Consumer acceptance of edible insects

A value proposition development for the case of an entomology-based venture

Laura Capponi - 911204155030

Supervisor: Valentina Materia
Management Studies Group
Wageningen University, January 2016

Co-supervisor: Anita Linnemann
Food Quality and Design Group

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Abstract

Jumping Jack Snacks is an entomology-based venture, founded in 2015 and still in its seed stage. With the desire to scale up production, the start-up wants to create a thorough value proposition based on the significantly accepted attributes and multisensory characteristics for its products to be appealing to consumers. It is important to match the most appropriate type of product with the right set of brand values. Therefore, this study intends to determine what are the significantly accepted product attributes and to advise the *Jumping Jack* team on its value proposition strategy.

After a preliminary desk search, a two-step study was carried out amongst European consumers. In-depth laddering interviews were followed by a quantitative survey, allowing discrimination between advantages and disadvantages of a product-set and the understanding of consumer acceptance dynamics. Food Choice Motives questionnaire and Food Neophobia Scale were applied.

Visibility, sweetness, perceived healthiness, sensorial attractiveness of the matrix and convenience are all attributes and benefits to be taken into account. Two potential strategies for value creation emerged from the study: one is rationally-oriented, with a focus on healthy and balanced snacks rich in proteins; the other is a sensory strategy, focused on tasty treats being indulgent, highly attractive and with the unconventional, adventurous twist of insects. For both options it is important to use only flour and not visible insects, thus maximizing acceptance of neophobic consumers.

Jumping Jack Snacks should pursue the sensory strategy, but after basing the final decision on the additional variables of its business model.

Keywords: edible insects, radical innovation, entrepreneurship, consumer driven new product development, food neophobia, food choice motives

Executive Summary

Nowadays a new generation of chefs, farmers and sustainability experts is embracing the thought that insects belong to the future of food. In fact, a considerable number of start-ups, from the USA to Europe, are taking chances and exploring the opportunities brought to the fore by entomophagy.

Jumping Jack Snacks is one of these several entomology-based ventures. Founded in April 2015 and located in the Netherlands, the company saw a consistent market opportunity and the potential of insects as a wholesome snack. However, having the desire to scale up production, it is necessary to create a thorough value proposition and to understand what are the suitable attributes and multisensory characteristics for the product to be appealing to consumers. Furthermore, it is important to match the most appropriate type of product with the right set of brand values. The aim of this study is therefore to determine which are the significantly accepted attributes and advise the *Jumping Jack* team over its value proposition strategy.

After a preliminary desk search on the state of the art of edible insects, novel foods and consumer driven product development, a two-step study was carried out amongst European consumers. First of all, a qualitative analysis carried out through in-depth laddering interviews provided a profound insight on the matter and helped in developing a questionnaire. Secondly, a quantitative factor analysis allowed the researcher to discriminate between advantages and disadvantages of a product-set and understand the dynamics of consumer acceptance. The survey was conducted by applying factor analysis over a selected range of attributes from the Food Choice Motives questionnaire and by segmenting consumers through the Food Neophobia Scale. Lastly, recommendations on how to design the Value Proposition Canvas were formulated.

The laddering interviews confirmed most of the attributes retrieved from literature, while adding new ones on the basis of which it was possible to discriminate and develop a product-set. Taking into account the information obtained from the state of the art and the in-depth interviews, products were differentiated based on: the degree of healthiness and indulgence, visibility of edible insects, the type of insects, savoury/sweetness, convenience and handiness. The five selected items were: chocolate chip cookies, a granola bar, tortilla chips, a protein milkshake and a chocolate candy topped with a gold-coated cricket.

Some defined patterns emerged already during the qualitative interviews, such as the innate preference for more familiar products like cookies and granola bars. Visibility, sweetness, perceived healthiness, the sensorial attractiveness of the matrix, as well as convenience are all

attributes and benefits to be taken into account when developing the value proposition. Two potential strategies for value creation emerged from the study: one is more of a rational strategy, with a focus on healthy and balanced snacks rich in proteins; the other is a sensory strategy, focused on tasty treats that are indulgent, highly attractive and with the unconventional, adventurous twist of insects. For both options it is important to carry on the hiding strategy, e.g. using only flour and not visible insects, with the aim to maximize acceptance of neophobic consumers.

Jumping Jack Snacks should promptly decide for one strategy or the other and make an informed decision based on the additional key variables of its business model. In fact, the Value Proposition Canvas is only the first step for constructing a thorough business strategy and the final decision has to be made considering the whole framework of the Business Model Canvas. Either way, the firm cannot keep on using the granola bar while promoting a sensory strategy based on indulgence, but should rather separate the two elements and choose one or the other. Moreover, according to the state of the art, rational proofs usually barely work to drive food choices of existing products, not to mention novel food products. Sensory strategies are needed to promote a shift in the paradigm and the key is to convince consumers of insects' hedonic characteristics and social acceptability. Furthermore, both the focus and the expertise of the start-up are heading towards hedonic consumers.

The *Jumping Jack* team should therefore carry on its current hedonic strategy and create a brand image and a product mix based on indulgence, uniqueness and adventurousness. This approach has a higher potential to succeed and can be the perfect icebreaker to get Europeans familiarized with edible insects.

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1. Introduction

1.1 Background and selected problem

Nowadays a new generation of chefs, farmers and sustainability experts is embracing the thought that insects belong to the future of food. In fact, edible insects are thought of as a sustainable source of protein, due to their low requirements of feed, water and land.

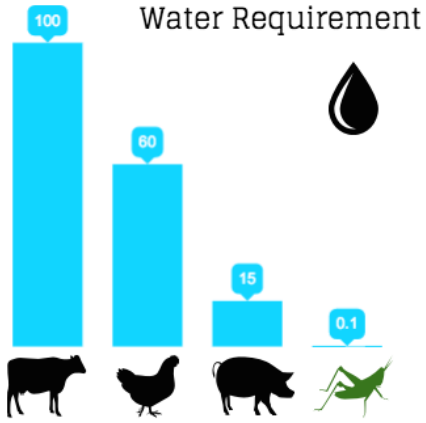

Figure 1: Water requirements of livestock

Insects do have a high feed-conversion rate (van Huis, 2013), so much that crickets can convert feed mass into increased body mass much more efficiently than cattle (namely sixfold), poultry or pigs (more precisely, twice as high). Furthermore, edible insects can be reared on organic side streams, adding value to waste while reducing environmental contamination. The same goes for the water requirement, a key determinant of land productivity (figure 1). One kg of beef does in fact require 22,000 litres of water, in the best-case scenario, compared with the single litre needed for rearing 1 kg of crickets. Lastly, insects emit 80 percent less methane than cattle (figure 2) and provide twice as much protein as chicken and beef (Chemnitz et al., 2014).

Another benefit to keep in mind when considering edible insects is their outstanding nutritional profile, due to the presence of proteins, unsaturated fats and fibre. Insects are also rich in lysine, threonine and tryptophan amino acids (Bukkens, 2005), as well as in micronutrients, such as iron, zinc, calcium and vitamins. They are also particularly rich in chitin, an insoluble fibre derived from their exoskeleton, which has been found to improve immune responses in humans and decrease allergies (Goodman, 1989).

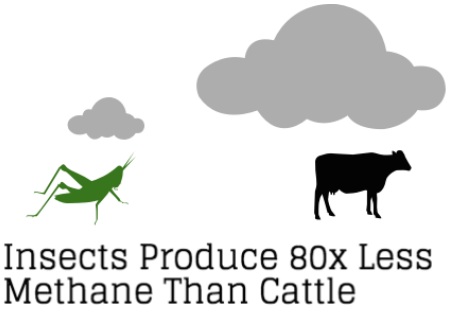

Figure 2: Insects and sustainability

Entomophagy is uncommon only in Western societies, as already 80% of the world considers insects as part of its diet. However, insect harvesting has been associated with the hunter-gatherer era and therefore thought of as something primitive (van Huis, 2013). The average assumption is that even those remote primitive tribes consume insects only as a last resort, and many more other common myths stand around this practice.

Are these arguments sufficient to drive a change through the European diet yet? Sustainability, nutrition and exemplarity are all rational proofs, which usually barely work to drive food choices of existing products. Therefore, how could they thus drive consumers acceptance of a novel food? The Westernized world seems to be largely averse to the practice of eating insects, which usually evokes disgust and phobia in the minds of consumers. However, policy-makers do not seem to take such dynamics into account. Introducing insects in the Western market is indeed a challenge that big corporations seem not to be interested in at the moment. It is a venture involving the introduction of a radical innovation on the food market, rather than an incremental one. Industry leaders simply cannot afford to embrace radical change, as being the first mover usually brings more cons than pros (Stringer, 2000). This is truly an issue of organizational culture. On the contrary, a considerable number of start-ups, from the USA to Europe, are taking chances and exploring those opportunities brought to the fore by entomophagy.

1.2 The case of Jumping Jack Snacks

Jumping Jack Snacks is one of the several entomology-based ventures that have been undertaken in the last few years. Founded in April 2015 and located in the Netherlands, the company was established by two master students of Wageningen University. The start-up saw a consistent market opportunity and the potentials of insects as a wholesome snack. The idea was to find ways to prepare insects (specifically crickets and mealworms) as an appealing gastronomic item to today's European consumers, starting from the Dutch market.

The first concept the *Jumping Jack* team came up with was a granola bar with insect flour. However, when selling directly to consumers, the product mix was enriched by more indulgent sweets, such as cookies, brownies and candies. Therefore, the focus shifted to tasty, delicious bakery products having an adventurous twist, as the beachhead target market consisted of Dutch foodies attending Food Festivals. This segment is an economically well-disposed generation of eaters, usually looking for their fixes in new, atypical eats and getting a thrill from consuming both ethically and ethnically. The fact that foodies are open-minded, curious and eager to experiment is a clear indicator to marketers that this is a willing audience for product launches (Packaged Facts, 2009). Furthermore, the expected audience of the Food Festivals in the Netherlands amounts to approximately 80,000 people per year (Van Loon, 2013). However, the start-up doubts whether to keep the granola bar in the product mix, since it could clash with the current hedonic approach. On the other hand, the healthy sector looks really attractive and rich in opportunities, with the rise of protein-rich supplements targeting fitness enthusiasts.

The next challenge therefore is to shift the choice decisively in one direction and to create a more thorough value proposition, able to attract the next target market. In fact, it is important for the firm to clarify and articulate which are the compelling reasons why consumers should buy an insect-food product. Which benefits and added values does the company need to deliver? How to create the belief in the customer that such value will be delivered and experienced? Foodies are adventurous eaters by definition and the perfect early adopters, but what about the less neophilic consumers? With the desire to scale up production, it is necessary to understand what will be the suitable attributes and multisensory characteristics able to make the product appealing to neophobic consumers as well. Furthermore, it is important to match the most appropriate type of product with the right set of brand values. The aim of this study is therefore to determine what are the significantly accepted product attributes and develop a value proposition strategy through consumer driven new product development.

2. Literature

2.1 Edible insects and the state of the art

It goes without saying that reluctance to eat insects in many modern societies is a strong barrier against the commercialization of insect-containing food products. It can be argued that entomophagy is a "failed diffusion" (Shelomi, 2015), since its adoption never reached or approached universal acceptance in its target population (Rogers, 2003). This barrier is mainly triggered by a cultural representation, according to which insects cause either fear (of dirt and diseases) or curiosity (Yen, 2009). Furthermore, the disgust factor is deeply embedded in the Western psyche, since insects are mainly viewed as pests, no matter how great the amount of literature underlying their nutritional and sustainable features (van Huis et al., 2013). This could be partly explained by the lack of exposure to the taste, flavour, visual and tactile sensations of edible insects (Deroy et al., 2015) together with the geographical availability of other proteinaceous sources of food, such as cattle, pigs and poultry (Harris, 1999).

The lack of knowledge and exposure can only raise the levels of fear and misconception towards entomophagy. For instance, the naïve categorization of insects implies a group including even spiders, lizards, scorpions, as well as snakes and bats (Costa-Neto, 2000). Fortunately, the mass media and the institutions in Europe are increasingly focusing on the subject. Until the harmonization of the European regulatory framework, some Member States decided to self-regulate their internal markets. For instance, on 15 October 2014 the Dutch Office for Risk Assessment and Research stated that three kinds of insects could be produced and sold in the Netherlands, namely two kinds of mealworms and crickets. Likewise other countries, such as Belgium, France, UK and Denmark, are self-regulating the commercialization of edible insects.

In 2010, the United Nations' Food and Agriculture Organization (FAO) published a report on the importance of edible insects; however, it largely failed in convincing European and American consumers to change their habits. On the other hand, TV shows negatively portrayed the insect-eating experience. For instance, looking at the Netherlands, based on the results of a focus group (Tan et al., 2015), most of the Dutch participants gained their awareness from special events, travels and TV. When divided amongst eaters (respondents that ate edible insects at least once) and non-eaters (respondents that never tried them), the former had the chance to taste insects once or twice during these events and during their travels, whereas Dutch non-eaters had never tasted insects before, but had gained awareness of the topic mainly through the same events and the mass media. While the exposure to the concept of edible insects is growing day by day in the Netherlands, Dutch consumers (as well as European

consumers in general) do not have a strong cultural basis to understand them as a gastronomic item. In fact, when asked about preparation methods, taste and flavour, or the distinction between edible and inedible insects, consumers have barely any capability to discriminate at the moment (Tan et al., 2015).

Despite the lack of cultural exposure, in recent years European consumers have been offered plenty of reasons to consider the eating of insects, such as novelty, environmental and health benefits. For instance, insects have already been introduced in Dutch supermarkets as a sustainable alternative to meat. In fact, most of the scientific literature on the topic regards insects as a meat replacer. It is a logical conclusion, if the premises are that insects are a sustainable source of protein first of all and should therefore be eaten by Western consumers instead of beef, poultry and pork.

Are meat substitutes of any appeal to new consumers? What does it take to increase their consumption? The main key barriers are unfamiliarity and the lower sensory attractiveness, no matter if it arises from insects or plant-based ingredients (Hoek et al., 2011). Although meat lovers understand the ethical and health-related aspects of meat replacers, these reasons are not relevant enough to make the shift happen. The main focus of communication strategies is on rational and ethical arguments, but what should rather be improved is the resemblance to meat itself, together with the sensorial properties. Lastly, familiarity is the key when it comes to acceptance, in particular in the neophobic subjects: the individual level of food neophobia affects the degree of acceptance of novel products, equally before and after tasting (Henriques et al., 2009; Pliner et al., 1998). The logical failure lies in understanding the mind-set of hedonistically motivated meat consumers, who would rather cut their rations than substitute meat with its analogues. If policy-makers keep on proposing insects under the category of animal protein, just because of their high protein content, the wrong representation will be created in the mind of consumers, with high expectations of visual appearance, smell, texture and the flavour of meat (Deroy et al., 2015), all of which might be not easy to achieve with edible insects (Harrison-Dunn, 2014).

It is a matter of appropriateness and categorization: in order for a novel product to be accepted by the market, it has to belong to the most appropriate category, i.e. the one able to make sense in the mind of product buyers (Loken et al., 2008). For instance, Dutch people traditionally eat meat as a main course, although, in the last few years, pasta and rice dishes with meat sauces have become more and more attractive (Schösler et al., 2012). It has been suggested that meat substitutes might be more successful as additional ingredients in the context of a meal, rather than as a separate, individual meal component (Aiking, 2006). The

same could be true for edible insects. In fact, in a cross-cultural study between Germany and China, results revealed that Germans are more willing to eat processed insect-based food when integrated with other ingredients in a meal context, in comparison with unprocessed insects (Hartmann et al., 2015).

When considering other cultures, protein-rich species such as grasshoppers and locusts were no part of the dietary pattern of aborigines and other populations now integrating insects in their diets (Deroy et al., 2015). In some cases, such as that of the Australian Aboriginal hunter-gatherers, the preferred insect species are associated with sweet food, fruits, and are integrated mainly for their fat content (O'Dea et al., 1991). On the contrary, in the milieu of the Thai culture insects are more properly prepared in a savoury rather than a sweet manner (Tan et al., 2015). However, when it comes to Western culture consumers are keener to try sweet varieties of insect-based food, because of humans' innate preference for sweet taste (Drewnowski, 1997).

