

The Buzzing Future of Food

Opportunities and Barriers for Denmark to Normalize Insects as a Sustainable Meat Alternative

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Sustainability Studies



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Abstract

Insects have been recommended by the FAO as a sustainable food alternative to meat. Despite their nutritional quality and sustainability, most Western countries still see insects as belonging far away from the dinner table. Although still a niche market, Denmark has been at the forefront of innovation and adoption of edible insects. I used integral theory to map out the structural, cultural and personal opportunities and barriers for Denmark in transitioning to this sustainable meat alternative.

To do so I used three methods to get a holistic understanding of the problem. Firstly, I conducted a literature review of 30 articles, collecting the opportunities and barriers mentioned to increase insect eating in Western countries. The literature review results guided me for the media analysis as the categories derived were used to find opportunities and barriers within the media. The media analysis covered 48 Danish online news articles and built upon the categories from the literature. The results from the literature review and the media analysis were then used as a basis for the interviews where six industry experts from the public and the private sector in Denmark rated the opportunities and barriers based on their importance in increasing insect eating in Denmark.

The results showed that the biggest opportunity across all three methods to increase insect eating in Denmark is the structural opportunity of presenting insects invisibly or mixed in with familiar dishes for higher consumer acceptance, whereas the biggest barrier to increase insect eating in Denmark is the personal barrier of negativity towards eating insects. The results also showed the interconnectedness of the opportunities and barriers and thus the importance of a holistic approach needed to change behavior when it comes to adopting edible insects into diets as a sustainable alternative to meat.

Key Words: edible insects, entomophagy, meat alternative, integral theory, barriers, opportunities.

Word Count: 13,995

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1 Introduction

1.1 Problem Conceptualization

Agriculture and the land use change that comes with it, is responsible for 26% of anthropogenic global greenhouse gas emissions, with the majority driven by animal products (Poore & Nemecek, 2018). If we manage to stay within the 2-degree warming budget, this number could rise to 70% by 2050 as the demand for meat and dairy products is expected to grow by 80% between 2006 and 2050 (Ranganathan et al., 2016). The demand for the highest greenhouse gas emitting meat, beef, is expected to grow by 95% within the same time frame (Ranganathan et al., 2016). When it comes to meat, beef is the climate's worst enemy, being the least efficient meat produced as only 4% of the protein that goes into the production is converted to food (Ranganathan et al., 2016). Beef production is also responsible for 65% of deforestation in the Brazilian Amazon (Recanati et al., 2015).

Different pathways to reduce meat consumption and its climate impact have been discussed, ranging with everything from moving towards a more plant-based diet (Ranganathan et al., 2016; Schösler et al., 2012), to cultured meat (Alexander et al., 2017), to eating insects (Alexander et al., 2017; Schösler, Boer, & Boersema, 2012). The Food and Agricultural Organization of the United Nations (FAO) is among those who has recommended insect eating as a healthy and sustainable alternative to meat consumption (Van Huis et al., 2013). As shown in *Figure 1*, crickets need over 12 times less land, 11 times less feed, and 12 times less water compared to beef to produce one kilogram of edible beef or cricket (Dobermann, Swift, & Field, 2017). In addition, *Figure 2* shows that beef production is responsible for on average 1,815 times higher emissions of CO₂ equivalents compared to crickets per kilogram of mass gain (Oonincx et al., 2010).

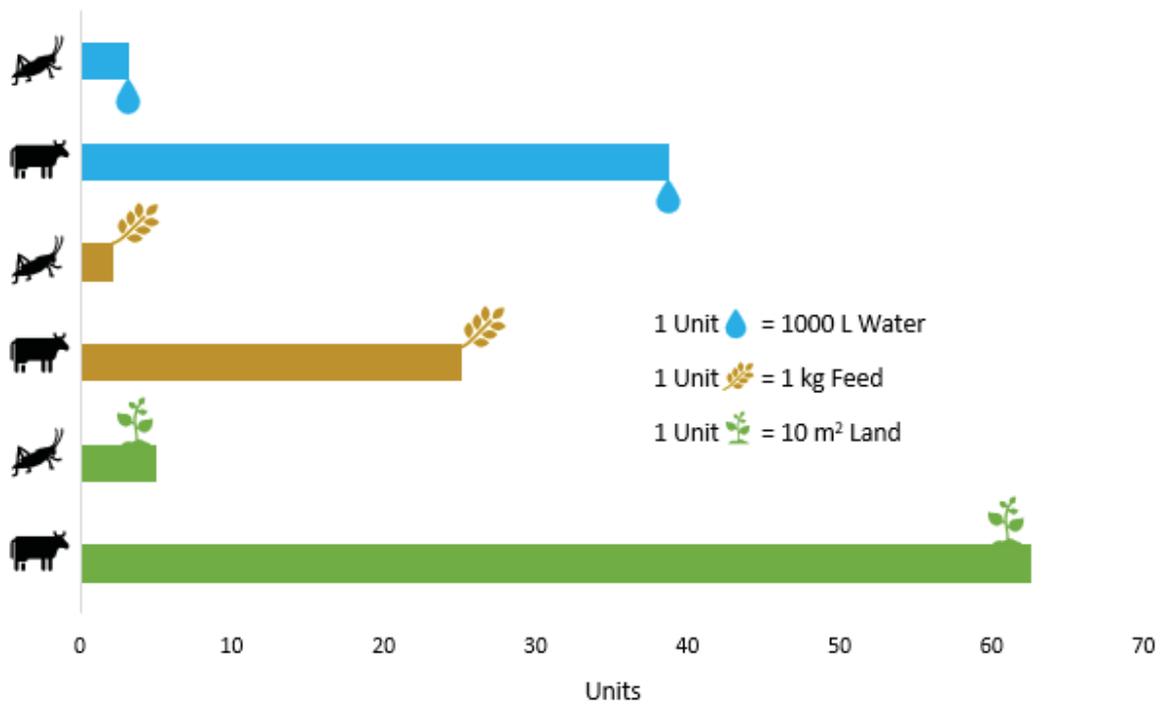


Figure 1. Comparison of land, feed and water needed to produce 1 kg of edible beef and cricket. Own illustration using data from Dobermann et al., (2017).

