the menus with this exotic character, through menus of tasting or the like, to create an exclusivity of the product, because the more exclusive the better (in this case)."- Chef Rossano Linassi</p> <p>"The popularisation of insects will only happen once insects start to be selling in supermarkets [...] providing tasting stands where people can experiment." – Dr. Casé Oliveira</p> <p>"If insects are only available in haute cuisine restaurants [...] it may lead the "ordinary consumers" to think that they will hardly have the opportunity to reach this product. Then, they will give up the idea of eating insects for being expensive." – Dr. Casé Oliveira</p>
<i>Price Strategies</i>	<p>"The goal is to spread insects to all levels. It does not matter that it is just a delicacy for those who have a lot of money and can pay dearly to eat that exotic dish; But it also does not help that it is only offered to the poorest people who do not have access to the protein. The interesting thing, in my opinion, is that we eat insects because it is good. [...] some alternatives may be based on the categorization of the insect according to its quality, or the use of seasonings used in the feed that will add flavour. So, I think you can do both: reduce the cost of production and create insects at a standard price without losing the quality of it; On the other side, create a premium range. [...]" – Dra. Shaeiene Moreno</p> <p>"[...] create an image of the insect as something exotic and perhaps with a higher price in order to create a status of exclusivity. “- Chef Rossano Linassi</p> <p>“There is a difference between the culinary preparation of a thin cut of a steak, and killing an ox and eating it directly there. The same applies with insects: there are gourmet insects, regular insects and inedible insects.” – Dr. Eraldo Medeiros Costa Neto</p> <p>"In order to make this product popular, it will be necessary to lower the price." – Dr. Casé Oliveira</p>

	<p>"There must be a lot of people consuming insects to become popular, and prove that it is worthwhile and economically viable to implement this production in Brazil. There must be people to invest. It cannot be something totally exclusive, otherwise it will lose market share. Therefore, there are two paths that must be followed: selling it in a popular and familiar way, and keeping visible the shape of the insect, clarifying that this is a normal source of food; On the other hand, to offer the insects in special recipes, in which only they are produced in that place or with special seasonings." – Dr. Gilberto Schickler</p>
<i>Communication & Categorisation</i>	
<i>Communication</i>	
<p><i>Transparency Process & Displaying of Reliable Information</i></p>	<p>"Whenever we conduct an insect offering, we display a presentation that attempts to demonstrate both the nutritional and flavour benefits, emphasizing also the sanity of the product to demystify the idea that insects are dirty [...] and, therefore, those presentations aroused curiosity to the consumer and led them to believe in the potentialities of the product and finally to try it out. And we always got a positive response." – Dr. Shaiene Moreno</p> <p>"When we did the experiments offering only the dehydrated insect, for sensory evaluation, the difficulty for us [researchers] to get people to try was always greater than when there was a pre-preparation of the whole product process." – Dr. Shaiene Moreno</p> <p>"[...] conferences, symposia, marketing, education, lectures could be used to make people see insects not as pests but as a bio-resource that is available." – Dr. Eraldo Medeiro Costa Neto</p> <p>"[...] work on the spread of insects in various areas such as gastronomic and university and create television programs aimed at the consumption of insects as a normal and flavourful habit." – Dr. Casé Oliveira</p>
<p><i>Peer Influence</i></p>	<p>"In addition to experts, students who worked on these projects were used to spread insects during tasting activities, but always with supervision. The goal was avoiding the "voices of experience" being the only ones who spoke about the subject, but rather students who belonged to the same groups of many other young people." – Dr. Shaiene Moreno</p> <p>"[...] only after some prove that the others decided to do the same" – Dr. Eraldo Medeiros Costa Neto</p>
<p><i>Expert's Persuasion</i></p>	<p>"It is important to take into consideration the person who is presenting the insects. It has to be a person who thoroughly-</p>

	<p>understands the material of which it speaks and that transmits security when it does. It could be either a biologist or a salesman, for instance" – Dr. Casé Oliveira</p>
	<p>"[...] many times he [the speaker] does not need to understand, he just needs to follow a good script." - Dr. Gilberto Schickler</p>
<i>Categorisation</i>	
<p><i>Sensu Lato</i> (<i>Specific Insect Species</i>)</p>	<p>"With a careful choice of the type of insects to be served makes it easier for consumers to accept it." – Dr. Eraldo Medeiro Costa Neto</p>
	<p>"We often take specific cockroaches to the public events [...] we take two sort of cockroaches: <i>Cinerea</i> and Madagascar. And incredible as it may seem, very few people reject [...] and we emphasise the fact that this cockroach is not the household or sewage cockroach that people are accustomed to associate." – Dr. Casé Oliveira</p>
	<p>"The people experiment the beetle and the cricket first and then the cockroach. Never choose the cockroach first." – Dr. Casé Oliveira</p>
	<p>"By studying various diets of various indigenous groups in Brazil, new types of insects for human consumption can be discovered and gastronomically developed to increase the range of species currently available." – Dr. Casé Oliveira</p>
	<p>"One thing that is very important is the distinction between edible and inedible insects, and the fact that insects should not be collected directly from nature but rather carefully treated in the laboratory or elsewhere where food safety is guaranteed." – Dr. Casé Oliveira</p>
	<p>"Both the cricket and the tenebrio were usually the first to be chosen by the participants. Once one of them was eaten the participant want to try the cockroach. However, she was never the first to be chosen." – Dr. Gilberto Schickler</p>
	<p>"The use of crickets as the main ingredient in our bars is due to the fact that the flavour of this insect is one of the most acceptable to human taste." – Dr. Gilberto Schickler</p>
<p><i>Hiding</i></p>	<p>"Not seeing the insect is decisive in the first approach to the consumer. [...] The perception that we [researchers] have is: for the presentation of the insect as food, it has to be initially disguised; [...] there is a difference when the consumer experiences and adopts the insect in their diet. [...] as the first short-term strategy will be to 'camouflage' the insect. Once the consumer realises that nothing bad has happened, and associate the taste with something tasty, the motivation of eating the whole insect increases exponentially (despite the willingness to put in your daily diet requires further</p>