This is not only is a matter of categorization, but also one of presentation. Visualization is indeed a big issue for consumers' acceptance, creating concerns and leading them to rejection due to disgust and/or neophobia. It could dampen the market acceptance and value creation potentiality of insect-based food products. For instance, consumers prefer and are willing to pay a premium price for insect-based products with a nutritional health claim, but they are not willing to pay for a product with a visualized insect (de-Magistris et al., 2015). The hiding strategy could therefore be a winner. Belgian consumers were more ready to accept insects into a familiar context, together with known flavours and when they were not visible (Megido et al., 2013). On the other hand, hiding could communicate a lack of transparency and a loss of distinctiveness and differentiation between the different kinds of insects (Deroy et al., 2015).

Sensory strategies, rather than rational ones, are needed to promote a shift in this paradigm. An example could be to understand the most appropriate plating technique, as used in fine dining (Spence et al., 2014). The downfall of this approach is that it relegates insects to Michelin-starred restaurants, making them far from being a consumer good. However, when it comes to consumer products, an advertisement of insects as a food source solely based on its nutritive advantages is unlikely to be effective, while convincing consumers of hedonic characteristics and social acceptability could be the winning strategy (Hartmann et al., 2015). Furthermore, processed insects-based foods could reduce neophobic reactions, when introduced in a familiar product category or flavour profile, therefore leading to a higher willingness to eat.

Nonetheless, when it comes to mass consumption products, consumers often struggle in evaluating major innovations, not having a clear mental picture of which needs the new products could fulfil. It all depends on the previous information and the visibility of the attributes. In the case of entomophagy, this attitude clearly emerges during the previously mentioned focus groups with Dutch participants (Tan et al., 2015). While barriers to consumption are deeply rooted, the same cannot be stated for the values associated with edible insects.

However, the relevant literature is fairly limited at the moment and given the limited sample size it is not possible to speculate about general population attitudes. In particular, the focus is not wide enough to cover all of Europe. The majority of the qualitative studies are carried among Dutch, Belgian and German consumers, or in cross-cultural contexts with Asian populations. Quantitative research is therefore needed in order to understand consumer expectations, attitude and paradigms of acceptance.

2.2 Entrepreneurship, radical innovation and consumers' voice

Start-ups might play an important role in the widespread acceptance of entomophagy, being the perfect cradle for creativity and lacking organizational culture boundaries. Venture creation and innovations follow a similar pattern, starting from an idea followed by its comprehensive assessment (de-Magistris et al., 2015).

Edible insects can be called a radical innovation, being "new to the world" and not a mainstream product on the European markets (Bessant & Tidd, 2007). Therefore, in the case of entomology-based enterprises, the new venture creation has to be contextualized within the field of radical innovation, thus raising the chances of failure.

In fact, if the most optimistic estimate of failure rate for new ventures is around 46% (Timmons & Spinelli, 2009), when it comes to food introductions on the market two out of three new products never live to see their second year on the shelves (ECR Europe, 1999). Furthermore, 72% of true new products and 55% of line extensions fail (Lord, 2000). Always according to Lord (2000), non-leading, smaller companies introduced up to 14,298 products and had only 12% success rate. Lately, in order to improve the chances of success, the traditional cook-and-look approach has been replaced with structured methodologies (Linnemann et al., 2006), which are more commonly used by bigger companies.

In order to remove any degree of uncertainty a full commitment to research and development is needed. Particularly when it comes to food, large attention to product design and features is necessary. Most start-ups use a circular trial-and-error process to create solutions: figure 3 shows how the radical innovation development model has an hourglass shape, expressing its iterative and circular nature (Griffin et al., 2014). The circularity of the process is able to overcome some of the organizational barriers to radical innovation: entrepreneurs keep going through feedback loops until they are

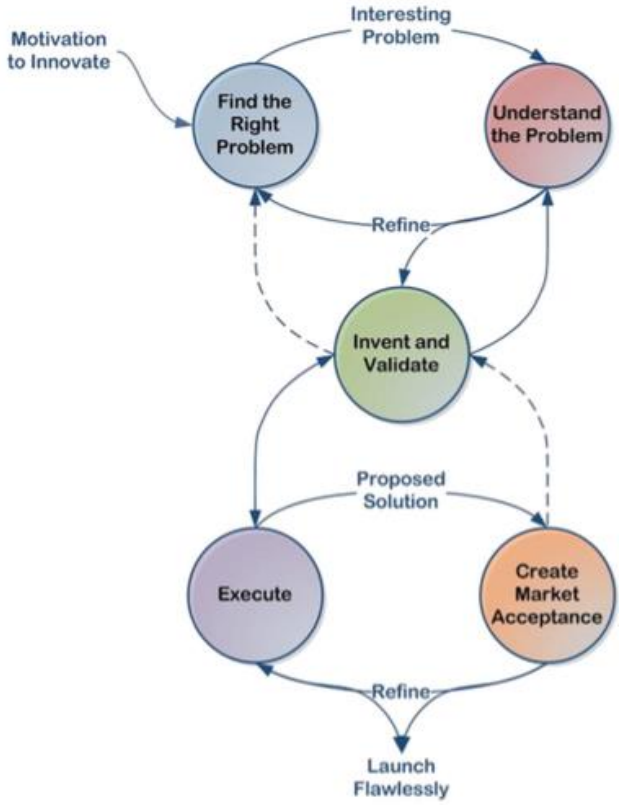

Figure 3: The hourglass model of how serial innovators innovate

convinced of having a potentially successful product. As already mentioned elsewhere, alongside with the trial-and-error techniques, more structured methodologies, based on consumer wishes, have been developed.

Successful product development means also building the right set of cues that consumers can use to infer the presence of quality (Grunert, 2007). For instance, intrinsic quality cues refer to physical characteristics of the product, while extrinsic quality cues refer to the price of the product, the store in which the product is bought, advertising claims about the product and the brand (Grunert, 2002). Therefore incorporating and integrating the voice of the consumer in the early stage has been identified as a critical success factor: even though it might be difficult for consumers to vocalize their needs and wishes, it is important to understand how they perceive products, shape their needs and make food choices (van Kleef et al., 2005).

2.3 Consumer driven product development and value propositions

Consumers truly are at the heart of the Business Model Canvas (figure 4), a strategic management and lean start-up tool to describe how an organization creates, delivers and captures value (Osterwalder et al., 2014).

This template defines a business model as made of the following nine building blocks: Value propositions; Customer segments; Channels; Customer relationship; Revenue streams; Key partners; Key activities; Key resources; Cost structure; Profit.

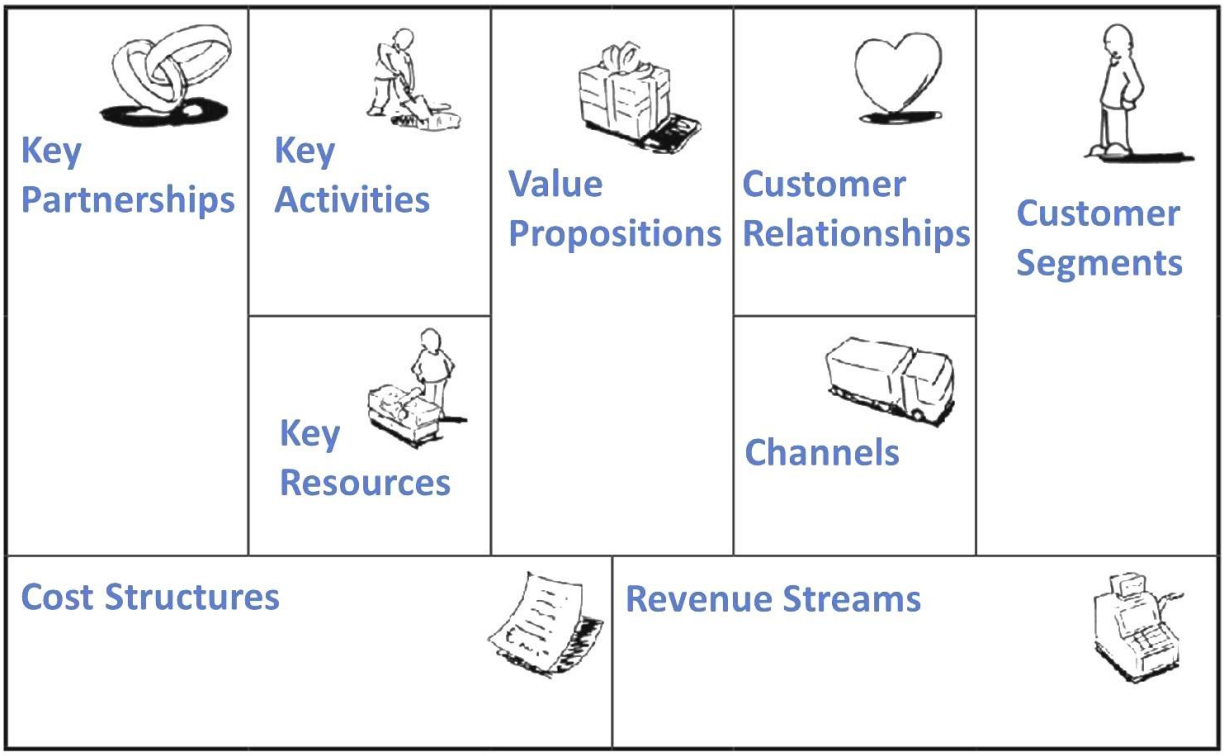

Figure 4: The Business Model Canvas

In particular, the value propositions building block describes the bundle of products and services that create value for a specific customer segment.

The Value Proposition Canvas (figure 5) can be thought of as a plug-in to the Business Model Canvas: it allows entrepreneurs to zoom into the details of how to create value for customers.

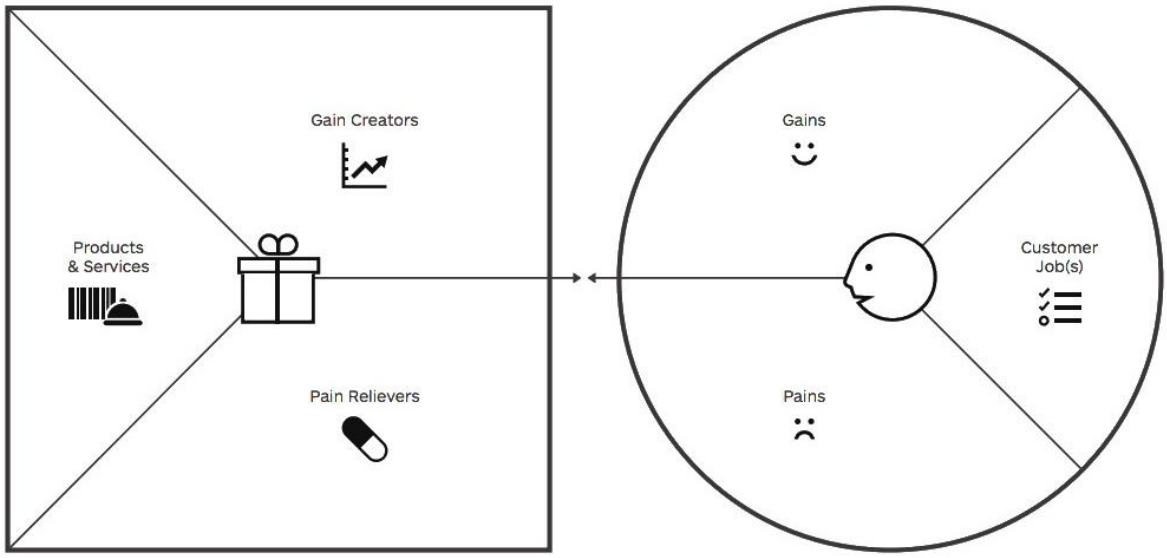

Figure 5: The Value Proposition Canvas

The Value Map (on the left) describes the features of a specific value proposition in a structured and detailed way, breaking the value proposition down into products and services, pain relievers and gain creators. At the same time, the Customer Profile (on the right) describes a specific consumer segment, breaking the customer down into jobs, pains and gains. A perfect fit is achieved once the Value Map meets the Customer Profile, namely when products and services produce pain relievers and gain creators that match one or more of the jobs, pains and gains that are important to the customer (Osterwalder et al., 2014).

Therefore it becomes necessary for the entrepreneur to understand the customer mind-set and attitude, taking an informed decision when it comes to the value proposition. Quantitative research is thus needed, in order to understand consumer expectations and eating behaviour in relation to snacks and edible insects. Formal assessments and psychological measures are necessary, such as the Food Neophobia Scale (Pliner & Hobden, 1992) and the Food Choice Questionnaire (Steptoe et al., 1995).

Food Neophobia is defined as the reluctance to eat and/or the avoidance of novel food and was theorized by Pliner and Hobden (1992) as an individual attitudinal trait that can be measured quantitatively through a 10-item test called the Food Neophobia Scale or FNS (figure 6). The scale uses five positively worded and five negatively worded statements, which are measured on a 7-point scale that ranges from strongly disagree to strongly agree. The negative items are reversed, so that lower FNS scores reflect greater reluctance to try novel foods. The Food

Neophobia Scale plays a crucial role in consumer segmentation, making a sharp distinction between neophobic and neophilic consumers. It helps to identify, in accordance with that consumer's level of neophobia, the product attributes and benefits that are key for acceptance, as in general the success of a new product depends on the degree to which it provides benefits sought by consumers (Barrena & Sanchez, 2013).

Food Neophobia Scale (FNS)	I am constantly sampling new and different foods.
	I don't trust new foods.
	If I don't know what is in a food, I won't try it.
	I like foods from different countries.
	Ethnic food looks too weird to eat.
	At dinner parties, I will try a new food.
	I am afraid to eat things I have never had before.
	I am very particular about the foods I will eat.
	I will eat almost anything.
	I like to try new ethnic restaurants.

Figure 6: Food Neophobia Scale

The Food Choice Motives, on the other hand, express the importance that individuals attach to factors such as convenience, health, price and sensory appeal (Steptoe et al., 1995). Motives can be drivers or barriers to the acceptance of food products and through the Food Choice Motives (FCMs) questionnaire consumers' level of involvement in food can be separated into distinct motivational goals (de Boer et al., 2013). For instance, consumers with an adventurous taste feel right when eating exotic sources of proteins; those with more of a reflective orientation are equally satisfied when they choose a pure or natural source of proteins. As far as a snack is exotic and pure, these consumers may choose the same one for different reasons (de Boer et al., 2013).

These two approaches combined could help to put empirical work on food neophobia and novel food acceptance into a broader perspective, taking into account product-related attitudes and beliefs, and help filling in the major quantitative gaps of the state of the art regarding

edible insects. However, to construct such a complex quantitative research method, a preliminary qualitative analysis is needed, in order to better develop the right product set and decide the set of variables to test it with.

There is a whole set of product-driven qualitative methods able to elicit consumer needs through a familiar series of stimuli. In fact, consumers can generally give reliable judgments about new products that are relatively similar to familiar products (van Kleef et al., 2005). Hence, these methods could be useful when the researcher has already identified an opportunity and has developed an innovative concept.

Laddering, Kelly repertory grid, free elicitation and focus groups are highly actionable for marketing purposes, as they reveal more abstract consumer needs and values (van Kleef et al., 2005). In particular, laddering can help define product-driven salient attributes, consequences and values (figure 7). Laddering has gained popularity within consumer research as it proved to be superior to other elicitation methods for attributes and values (Grunert et al., 2005).

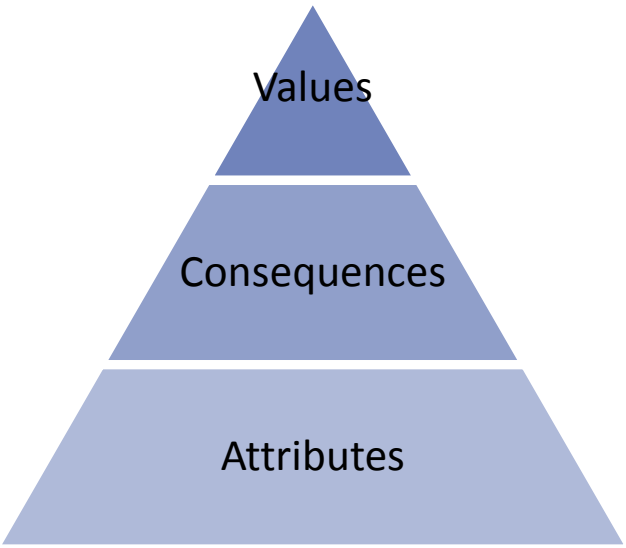

Figure 7: The Means-end Value Chain

Laddering refers to an in-depth, one-on-one interviewing technique used to develop an understanding of how consumers translate the attributes of products into meaningful associations with respect to self, following means-end theory (Reynolds & Gutman, 1988). The Means-End Theory states that people choose a product because it contains attributes – the means – perceived as instrumental to achieving the desired consequences and fulfilling values – the ends (Vanden Abeele & Zaman, 2009).