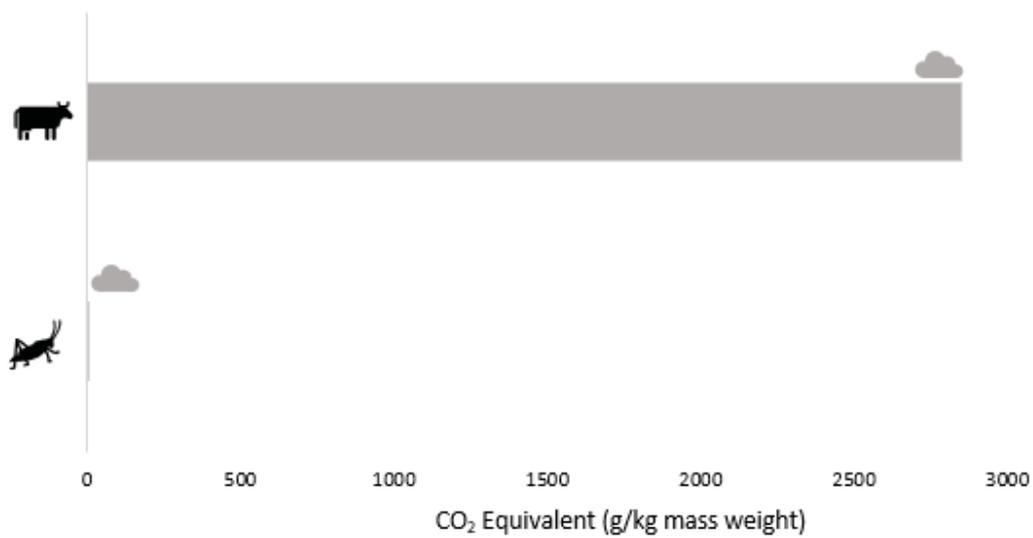


Figure 2. The CO₂ equivalents emissions per kilogram of mass gain from producing crickets compared to beef. Own illustration using data from Oonincx et al., (2010).

Insect eating has historically been practiced worldwide but is under a threat due to Westernization of diets and the Western view of insect eating being a primitive practice (Van Huis et al., 2013). With increased income levels, urbanization and the lack of accessibility to nutritious food, more people have moved towards the Western style diet which is too high in calories, heavily processed and contains high amounts of animal source foods (Willett et al., 2019). This diet is unhealthy to humans and highly environmentally unsustainable (Willett et al., 2019).

Due to the Western aversion to eating insects and the spread of Western diet around the world, the FAO has emphasized the importance of education about the benefits of eating insects for higher acceptance of it in the West and worldwide (Van Huis et al., 2013). However, several authors have argued that a change towards a more ecological behavior can be difficult and often does not happen through information alone as behavior is complicated and influenced by many factors that can sometimes seem non-rational (Deroy, Reade, & Spence, 2015; Ericson, Kjørstad, & Barstad, 2014; Hedlund-de Witt, 2012; Maiteny, 2002; Owens, 2005; Wamsler & Riggers, 2018). Thus, it is important to explore whether providing information through education can facilitate a behavior change of Western countries adopting insects into their diets and if not, look at what other opportunities there are to do so.

In general, Western countries seem to be still far away from adopting insect eating. As of 2018, the EU categorizes insects under the novel food regulations. The law can be both interpreted and applied differently in different countries within the EU (International Platform of Insects for Food and Feed, 2018). Belgium, Denmark, Finland, the Netherlands and the United Kingdom are currently the only five countries within the EU that have fully accepted insects as food and made their own regulations regarding which species can be produced and marketed (Lähteenmäki-Uutela et al., 2018), other countries such as Sweden, Spain and Italy do not authorize the production or marketing of insects as food within their countries (International Platform of Insects for Food and Feed, 2018).

It is easy to point fingers and suggest that developing countries need to adopt a more sustainable diet consisting of sustainable alternative to meat such as insects, so the developed countries do not have to make changes to their current diets. However, as the world is moving towards a more Westernized diet (Van Huis et al., 2013), we need to abandon that narrow view and start to re-think our diets globally as the Western diet is the root of both health and environmental problems.

1.2 Why Denmark?

In this thesis, I will be studying the case of insect eating in Denmark. Denmark has been involved in innovative initiatives aimed at rethinking our diets in several ways. The country has not been known for having a particularly strong cuisine until the last few decades with the emergence of the New Nordic Cuisine (Byrkjeflot, Pedersen, & Svejenova, 2013). The New Nordic Cuisine aimed at putting the Nordic countries on the culinary map by re-inventing what Nordic food consists of, moving away from the heavy traditional cuisine and incorporating new local ingredients such as birch sap and arctic brambles. Since then, Nordic restaurants have been recognized worldwide with the Danish restaurant Noma being elected the best restaurant in the world repeatedly over the past years (Byrkjeflot et al., 2013). Noma is known for untraditional dishes and has opened people's eyes to eating insects by serving luxurious dishes containing insects (Videbæk & Grunert, 2017).

In addition to re-identifying Nordic cuisine, the Danish Consortium on Insects as Food and Feed has started their ongoing multidisciplinary project with several universities in Denmark, partners from the private sector, NGOs, and international networks and research centers, all working together on various areas related to insect eating (University of Copenhagen, 2019).

Verneau et al., 2016, have suggested that the overall acceptance and curiosity of Denmark towards insect eating is due to this innovativeness and rapid change that the Danish food culture has seen over the last decades. Although Denmark has not normalized insects as meat substitute yet, a Danish study from 2017 has indicated that there are potentials to do so with 28% of Danes being open to the idea of eating insects whereas only 23% said that they were against it (Videbæk & Grunert, 2017). Thus, given the interest and status of Denmark as a frontrunner among Western countries when it comes to insect eating, this thesis will explore further the barriers and opportunities for Denmark to become the first Western country to normalize insect eating.

1.3 Thesis Aim and Research Questions

The aim of this thesis is to map the structural, cultural, and personal opportunities and barriers for Denmark to increase insect eating and explore how the opportunities and barriers influence the end behavior of whether people choose to eat insects. To answer the overarching research question: *What barriers does Denmark need to overcome, and what opportunities can they take an advantage of, to normalize edible insects as a meat substitute?*, I have come up with three sub-questions that will unravel the opportunities and barriers each from a different angle and will collectively contribute to answering

the overarching question. The first research question explores what the current literature has identified as barriers and opportunities, the second question answers what opportunities and barriers are reflected in the Danish media, and the third one aims to answer which barriers and opportunities are experienced by industry experts (Table 1).

Table 1. The three research questions that will be answered in this thesis and used to answer the overarching research question.