	<p>studies), and therefore overcoming the firsts cultural barriers: the fear and the disgust." – Dr. Shaiene Moreno</p> <p>"Although I often present the insects in a more familiar way, [...] in television programs for example, I usually take them also alive, and whole and dehydrated for the person to see what they are eating. Presenting in disguised form the person can eat, but having no idea of what he is doing. And it is not good for us to deceive the consumer. That is why we do not omit the existence of insects." – Dr. Casé Oliveira</p> <p>"The final product has to be served in a clear way. You have to clarify what the product is, regardless of whether the insect comes in a flour or cereal bar." – Dr. Caré Oliveira</p> <p>"We did not notice any repulsion when cockroaches were not visible on the cake, even if the participant had knowledge of the insect's existence." – Dr. Gilberto Schickler</p> <p>"Once the consumer tastes through a cake or bread, this usually wants to taste it [insect] whole." – Dr. Gilberto Schickler</p>
<p><i>Naming</i></p>	<p>"[...] the name "cockroach" is enough to have a very strong negative impact." – Chef Rossano Linassi</p> <p>"The name will have a cultural influence on the acceptance of the insect. People must know what they are consuming, but definitely that a certain name can bring more refinement to the product." – Dr. Eraldo Medeiro Costa Neto</p>
<p><i>Re-Branding & Status</i></p>	<p>"Here in Brazil, there were other initiatives like using the insect as the solution to hunger. Flours and other products derived from easy-to-produce insects were sold as 'poor food'. [...] If this strategy is taken forward, it will damage the image of the insects. The rich do not eat because it is the food of the poor, and the poor do not eat because they feel inferior, because they see the insects as 'a remnant of society'." – Chef Rossano Linassi</p> <p>"Use the same strategy that sushi did around the world. First of all, Westernised the food; after bring tastes that are more familiar in each region of Brazil; also, work as something exotic and perhaps with a higher price in order to create a status of exclusivity. From these strategies, the insect's popularisation will be easier." – Chef Rossano Linassi</p> <p>"[...] Brazilians tend to follow the example of Europe and the United States. That is why an international strategy could be the starter for</p>

	<p>future action in the domestic market.” – Dr. Eraldo Medeiros Costa Neto</p> <p>"A gastronomic culture should be created to further expand the idea of insects as food; But not a culture of high gastronomy. For example, one of our great chefs, Chef Alex Atala, uses an ant to complement his dishes. However, it sells them at a very high price. Therefore, I do not see this kind of strategy being used to reach the general public." – Dr. Casé Oliveira</p> <p>"The marketing strategies we normally use are based on the environment as a main driver, [...] then we highlight the fact that insect derivatives are already consumed today, [...] the nutritional value of insects, [...] and finally the flavour. In addition to all the above factors, we have added that the insects are quite delicious [...] showing that insects are being used in various gastronomy schools and on various television programs [...] and we get a lot of people talking about it in order to create a culture about insects." – Dr. Casé Oliveira</p>
<i>Legislations & Regulations</i>	
<i>Food Policies</i>	<p>"[...] there must be regulation of the network of feed producers that provide rations for these insect farmers. [...] when a regulation for the consumption of the human being is created, it has all legislation similar to the production of other animals for human production, which producers will have to follow. One of them will be the inspection of the feed production processes." – Dra. Shaiene Moreno</p> <p>"In Brazil, there needs to be a strong association of producers and consumers to encourage the Government to pass this legislation. It is a political issue, and today this sector is not a priority for the Government to think about this legislation." – Dra. Shaiene Morena</p> <p>"People will be much safer knowing that the Government ensures that this food is safe under the law. Legalising the insect as human consumption will undoubtedly give credibility to the eyes of the population." – Chef Rossano Linassi</p> <p>"It is necessary to remove the word 'insect' from the category of 'plague', or at least categorise into two dimensions: 'plague' and 'food'." – Dr. Casé Oliveira</p>

Source: Author's Table

5.2 Discussion of the Main Results

This exploratory research aims to come up with different insights in which only stressing the nutritional and sustainable values of edible insects are not the sole viable strategies.

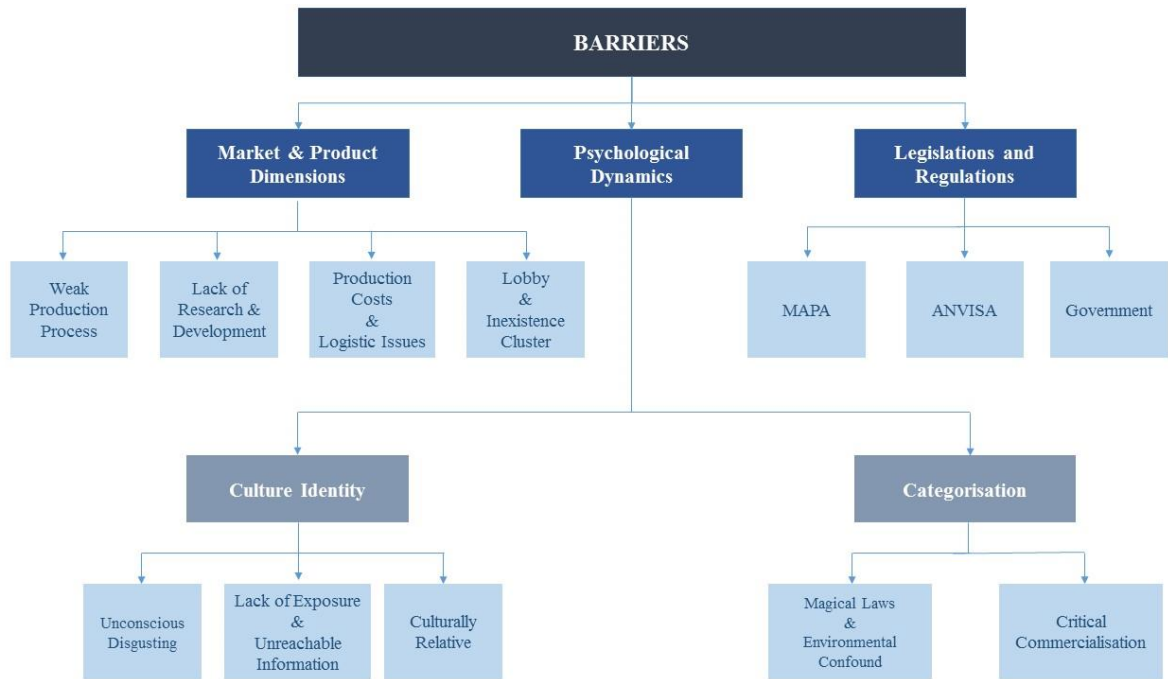
After a large collection of the main topics of enquiry, an in-depth will be carry out. The present chapter aims to outline the principal reasons that leads a person either to reject or accept an insect as a legitimate food ingredient.

In the book “*Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*”, John W. Creswell (2013) presents a method whereby three different codes are suggested to be employed for data collection analysis. In accordance with this Creswell’s method the discussion of the main results will be pursued into three categories:

- **1° Code** – On the first category lies on the all aforementioned information in the literature review, and afterwards confirmed throughout the interviews.
- **2° Code** – In the next step, it is bringing into discussion the facts and point of views that have missed by the author in a determinate category, but emphasised by the interviewees. Here, no anticipated elements will be contextualised in the present study.
- **3° Code** – In this last part, it is outlined the evidences from parallel dimensions that were not considered as hypothesis. A set of information that goes well beyond the author knowledge, and is hardly obtain by theoretical and academic means.