2.4 Theoretical framework

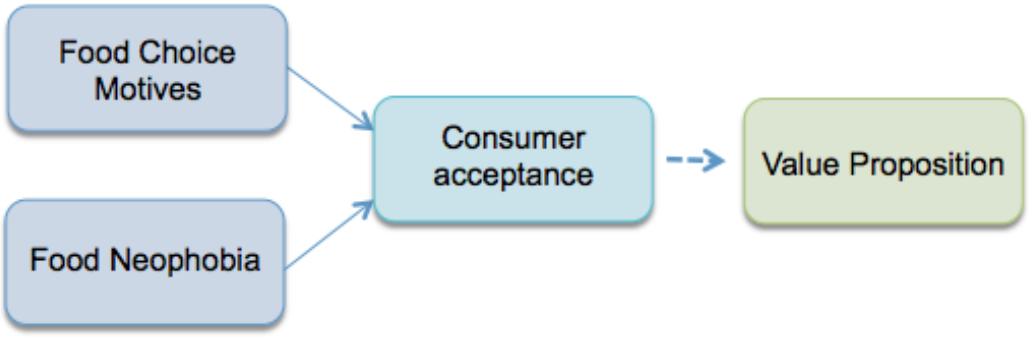

Figure 8: Theoretical framework

Figure 8 shows the theoretical framework of the study. The degree of consumer acceptance is defined both by the level of Food Neophobia and the Food Choice Motives profile. Once the two models are combined, it is possible to segment and frame the various shapes of consumer understanding and attitude towards edible insects. Profiling consumers into neophobic and neophilic, while looking at which benefits these two groups consider as an added value, will help developing an appropriate value proposition in the form of the Value Proposition Canvas.

2.5 Conclusions based on literature

The major gap in the relevant literature is the complete lack of quantitative data over a population and the absence of a focus on insects as snacks. Edible insects have been mostly investigated as a meat replacer, or frequently using a biased or not representative sample - as the kind of people who visit an entomology museum are more likely to have positive views of insects, and as who eats at the *Explorer's Club* is less prone to neophobia (Shelomi, 2015). However, the current state of the art contains several attributes that can help set up study, such as:

- The savoury/sweet dichotomy;
- Healthiness;
- Visibility of edible insects;
- Insects are seen as a good source of protein and other nutrients;
- Sustainability;
- Price.

3. Problem Analysis and Research Design

The methods used to address useful information and obtain valid data are described in this section. These were chosen in order to provide an answer to the central research question, as well as recommendations to the start-up.

3.1 Problem definition and research questions

3.1.1 Objective in relation to the problem

This study wants to advise the *Jumping Jack Snacks* team on their future decisions regarding product development, customer segment and value proposition. With the aim to clarify what is the next target market and how to reach it, the study determines which are the significantly accepted product attributes and develops an operative value proposition strategy for consumer driven new product development.

3.1.2 Objective in relation to the research project

The goal is to formulate a new product development strategy based on consumer preference of edible insects, through a market investigation in Europe. The research was conducted with in-depth interviews and using quantitative factor analysis, in order to determine the appropriate meal context, benefits, product attributes and multisensory characteristics appealing to consumers. Lastly, recommendations on how to design the Value Proposition Canvas were formulated.

3.1.3 Main question

What is the most suitable product development and value proposition strategy for *Jumping Jack Snacks* in order to upscale production, based on consumer needs and acceptance of edible insects?

3.1.4 Sub-questions

- What type of product would reduce rejection and improve acceptance in consumers who are new to edible insects?
- What are the significantly accepted product attributes of snacks based on edible insects?
- What are the person and product-related drivers and barriers to consumer consumption?
- Which are the significant benefits that consumers see as an added value?
- For which customer segments would the company be creating value?
- Which consumer needs does the value proposition have to satisfy?
- Which one of the consumers' problems does it solve?

3.2 Research materials

The research material used for the project was:

- Scientific literature (library, digital sources);
- Interviews;
- Questionnaires;
- Internal information of the start-up;
- The media (printed and electronic).

3.3 Research framework

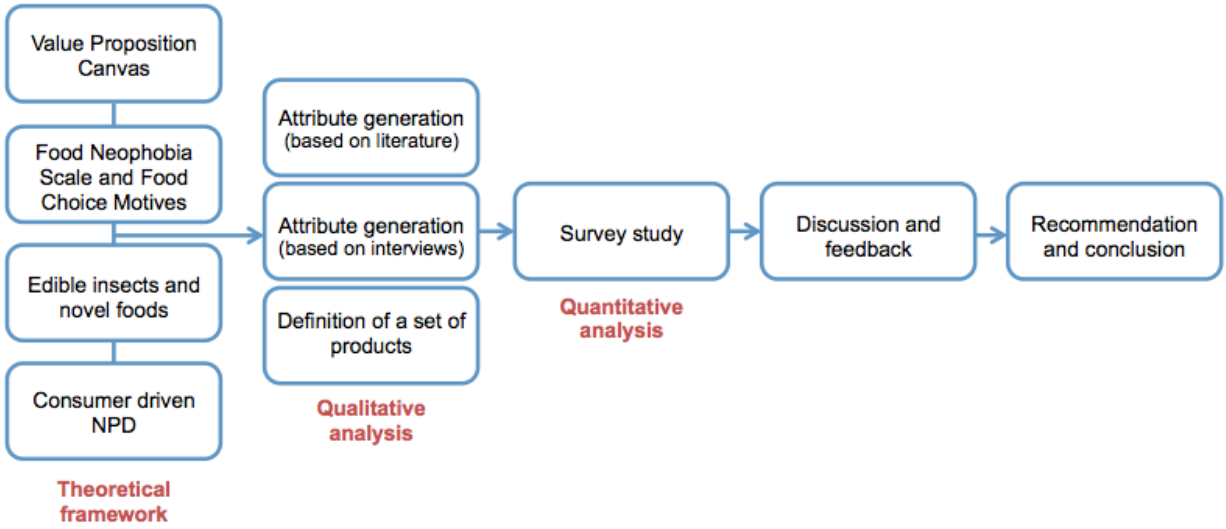

Figure 9: Research framework

3.4 Research strategy and methodology

The first part of the research was a literature study. Literature was retrieved from the library of Wageningen University and from other scientific sources based on the Internet. A preliminary desk search was carried out, concerning edible insects and the state of the art. Furthermore, literature was investigated during almost the whole research period, with a focus on food neophobia, personal consumer values and novel food acceptance, as well as radical innovation, entrepreneurship and consumer driven new product development.

The research project gains its validity through a two-step study, namely a qualitative and a quantitative analysis. First of all, a qualitative analysis carried through in-depth interviews provided a deep insight on the matter and gave support information following theoretical analysis. Secondly, a quantitative factor analysis allowed the researcher to quantitatively

discuss the research questions and present them with statistical relevant figures. Recommendations related to strategic decisions for *Jumping Jack Snacks* were elaborated through the outcomes of the qualitative and quantitative study, helping to construct a thorough design of the Value Proposition Canvas.

3.4.1 Qualitative research

In-depth interviews helped extrapolating attributes from literature and developing a set of products to test in the survey study. The laddering technique was used to understand consumer means-end chains regarding attributes, consequences and values of a particular product category (van Kleef et al., 2005). Examining the concrete product characteristics, benefits and values provided information about the consumer value orientations and helped the researcher identify the most relevant variables to include in the survey.

The use of *soft laddering* allowed measuring relevant consumer means-end chains through a natural, unstructured flow of conversation. The elicited attributes are strictly personal, as genuinely generated by the individual respondent. This approach eliminates all the potential biases from the interviewer, focusing only on the thoughts of the consumer (Gains, 1994). In a triadic sort, three distinguished elements are presented to a respondent, who is asked about similarities and differences that two of them have in relation to the third (Vanden Abeele & Zaman, 2009). Consumers were therefore presented with three different products, namely a chocolate cookie with cricket meal, a granola bar with mealworm flour and protein shake powder based on proteins extracted from crickets. This choice of items was strictly related to the current product mix of the start-up and its future projects of product development.

As this part of the study was only preliminary and had an exploratory aim, the sample of consumers did not have to be representative. The respondents were therefore chosen through convenience sampling and most of them were Wageningen University students, of different nationalities and age (see Appendix A, figure 24 and 25).

Content analysis and coding of the data was performed according to the relevant literature (Reynolds and Gutman, 1988). Out of 30 respondents (23% men and 77% women; ages ranging from 19 to 30 years) it was possible to extract up to 83 meaningful ladders and categories of meaning. The coding for items, attributes, consequences and values resulted in a list of 50 categories (see Appendix A, table 2 and 3). The LADDERMAP software by Gengler and Reynolds (1993) was used to derive the implication matrixes and the relevant Hierarchical Value Map (HVM).

The outcome of the qualitative analysis helped the development of a differentiated product set and the discriminative attributes to test it with.

3.4.2 Quantitative research

After defining the set of products, quantitative research was conducted through a structured survey aiming to discriminate between the main advantages and disadvantages of the chosen items and understand the dynamics of consumer acceptance. In particular, the focus was on the perception of the various products and their most accepted attributes, together with the segmentation of consumers in neophobic and neophilic.

The research was conducted by applying factor analysis on the Food Neophobia Scale and a selected range of attributes from the Food Choice Motives questionnaire. Through multivariate analysis it was possible to define the underlying structure among the selected attributes and outline sets of discriminative variables that are highly interrelated, known as factors. Factors were used to understand the product space and the perceived benefits.

Furthermore, consumers were segmented on the basis of the Food Neophobia Scale, in order to better understand which type of product and characteristics can minimize rejection and maximize acceptance in consumers who are less keen to try novel foods.

Figure 10: Food products chosen for the questionnaire on insect-based snacks

The five selected items were: a chocolate chip cookie, with dark chocolate and mealworm flour; a granola bar, with oat flakes, apricots, raisins, honey and cricket flour; tortilla chips, with corn and mealworm flour; a protein milkshake based on cacao, cricket flour, spirulina, hemp seeds, chia seeds and lucuma; a chocolate candy topped with a gold-coated cricket (figure 10). This choice was justified by the outcomes of the literature study and the laddering interviews. The attributes presented to respondents are listed in figure 11.

I think this food product is:	
	Attractive
	Innovative
	Looks nice
	Has a pleasant texture
	Tastes good
	Handy
	Ready to consume
	Nutritious
	Energy giving
	Healthy
	High in protein
	What I usually eat
	Familiar
	Sustainable

Figure 11: Attributes chosen for the questionnaire on insect-based snacks

A product statement and a picture were displayed for all five snacks. Each product concept was evaluated with the chosen attributes. Each attribute was rated on a scale of 1 to 7, with 1 standing for complete disagreement and 7 for complete agreement. The rating of attributes was followed with some demographic questions such as gender, age and nationality. It was also asked which products were the preferred ones and the level interest to try edible insects. Moreover, consumer were segmented on the basis of the Food Neophobia Scale, with each of the 10 items rated on a scale from 1 to 7, with 1 standing for strong disagreement and 7 for strong agreement. Afterwards, the negative items were reversed, so that lower FNS scores reflect greater reluctance to try novel foods. Respondents were split into neophilic and neophobic using the mean of the population. The questionnaire was first pre-tested to check

whether the survey was interpreted the way it was intended. It was also checked if all terms used were familiar. The final questionnaire can be found in Appendix B.

Data were mainly collected in The Netherlands, by distributing surveys in the most urbanized Dutch centers, including Amsterdam, Den Haag and Rotterdam. Respondents (*n* = 113; 32% men and 68% women; ages ranging from 17 to 70 years) were stopped before or after their grocery shopping, in different kinds of supermarkets (from GDO distributors to organic grocery stores). Furthermore, respondents from the rest of Europe, such as UK, France, Belgium, together with Scandinavian and Mediterranean countries, were contacted through an online survey (via Qualtrics).

The data collected through the questionnaire were analysed using factor analysis. In general, an important precaution for data collection is to ensure that there are no missing data. Therefore the first part of data analysis consisted of checking for missing values. Thereafter a factor analysis was carried out later on, using SPSS and applying a Varimax rotation (Hair et al., 2010). Factors were used to understand the product space and the perceived benefits. In fact, factor analysis usually attempts to find a reduced set of strategic dimensions that represents the information contained in a larger set of customer needs. The hypothesis is that customers reveal their primary needs through their evaluation of products and concepts or the attributes that characterize them. The evaluation of the products can be strategically summarized by a small number of dimensions (e.g., health, sustainability, convenience), which are found by examining the matrix of correlations among the detailed attributes (Urban & Hauser, 1993). Three factors were selected and labelled and the relative compositional perceptual maps were obtained.

4. Results

4.1 Qualitative results

4.1.1 The Hierarchical Value Map

After data collection, the first step was content analysis and the coding of all the items, attributes, consequences and values mentioned, generating a list of 50 different categories (Table 4, Appendix A). After summarizing all ladders into a score matrix (Table 5, Appendix A), the so-called implication matrix was derived, which is a square matrix reflecting the number of elements to map. This contingency table reports the frequency of connections between all the single 50 categories (Table 6, Appendix A). On this basis, the Hierarchical Value Map was constructed (figure 12), with a cut-off level of 3.

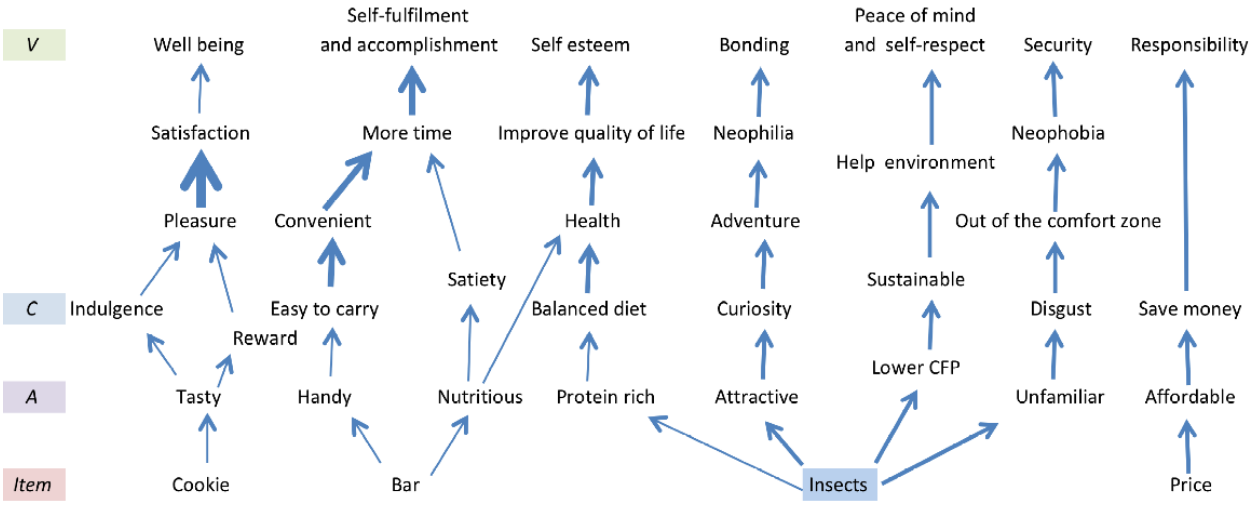

Figure 12: Hierarchical Value Map of snacks with insect flour

First, it is important to notice that, out of the three products, respondents did not construct ladders starting from the protein shake powder. However, both the cookie and the granola bar had significant and straightforward patterns. The chocolate chip cookie was significantly found to be indulgent and rewarding, leading to feelings of pleasure and satisfaction, therefore aspiring to well-being. With or without edible insects flour, what is important to respondents is that the cookie tasted good. The granola bar, on the other hand, was seen as both handy and convenient, a useful snack to grab on the go or eat at work, in order to have more time and seek self-fulfilment and accomplishment. Furthermore, a nutritious snack is seen as healthy and able to improve the quality of life, positively influencing one's self-esteem.