Overarching Research Question
What barriers does Denmark need to overcome and what opportunities can they take an advantage of to normalize edible insects as a meat substitute?
Sub-Research Questions that will help answer the overarching research question
RQ1: What are the opportunities and barriers identified in academic literature to increase insect eating?
RQ2: What are the opportunities and barriers identified in the Danish media to increase insect eating in Denmark?
RQ3: What are the opportunities and barriers identified by industry experts to increase insect eating in Denmark?

1.4 Navigating Through the Thesis

I will start by introducing the theoretical framework of how I used integral theory to guide me in an inclusive collection of opportunities and barriers. Following the theoretical background, I will introduce the methodology used to answer each research question. Thereafter, I introduce the results of each research question before discussing the implications of the results and how they jointly answer the overarching research question. I then address the limitations of the thesis and provide suggestions on relevant future research.

2 Theoretical Framework

2.1 Integral Theory Framework

I used Integral Theory as my theoretical framework to assist me in answering my research questions. Integral theory, first termed by Ken Wilber, aims at producing a holistic view of the world which instead of labeling a right and a wrong approach to a problem, recognizes the many truths that need to be considered to represent a problem as a whole (Owens, 2005). Since then, other authors have adapted it to different disciplines. In this thesis I will be using an adapted version of Wilber's framework created by Owens (2005).

The only change that I have applied in implementing Owens' version of the framework is that I identified both the opportunities and the barriers to the behavior of eating insects whereas Owens' research aimed at identifying only the barriers to the behavior problem of waste. Owens' use of Wilber's integral theory aims at enhancing the understanding of and contribute to resolve a socio-ecological problem by considering all sides of the particular problem (Owens, 2005). Therefore, instead of creating new knowledge in more radical ways, integral theory acknowledges the knowledge that has already been created but has not been considered as a whole and thus needs to be brought together for a holistic view of a behavior through an integral approach (Owens, 2005).

The three factors influencing the end behavior of a socio-ecological problem, which in my case are the factors enabling or inhibiting the behavior of insect eating, are cultural, structural, and personal (Owens, 2005). According to this, every barrier and opportunity that I identified in my research was categorized as cultural, structural, or personal. Through this categorization, the framework shows if one area is being privileged and thus gives us an opportunity to look at who is privileging that area and why (Esbjörn-Hagens, 2005).

Each category is further explained below, but in guiding me through consistent categorization according to the framework, I used Owens' (2005) guiding questions in the categorization process which are shown in *Table 2*. A positive answer to a guiding question determined the category of either an opportunity or a barrier.

Table 2. The guiding questions for the categorization of data into integral theory, adapted from Owens (2005).

Category	Guiding Question
<i>Structural</i>	Is the “It/s” (some aspect of the social or physical environment) the opportunity or barrier?
<i>Cultural</i>	Is the “We” (the group or culture) the opportunity or the barrier?
<i>Personal</i>	Is the “I” (personal experience or beliefs) the opportunity or the barrier?

2.1.1 Structural

The structural category is the one that usually receives the most attention in academia and society in general as the implementation of a new system or a law is often the first step taken to support a sustainable action (Owens, 2005). In my case, this means looking at what structural aspects of the social or physical environment represent the opportunities and the barriers to increase insect eating in Denmark. The structural factor is important for a good reason; if there is a lack of clear legalization around the production or selling of edible insects, this acts as a barrier to increase insect eating as people will not be able to purchase insect-based products in the supermarket. In the same sense, if insect eating is promoted through legislation, this acts as a structural opportunity to increase insect eating as the products become readily available. However, as with all factors within integral theory, they are co-dependent (Owens, 2005), and thus the structural category is dependent on favorable cultural and personal conditions for people to then take advantage of the positive structures which have been put in place.

2.1.2 Cultural

The cultural category represents how our final behavior is influenced by factors such as group norms, worldviews and discussions that we have with other people (Owens, 2005). By creating a dialogue within the education system, between citizens, and in government by taking a look at whether the group or the culture is the opportunity or the barrier, we can challenge worldviews such as the ones linking status or a special occasion to eating a steak rather than a more sustainable alternative (Leroy & Praet, 2015; Owens, 2005). Cultural beliefs around insect eating can therefore influence an individual’s decision of whether to eat insects.

2.1.3 Personal

The personal category consists of somatic realities such as emotions, feelings and sensations (Owens, 2005). This is a category that is based on subjective experiences and is sometimes underexplored in both

the academic and the public sphere (Esbjörn-Hargens, 2010). However, it should be considered carefully as it can provide an important insight into a behavior or a lack thereof as the final decision of whether to eat insects is after all a personal one that might be somewhat based on subjective experiences although it is likely to be influenced by structural or cultural factors as well. The personal factor can sometimes be the final factor hindering a person's behavior as the person might be well aware of the ecological effects of their behavior and have all the resources possible to change the behavior but still not make the change due to a psychological barrier of the fear of unknown, wanting to stay within a comfort zone, or due to other cognitive dissonance that can be difficult to pinpoint what causes (Owens, 2005).

2.2 Integral Theory and Sustainability Science

The inclusive way of looking at a problem such as the unsustainability of meat consumption, under the lens of the integral theory framework aligns well with the field of Sustainability Science which aims to integrate available knowledge from different disciplines and perspectives to solve a particular sustainability problem (Clark & Dickson, 2003; Lang et al., 2012). Wicked problems such as climate change are full of complex interactions and uncertainties (Frantzeskaki, Loorbach, & Meadowcroft, 2012). These wicked problems consist of multiple sub-problems such as complex behavioral problems, but behavior can often be paradoxical and consist of competing factors (Kollmuss & Agyeman, 2002). Thus, in the spirit of sustainability science, I have attempted to bring together and synthesize these competing factors with the help of integral theory as it brings together knowledge from different angles that affect the end behavior of whether people choose to adopt insects as a sustainable food alternative.

2.2 Applying the Framework

Figure 3 below illustrates how the integral theory framework applies and assists in answering my research questions. The most prevalent opportunities and barriers will be identified within all three research questions. These will then be sorted into structural, cultural, or personal opportunities or barriers according to the guideline described above to better understand the behavior of Danish people when it comes to eating insects.