During the interviews, quite a few barriers and strategies were mentioned and explained. In regards to the barriers, three main themes have come out from this section: *Market & Product Dimensions*; *Psychological Dynamics*; and *Legislation & Regulations*. Each one was composed by diverse sub-categories (as *Figure 1* demonstrates).

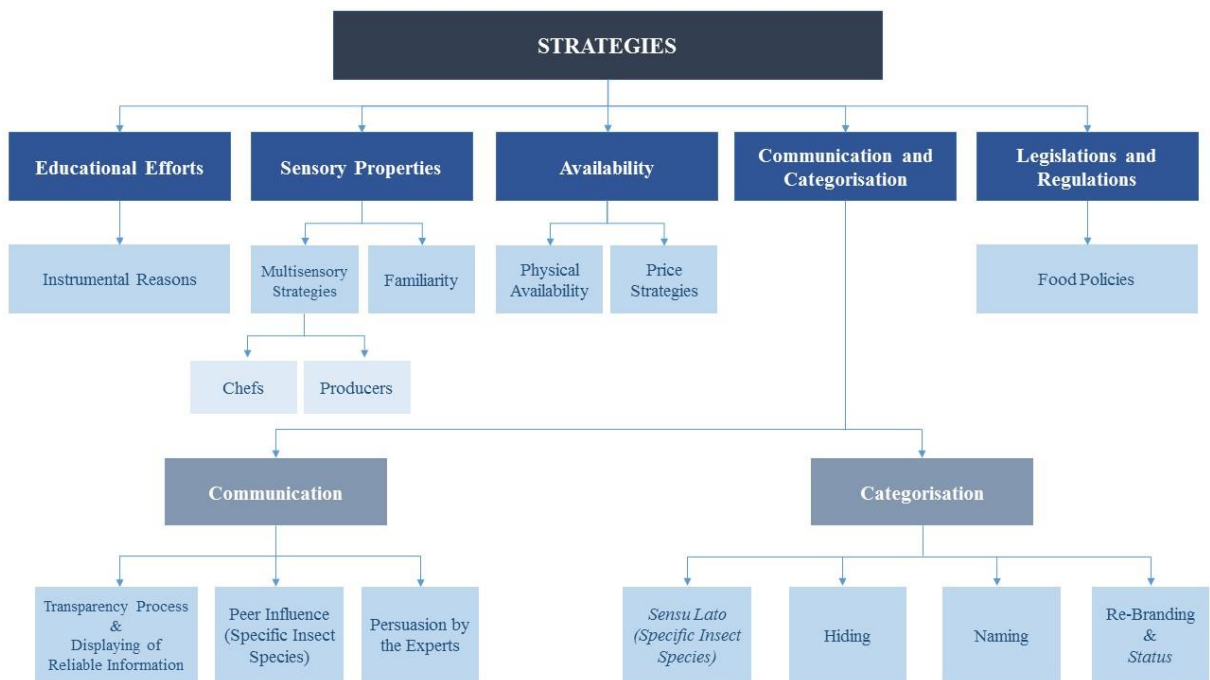
Figure 1 - Map of Barriers



Source: Author's Table

On the other dimension, the diverse strategies were fallen into five categories: *Educational Effects*; *Sensory Properties*; *Availability*; *Communication & Categorisation*; and *Legislation & Regulations*. Likewise, each division is composed of several subtopics (Figure 2).

Figure 2 - Map of Strategies



Source: Author's Table

Therefore, the following chapter will outline the potential of insects as a human food throughout those categories, based on what was commented by the various participants.

5.2.1 Analysis of the General Data

5.2.1.1 Barriers

Within the anthropo-entomophagy universe, a single motivation on insect consumption could be influenced from diverse elements such as the nature of the animal (species), sociocultural representations, the sharpness of how the insect is served, the preparation method, the unconscious feelings, and so forth. Nonetheless, in regards to its barriers it is possible to wrap up into two psychological dynamics: *Culture Identity & Categorisation*.

The cultural representations about the insects' consumption and individual experiences (or lack thereof) are two of the core building blocks of the consumer's acquired distaste (Rozin P. , 1984; Rozin P. , 2002). The diverse interviewees advocated the fact that the culture significantly influences motivations from everyone. This sociocultural barrier provokes an *unconscious disgusting*. An inner revulsion is noticed even before the visual contact with the dish, as mentioned by Chef Rossano Linassi. The simple idea of eating insects, as previously stressed, is one of the main drivers of their disgusting. Besides the negative culture impact that sows confusions, doubts and stereotypes towards insects, the people's experiences (or lack thereof) has a significant impact on food choices. As mentioned in the literature review and again confirmed during the interviews, a *lack of exposure and unreachable information* is a reality today. Dr. Gilberto Schickler mentioned that the Brazilians have never had the opportunity to assist an insect production process, such as the rearing and harvesting techniques; no one has educated them about the nourishment and environmental benefits of the insect; or they have hardly ever seen anyone that is close to them eating insects with pleasure. Furthermore, also society plays a negative role on the people's psyche. From birth, Westerners are enculturated by their societies with diverse beliefs and principles. Values which shape our perceptions and behaviours, and food belongs one of these dimensions (Looy, Dunkel, & Wood, 2014). Dr. Eraldo Medeiros Costa Neto highlighted the fact that the image of insect being harmful to humans has been constantly taught. Our parents have been positioning the word "insect" as something bad and contaminated. Therefore, our perceptions about what is wrong or good, clean or dirty, danger or safe, acceptable or unacceptable is *culturally relative* (Douglas, 2003). This brings us to the second psychological dynamic: *Categorisation*. Because this culture exposure, the repulsion against insects is deeply rooted in people's psyche. When it comes a

novelty, the individual has the tendency to automatically rejected the unknown. Nevertheless, due to illogical associations, numerous inaccurate assumptions are made among different objects or environments. The Westerners moved by an *environmental confound* tends to homogenise the different insect species, and to position them as living in dirty urban environments, being in contact with dirty or dangerous substances (Deroy, Reade, & Spence, 2015), as cited by Dra. Shaiene Gouvêia: “[...] *the idea that insects are dirty is always the first thing people talk about*”. These incoherent associations were visible during several social experiences. Even if the visual presentation or the smell the dish is good, and the participant knows that the hygienic safety of the product was guaranteed, the insect would still be an object of disgust (*magical laws*), as Chef Linassi reported. Moreover, Dr. Casé Oliveira has criticised the *critical commercialisation* that has been applying in our societies. Directly or indirectly movies, television shows, and other medias brings negative assumption, which again affects the people’s imagination, and cultivates those sociocultural barriers towards insects as an everyday food ingredient.