A more diversified pattern can be observed when it comes to insects. First and foremost, they are seen as sustainable due to their low carbon footprint, in comparison to the more mainstream sources of protein. Helping the environment is a consequence that leads consumers to peace of mind and self-respect. This type of ladder, with a strong societal focus, has a highly rational structure. Furthermore, respondents are divided into those particularly attracted by the idea of trying insects out of curiosity and those that are intrinsically disgusted, since they find insects to be unfamiliar and therefore out of their comfort zone. These two kinds of patterns can be distinguished into neophobic and neophilic attitudes: adventurous consumers are keener to try and share new foods, as a thrilling and hedonic occasion of social bonding (neophilia). On the other hand, conservative consumers prefer to stay in their comfort zone, relishing in a sense of security (neophobia). Lastly, insects can be seen as a source of protein and therefore a useful part of a balanced diet and a healthy lifestyle. This type of ladder has a highly rational structure, but this time with a personal focus. It follows the same pattern of the granola bar, with a life quality improvement and positive influence on one's self-esteem.

Lastly, price plays an important role as well. In fact, respondents stated that they would not appreciate a visible increment in the sales price and are not willing to spend extra money for insect based products. Saving money and rationally spend it gives them a feeling of responsibility.

4.1.2 Attribute and product set definition for questionnaire

The laddering interviews confirmed most of the attributes retrieved from literature, while adding new ones that are both related to snacks and edible insects, such as: Convenience; Attractiveness; Sensorial appealing. The derived product set was differentiated based on the following attributes:

- The degree of healthiness;
- The degree of indulgence;
- Visibility of edible insects;
- The type of insects used;
- Savouriness and sweetness;
- Convenience and handiness.

Price was not included, since it is a highly specific variable, to be tested with a more restricted and less differentiated set of products. It should be considered only after the development of a more precise value proposition. Sustainability and protein content were inserted in the questionnaire as variables to test, rather than being taken into account during the product selection.

4.2 Quantitative results

Only respondents with complete answers were taken into account (*n* = 113; 32% men and 68% women; ages ranging from 17 to 70 years, mean 25). The sample was composed by 57% of Dutch respondents, while the remaining 43% were respondents from the rest of Europe (see figure 26, Appendix C).

The average score on the Food Neophobia Scale, which was ranging from 1 to 7, was 5.47 (SD = 0.76). When splitting the sample into neophilic and neophobic consumers using the mean of the population, 49% of the respondents were found to be neophobic and 51% neophilic.

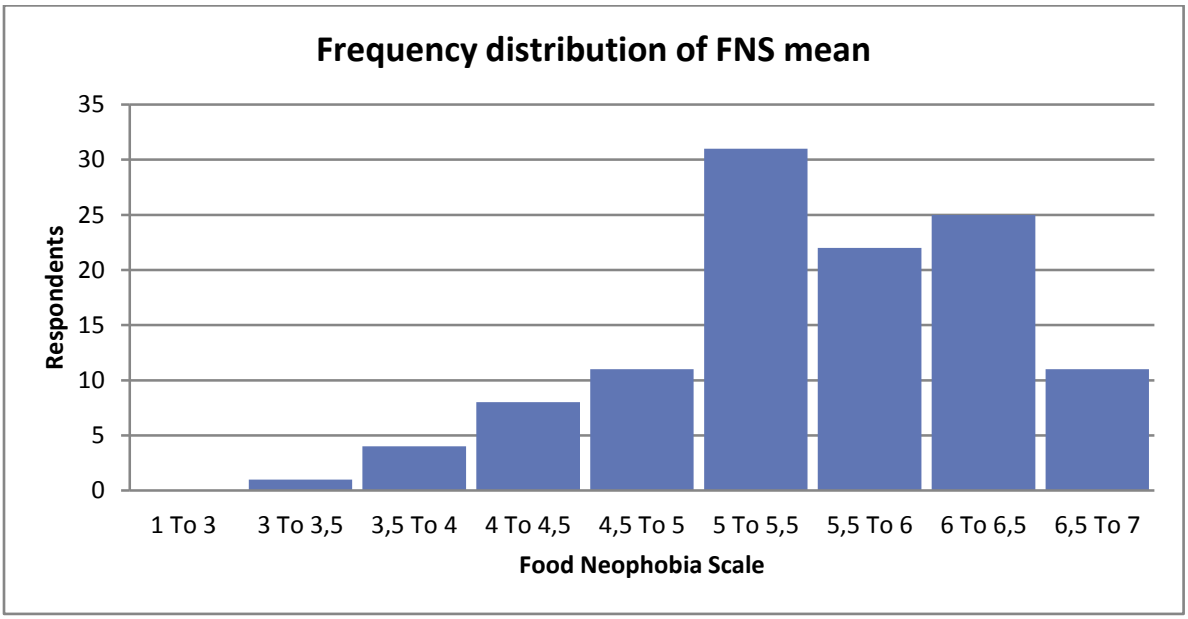

Figure 13: Frequency distribution of the Food Neophobia Scale mean

When looking at the histogram with the frequencies of FNS mean distribution (figure 13), the axis X divides respondents based on their scores for neophobia and axis Y indicates the number of respondents. The lower the FNS scores, the greater is the reluctance to try novel foods.

Furthermore, concerning the selected sample, the attitude towards edible insects is generally positive, when considering the willingness to try crickets, mealworms or insects (figure 14). Consumers were asked to indicate, being able to choose more than one option, which kind of edible insects they were more curious to try. Up to 46% declared themselves to be interested in edible insects in general, while 27% was curious to taste crickets and 15% mealworms. However, 17% declared themselves to not be interested into trying them at all.

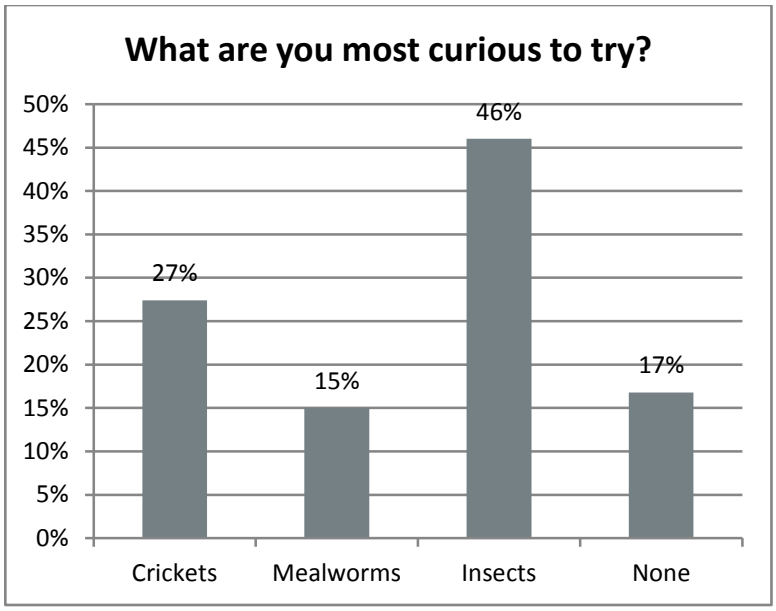

Figure 14: Willingness to try edible insects

The two most preferred products were the chocolate chip cookie (56%) and the granola bar (46%), while the other three products had similar scores, ranging from 32 to 35%. Only 6% of the respondents declared to not be interested in any of the products (figure 15).

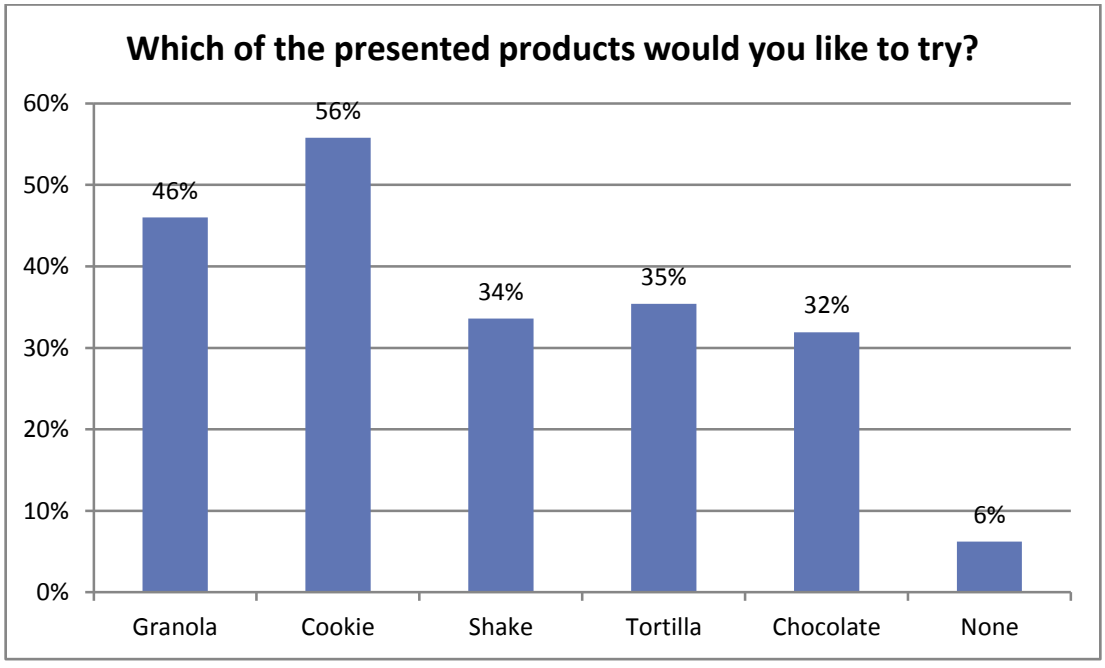

Figure 15: Willingness to try the selected products

4.2.1 Factor analysis over the whole sample

Both the KMO index (0.840) and the Bartlett's test of sphericity ($\alpha = 0$) showed that the data set is appropriate for factor analysis.

A run with all fourteen variables using Varimax rotation was performed. The analysis showed that three relevant underlying factors could be identified. This number of factors is based on the eigenvalues above 1 and the explained variance (see Appendix C, figure 29 and table 7). The threshold for variable significance was determined at a value of 0.5, with all absolute values of the Rotated Component Matrix higher than 0.5 showing a correlation with the factor (see table 9, Appendix C).

Table 1: Factors, variables and labels of the selected products

Factor 1	**Factor 2**	**Factor 3**
Nutritious (0.866)	Attractive (0.810)	Familiar (0.825)
Healthy (0.851)	Looks nice (0.838)	What I usually eat (0.699)
High in protein (0.854)	Has a pleasant texture (0.775)	
Energy giving (0.710)	Tastes good (0.760)	
Healthiness	**Attractiveness**	**Familiarity**

Table 1 shows the three obtained factors and their relative variables. Factor 1, labelled as Healthiness, has high scores for Nutritious, Healthy, High in protein and Energy giving. Factor 2, labelled as Attractiveness, has high loadings for Attractive, Looks nice, Has a pleasant texture and Tastes good. Lastly, factor 3, labelled as Familiarity, has high scores for the variables Familiar and What I usually eat. Three of the fourteen variables, namely Sustainable, Ready to consume and Handy had communality values below 0.5 and therefore were not significant (see table 8, Appendix C).

After calculating the mean factor scores for each product, it was possible to graphically present the product set over three different compositional perceptual maps.

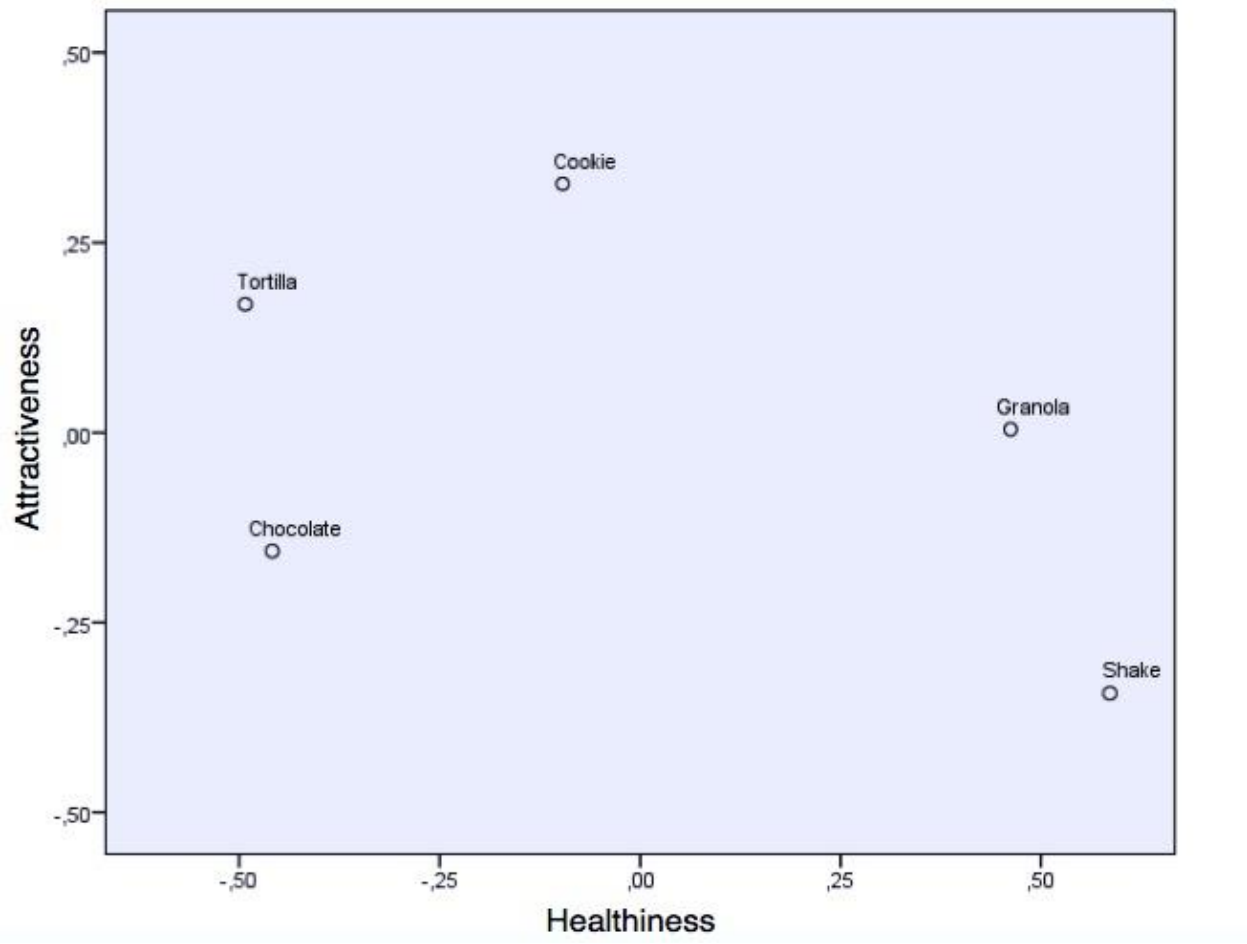

Figure 16: Compositional perceptual map "Attractiveness over Healthiness"

Figure 16 expresses the relationship between the dimensions Attractiveness and Healthiness. The factor Healthiness is defined on one extreme by the shake and the granola bar (both perceived as the healthiest products of the set) and on the other by the tortilla and the chocolate candy (perceived as the least healthy).

The chocolate chip cookie stands in between, but with a negative score for Healthiness. However, the cookie stands out if considered by its Attractiveness factor, since the respondents perceived it as the most attractive, good looking and good-tasting product. On the other hand, the milkshake ended up as the least attractive item of the group, while being perceived as the healthiest one at the same time.

The chocolate candy has the least advantage over the product set, being perceived both as the least healthy and the least attractive product.