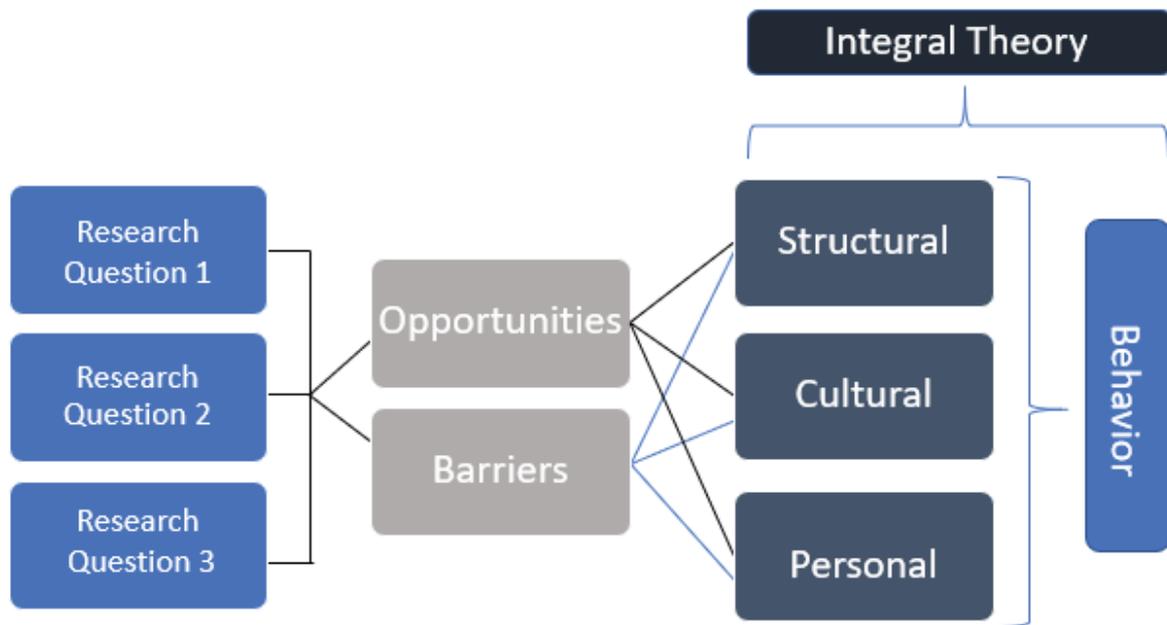


Figure 3. The research design shows how opportunities and barriers were identified from each research question and then categorized according to integral theory to better understand how behavior is influenced.

3 Methodology

3.1 Research Philosophy

In this thesis, I take an ontological position of critical realism. Critical realism observes both aspects of natural and social science by recognizing reality as being independent of our experiences (Moses & Knutsen, 2012). In line with integral theory, critical realism demonstrates that there are many layers to reality, which is why I looked at the problem from three different angles to try to reach a better understanding but reaching a true understanding of reality is highly complicated (Moses & Knutsen, 2012). Thus I take an epistemological stance of recognizing that I cannot unravel all opportunities and barriers that exist in increasing insect eating in Denmark, but by taking an integral approach of examining the three different aspects of integral theory through the three different methods, I can get a better picture and move closer to the answer and to reality.

3.2 Research design

As mentioned before, to answer the overarching research question, I created three sub questions that each have their own methodology. The act of using more than one method in research has been termed triangulation and is said to add credibility to the findings (Bryman, 2012). In my case, each method extracts and builds on the information gathered from the previous method, thus, the first research question helps answer the second one which helps answer the third one. The findings are then cross checked against each other as shown in Figure 4. Collectively they help answer the overarching research question.

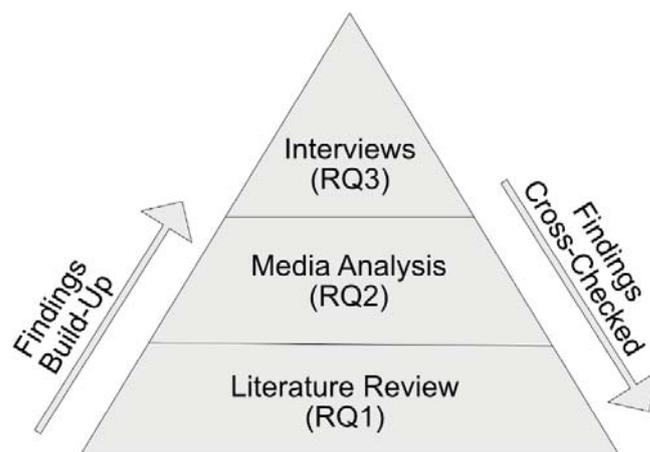


Figure 4. Triangulation used to build up findings with each research question and then cross check them against each other (own illustration).

Table 3 below provides an overview of the three research questions, what data is collected from each question, and the methods used to answer the questions. Each method will be further explained in detail in the following section.

Table 3. An overview of the research questions in relation to both the theoretical framework and the methods used to answer each research question.

Overarching Research Question		
What barriers does Denmark need to overcome and what opportunities can they take an advantage of to normalize edible insects as a meat substitute?		
Research Questions	Data	Method
RQ1: What are the opportunities and barriers identified in academic literature to increase insect eating?	Opportunities identified in academia	Literature Review of opportunities and barriers of normalizing insects in Western Countries.
	Barriers identified in academia	
RQ2: What are the opportunities and barriers identified in the Danish media to increase insect eating in Denmark?	Opportunities identified in the media	Media analysis of Danish online media.
	Barriers identified in the media	
RQ3: What are the opportunities and barriers identified by industry experts to increase insect eating in Denmark?	Opportunities identified from industry experts	Interviews with industry experts in Denmark.
	Barriers identified from industry experts	

3.3 Methods

3.3.1 Literature Review

To answer the first research question, I conducted a literature review on January 4th, 2019, using the search engine Scopus as it provides the most comprehensive collection of peer reviewed literature such as scientific journals, books, and conference records (Scopus, 2019). I conducted the following search

within abstracts, titles and keywords: ("*eat insects*" OR "*eating insects*" OR "*insects as food*" OR *entomophagy* AND *barriers* OR *opportunities*). The search provided me with 38 results. After screening the abstracts and then the articles, 20 articles were deemed relevant. However, after a full readthrough, I conducted a supplementary search based on reference lists and citations of the previous search and was able to identify 10 more relevant articles for the literature review, adding up to 30 articles in total. As there has been limited research done on Denmark, I focused on finding opportunities and barriers that have been identified in adopting insect eating in Western countries. Although most of the articles were empirical research articles, review articles that appeared in the search were included as they provided information on opportunities and barriers such as policies and historical accounts that were not covered in the empirical research but provided important information on possible opportunities and barriers.