5.2.1.2 Strategies

The strategies to meet the aforementioned barriers could be fallen into two universes: pedagogic & psychological approaches. Besides entomophagy is a fairly new concept in the First World, a significant amount of academic papers has been already published. Dr. Costa Neto believes: “[...] *The greater the scientific dissemination on the subject, the greater the public acceptance*.”. Such experts on the area as Dra. Gouvêa also have been defending that a child education in relation to insect consumption should be implemented such that safety and nutritional value are presented accurately as well as adopting this food habit will bring great environmental benefits.

In case of being solely a cognitive repulsion, *educational efforts* would be sufficient to change negative culture representations. Through pedagogical manners, rich literatures, public lectures, or even educational programmes, those cognitive components might be fully eradicated from the consumers’ mind. Nevertheless, the people’s repulsion is likewise seemed as acquired distaste. This disgust “rooted in the sensory of distaste” (Looy, Dunkel, & Wood, 2014), in addition to cultural issue, comes from the absence of any sensorial contact from the Westerners. Moreover, when individual experience is limited, detailed visual presentation in a food context could play an important role because it provides a concrete representation of the item (Tan, et al., 2015). Therefore, in this sense, the would-be strategies implemented should be lie on a “psychologically realistic motivation and gastronomic interest”, instead of simply persuading

with *instrumental reasons* based on the nutritional and sustainable value (Deroy, Reade, & Spence, 2015). To meet these interests, *multisensory strategies* were many times mentioned as one of the major approaches. The sensorial properties were mentioned particularly often during the interviews as a key element for the development of sustainable and efficient strategies to compete with other appealing foods. It is crucial, especially in the food market, that the quality of the products is guaranteed, so a large amount of receipts should be conceived in order to bring out the best of this product. Due to the extensive number of different species, and the distinctive textures and flavours, there is a myriad of potentialities to develop decent products with distinctive characteristics, which increments value to the product. Additionally, some insects owe particular sensorial characteristic that are not the most appealed ones. Dr. Schickler has commented that the cockroach, for instance, has an unpleasant smell, so through gastronomic tools the smell should be altered. Nonetheless, from the point of view of the interviewees the insects must be prepared in familiar manners.

In regards to the latter one, familiarising the insect dishes is essential to narrow the gap between these animals and people's food habits because it will reduce the negative connotations with other disgusting objects. To do so, Chef Linassi argued a Westernisation of the insect's preparation as a reliable strategy. He is used to adapt the insect's dishes to the Western ones by mixing the whole insect with either a *risotto* or a *yakisoba*, or use it as filling for other foods. The goal here is to reduce the visual barriers by making insects more visually desirable, and meeting the flavours that people are more familiar with. Hiding strategies could be one of the strategies in terms reduce the visual repulsion. The powder of flour made by insects could a feasible solution. Notwithstanding, one of the solutions is indeed the *categorisation* of insects. Both Dr. Gouvêa and Dr. Casé defends to hide the insects as first approach. It was observed that once the insects were not visible in the dish, people's willingness to eat food increased exponentially. After this first barrier was overcome, and the person realised that nothing bad happened to him, the individual would end up eating the whole insect. Therefore, the insect can be served in disguise, however in medium-/long-term strategies the insect has to be served in a clear way so as not to lose its own category.

In addition, because the undifferentiation of insect species and the distinctive attitudes towards each of them, it is fundamental the Westernisation follows a carefully selection of what species should be used as a main ingredient. Not only based on the sensory preferences of each segment, but also its acceptance. Dr. Oliveira may find that during public tasting of insects when people only were willing to eat the cockroach after have tasted other sorts of insects such as cricket or

beetle. Naming was another area mentioned during the interviews related to the insect's categorisation. According to Dr. Costa Neto the name influences the acceptance of the insect. Names as "cockroach" could provoke automatically repulsion.

Once more, the most important thing is to emphasise the flavour of the insect. A gastronomic culture must be taken forward to further expand the idea of insects as food, as argued by Dr. Oliveira. Insect could follow Westernisation's examples such as sushi, however move towards its normalisation. Chef Linassi has stated that insects could be related as the key solution to the problem of world hunger, avoiding the label of "poor food". High prices could be the first strategy to create a status of exclusivity. On the other hand, Dr. Oliveira has defended that an haute cuisine should be avoid as a category of insect because the main goal is to reach the general public, so prices should be significantly reduced. Nonetheless, Dra. Gouvêa along with Dr. Costa Neto have recommended a third option. In order to promote insects for all levels, several alternatives must be adopted, always focusing on the quality of the product. So, either could be created a more premium range in which the category of the insect was based on the quality of the feed or with the different seasonings that are used to add value; or reduce the cost of production and create insects at a standard price without losing the quality of it.

The point is, an *availability* of the product must to be guaranteed, otherwise any strategy will be useless. The normalisation of the insects as an everyday food ingredient must be conducted and only will be possible if the availability of the product would be not only based on an affordable price, but also if it is easy to reach. Dr. Casé shares the view that a popularisation of insects will only be reality if the insects start to be sold in supermarkets or restaurants. The fact that insects are alongside with other regular foods will bring a normalisation of the product mitigating the stereotypes about this food.

In relation to communication strategies, to normalise the everyday entomophagy focus on the insect's quality is the key message that should positioning on the consumer's minds. It was possible to verify in the interviews that the curiosity of the people was aroused whenever presentations were displayed. Not only were the nutritional and environmental values demonstrated, but also the entire production process. People's confidence with the product augments significantly if they have the idea of how insects were bred, treated, and dehydrated. Additionally, it was possible to see that several times during public events some participants have decided to eat insect only after others have done the same. Almost all the presentations have showed images of people eating insects. These factors are not enough to prove this idea, but based on the behaviour of the human being, as we live in community we are subject to be

influenced by the behaviours of those around us, especially when those sharing the same interests, status, and age (*peer influence*).

5.2.2 *Analysis of the Unanticipated Facts*

In the following sub-chapter, it will be discussed the elements that were unexpected at the beginning of the study but still are linked with dimensions already emphasised. These surprised facts belong to the following groups: *Sensory Properties*; and *Legislations & Regulations* (both Barriers and Strategies).