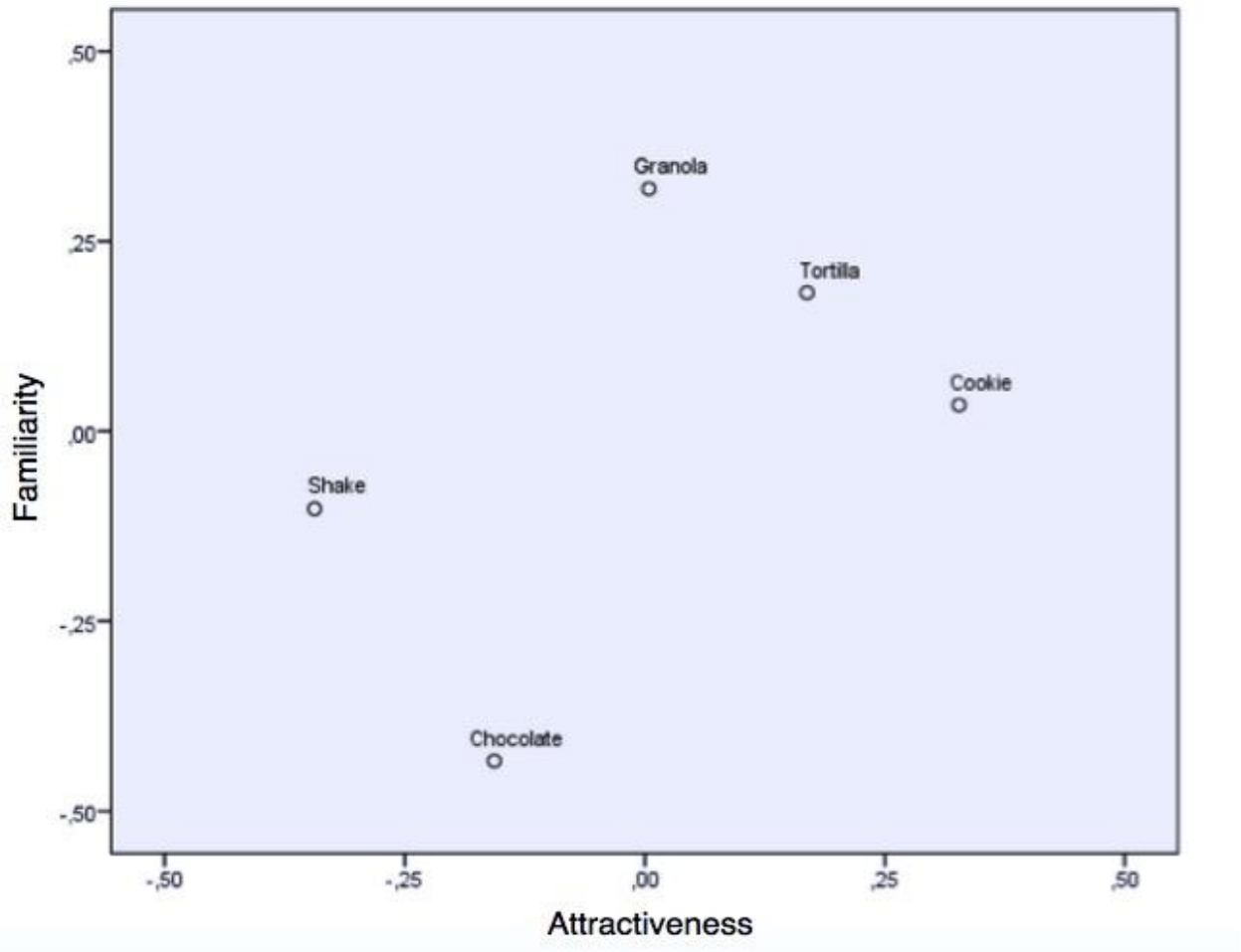

Figure 17: Compositional perceptual map "Familiarity over Attractiveness"

Figure 17 shows the Familiarity over Attractiveness dimensions. The milkshake and the chocolate candy are not only the least attractive products, but also the least familiar ones. In fact, protein shakes are not a common food item for the average consumer, as it is also the case with artisanal chocolate candies. On the other hand, consumers seem to be more familiar with granola bars and tortilla chips.

The two products with high scores and positioned in a competitive area are on one hand the granola bar, being highly perceived as healthy, familiar and passably attractive, and on the other the chocolate chip cookie, considered highly attractive and familiar.

4.2.2 Respondent segmentation based on FNS

When splitting the consumer sample based on their neophobia attitude, two distinct datasets were obtained, both meritorious based on the KMO values (respectively 0.837 for neophobics and 0.822 for neophilics) and Barlett's test of sphericity ($\alpha = 0$ for both).

The number of factors, the labels and variables entirely overlap with the previous dataset, while the rotated component scores for neophilics and neophobics can be found in Appendix C. The most significant differences emerge from the comparison between the two sets of compositional perceptual maps.

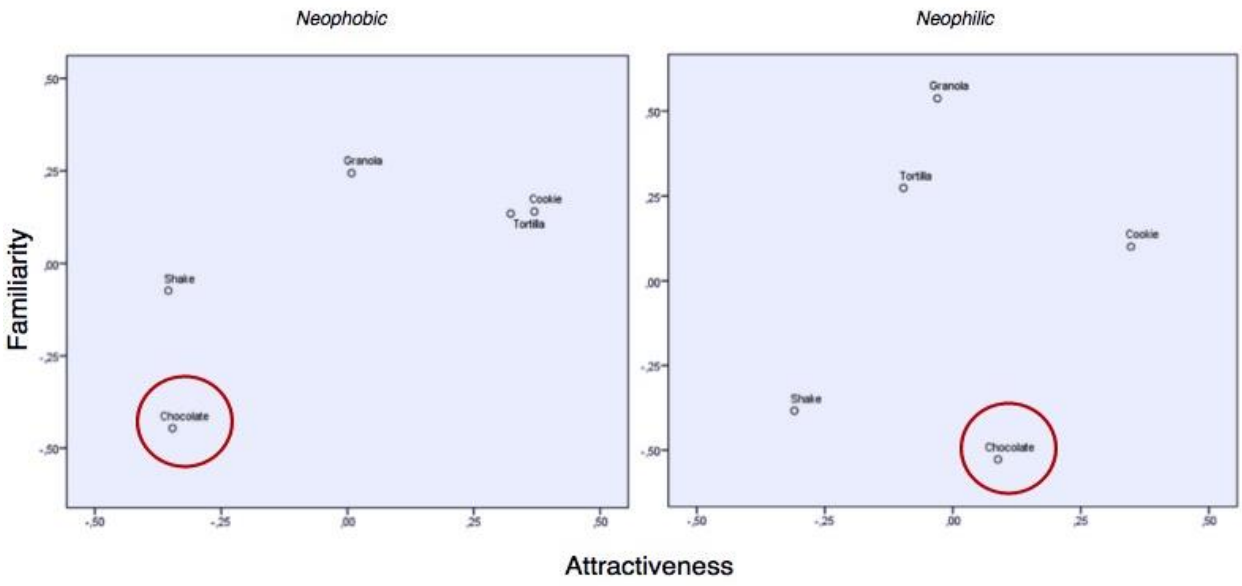

Figure 18: Compositional perceptual maps "Familiarity over Attractiveness" for neophobic (left) and neophilic (right) respondents

When considering the factor Familiarity over Attractiveness, both groups perceive the chocolate candy to be an unusual item to eat (figure 18). However, neophobic respondents find it highly unattractive, since this product is topped with a whole golden cricket, while neophilics find it even more appealing than tortillas and granola bars.

Moreover, it is also interesting to notice how neophobic consumers almost equally value tortilla chips and the chocolate chip cookie to be both highly familiar and attractive. On the other hand, neophilics did not perceive tortilla chips to be particularly attractive.

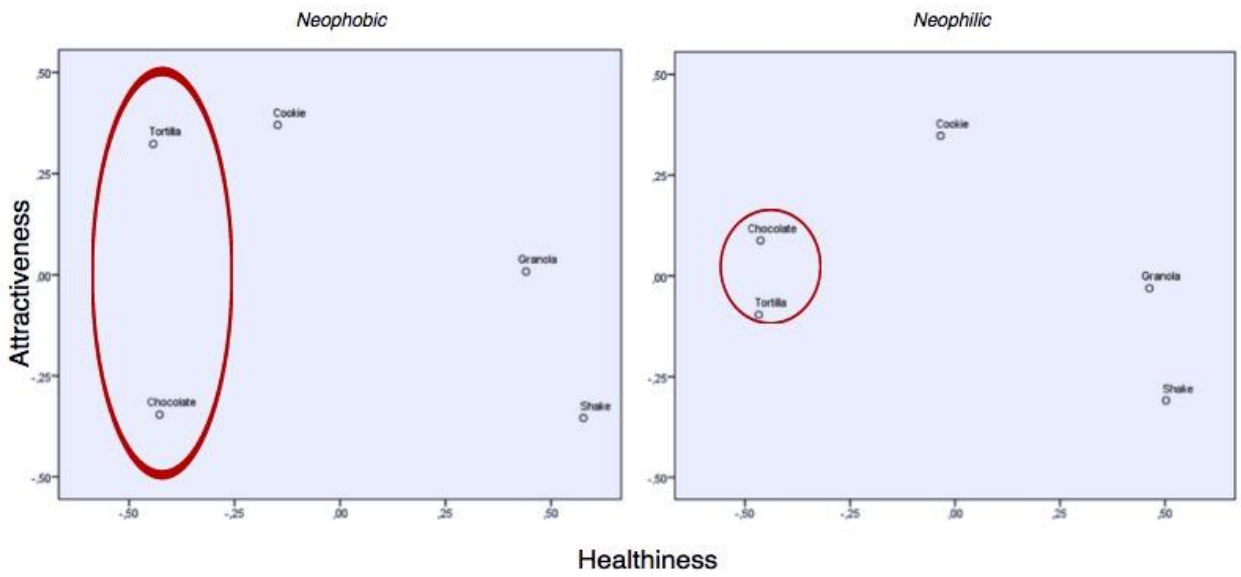

Figure 19: Compositional perceptual maps "Attractiveness over Healthiness" for neophobic (left) and neophilic (right) respondents

The difference between the two groups is even more emphasized when comparing Attractiveness over Healthiness (figure 19). For neophobic consumers, the chocolate candy is as unattractive as the shake and extremely opposed to the tortillas and the chocolate chip cookie. Once again, neophilics rated the candy much higher than the granola bars, the tortillas and the shake. Lastly, the cookie, the granola and the shake are valued with a similar trend by the two different datasets.

5. Discussion

5.1 Attributes and product appropriateness

The two-step research strategy helped answering the several research sub-questions and made it possible to understand which type of product could reduce rejection and improve acceptance of neophobic consumers. From the quantitative study, clear patterns emerged concerning the significantly accepted attributes, the product-related drivers and barriers and the benefits that consumers see as added values, answering the first three research sub-questions (figure 20). Only after an exhaustive explanation of these core issues, it was possible to develop a suitable strategy for the start-up, including a thorough value proposition and the choice of the most appropriate product category for commercialization.

Some defined patterns emerged already during the qualitative interviews, such as the innate preference for more familiar products like cookies and granola bars. In fact, the protein shake powder is poorly understood and not even taken into consideration for laddering, thus making the two other products more appropriate matrixes. The cookie is highly appreciated and valued as a tasty, pleasurable treat, while the granola has multiple benefits – convenience, satiety, and healthiness. Furthermore, the ladder describing the granola bar as nutritious and consequently healthy is intertwined with the one of insects as a source of protein, a fundamental component of a balanced, healthy diet. The shared goals and values could make the two products a perfect fit.

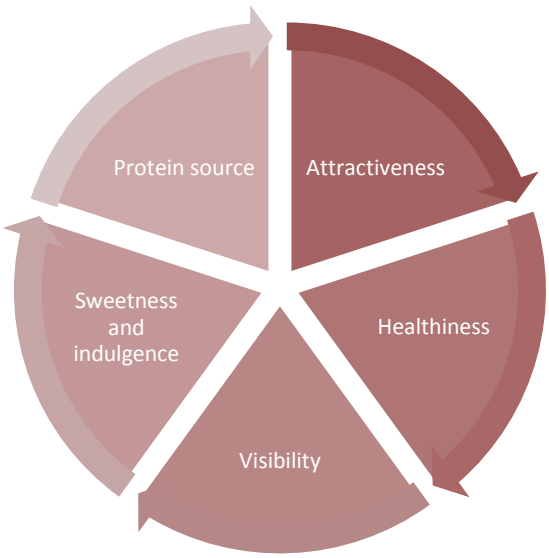

Figure 20: Significant attributes influencing consumer acceptance of edible insects

Concerning sustainability, this was mentioned by the respondents within the context of meat replacements and alternative sources of protein, therefore not representing a competitive edge within the snacks category.

Some significant dimensions that emerge from the qualitative research were not as significant for the quantitative study. Price was not included, as previously mentioned. Moreover, convenience was not a discriminative dimension for the product set, but this does not imply that these two factors should be forgotten for the value proposition development. In particular, handiness was highly relevant during the qualitative stage.

Concerning the tested attributes, visibility is a high barrier for acceptance, in particular in neophobic consumers, who find whole insects to be highly unattractive. Furthermore, visible insects are equally perceived as unfamiliar by neophilics and neophobics, belonging more to a niche market.

The savoury/sweet dichotomy is not particularly significant among European consumers, contrarily to Asian ones. In Asia edible insects are considered as meat and always eaten in a savoury meal context, as emerged both from literature (Tan et al., 2015) and during interviews. However, European consumers do not have prior knowledge of consumption and thus neither an opinion on the matter, nor find sweets to be an inappropriate context. Furthermore, the sweet snacks are what the start-up already focused its production on and are found to have a competitive edge over the product set. In fact, sweet taste, indulgence and sensory appeal are all attributes able to drive consumption of all respondents, no matter the individual attitude towards food neophobia. The chocolate chip cookie is a strong example of a pleasurable treat that captured the attention of all respondents.

Healthiness can be a driver for consumption as well. Protein-rich food is perceived as extremely healthy and this applies to both the granola bar and the shake. The granola bar, in particular, was perceived as a familiar and healthy snack, gaining a competitive edge over the other items. On the other hand, the protein shake has a lower potential, since it was considered as highly unattractive and unfamiliar. The shake is confined to a highly specialized niche, far from being a consumer good but rather an item targetable to body builders and athletes. This target is completely out of the company's focus and needs further R&D investment, in both time and money.

5.2 Two potential strategies for value creation

The two products with the highest potential are the granola bar and the chocolate chip cookie. Respondents indicated them as the most interesting to sample and taste. Furthermore, both snacks have high competitive advantages, albeit for different reasons (figure 21).

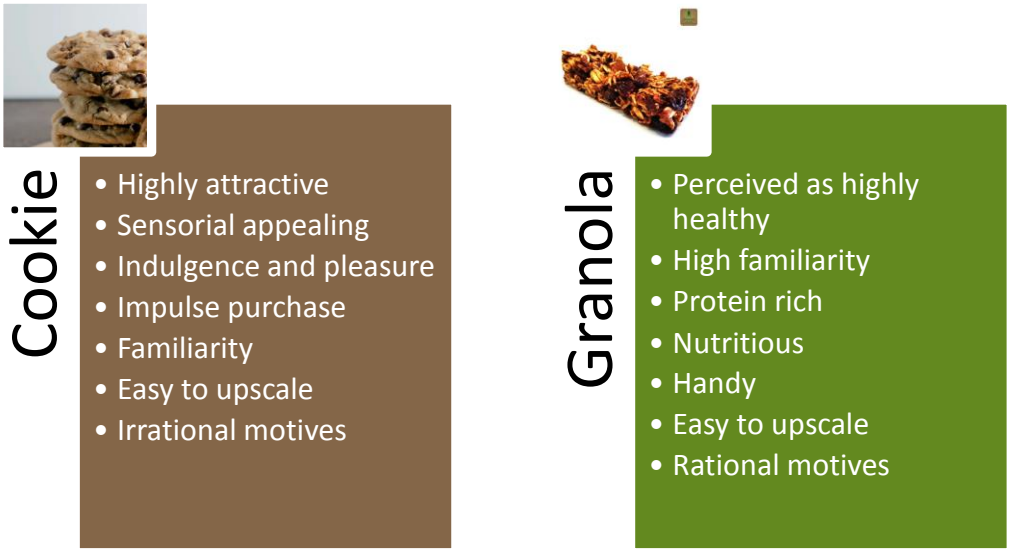

Figure 21: Comparison of the advantages of the two products with the highest potential

On one hand, the granola bar is a product perceived as highly familiar and usually eaten, fitting in a healthy lifestyle and marketable as balanced, nutritious and protein rich, thanks to the presence of insect flour. This set of positive benefits emerged already during the qualitative interviews, portraying it as a highly rational and balanced food choice. The combination of granola and edible insects appears to be the perfect match in terms of healthiness and improved quality of life.

On the other hand, the chocolate chip cookie is the most attractive product, highly valued for its sensorial appealing. Thanks to its attributes and associated values – tastiness, indulgence and pleasure – the cookie belongs to the most appropriate product category for embodying a successful sensory strategy able to shift the mind-set of European consumers. In fact, during the qualitative interviews respondents expressed the importance of sensory appealing for acceptance of edible insects, being willing to sample products having edible insects in them as long as the taste is good.