I read through each article and identified themes of opportunities and barriers that were either stated directly (such as: the legislation is a barrier) or indirectly (such as: people think insects are disgusting) within the articles and collected them in an excel sheet (Appendix A). After having gone through the 30 articles, each opportunity or barrier that was mentioned within three or more articles was coined as a category which carried forward in analysis. The remaining categories of opportunities and barriers were then classified as structural, cultural or personal according to integral theory and the guiding questions in Table 2.

3.3.2 Media Analysis

To answer the second research question, I conducted a content analysis of the Danish online news media. The purpose of the content analysis was to both identify the similarities and differences of opportunities and barriers identified in the literature review, and to build up-on the knowledge gained from the literature by identifying possible new opportunities and barriers that were not mentioned three or more times in the literature but might be in the media.

The newspapers selected for the media analysis were chosen from Gallup's most recent report on reading numbers for the national daily newspapers in Denmark (Kantar Gallup, 2019). The newspapers and the reading numbers that are bolded in Table 4 below were selected for analysis as these six newspapers had an open online access to their news articles, those are: B.T., Berlingske, Ekstra Bladet, Jyllands-Posten, Kristeligt Dagblad, and Politiken, representing 56% of the total readership according to the most recent numbers presented in Table 4.

Table 4. The selection of the newspapers used for the media analysis and their reading numbers. Table translated and adapted from Kantar Gallup (2019).

NATIONAL DAILY NEWSPAPERS	1ST HALF OF 2018	2ND HALF OF 2018
B.T.	81,000	75,000
B.T. metro	425,000	264,000
Berlingske	145,000	141,000
Borsen	115,000	109,000
Extra Bladet	96,000	91,000
Information	78,000	82,000
Jyllands-Posten	171,000	172,000
Kristeligt Dagblad	94,000	109,000
Licitationen	9,000	7,000
Politiken	237,000	254,000
Weekendavisen	197,000	190,000

The timeframe for the search was set from the beginning of the year 2012 until the date of data collection, February 4th, 2019. The starting point of 2012 marks the year where the Danish Technological Institute (DTI) began researching the topic (University of Copenhagen, 2019), and was therefore selected as an appropriate starting point for the media analysis.

As the Danish Google does not have a news search function and some of the news websites do not allow you to search directly on their website for older news, I searched the selected search terms followed by the newspaper's name on the Danish version of Google to get the most accurate and consistent results. After getting familiar with the terminology used in Denmark through a random sampling of the Danish media, I selected the following search terms: "eating insects" OR entomophagy OR "edible insects" OR "insect products" OR "insects as food"¹. Although the research question aims to find the opportunities and barriers identified within the Danish media, I did not find it necessary to narrow down the search

¹ In Danish: "spise insekter" OR entomofagi OR "spiselige insekter" OR insektprodukt OR "insekter som mad".

results by including the words as the results was not so big and my aim was to identify the broader representation of the topic in a Danish context and see if and how the opportunities and barriers identified through the literature review were represented in the media.

The initial search result showed 66 news articles, out of those, 48 were deemed relevant (Appendix B). As Berlingske Tidene and B.T. are both owned by the same company, Berlingske Media, and Ekstra Bladet, Jyllands Posten and Politiken are all under the JP/Politikens Hus umbrella, a few articles were removed as they appeared twice within the search results. Other articles were deemed irrelevant if the topic of edible insects was mentioned briefly in an otherwise unrelated article.

To analyze the media after having collected the articles, I used a mixed method which utilizes both quantitative and qualitative aspects of a content analysis as a way of displaying a more comprehensive account of the opportunities and barriers identified in the Danish media to normalize insects as a meat substitute, this is termed as “completeness” by Bryman (2012). The aforementioned categories collected from the literature review were used to code the media articles as each opportunity or barrier that was mentioned in the media that had already been categorized by the literature would be coded into the relevant category. However, in order to not neglect other themes that might emerge in the media that had not been covered in the literature, new themes could emerge if they were mentioned in three or more news articles.

I used the software NVivo 12 Plus to code the articles into the categories. When coding the articles, text was coded in an interpretive way of both including manifest and latent content. Manifest content refers to the clearly stated meaning read from the text and should not be up for interpretation whereas latent content refers to uncovering not as apparent meanings of the texts by digging beneath the superficial layer of what is being said (Bryman, 2012). A part of doing so was to also analyze the images that came along with the articles and code them into the relevant categories.

3.3.3 Interviews

To answer the third research question, I conducted semi-structured interviews with industry experts. The industry experts were identified through the media analysis. I collected all the names that appeared in the articles used for the media analysis and after scanning through the list of 47 names, 18 were excluded for one of the following reasons: if the person had no direct relationship with the Danish insect community or if the person had briefly been involved in the edible insect community but had switched careers a long time ago. The remaining 29 people were contacted through email or LinkedIn if the email address was not

readily available. Reminders were sent to people if they had not responded within a week, and out of the 29 candidates, 6 people (21%) were able and willing to be interviewed within the given timeframe.

I prepared the interview guide, which can be found in Appendix C, based on the results of RQ1 and RQ2 which formulated the listed categories of opportunities and barriers. Before going over the pre-defined categories with the interviewees, I had a couple of introduction questions, firstly asking how they were associated with the edible insects field in Denmark and secondly I asking what they thought were the most important barriers and opportunities to increase insect eating in Denmark, in order to see if other categories emerged than the pre-selected ones. Thereafter, I asked the interviewees to rate the list of the items from the literature review and media analysis on a 5-point Likert scale according to how much they agreed that those items were important barriers and opportunities to increase insect eating in Denmark. Furthermore, although I made sure to go through the list, and have the interviewees rank each factor, as the interviews were semi-structured, I did allow the respondents to go off topic and allowed new questions to emerge if it was seen as appropriate or relevant (Bryman, 2012).

3.3.3.1 Ethical Considerations

The four people that were interviewed in person signed a consent form which can be found in Appendix D. The other two people that were interviewed via Skype, agreed to the interview being recorded, and were then verbally introduced to the study in the same way as the consent form did and made aware of their rights to ask questions or clarifications at any point. Direct quotes or mentions that were used in this thesis were all pre-approved by the interviewees, which were given the chance to deny the usage of the quotes, modify the wording, or stay anonymous for the quotes.