5.2.2.1 *Sensory Properties: Producers*

During the interviews, one of the strategies that was highlighted was the implementations of strategies focus on the maximisation of sensory properties. In this case, this approach tries to meet one of the key objectives settled by the experts – making insects and related species a delicious food. From the theoretical part, it was stated that chefs could be the bridge between an apparently disgusting item to a desirable and delightful food. Through numerous gastronomic techniques along with sauces, herbs, spices, or other ingredients an insect could be a gateway of the prevailing cultural bias by Westerners. Nonetheless, besides quality was referred as fundamental characteristic of the product, the importance of the feed production process on the insect's flavour was not anticipated by the author, until the interviews revealed it. The sensory characteristics of a specific insect is not solely explored during the cooking process. The animal feed could also manipulate the flavour. Hence, *producers* are the second pole of sensorial strategies. Their role is based on create the perfect formula according with final flavour that they aim to achieve. Moreover, in the light to maintain quality safety, producers such as Dra. Gouvêa erased ration based on animal source. That is, plentiful producers use bone- and fish-meals to feed the insects adding a shrimp flavour as the interviewees has commented. Despite the familiar palate, which it was above-mentioned, reduces the resistance of tasting it, the use of any sort of animal powder source could hazard the nature of the product. The food safety is at stake, as the most of the producers do not know the origin of the product, and if it contains any kind of toxins that contaminate the insect. Therefore, Dr. Gouvêa indorses feeding-stuff should comprise solely ingredients of vegetable origin. Plus, with the purpose to make the insect more suitable according with *eater* preferences, Dr. Gouvêa proposes seaweed meal should be use as ingredient in the feed's recipe to add value to the flavour experience in the insect. Lastly, as previously denoted, through the insect's feed

the producer could set which segment the bug will target, as the quality and sensorial value of the product can be managed depending on the type of ingredient used.

5.2.2.2 *Legislation & Regulations – Barriers & Strategies*

The second element comes from the legislative universe. Due to the complexity and scarcity of information about the issue, a further analysis was not possible to be carried out in the literature review chapter. Once the interviews were employed within the Brazilian market landscape, the following discussion will be run under the Brazilian legal framework.

The opinion is unanimous: there is no legislation whatsoever. As of today, there is no regulation of insects for consumption of the human being. In Brazil, there are two governmental identities charged for the food regulations:

- MAPA: *Ministério da Agricultura, Pecuária e Abastecimento* (Ministry of Agriculture, Livestock and Food Supply) – A ministry of the Executive Power of Brazil whose competence is to formulate and implement policies for the development of agribusiness (Ministério da Agricultura Pecuária e Abastecimento, s.d.).
- ANVISA: *Agência Nacional de Vigilância Sanitária* (National Health Surveillance Agency) – It an autarchy under a special regime whose function is to promote the protection of the health of the population through the sanitary control of the production, and consumption of products and services subject to sanitary surveillance (Institucional, s.d.).

Currently the insects for human consumption is in legal “grey zone”, i.e., it is neither legal or illegal. Pursuant to Dr. Costa Neto, the few legislations issued by the Brazilian Government, those were designed to animal consumption. The word “insect” is legally considered as a plague, so it is not possible to transport this product from one state to another, or even outside the country, as Dr. Oliveira has explained. Only when is intended for public experiments, or with the purpose to conserve and maintain the local culture (e.g. *atta* festivals in Ceará) that both MAPA and ANVISA allow the commercialisation of the insect as a human food. Because of the absence of an official regulation there is no supervision and inspection both in the feed and food production process. An official guarantee of food safety is not possible due to the nonexistence of a regulatory body.

Marketing speaking, for the sake of a reliable promotion of insects, it is essential that a governmental body approves these animals as a safe food. Chef Linassi believes if the Government officially ensures that insects are edible food under the law, it will certainly give credibility to the eyes of the population. Notwithstanding, the lack of legislations and

regulations is basically a political issue in accordance to Dr. Gouvêa. Today, these regulations are not a priority for the Government. The current market demand does not justify the adoption of this legislation. Furthermore, Dr. Gouvêa argues because of the lack of knowledge in the area no one knows exactly how to safely produce insects so far. Which means even if there was a motivation from the Government to create such food policies, they do not know from which legal parameters should they base from. Therefore, a strong association of producers and consumers to encourage the government to approve this legislation is needed as well as an extensive investigation about its productive systems.

5.2.3 Analysis of the Other Dimensions with Similar Relevance

The interviewees have unveiled to the author a new category: *Market & Product Dimensions*. Due to the nature of this topic was not conceivable for the author predict it. This dimension was split into four issues: *Weak Production Process*; *Lack of Research & Development*; *Production Costs & Logistic Issues*; and *Lobby & Inexistence Cluster*.

5.2.3.1 Weak Production Process

Even though the participants of the interviews have pinpointed the market and production issues in Brazil, these can also be somewhat widespread in other Western nations. Presently the insect's industry is quite underdeveloped. In accord with Chef Linassi, besides the absence of economies of scale, the productions are still handcrafted and manual. There are still plenty of insect productions without any genetic engineering, without any knowledge of what that insect really needs to eat, and what are the cheapest and most efficient ways of production, as Dr. Schickler further added. A more efficient production process and a greater industrialization are urgent. Also, as mentioned in the sub-chapter before, insects as a potential edible food does not constitutes in the Brazilian Government's agenda. Then, the Government funds are non-existent, which means the private financing are the only monetary source for the investment in this industry.

5.2.3.2 Lack of Research & Development

Continuing the same line of reasoning, there is still a large-scale production to be developed not solely in Brazil, but in the whole Western world. According to Dr. Schickler, besides roughly one third of the world population consumes insects, it is still a weak industry. It might be said breeding and harvesting techniques are fifty years behind, as most are animals collected in nature. Dr. Gouvêa have mentioned the fact that no one, at least in Brazil, knows how to produce insects in the safest methods and conditions. The producers do not know whether the

methods they use is the most appropriate feed. In fact, the feed used by them is practically the same for insects of both human and animal consumption. The lack of studies on insect biology and feed efficiency is the main issue here. This absence of research leads to a limit range of insects available to be prepared in dishes. Chef Linassi emphasised the existence of solely seven to ten species of insects available to be commercialised in Brazil. Not only limits the creativity of the chefs but also it will devalue the potential of other edible insects. Thus, following the same line of Dr. Schickler's thought it is essential great developments in investigation on rearing and production processes.

5.2.3.3 Production Costs & Logistic Issues

The lack of research and development in insect industries brings negative consequences to its production. Dr. Schickler argues that with the advent of new technologies the costs of production will fall and, consequently, the price of the product. Nonetheless, looking at the current situation in Brazil it is possible to verify that an efficient and sustainable insect market is far from being a reality. The demand has raised over the last five/ten years, so a price drop was expected. However, because of an underprepared industry able to answer the market needs, the prices have been raising significantly. Today, the prices applied to insect's products are exorbitated. According to the several interviewees, the relative price of ants, for instance, is over three hundred *reais* per kilo instead of thirty *reais* a kilo of *picanha*. Dr. Oliveira argues that those prices are the worst strategy to achieve the general public. Furthermore, the fact that there is a serious logistical problem in this sector likewise leads to higher production costs. The food supply system is inefficient and time consuming, as Dr. Gouvêa referred. The reason why most of the insects sold currently in the market are dehydrated is due to food storage and transport. Chef Linassi suggested the use of freezing may be an option, but to carry it will be more complicated and expensive. This is another factor that limits the possibilities of creating new flavours, as fresh insects have a completely different flavour and texture compared with the dehydrated ones.