The “cookie strategy” fits perfectly within the company’s focus on tasty, delicious bakery products having an adventurous twist, while the granola bar is highly inappropriate for such context. It is therefore important to distinguish between two different strategies with which the start-up can choose to proceed: one is rationally-oriented, with a focus on healthy and balanced snacks rich in proteins; the other is a sensorial strategy, focused on tasty treats being indulgent, highly attractive and with the unconventional, adventurous twist of insects.

The following sections articulate the two approaches through the Value Proposition Canvas. In order to construct the Canvas, it is important to first develop the Customer Profile, listing customer jobs, pains and gains and consequently a matching Value Map, with suitable pain relievers and gain creators. The aim is to articulate a concrete answer to the remaining research sub-question, on the basis of the outcomes of the qualitative and quantitative study, together with the start-up internal knowledge. The goal is to define for which customer segments the company would be creating value, which consumer needs the value proposition has to satisfy and which are the significant benefits that consumers see as an added value.

5.2.1 The rational strategy

The first strategy sees the potential of edible insects in their nutritional profile, as the value creator of a healthy and balanced snack. As mentioned in the qualitative results, the product fits within a highly rational means-end chain structure, with a personal focus on the individual self-esteem, quality of life and physical wellness.

The specific consumer segment that would be interested in a healthy snack with insect flour is a health conscious consumer, namely an individual that is focused on nutrition, fitness and a “wellness-oriented” lifestyle, but not necessarily at a professional level (Kraft & Goodell, 1993). Consumers who seek a healthy lifestyle follow the latest health and fitness trends and are often looking for balanced snacks to eat on the go – before going to the gym, during workouts or breaks. However, supermarkets often offer boring and tasteless options on one hand, or unhealthy and sugary alternatives on the other. For fitness enthusiast is hard to find balanced, convenient snacks to buy on the go, without giving up on taste and naturalness. Actually, consumers that follow a carb conscious diet often have to renounce to their cereal and sugar fix. Satiety, more time to work, study or train, healthiness and social bonding are all customer gains in which this segment is interested.

Thus the introduction of edible insects has the potential to revolutionise the snack bars market. The product would have a competitive edge over the already existing healthy snack, due to its remarkable nutritional profile given by the combination of cereals and insects. It has multiple

distinctive pain relievers for the selected customer segment, such as the maximized healthiness of a sweet snack. In fact, the presence of insect meal allows the production of a cereal-based snack with a balanced nutritional profile, without compromising taste. Furthermore, giving the handiness of the product, proteins can finally be a convenient snack, easy to integrate in an active lifestyle. Introducing insects as a superfood, rich in several amino acids, vitamins and micronutrients might help creating a wholesome alternative to the granola bars and other snacks already on the market. The insect granola bar would create gain for consumers through its balanced and nutritious nature, being healthier than the average cereal bar but also having a better taste than the average protein bar. Moreover, insect would be introduced as flour in a highly familiar food matrix, while offering a valuable and fibres-rich source of proteins. Namely, this product could reunite the need for convenience, healthiness and satiety in a familiar snack that is easy to accept and rationalize. A visual representation of the Value Proposition Canvas for the rational strategy can be found in figure 22.

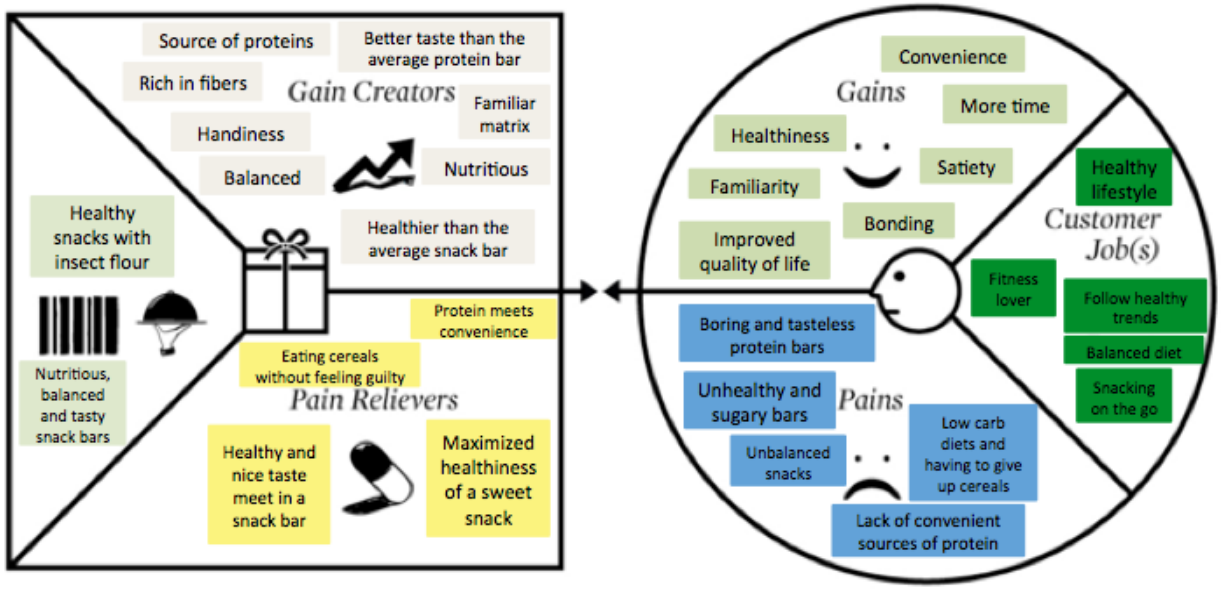

Figure 22: Value Proposition Canvas for the rational strategy

To deliver this value proposition to the customer is necessary to develop the right set of cues, namely information used by consumers to infer quality (Grunert, 2007). For instance, when it comes to healthiness, healthfulness conveyed by images rather than health claims could lead to the most favourable evaluation of a product's healthfulness (Chrysochou & Grunert, 2014), as well as certified organic food is perceived to be healthier than conventional food (Guilabert & Wood, 2012).

In the case of the rational strategy, it is important to work on the extrinsic quality cues, such as health claims, certifications, naturalness, association with popular superfoods, packaging and brand name. However, it is also necessary to keep an eye on taste and texture to encourage repurchase and to create a remarkable edge over competitors. Table 2 shows which are the technological conditions that translate consumer cues and wishes in product requirements.

Table 2: Cues and technological requirements for the granola bar with insect flour

Cues	Technological requirements
Health claims	• High protein (at least 20% of the energy value of the food is provided by protein). This implies a high content in insect meal, which would drastically increase the unit cost per bar. The current recipe has only 10% of the energy value provided by protein, which is not enough for a protein-focused health claim. • High fibre (at least 6 g of fibre per 100 g). This content is already present in the current granola recipe. • The use of further claims (e.g. omega 3, chitin, etc.) should be tested according to the final industrial prototype and adopted after further consumer research.
Certifications	Certified organic: purchasing exclusively organic raw materials
The idea of naturalness	Free of artificial flavours, preservatives and trans fat
Association with superfoods	Adding popular superfood in the ingredients list, such as goji berries, cocoa nibs, hemp protein, flax and chia seeds, etc.
Packaging	Has to allow consumers to quickly and easily identify the nutrition claims, through appropriate colours, pictures and font size
Brand name	The name *Jumping Jack* is connected to insects but also to fitness and training
Taste and texture	Crunchiness and Maillard reaction of toasted oats

5.2.2 The sensory strategy

The second strategy has a sensory, hedonic and exotic approach, giving great value to taste, attractiveness and novelty. Insects are considered the adventurous twist of an eccentric, delicious treat. Figure 23 shows a visual representation of the Value Proposition Canvas for the sensory strategy.

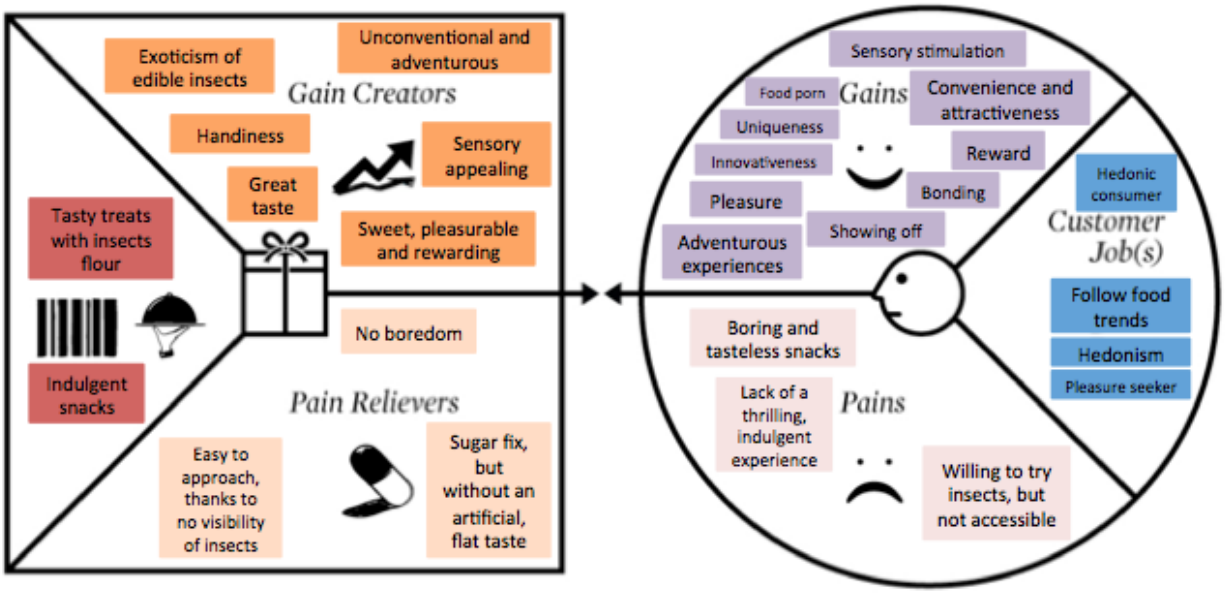

Figure 23: Value Proposition Canvas for the sensory strategy

Hedonic consumers are attracted by indulgence, gratification and pleasure, seeking sensory stimulation and novelty. In fact, in today's world of over-processed, industrialized and unexciting eats, food lovers are constantly looking for interesting and innovative experiences. The snacks available on the market often have a flat taste and do not offer a thrilling, indulgent experience. Actually, there is a consumer niche that is already interested in edible insects, but cannot easily access them. Not only are hedonic consumers pleasure seekers, but also they are interested in innovativeness and uniqueness of their food experiences. Sharing and celebrating their adventurous and indulgent food experiences through social medias is often a way for consumers to both show off and bond at the same time (Rousseau, 2014). For them, sharing with others (on Instagram, Facebook or in real life) their unique food experience can be as gratifying as the experience itself.

Edible insects could therefore be the adventurous twist that hedonic consumers are looking for. Indulgent snacks and tasty treats with insects flour are the extravagant and rewarding sugar fix

that can save consumers from everyday boredom. Moreover, introducing insects in a rewarding context might be the most successful strategy to create a great first impression. The cookie is only one of the several treats in which insect flour can be integrated. Candy bars, for instance, can reunite handiness with sensory fulfilment. Great taste, high quality, exotic ingredients and a product mix focused on rewarding treats are all strong gain creators.

For the sensory strategy the essential cues are first and foremost the intrinsic qualities of the product, namely its sensory appealing to consumers. This time the repurchase factor is more linked to the uniqueness in flavour and the competitive advantage needs to be strongly ingrained in the sensorial profile of the product. However, extrinsic cues are nonetheless fundamental to encourage consumers to try the product. Table 3 shows the necessary cues and the related technological requirements for the sensory strategy.

Table 3: Cues and technological requirements for treats with insect flour

Cues	Technological requirements
Sensorial appealing	• Appearance, flavour and texture are all essential elements for the sensory strategy. The idea is to make them as indulgent as possible, in appearance and taste. • Crunchy, sweet and fatty. • Maillard reaction is the key for all baked goods.
Significant content of insect flour	• Consumers would like to be informed in which percentage insects are part of their product. However, the content has to be compatible with the technical feasibility of the recipe and the cost structure of the final product. • For instance, telling how many crickets there are per cookie/candy bar is much more suggestive than a percentage
Showing that the product is insect-based, without showing the actual insects (hiding strategy)	Finding a visual cue to characterize the cookie/candy bar: • Shape of the cookie that resembles an insect • Printing the outer layer of chocolate with the image of a cricket or other insects

Make the "insect flavour" unique by exalting it	• Crickets are usually salty and have a "fishy flavour". The latter needs to be avoided through the use of Maillard reaction, while the former needs to be exalted, for instance through the use of salt flakes • Mealworms have a nutty, pleasant flavour. It should be exalted (through harmonized ingredients pairing) and then explicitly marketed
Pairing with exotic flavours or eccentric, luxurious ingredients	• The idea is to pair edible insects with other elements that won't make consumers think: "Oh, but this is like any other chocolate chip cookie!" but rather "This is the best cookie I've ever tasted!" • Chocolate, elderflower, lavender, salted caramel, cardamom, salt flakes, etc. • The pairing of sweet with salty • This gimmick will facilitate the development of a product line and customer retention
Certifications	All certification help increase expectations and the perception of high quality in food products. Therefore are recommended: • Organic ingredients • UTZ or Rainforest Alliance Certified Cocoa • Fair trade
Packaging	Colours, pictures, style and font have to communicate directly to consumer: • Hedonic needs • The adventurous experience

6. Conclusions and Recommendations

6.1 Conclusions

Nowadays the Western world is facing the raise of several entomology-based ventures that see plenty of potential in edible insects. *Jumping Jack Snacks* is one of them and, before launching one of their products and upscale production, wants to understand what is the most successful value proposition strategy, with highly accepted attributes, multisensory characteristics and values.

After a literature review on the state of the art of edible insects, a study regarding the acceptance of European consumers was carried out, by means of both qualitative interviews and quantitative analysis. Afterward, recommendations on how to design a thorough Value Proposition Canvas were formulated.

Visibility, sweetness, perceived healthiness, sensorial attractiveness of the matrix and convenience are all attributes and benefits to take into account when composing the value proposition. In particular, two potential strategies for value creation emerged from the study: one is more of a rational strategy, with a focus on healthy and balanced snacks rich in proteins; the other is a sensorial strategy, focused on tasty treats that are indulgent, highly attractive and feature the unconventional, adventurous twist of insects. For both options it is important to carry on with the hiding strategy, e.g. using only flour, rather than visible insects, with the aim to maximize acceptance of neophobic consumers.

However, according to literature, rational proofs usually barely work to drive food choices of existing products, not to mention novel food products. Sensory strategies are needed to promote a shift in the paradigm and the key is to convince consumers of insects' hedonic characteristics and social acceptability. Thus the sensory strategy described in this study has a higher potential to succeed and can be the perfect icebreaker to get Europeans familiarized with edible insects.

6.2 Limitations

The dropout rate of the online survey was quite high, since the data from 37 respondents were not complete and had to be excluded from the statistics. This could be due to the length of the survey and to the respondents' lack of interest. Therefore consumers not attracted by edible insects might have not been engaged and motivated enough to dedicate 10 minutes of their time to the questionnaire. This is also why the presence of a positive attitude towards edible insects should not be interpreted too enthusiastically, in terms of market share or general

consumer interest. However, it proved useful for segmenting consumer attitude and wishes based on food neophobia.

Furthermore, a cultural bias could have been caused by the inclusion in the sample of different nationalities without heterogeneous proportions. Consumers from Mediterranean countries were included as well; therefore the results concerning the degree of acceptance and interest towards edible insects cannot be generalized for Northern Europe. In fact, norms, food culture and quality perception are different between the North and South of Europe, thus varying the patterns of acceptance among consumers. However, generalization of results was not the main aim of the study, since its main goal was a specific strategy development for the selected company. Nonetheless, the applied methodology is highly replicable and can be tested again with different products or with a generalization purpose.

Moreover, when showing images of insect-based products, the lack of information about the nutritional value, the list of ingredients and the percentage of insect flour might have not allowed respondents to thoroughly judge whether the products were safe or not to eat. This could particularly be true for the golden coat of the chocolate candy.

Lastly, the outcome of the study shows trends and valuable material for a branding strategy, but it does not provide a measure of buying and repurchase behaviour. In fact, customer retention was not the focus of this study.

6.3 Suggestions for further research

The aim of this study was to take qualitative and quantitative psychological measures of eating behaviour in regards to edible insects. Respondents did not taste samples, but rather rated and based their preference on inferred properties, such as quality, taste and flavour. This might culturally vary between Northern and Mediterranean consumers, or even within the same country, among clusters of consumers. Further quantitative research should focus on formal taste assessments.