4 Results

4.1 Literature Review

Through the method described in Chapter 2.3 used to answer the first research question. I identified a total of 8 categories of barriers and 7 of opportunities. These were then categorized according to the Integral Theory Framework into structural, cultural, or personal opportunities and barriers as shown in Table 5 below. A short description of each category can be found in Appendix E. Figure 5 below compares the total amount of barriers and opportunities within each category.

Table 5. An overview of the opportunities and barriers identified from the literature review of the 30 articles and their categorization according to the Integral Theory Framework.

INTEGRAL THEORY	BARRIERS	#	OPPORTUNITIES	#
STRUCTURAL	Communication	8	Tasting	9
	Regulations	4	Communication	3
	Accessibility	4	Accessibility	5
	Knowledge on How to Incorporate into Diet	3		
CULTURAL	Westernization of Diet	4	Social Acceptance	5
	Social Acceptance	6	Luxury Food	8
	Cultural Appropriateness	5	Presentation	11
PERSONAL	Negativity	15	Curiosity	7
TOTAL		49		48

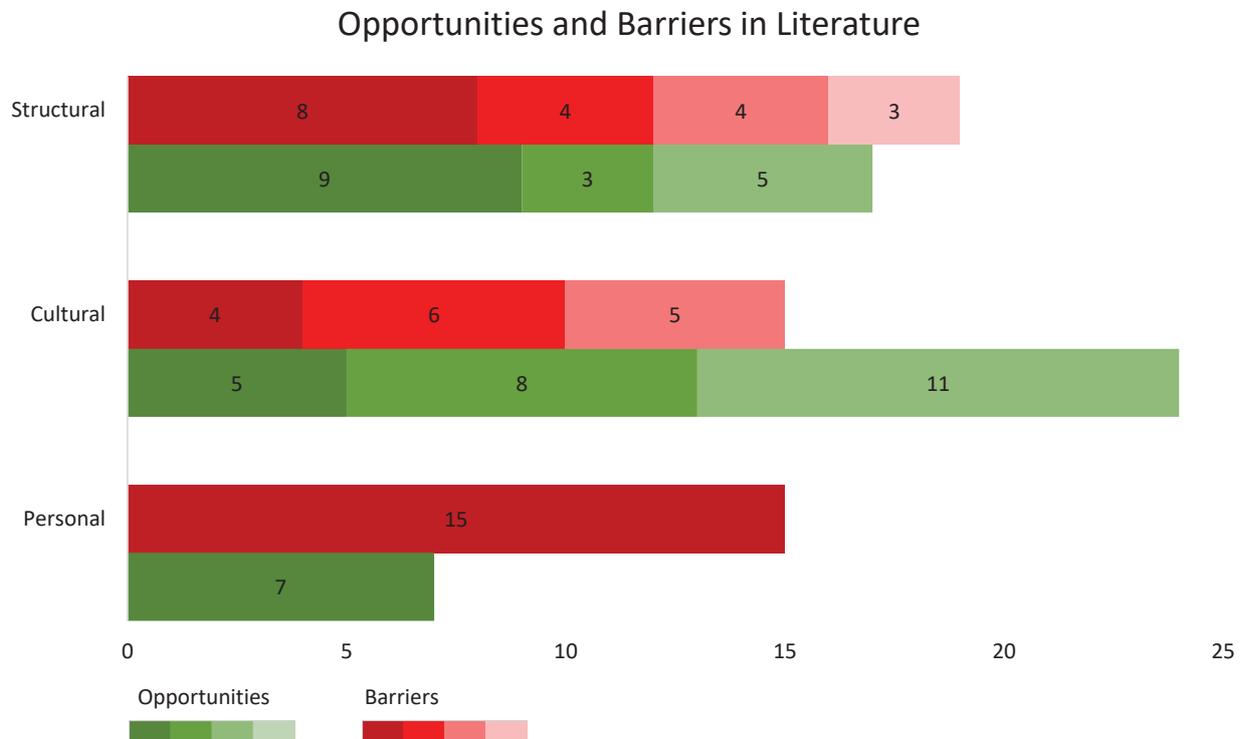


Figure 5. The opportunities and barriers identified from the researcher’s analysis of 30 articles categorized according to the Integral Theory Framework. The numbers on the bars correspond to the categories shown in Table 5 (own illustration).

4.1.1 Barriers

4.1.1.1 Structural Barriers

A reoccurring structural barrier mentioned in the literature has to do with the **regulations** around eating insects. The uncertainty and lack of consistency in the regulatory framework of the marketing, safety, insect welfare and farming within Western countries contribute to a difficult environment for insect producers and sellers to establish themselves (Dobermann et al., 2017; Lähteenmäki-Uutela et al., 2018). However, although the regulatory framework has not reached a level of consistency, progress has been made with the EU recognizing insects as novel food in 2018 (International Platform of Insects for Food and Feed, 2018). Furthermore, regulations on labelling need to be established considering the fact the insects have found to cause an allergic reactions in individuals that have arthropod allergies (Dobermann et al., 2017).

Another structural barrier to normalize insects as food that was identified several times throughout the literature was the **lack of accessibility**. As insects are not widely available in restaurants, supermarkets or delicacy stores, people are not exposed to the idea of seeing insects as food and are therefore more inclined to display a negative attitude towards eating insects (Hartmann, Shi, Giusto, & Siegrist, 2015; House, 2016; Looy, Dunkel, & Wood, 2014; Looy & Wood, 2015). An empirical study in the Netherlands found the lack of access to insect-based products in supermarkets to be problematic as it led to consumers that otherwise might have liked to consume insects on a regular basis to not do so (House, 2016). Three articles (10%) noted that access is not the only factor that needs to be addressed, but people also lack the **knowledge of how to incorporate insects into their diets** as recipes are not readily available and people often simply do not know how they would cook insects (Balzan, Fasolato, Maniero, & Novelli, 2016; Clarkson, Miroso, & Birch, 2018; Looy et al., 2014).

The last structural barrier identified within the literature is the **communication** around insect eating. Multiple articles have found that utilitarian claims do not work as a marketing tool to get people to eat more insects, whether it is stating the health or environmental benefits of eating insects (Berger, Bärtsch, Schmidt, Christandl, & Wyss, 2018; Deroy et al., 2015; Hartmann & Siegrist, 2017a; Looy & Wood, 2015; Shelomi, 2016; Verbeke, 2015; Videbæk & Grunert, 2017; Wilkinson et al., 2018). If people are disgusted by insects, they are not able to react rationally to utilitarian claims as they are consumed by the emotional state of disgust (Berger et al., 2018). Therefore, utilitarian claims that have been commonly used by the UN, the media and private companies to promote insect eating are not effective (Deroy et al., 2015). Using a Malthusian argument of how we need to start eating insects for food security purposes due to growing population is a farfetched argument to use to target Western consumers living a life of abundance (Looy & Wood, 2015; Shelomi, 2016).