5.2.3.4 Lobby & Inexistent Cluster

On the top of all of this, in countries like Brazil, this business faces a very strong livestock industry. Diverse professionals in the area have sent several proposals to the federal government to allow a possible release of insects for human consumption. But, as Dr. Costa Neto has explained, there is a strong government lobbying in the livestock sector that has been hampered the process of legalising insect production for human consumption.

The other market barrier are the producers themselves. Broadly-speaking, there is no strong cooperation between the producers. A consolidated and official formalised association of producers has not yet been made. A cohesive and dynamic group of producers is still weak, because there is no strong group idea yet. Although this has been developed, and could be very positive in the near future, the reality today is that as much as they have an interest in increasing insect consumption so they can increase production, the producers do not want new people to produce insects. Concerned of losing market share and profitability are main reasons of this behaviour. The producers do not want other people to start a business in the insect sector, afraid that competition will increase, and they would be forced to lower the price. However, a poorly cohesive and unsustainable insect industry for human consumption is the last thing they need at this challenging time. Therefore, a strong and unified group of producers, where there is a free-flow of information, technologies, and worker skills, should be pursued with the purpose to create synergies, and increase their competitiveness against livestock industry.

6. CONCLUSIONS

6.1 Final Conclusion

Within the Western's societies, edible insects as a food choice is a loathed and despicable habit by the majority (DeFoliart, 1999; Huis, et al., 2013; Costa Neto, 2013). For being a novelty, visual similarities and imagination overlap the true reality of the insects' nature (Deroy, Reade, & Spence, 2015). Moreover, due to the lack of exposure and individual experiences with insect-cuisine, people are at the mercy of a strong cultural influence (Tan, et al., 2015). Because of this very reason, people have the tendency to elaborate prejudices in the light of their cultural beliefs (Mignon, 2002; Ramos-Elorduy, 2009; Martins & Pliner, 2005). Notwithstanding, other novelties have surpassed this culture barriers such as sushi (raw fish) or lobster (seafood) (Shelomi, 2015; Townsend, 2011). Bearing this in mind, and considering the high nutritional value of insects and their low environment impact (Huis, et al., 2013), a shift in the Westerners' perception, and thus a change in their eating habits it is not too far from the reality (Huis, et al., 2013).

Over the past years, diverse social experiments have been made in Western countries, often along with traditional-entomophagy societies such as Thailand or Mexico (Tan, et al., 2015; Verneau, et al., 2016; Costa Neto, 2000; Megido, et al., 2013; House, 2016). The results were astounding, and the data retained from them were vital to the advancement of the science of human entomophagy. However, more in-depth studies are demanded in order to reach a full-knowledge of such a complex subject, as it is the consumer behaviour. The nourishment knowledge and its little environmental footprints, compared with other traditional protein-sources, are already well-developed, yet its dissemination is still scarce in more developed countries. The Westerner's eating behaviours towards insects' consumption falls short of the comprehending of the majority. Above all, when it comes to overcome those psycho-cultural barriers, strategies to do so are missing or have been little-tested. To achieve a thorough understanding about social norms it should be necessary educated the general population and "work on the field". That is, as stressed before, education is strong and value tool to change the people's outlook about something, but to get the full-turn, only if the individual's behaviour switch, as well. For this very end, it is essential to create different ways to change their minds. Direct or indirect strategies should be implemented and continually tested until find out any reliable solution. People, by rule, are sceptic when it comes novelty habits, avoiding to cross their comfort zone (Al-Shawaf, Lewis, Alley, & Buss, 2015; Birch, 1999; Martins & Pliner,

2006; Huis, 2013). Hence, keeping spreading human entomophagy as normal eating habit, possibly it will end up by familiarising people with this novel diet, and hereafter accepted as another category of aliment in their food pyramid (Verbeke, 2015; Verneau, et al., 2016; Huis, et al., 2013).

Almost no single novel product is launched to the market without limitations. When it comes changing habits even less so likely. In this case, it is not a simple food choice that is at stake, but negative attitudes rooted in our mind and enculturated by a “confused” society. For that reason, psycho-cultural strategies must to be implemented. These strategies vary in *time* and *objective* (Figure 3). The time is divided into *short-term* and *medium-/long-term*, whereas objective is fallen into *acceptance* and *exploration*. The acceptance encompasses a short-run approach focus on the first sensory experience, while exploration bases on a medium-/long-term adoption of insect as an everyday ingredient. When entomophagy is still a novelty, communication should be the backbone of the psycho-cultural strategies. Communication is one of the key means to raise awareness of eating insects. The negative culture identity must be replaced by the dissemination of accurate information from reliable sources. Nevertheless, it will be pointless if the population is restricted to sensory experience of these foods. In light of this, people must be educated and exposed through contemporary media, and public events or other occasions where they have the opportunity to taste them. Visual features are strong and feasible means to break down the first psychological barriers. People's resilience towards a product is diminished through resemblance to familiar experiences or objects. A careful selection of the insect could likewise prevent negative assumptions. Moved by curiosity, the individual is more prompted to challenge their fears and prejudices when the signs of insects are visually hidden. Furthermore, the attitudes of peers as well as the persuasion of reliable agents constitute an influential driver on the individual's behaviour towards to this very end.

Still regarding to this dimension, the product development is a main role on the final goal – acceptance. The process is mainly driven by two agents: chefs and producers. From one pole, feed formulations must take into account the raw-materials and ingredients used with the purpose to add familiar and palatable flavours to the final product. On the other hand, the use of feasible gastronomic tools through familiar manners will meet, or even exceed, the consumer's expectations.

Figure 3 - Strategy Map



Source: Author's Scheme

Respecting the medium-/long-term approaches, those aim to the product disclosure. In this dimension, the consumer is already familiarised with entomophagy. The essence of the issue comes from persuade the final costumer to adopt insects as an everyday food ingredient. Given the saturation of conventional livestock market alongside with an emerging global hunger, entomophagy could be promoted as a sustainable solution (Gerber, et al., 2013; Huis, et al., 2013). Nonetheless, a paradox comes up: if mini-livestock owes a great benefit for the most needed populations, why this could undermine the image of insects as human source of food? Basically, if entomophagy is considered as poor's habit neither the rich people are amenable to be related with it nor those with less possessions want to be feed by poor's food. Therefore, normalisation is key strategy on launching the product on the market. Insects must find their own categorisation as a regular, healthy, and delightful food rather than a substitute of chicken, or solely hidden in a cake. In the acceptance process of this controversy eating habit will be inevitably jeopardised for being considerable "the future beef" or "the new meat" as several authors have called it (Huis, Gulp, & Dicke, 2015; Huis, 2013; DeFoliart, 1999; Dicke, 2010; Schösler, Boer, & Boersema, 2012; Müller, Evans, Payne, & Roberts, 2016; Verbeke, 2015). To promote the normalcy of entomophagy, insects must to be placed in familiar environments such as on the menus of the restaurants, or in supermarkets alongside other everyday products. Price strategies should be one of the building blocks of insect's categorisation. The goal is to disclose the insects in various segments instead of a particular niche. The price is an important marketing mix tool in which influences directly the brand positioning and status of the product as well as the decision-making of the final costumer. Therefore, there are two paths: sell it in a popular and familiar way, and that by keeping the whole form of the insect, clarify that this is a normal source of food; alternatively, create a premium range of insects in special recipes, in which only they are produced in that place or with special seasonings. Plus, the sort of feed it will have a direct impact on both quality and price of the final product. Lastly, the whole