In fact, as mentioned in the state of the art, consumers might be less resistant when introduced to the sweet varieties of insect-base food, but it is still unclear if the willingness is equally high for the savoury version of such products.

Lastly, when examining the willingness to eat insect-based food, factors like safety concerns, risk perception and perceived food quality should be taken into account and therefore are worth exploring in further studies.

6.4 Recommendations for the company

Jumping Jack Snacks should promptly choose between one strategy and the other and make an informed decision based on the additional key variables of its business model. The Value Proposition Canvas is only the first step for constructing a thorough business strategy and the final choice has to be made considering the whole framework of the Business Model Canvas. In fact, in order to make an informed decision, it is necessary to take into account other variables, such as profit margins, the competitor environment, the size of the market, possible barriers to enter, the channels and so on. For instance, a healthier version of the average granola bar requires a high content of insect flour, which would drastically increase the unit cost per bar. Nevertheless, the firm cannot keep on using its granola bar while carrying on a sensory strategy, but should rather separate the two elements and choose one or the other.

It is also true that the current state of the art is more prone to see potential in the sensory strategy and indulgence has been acknowledged to be a strong driver for acceptance. Furthermore, both the focus and the expertise of the start-up are heading towards the sensory strategy. The *Jumping Jack* team should therefore carry on its current strategy and create a brand image and a product mix based on indulgence, uniqueness and adventurousness.

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Appendix

Appendix A

Laddering tables and figures.

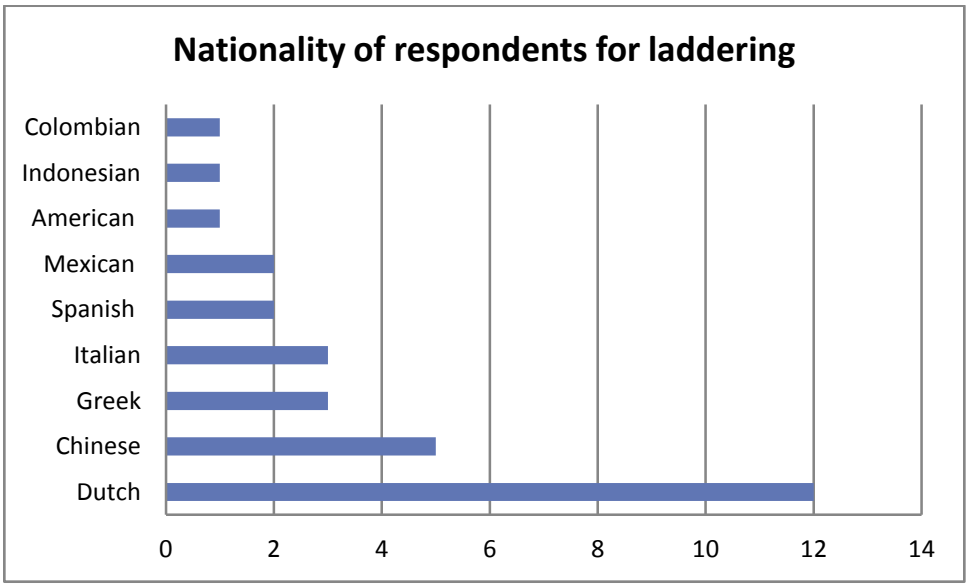

Figure 24: Nationality of respondents of the laddering interviews

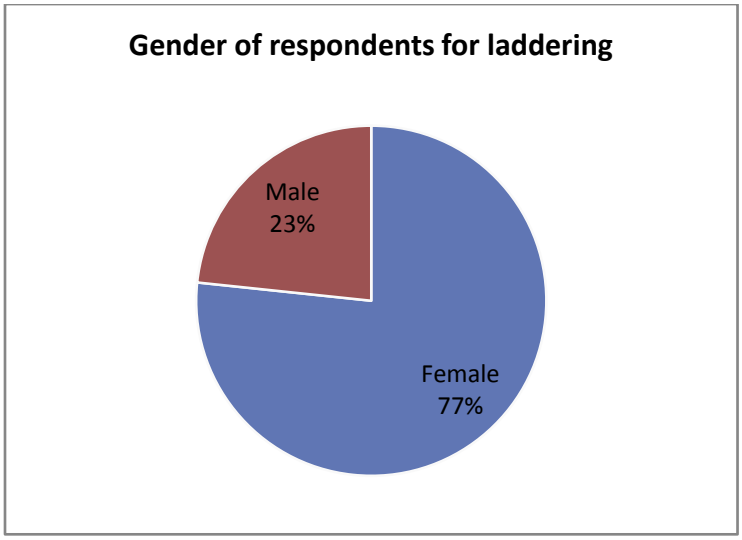

Figure 25: Gender of respondents of the laddering interviews

Table 4: Summary Content Codes for Laddering

Item	Attributes	Consequences	Values
(1) Cookie	(6) Tasty	(20) Pleasure	(44) Self-fulfilment and accomplishment
(2) Bar	(7) Nutritious	(21) Satisfaction	(45) Security
(3) Insects	(8) Handy	(22) Balanced diet	(46) Bonding
(4) Price	(9) Innovative	(23) Health	(47) Responsibility
(5) Chocolate	(10) Low CFP	(24) Improved quality of life	(48) Peace of mind and self-respect
	(11) Sweet	(25) Indulgence	(49) Well being
	(12) Unfamiliar	(26) Curiosity	(50) Self esteem
	(13) Healthy	(27) Neophilia	
	(14) Treat	(28) Sustainable	
	(15) Milled	(29) Help the environment	
	(16) Energetic	(30) Rewarding	
	(17) Attractive	(31) Out of the comfort zone	
	(18) Affordable	(32) Satiety	
	(19) Protein rich	(33) More time	
		(34) Adventure	
		(35) Disgust	
		(36) Hygiene	
		(37) Easy to carry	
		(38) Convenient	
		(39) Easy to approach	
		(40) Appropriate	
		(41) Save money	
		(42) Neophobia	
		(43) Fear	

Table 4 is the outcome of the first step of laddering content analysis, where all the relevant items, attributes, consequences and values were labelled. The focus is on the relationship between elements and not on the elements themselves. For instance, “More time” is a summary of more detailed expressions, such as “Going rapidly back to work”, “More time for myself”, “More time to study” and “Optimize my time”. Afterwards, numbers were assigned to the codes and then used to label each element of each ladder (Table 5).

Table 5: Score Matrix

Ladder	Content codes					
1	1	6	25	20	21	49
2	2	7	22	23	24	50
3	2	8	37	38	33	44
4	3	9	26	27	49	0
5	3	10	28	29	48	0
6	1	11	30	20	21	49
7	2	13	22	24	50	0
8	3	12	31	35	45	0
9	2	7	32	33	44	0
10	1	6	25	20	21	49
11	3	17	26	34	27	46
12	4	18	41	47	0	0
13	1	6	25	30	20	49
14	3	17	26	34	27	46
15	3	10	28	29	48	0
16	5	14	25	20	49	0
17	1	6	25	20	49	0
18	3	12	31	35	36	45
19	3	12	31	35	45	0
20	2	7	22	23	24	50
21	1	6	25	20	49	0
22	3	12	31	35	45	0
23	2	8	37	38	33	44
24	1	6	25	20	21	49
25	2	13	22	24	50	0
26	5	6	25	20	49	0
27	3	12	31	35	45	0
28	3	15	39	40	45	0
29	4	18	41	47	0	0
30	3	19	22	23	24	50
31	1	6	25	20	49	0
32	2	7	32	33	44	0
33	3	15	39	40	45	0
34	5	6	25	20	49	0
35	3	12	35	42	45	0
36	3	12	35	42	45	0
37	1	6	25	25	20	49

38	2	16	32	33	44	0
39	3	17	26	34	27	46
40	5	6	25	20	49	0
41	2	8	37	38	33	44
42	2	16	32	33	44	0
43	3	17	34	27	46	0
44	2	8	38	33	44	0
45	1	6	25	20	49	0
46	2	7	23	24	50	0
47	3	17	26	34	27	46
48	3	10	28	29	48	0
49	4	18	41	47	0	0
50	2	14	32	33	44	0
51	4	18	41	47	0	0
52	3	17	26	34	27	46
53	3	12	35	43	42	45
54	1	14	30	20	49	0
55	3	19	22	23	24	50
56	3	19	22	23	24	50
57	3	10	28	29	48	0
58	2	7	23	24	50	0
59	4	18	41	47	0	0
60	2	7	32	33	44	0
61	3	17	26	27	46	0
62	3	19	22	23	50	0
63	4	18	41	47	0	0
64	3	15	39	40	45	0
65	1	11	25	20	21	49
66	2	7	32	33	44	0
67	2	7	32	33	44	0
68	3	17	26	27	46	0
69	3	10	28	29	48	0
70	3	17	26	27	46	0
71	3	10	28	29	48	0
72	3	19	22	23	24	50
73	3	19	22	23	24	50
74	3	10	28	29	48	0
75	1	14	30	20	49	0
76	3	12	35	43	42	45
77	1	6	25	20	49	0

78	3	17	26	34	27	46
79	3	19	22	23	24	50
80	4	18	41	47	0	0
81	3	17	26	34	27	46
82	2	8	37	38	33	44
83	3	10	28	29	48	0

Table 5 is a matrix with rows indicating an individual respondent's ladder and columns being the elements of each ladder. A respondent can have multiple ladders and therefore multiple rows. In this study, out of 30 respondents it was possible to extract up to 83 meaningful ladders and categories of meaning.

Table 6 shows the Implication Matrix, a square matrix that displays how many times each element leads to all the other elements of the same row (e.g. of the same ladder), directly or indirectly. The numbers are expressed in fractional form with direct relations to the left of the decimal and indirect relations to the right of the decimal. For instance, "Cookie" leads to "Tasty" nine times directly and zero time indirectly (9.0) and it leads to "Pleasure" zero times directly and thirteen times indirectly (0.13).

Table 6: Implication Matrix

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	sum
1 Cookie	9.0		0.1			2.0			2.0				0.1		0.13	0.4				0.10					0.4			0.1				0.1	0.1			1.0			0.1			1.0		0.13		16.51
2 Bar		8.0	5.0					2.0	1.0		2.0						0.4	0.4	0.6							0.7	0.12				0.4	0.5						0.11					0.6	18.59
3 Insects				1.0	8.0		9.0			3.0		10.0		7.0			0.7	0.7	0.6		0.10	0.11	0.8	0.8		0.5		0.8	0.9	0.1			0.3	0.3		0.4	0.2		0.12	0.10		0.8	0.1	0.7	38.130
4 Price													7.0																						0.7							0.7			7.14
5 Chocolate	3.0								1.0						0.4					0.4																							0.4		4.12
6 Tasty															0.13	0.3				13.0					0.1																	0.13		13.30
7 Nutritious																	2.0	2.2	0.4								5.0	0.5											0.5				0.4	9.20
8 Handy																												0.5				4.0	1.4					0.4						5.13
9 Innovative																					1.0	0.1																					0.1		1.2
10 Low CFP																							8.0	0.8																			0.8		8.16
11 Sweet															0.2	0.2				1.0					1.0																	0.2		2.6
12 Unfamiliar																										5.0				4.5	0.1					0.4	0.2		0.9					9.21
13 Healthy																	2.0		0.2																							0.2		2.4
14 Treat															0.3					1.0					2.0		1.0	0.1										0.1				0.3		4.8
15 Milled																																		3.0	0.3				0.3						3.6
16 Energetic																											2.0	0.2											0.2						2.4
17 Attractive																					10.0	0.11							1.7												0.11			11.29
18 Affordable																																				7.0						0.7			7.7
19 Protein rich																	7.0	0.7	0.6																								0.7	7.20
20 Pleasure																5.00				14.1					4.0																	13.5		36.6
21 Satisfaction																				0.4					0.1																	5.0		5.5
22 Balanced diet																		9.0	2.8																								0.11	11.19
23 Health																			10.0																								1.10	11.10
24 Improved quality of life																																											12.0	12.0
25 Indulgence																									1.0																	0.15		1.15
26 Curiosity																						4.7							7.0												0.10		0.1	11.18
27 Neophilia																													8.0												11.0		1.0	20.0
28 Sustainable																								8.0																			0.8		8.8
29 Help the environment																																										8.0		8.0
30 Rewarding																																											0.4	0.4
31 Out of the comfort zone																														5.0	0.1								0.5						5.6
32 Satiety																												8.0										0.8						8.8
33 More time																																0.4	5.0					12.0						17.4
34 Adventure																																									0.8				0.8
35 Disgust																															1.0					2.2	2.0		4.5						9.7
36 Hygiene																																							1.0						1.0
37 Easy to carry																																	4.0					0.3						4.3
38 Convenient																																						0.4						0.4
39 Easy to approach																																			3.0				0.3						3.3
40 Appropriate																																						3.0						3.0
41 Save money																																									6.1			6.1
42 Neophobia																																							4.0						6.0
43 Fear																																							0.2						0.2
44 Self-fulfillment, accomplishment																																												
45 Security																																												
46 Bonding																																												
47 Responsibility																																												
48 Peace of mind, self-respect																																												
49 Well being																																												
50 Self esteem																																												
	12.0	8.0	5.1	1.0	8.0	2.0	9.0	2.0	4.0	3.0	2.0	10.0	7.1	7.0	0.35	5.9	11.11	11.20	12.32	29.19	11.10	4.30	8.8	8.16	8.6	5.5	8.7	8.26	16.15	9.14	1.3	4.9	10.10	3.3	3.6	8.7	2.10	4.4	12.39	12.39	11.39	7.15	8.24	19.62	13.47	sum

Appendix B

Introduction

We're a start-up company willing to learn more about how European consumers perceive food products based on edible insects flour. The products in this survey are all consumed as a snack between lunch and dinner.

Imagine the following consumption situation: you are at home, it is 4 o'clock in the afternoon, and you are by yourself and hungry. This survey will take approximately 10 minutes of your time. All your answers will remain confidential. There are no right or wrong answers: we are only interested in your sincere and spontaneous opinion.

Thanks for your help!

Question 1

This page contains 10 statements. Please indicate your response that most closely reflects your current perception.

	STRONGLY DISAGREE						**STRONGLY AGREE**
I AM CONSTANTLY SAMPLING NEW AND DIFFERENT FOODS.	1	2	3	4	5	6	7
I DON'T TRUST NEW FOODS.	1	2	3	4	5	6	7
IF I DON'T KNOW WHAT IS IN A FOOD, I WON'T TRY IT.	1	2	3	4	5	6	7
I LIKE FOODS FROM DIFFERENT COUNTRIES.	1	2	3	4	5	6	7
ETHNIC FOOD LOOKS TOO WEIRD TO EAT.	1	2	3	4	5	6	7
AT DINNER PARTIES, I WILL TRY A NEW FOOD.	1	2	3	4	5	6	7
I AM AFRAID TO EAT THINGS I HAVE NEVER HAD BEFORE.	1	2	3	4	5	6	7
I AM VERY PARTICULAR ABOUT THE FOODS I WILL EAT.	1	2	3	4	5	6	7
I WILL EAT ALMOST ANYTHING.	1	2	3	4	5	6	7
I LIKE TO TRY NEW ETHNIC RESTAURANTS.	1	2	3	4	5	6	7

Question 2

Chocolate chip cookies, made with dark chocolate and mealworm flour.

I THINK THIS FOOD PRODUCT IS……

	Strongly disagree						Strongly agree
ATTRACTIVE	1	2	3	4	5	6	7
INNOVATIVE	1	2	3	4	5	6	7
LOOKS NICE	1	2	3	4	5	6	7
HAS A PLEASANT TEXTURE	1	2	3	4	5	6	7
TASTES GOOD	1	2	3	4	5	6	7
HANDY	1	2	3	4	5	6	7
READY TO CONSUME	1	2	3	4	5	6	7
NUTRITIOUS	1	2	3	4	5	6	7
ENERGY GIVING	1	2	3	4	5	6	7
HEALTHY	1	2	3	4	5	6	7
HIGH IN PROTEIN	1	2	3	4	5	6	7
WHAT I USUALLY EAT	1	2	3	4	5	6	7
FAMILIAR	1	2	3	4	5	6	7
SUSTAINABLE	1	2	3	4	5	6	7

Question 3

Granola bar, made with oat flakes, apricots, raisins, honey and cricket flour.