4.1.1.2 Cultural Barriers

An overall cultural barrier was evident of insects not being seen as a **culturally appropriate** food in Western countries which often have a tradition of meat heavy dishes within their food culture and identity, although this finding was most prevalent in countries with strong cultural food identity such as Italy (Cavallo & Matera, 2018; Cicatiello, De Rosa, Franco, & Lacetera, 2016; Clarkson et al., 2018; Looy et al., 2014). In line with that, Looy and Wood (2015) point out that through the **Westernization of diets**, we have taught the next generations to avoid, kill, and be frightened of insects. This is also reflected in our language as the way we talk about insects is far away from being associated with food, but rather used to describe undesirable traits (Looy & Wood, 2015). The Western countries often view insect eating as a

primitive practice done out of desperation (DeFoliart, 1999; Hartmann & Siegrist, 2017b; Looy et al., 2014), which discourages countries such as Thailand and Mexico where insect eating is traditional to hold onto their tradition as they become more Westernized and start to stigmatize it accordingly (Shelomi, 2016).

Insects being a culturally unaccepted food then leads to the barrier of **low social acceptance** within Western culture, hindering those who might want to try insect eating to do so (Hartmann et al., 2015; Sogari, 2015; Tan, Verbaan, & Stieger, 2017; Videbæk & Grunert, 2017). People even stated that they ate insects in private or were more likely to eat insects when they cook alone as they were afraid of being socially judged for cooking and eating insects around others (Balzan et al., 2016; House, 2016).

4.1.1.3 Personal Barriers

The most common barrier mentioned was that people often displayed an overall **negativity** towards insect eating with several studies noting that people stated that they would not choose to eat insects if they had another option (DeFoliart, 1999; Hartmann & Siegrist, 2017a, 2017b). The one Danish study within the literature review labelled 23% of the study participants as being against insect eating, while more of the sample (28%) showed interest in eating insects (Videbæk & Grunert, 2017). When it comes to insect eating, food neophobia, or the aversion to try unusual food items, is closely related with and influenced by disgust (Martins & Pliner, 2005). Thus, the two terms, food neophobia and disgust were grouped under the category of negativity. Food neophobia is a large barrier to insect eating (Balzan et al., 2016; Fischer & Steenbekkers, 2018; Hartmann et al., 2015; Verbeke, 2015; Videbæk & Grunert, 2017), or even to trying new meat substitutes in general (Caparros Megido et al., 2016). In line with that, several studies found Western consumer reporting that they found insects disgusting, dirty, and unhygienic, often without a particular reason (Clarkson et al., 2018; Dobermann et al., 2017; Hartmann & Siegrist, 2017b; Lensvelt & Steenbekkers, 2014). Furthermore, people tend to look at insects as a homogenous group, ignoring the many edible species and thus often categorize them all as dirty and disgusting due to insects such as cockroaches often being found in unhygienic spaces and known to be a carrier of diseases (Cavallo & Materia, 2018; Deroy et al., 2015; Looy et al., 2014).

4.1.2 Opportunities

4.1.2.1 Structural Opportunities

Multiple studies found that providing people with the opportunity to **taste** insects might be one of the best ways to get people to accept insect eating, as people who were familiar with insect eating and had

already tried eating insects were more open to eat them again (Caparros Megido et al., 2016; Fischer & Steenbekkers, 2018; Lensvelt & Steenbekkers, 2014; Menozzi, Sogari, Veneziani, Simoni, & Mora, 2017; Verneau et al., 2016; Videbæk & Grunert, 2017; Wilkinson et al., 2018). In addition people expressed a changed attitude towards eating insects after having tried it themselves, given the fact that it was tasty (Hartmann & Siegrist, 2017b; Lensvelt & Steenbekkers, 2014; Menozzi et al., 2017). Sogari, Menozzi, and Mora (2018) even stated that neophobic attitudes decreased after a pleasurable tasting experience.

Therefore, an important step for companies and restaurants to promote edible insects is to provide tasting opportunities for people by increasing **access** to edible insects. Exposure can increase acceptability and thus providing the right conditions for tasting by offering insects in restaurants can nudge people towards trying an unfamiliar meal that they would otherwise not cook themselves as a first tasting experience (Balzan et al., 2016; Cavallo & Materia, 2018; Clarkson et al., 2018; Hartmann & Siegrist, 2017a). Furthermore, having insects accessible in stores also normalizes the idea of insects being seen as food and can therefore increase the social acceptance of eating insects (Jensen & Lieberoth, 2019).

Another structural opportunity directly countering a previously mentioned structural barrier, is the **communication** of insects as food, as by marketing insects in a hedonic way and focusing on the taste and appearance of the product over more utilitarian claims, people become more drawn to the product (Berger et al., 2018; Hartmann et al., 2015; Wilkinson et al., 2018). The expectations of taste and appearance influence people's willingness to try insects (Wilkinson et al., 2018), thus it is important to focus communication on those factors. As the state of disgust is an emotional one, people that are disgusted by insects will not react to rational claims about health or environmental benefits, but are more likely to be influenced by emotional claims about taste and appearance (Berger et al., 2018). Berger et al. (2018) found this to be true in an empirical study done in Germany showing that people were more likely to be willing to eat a mealworm truffle if they had been shown a hedonic advertisement beforehand rather than a utilitarian one.

4.1.2.2 Cultural Opportunities

A cultural opportunity to try to normalize edible insects is to **present** insects to people either processed as insect flour or "hidden" amongst other ingredients, as studies have found that people tend to be very accepting of processed insects mixed into familiar food such as pizzas, energy bars, or chocolate, and are more likely to have lower neophobia and experiment with unprocessed insects after having tried them processed (Balzan et al., 2016; Caparros Megido et al., 2016; Cavallo & Materia, 2018; Hartmann et al.,

2015; Hartmann & Siegrist, 2017b; Jensen & Lieberoth, 2019; Menozzi et al., 2017; Schösler et al., 2012; Verneau et al., 2016; Wilkinson et al., 2018). Thus, a first step to people accepting insects as a meat substitute might be to introduce them to insect snacks that do not act directly as meat substitute (Hartmann & Siegrist, 2017b).