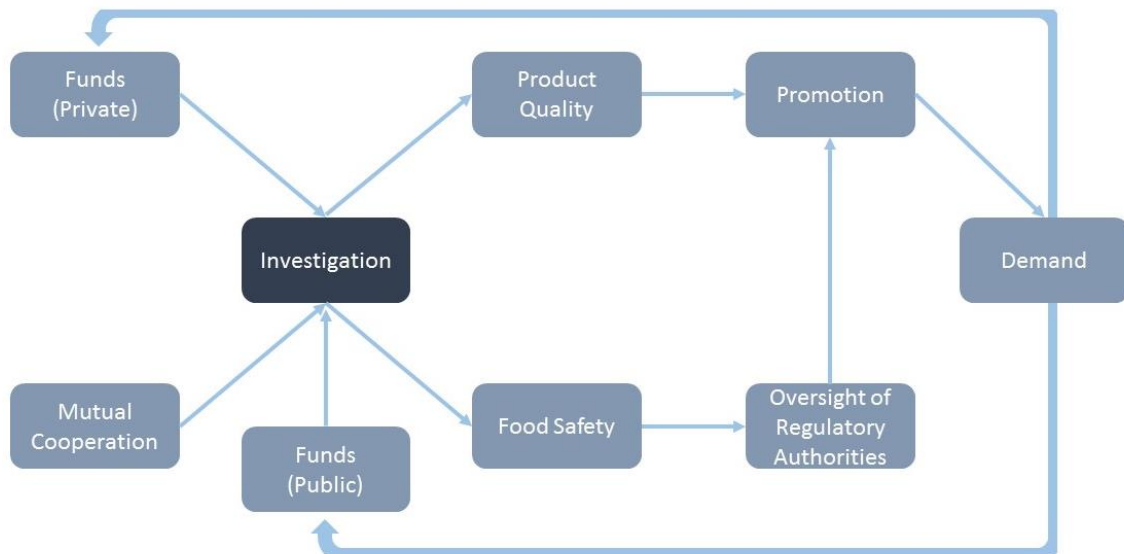
strategy process must be followed by a strong, reachable, and appealing communication in which provides reliable insights about the benefits of the this diet.

Apart from the aforementioned psycho-cultural strategies, another barrier resides on the most Western nations – food policies. This structural barrier comes from the absence of legislations and regulations. At the end of the day, strategies to overcome the psycho-cultural barriers will be fruitless with the current structural barriers. It is counterproductive run approaches towards the insect consumption if the product is not legally available to the final consumer. In order to regulate insect breeding and production it is necessary to have a strong association of producers and consumers that encourages the government to invest in the adoption of legislations. To this very end, the market demand must justify its presence on the government's agenda, and further investigation must be conducted to laid down monitoring parameters applied by regulatory bodies.

6.2 Conclusion Recommended to Brazil

In accordance to the insights gathered during the interviews along with the theoretical knowledge underpinned by the literatures, the present author has created a strategy model (Figure 4).

Figure 4 - Overview of the Final Strategy

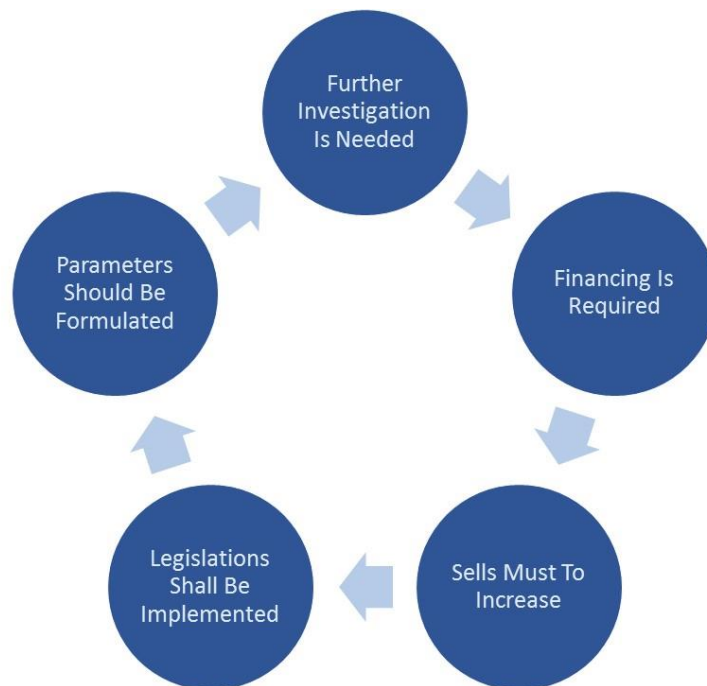


Source: Author's Scheme

The root of the problem stems from the lack of investigation. In order to develop a quality product, techniques and methods are advanced through research and studies. Strong financial investment and mutual cooperation among the various actors in the area are the pillars supporting a solid investigation. Broadly-speaking, the problem comes from the inexistence of a mutual cooperation due to the fear of increasing competitiveness, so that current producers lose market share. Information and knowledge have been lost or poorly developed, although a producer association has been developed, and can be very positive in the future. Moreover, because of the great difficulty of accessing public funds, the business is heavily dependent on funds from private identities. This last factor is due to this agricultural activity has not yet been legalised. Both the feed and food insect production are not subject to neither regulations nor inspections by regulatory bodies. The insect industry is not yet a priority on the part of the government due to its size and relevance. Plus, the lack of knowledge about insect food safety has been a deadlock in the development of sanitary surveillance measures. In regards to this latter aspect, the production methods of feeding and rearing insects have been strongly based

on the livestock sector. The reduce amount of studies on insect biology and feed efficiency, farmers and producers do not know whether the feed they use is the most appropriate one for each type of insect. Therefore, the current situation has a snowball effect: parameters must to be established in order to be legalised the activity; to define those requirements further investigation must be conducted; fund is required for this end; so, the market demand should growth to attract financing; nevertheless, this growth is compromised by the legislation (*Figure 5*).