I THINK THIS FOOD PRODUCT IS……

	Strongly disagree						Strongly agree
ATTRACTIVE	1	2	3	4	5	6	7
INNOVATIVE	1	2	3	4	5	6	7
LOOKS NICE	1	2	3	4	5	6	7
HAS A PLEASANT TEXTURE	1	2	3	4	5	6	7
TASTES GOOD	1	2	3	4	5	6	7
HANDY	1	2	3	4	5	6	7
READY TO CONSUME	1	2	3	4	5	6	7
NUTRITIOUS	1	2	3	4	5	6	7
ENERGY GIVING	1	2	3	4	5	6	7
HEALTHY	1	2	3	4	5	6	7
HIGH IN PROTEIN	1	2	3	4	5	6	7
WHAT I USUALLY EAT	1	2	3	4	5	6	7
FAMILIAR	1	2	3	4	5	6	7
SUSTAINABLE	1	2	3	4	5	6	7

Question 4

Tortilla chips with corn and mealworm flour.

I THINK THIS FOOD PRODUCT IS……

	Strongly disagree						Strongly agree
ATTRACTIVE	1	2	3	4	5	6	7
INNOVATIVE	1	2	3	4	5	6	7
LOOKS NICE	1	2	3	4	5	6	7
HAS A PLEASANT TEXTURE	1	2	3	4	5	6	7
TASTES GOOD	1	2	3	4	5	6	7
HANDY	1	2	3	4	5	6	7
READY TO CONSUME	1	2	3	4	5	6	7
NUTRITIOUS	1	2	3	4	5	6	7
ENERGY GIVING	1	2	3	4	5	6	7
HEALTHY	1	2	3	4	5	6	7
HIGH IN PROTEIN	1	2	3	4	5	6	7
WHAT I USUALLY EAT	1	2	3	4	5	6	7
FAMILIAR	1	2	3	4	5	6	7
SUSTAINABLE	1	2	3	4	5	6	7

Question 5

Protein milkshake based on cacao, cricket flour, spirulina, hemp seeds, chia seeds and lucuma.

I THINK THIS FOOD PRODUCT IS……

	Strongly disagree						Strongly agree
ATTRACTIVE	1	2	3	4	5	6	7
INNOVATIVE	1	2	3	4	5	6	7
LOOKS NICE	1	2	3	4	5	6	7
HAS A PLEASANT TEXTURE	1	2	3	4	5	6	7
TASTES GOOD	1	2	3	4	5	6	7
HANDY	1	2	3	4	5	6	7
READY TO CONSUME	1	2	3	4	5	6	7
NUTRITIOUS	1	2	3	4	5	6	7
ENERGY GIVING	1	2	3	4	5	6	7
HEALTHY	1	2	3	4	5	6	7
HIGH IN PROTEIN	1	2	3	4	5	6	7
WHAT I USUALLY EAT	1	2	3	4	5	6	7
FAMILIAR	1	2	3	4	5	6	7
SUSTAINABLE	1	2	3	4	5	6	7

Question 6

Artisanal handmade chocolate candy topped with a gold-coated cricket.

I THINK THIS FOOD PRODUCT IS……

	Strongly disagree						Strongly agree
ATTRACTIVE	1	2	3	4	5	6	7
INNOVATIVE	1	2	3	4	5	6	7
LOOKS NICE	1	2	3	4	5	6	7
HAS A PLEASANT TEXTURE	1	2	3	4	5	6	7
TASTES GOOD	1	2	3	4	5	6	7
HANDY	1	2	3	4	5	6	7
READY TO CONSUME	1	2	3	4	5	6	7
NUTRITIOUS	1	2	3	4	5	6	7
ENERGY GIVING	1	2	3	4	5	6	7
HEALTHY	1	2	3	4	5	6	7
HIGH IN PROTEIN	1	2	3	4	5	6	7
WHAT I USUALLY EAT	1	2	3	4	5	6	7
FAMILIAR	1	2	3	4	5	6	7
SUSTAINABLE	1	2	3	4	5	6	7

Question 7

Which of the presented products would you like to try? You can choose more than one option.

- ☐ Granola bar
- ☐ Chocolate chip cookie
- ☐ Protein milkshake
- ☐ Tortilla chips
- ☐ Chocolate candy
- ☐ None of the above

Question 8

What are you most curious to try? You can choose more than one option.

- ☐ Crickets
- ☐ Mealworms
- ☐ Edible insects in general
- ☐ None of the above

Background questions

Gender

- ☐ Male
- ☐ Female

What is your age? _____

What is your country of origin? _____

Thank you for your time and effort in completing this survey!

Appendix C

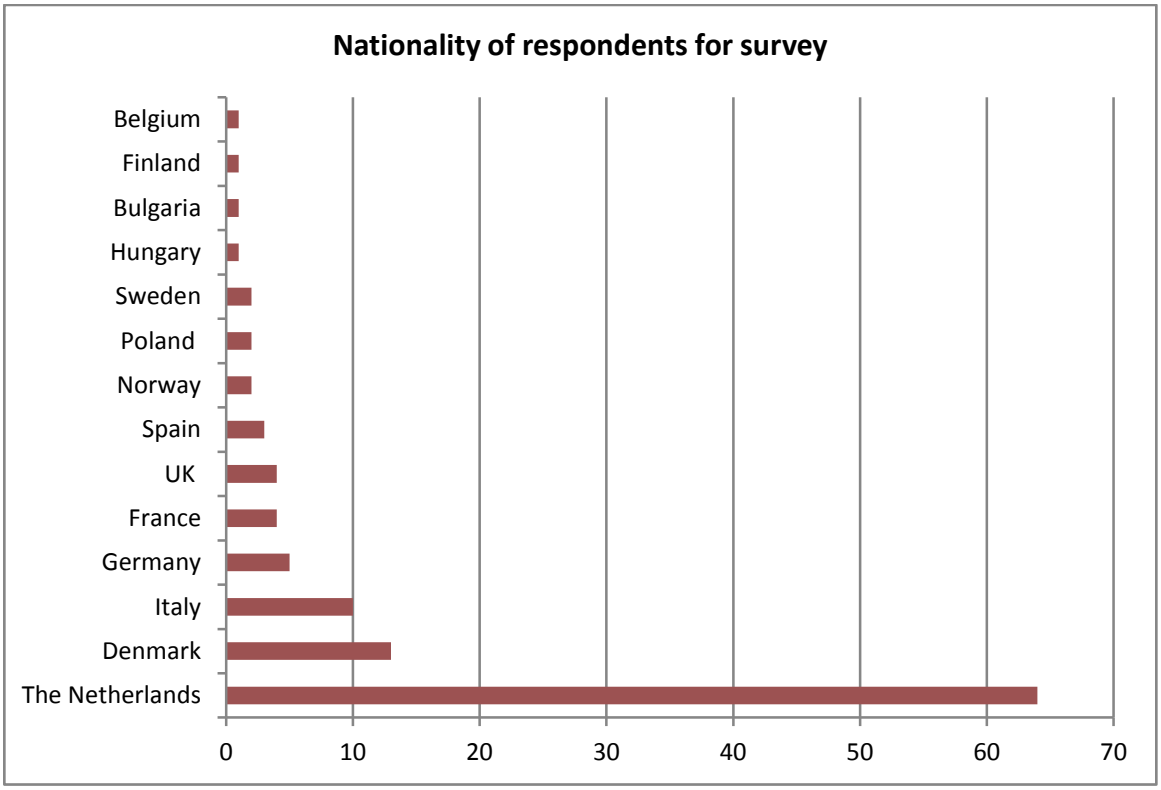

Figure 26: Nationality of respondents for the survey study

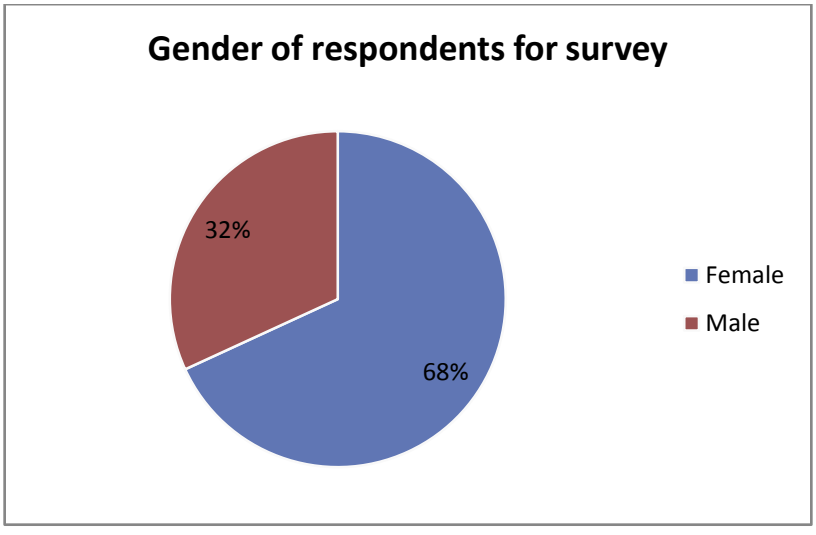

Figure 27: Gender of respondents for the survey study

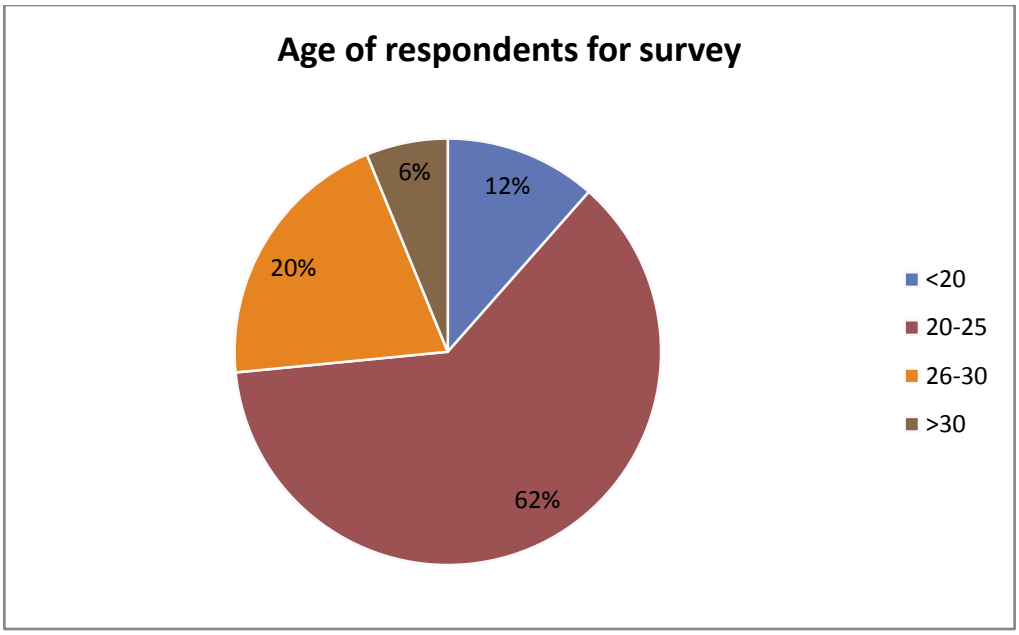

Figure 28: Age of respondents for the survey study

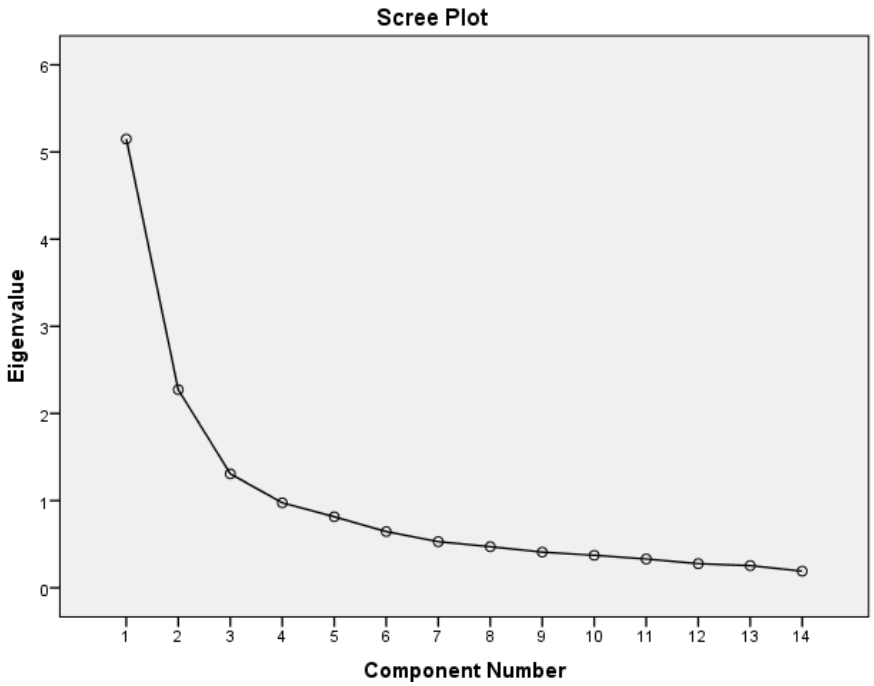

Figure 29: Eigenvalue and significant number of factors

Table 7: Total Variance explained for the first run of SPSS

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.149	36.778	36.778	3.527	25.190	25.190
2	2.273	16.235	53.013	3.306	23.614	48.804
3	1.308	9.344	62.357	1.897	13.553	62.357

Table 8: Communalities for the first run of SPSS

Variables	**Extraction**
Attractive	0.710
Innovative	0.582
Looks nice	0.735
Has a pleasant texture	0.663
Tastes good	0.635
Handy	0.478
Ready to consume	0.273
Nutritious	0.766
Energy giving	0.555
Healthy	0.741
High in protein	0.736
What I usually eat	0.632
Familiar	0.735
Sustainable	0.489

Table 9: Rotated Component Matrix for the whole dataset

Rotated Component Matrix	Component		
	1	2	3
Attractive	0.119	0.810	0.199
Innovative	0.430	0.443	-0.449
Looks nice	0.181	0.838	-0.011
Has a pleasant texture	0.105	0.775	0.225
Tastes good	0.035	0.760	0.239
Handy	0.366	0.368	0.457
Ready to consume	0.178	0.425	0.246
Nutritious	0.866	0.106	0.069

Energy giving	0.710	0.209	0.085
Healthy	0.851	0.051	0.122
High in protein	0.854	0.068	-0.044
What I usually eat	0.207	0.317	0.699
Familiar	0.039	0.229	0.825
Sustainable	0.605	0.203	0.287

Table 10: Total Variance explained for neophilic respondents

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.870	34.787	34.787	3.350	23.925	23.925
2	2.357	16.834	51.620	2.773	19.810	43.735
3	1.419	10.135	61.755	2.523	18.020	61.755

Table 11: Rotated Component Matrix for neophilic respondents

Rotated Component Matrix	Component		
	1	2	3
Attractive	0.101	0.844	0.255
Innovative	0.429	0.531	-0.327
Looks nice	0.128	0.854	0.025
Has a pleasant texture	0.087	0.611	0.502
Tastes good	-0.014	0.615	0.509
Handy	0.284	0.186	0.597
Ready to consume	0.069	0.388	0.261
Nutritious	0.867	0.079	0.070
Energy giving	0.699	0.118	0.147
Healthy	0.858	0.090	0.154
High in protein	0.848	0.063	0.004
What I usually eat	0.184	0.237	0.711
Familiar	0.002	0.075	0.823
Sustainable	0.563	0.136	0.426

Table 12: Total Variance explained for neophobic respondents

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %

1	5.176	36.975	36.975	3.658	26.129	26.129
2	2.211	15.793	52.768	3.173	22.666	48.795
3	1.409	10.066	62.834	1.965	14.039	62.834

Table 13: Rotated Component Matrix for neophilic respondents

Rotated Component Matrix	Component		
	1	2	3
Attractive	0.108	0.708	0.371
Innovative	0.452	0.417	-0.395
Looks nice	0.218	0.809	0.143
Has a pleasant texture	0.091	0.838	0.088
Tastes good	0.049	0.798	0.084
Handy	0.426	0.443	0.352
Ready to consume	0.277	0.335	0.342
Nutritious	0.861	0.104	0.122
Energy giving	0.714	0.260	0.089
Healthy	0.831	-0.029	0.160
High in protein	0.859	0.073	-0.047
What I usually eat	0.191	0.220	0.764
Familiar	0.034	0.163	0.862
Sustainable	0.638	0.194	0.134