Figure 5 - Snowball Effect of the Market



Source: Author's Scheme

Once there is a greater injection of capital together with a full cooperation of all the agents, a thoroughly and solid investigation can be carried out. From the results of several studies and research the quality of the product can be developed as much as its food safety. With the knowledge regards to production and conservation methods that ensure insect food safety, these can be used as a basis for the creation of requirements for the inspection of good practices for installation and operation, and basic criteria for effective sanitary surveillance. This will lead the government to regulate and legalise the agricultural activity in question which will bring greater credibility to the product. Along with the promotional techniques discussed above will lead to an increase in demand. Consequently, there will be a growth and appreciation of the market, which will attract more investment, both private and public. In addition, it will increase competitiveness in the industry, which will lead to a decrease in price and a product

improvement. In the end, these investments will be directed towards research and development, which will thus increase the quality and value of insects as a product of human consumption.

7. RECOMMENDATIONS & GENERAL LIMITATIONS

The present master thesis has aimed to understand more deeply the senses involved in the phenomenon of entomophagy. An explanatory research was conducted to identify the barriers to the introducing of insects into the Western diets, and which potential psycho-cultural strategies to overcome them. Diverse experts and professionals on the area have contributed with diverse insights about entomophagy. Biological, management, gastronomic, legislative, marketing, and sociological were the most relevant topics dealt and discussed during the interviews. The contextualisation of the discussion was mostly in Brazil but generalised to the Western societies. For this same reason, sociocultural elements may vary in other Western countries. In fact, within the Western society there are distinct nations with different behaviours and beliefs. Therefore, the conclusions of this paper are generalised within a Western context, and thus should not be fully applied to a specific society.

Considering the timeframe as another limitation, the author has conducted a theoretical study. Hence, in the light of the conclusions of this research, it would be interesting to pursue a practical consumer behaviour study whereby social experiences would be conducted and new psycho-cultural insights unveiled.

In regards to the current legislation in Brazil, in case of no polite change regarding to the legislation of human consumption of insects, it would be also interesting switch the segment focus to the international market. A worldwide trend in insect consumption has been noted, so with markets outside Brazil emerging, insect producers could shift their strategy to the public abroad. In addition, being the producer responsible for the product solely until the border, the insect could be sold as with the label "for animal consumption" , and thus avoid any regulatory interference.

8. GLOSSARY

- **Anthropo-entomophagy** – It is the new term used to describe the human consumption of insects and the insect made products. This term was coined by Costa-Neto and Ramos-Elorduy (2006) to better demarcate the human use of insects as food, since other animals, including insects themselves, also feed on these organisms (Costa Neto, 2015).
- **Brigadeiro** – It is a common Brazilian delicacy. The brigadeiro is sweet-bakery made from condensed milk, cocoa powder, butter and chocolate sprinkles to cover the outside layer.
- **Competent Eater** – A combination of consumers' knowledge, experience, attitude, and responsibilities to practice in the wisest manner the adoption of healthy eating habits toward their own benefit and well-being.
- **Dairy Products** – Dairy products or milk products are a type of food produced from or containing the milk of mammals, primarily cattle, water buffaloes, goats, sheep, and camels. Dairy products include food items like yogurt, cheese, and butter.
- **The Eater** – A term created by Claude Fischler to replace “consumer” as traditional definition to who are food consumers. He defends that the act of eating is a very particular form of consumption. The ordinary products the individuals consume normally are symbols of distinction and status, whereas eating is a very special type of consumption because food is introduced into your body and becomes part of it. The all nutritional values and components that compose the food ingested transform into our own body. Moreover, the act of eating is a very particular habit, nothing is so vital and so intimate. By ingesting food, they arrive at the innermost of each other. Unlike clothing, which only is in contact with the body, food becomes an intimate substance, it becomes the body itself (Goldenberg, 2011).
- **Entomophagy** – Human consumption of insects.
- **Feed-Conversion Efficiency** – An animal’s capacity to convert feed mass into increased body mass, represented as kg of feed per kg of weight gain.
- **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 Plan of Action, n°1).

- **Greenhouse Gas (GHG)** – Gas that absorbs and emits radiation within the thermal infrared range.
- **Homophilious** – Homophilous comes from the word homophily and it means people have similar interests, and associate and bond with similar others.
- **Instrumental Reasons** – The use of reason as an instrument for determining the best or most efficient means to achieve a given end.
- **Mini-livestock** – Domesticated, small animals, including arthropods, reared as food and feed.
- **Neophobic** – An individual who is sceptical, or even afraid, to try and/or have new experiences.
- **Nutritional Value** – The nutritive value depends on several factors: protein content, which varies widely among all foods; protein quality, which depends on the kind of amino acids present (essential or nonessential) and whether the quality complies with human needs; and protein digestibility, which refers to the digestibility of the amino acids present in the food. Amino acids are the building blocks required for the biosynthesis of all proteins through human metabolism to ensure proper growth, development, and maintenance. Essential amino acids are indispensable because the body cannot synthesize them and so must obtain them through food. Eight amino acids are classified as essential: phenylalanine, valine, threonine, tryptophan, isoleucine, methionine, leucine, and lysine.
- **Pé-de-Moleque** – “*Pé-de-Moleque*” is the Brazilian name to call “Brittle”. Brittle is a type of confection consisting of flat broken pieces of hard sugar candy embedded with nuts such as pecans, almonds, or peanuts.
- **Peer Influence** – It is a social pressure that influences people, or an individual who gets encouraged to follow others by changing their attitudes, values, or behaviours to conform to those of the influencing group or individual.
- **Picanha** - It is a cut of beef and it is popular in Brazil.
- **Reais** - The present-day currency of Brazil.
- **Risotto** – It is a northern Italian rice dish cooked in a broth to a creamy consistency.
- **Sensu Lato** – It is a Latin expression to describe "in the wide or broad sense".
- **Sustainability** – ability to maintain productivity without compromising the needs of future generations.

- **Sustainable Diets** – Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally accepted, accessible, economically fair, and affordable; nutritional adequate, safe, and healthy; while optimizing natural and human resources. (FAO, 2010b).
- **Push-Strategy** – A push promotional strategy involves taking the product directly to the customer via whatever means, ensuring the customer is aware of your brand at the point of purchase. - "Taking the product to the customer"
- **Virtual Water** – The concept of ‘virtual water’ indicates that in a reasonably safe and interdependent world, gains in water productivity can be achieved by growing crops in places where climate enables high water productivity at lower cost and trading them to places with lower water productivity (Winpenny, Burke, Faurès, Hoogeveen, & Steduto, 2012).
- **Western Society** – Western Society, or called as European civilization, is a term used very broadly to refer to a heritage of social norms, ethical values, traditional customs, belief systems, political systems, and specific artefacts and technologies that have some origin or association with Europe.
- **Westerners** – Westerners are the people who comes from to the Western European cultures, and nations derived from them such as United States of America (USA), Australia or Brazil.
- **Yakisoba** – Yakisoba noodles are made from wheat flour, and literally means "fried buckwheat". It is a typical food in Japan, however it is a product consumed worldwide.

9. BIBLIOGRAPHY

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