Sogari et al. (2018) found that **social acceptance** of insect eating by family and friends might be the most important factor for the success of the market, but some people have suggested that using celebrity endorsement might be the opportunity needed to increase social acceptance (Clarkson et al., 2018; Jensen & Lieberoth, 2019). Lensvelt and Steenbekkers (2014) on the other hand found that social acceptance would increase with the recognition and encouragement to eat insects coming from scientists, the government, or regular insect eaters themselves rather than celebrities. Whether insects are normalized through endorsements from scientists or celebrities, Looy et al. (2014) have noted that the social acceptance is an extremely important factor in having people introduce insects as food to their children and thus the next generations.

Another way towards a cultural acceptance of insect as food has been suggested to be to target the **luxury** market segment. Western countries have in the past years been very interested in health and nutrition, leading to many exotic products being accepted as a “superfood” and some have suggested that the same might happen with insects (Clarkson et al., 2018; Looy et al., 2014). It has also been suggested that insects might follow the same pathway as sushi or lobster, but lobster went from being prison-food to delicacy in New England (Balzan et al., 2016; Berger et al., 2018). Thus Balzan et al. (2016) have suggested a higher price range to reach this market segment and try to label insects as a luxury product. In line with that, in order to reframe insects as a luxury product, the language needs to change for people to disassociate insects with negative feelings (Caparros Megido et al., 2016). People say they eat pork and sushi but not pig and raw fish, in the same way there is an opportunity to use findings from cognitive science which have shown that wording can influence people’s perception and preferences when it comes to food and adopt more appealing words for insects that people connect to edible insects, but not the unwanted insects they find in their homes (Deroy et al., 2015; Looy et al., 2014; Looy & Wood, 2015).

4.1.2.3 Personal Opportunities

Within the personal category, **curiosity** is an important factor for acceptance of insects as food (Sogari, 2015), and people that tend to go to ethnic restaurants are more likely to want to try insects (Cicatiello et al., 2016) which is a good sign for increased insect consumption given that Western countries are

increasingly introduced to non-Western cuisine. Several studies reported high curiosity with most people being willing to try insects even amongst those who displayed negative attitudes towards the practice (Balzan et al., 2016; Caparros Megido et al., 2014; Jensen & Lieberoth, 2019; Videbæk & Grunert, 2017), with one study finding as many as one out of five people being willing to eat insects on a regular basis as a meat substitute (Verbeke, 2015).

4.2 Media Analysis

In addition to the pre-determined themes from the literature review, three additional opportunities and one additional barrier were identified throughout the media analysis that appeared in three or more news articles. These themes are shown bolded and italicized in Table 6 below which outlines the opportunities and barriers identified from the media analysis, the distribution between the categories of the integral theory is shown in Figure 6 below. A description of each opportunity and barrier can be found in Appendix E.

Table 6. An overview of the opportunities and barriers identified from the media analysis from the 48 news articles and their categorization according to the Integral Theory Framework.

INTEGRAL THEORY	BARRIERS	#	OPPORTUNITIES	#
STRUCTURAL	Communication	28	Tasting	11
	Regulations	9	Communication	4
	Accessibility	3	Accessibility	22
	Knowledge on How to Incorporate into Diet	0	<i>Government Support</i>	4
CULTURAL	Westernization of Diet	1	Social Acceptance	13
	Social Acceptance	1	Luxury Food	17
	Cultural Appropriateness	15	Presentation	14
	<i>Diet Changes Slowly</i>	6	<i>Acceptance of Insects by Other Western Countries</i>	11
PERSONAL	Negativity	18	Curiosity	13
			<i>Children</i>	3
TOTAL		81		112

Opportunities and Barriers in Media

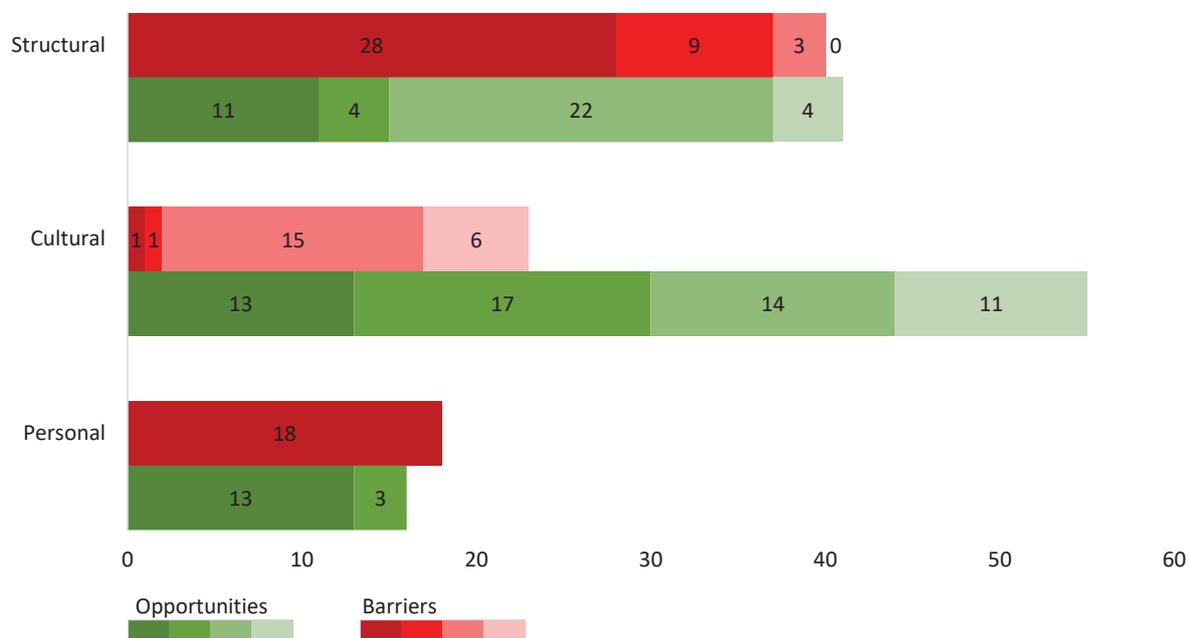


Figure 6. The opportunities and barriers identified from the researcher’s analysis of 48 news articles categorized according to the Integral Theory Framework. The numbers on the bars correspond to the categories shown in Table 6 (own illustration).

4.2.1 Barriers

4.2.1.1 Structural Barriers

Communication was the barrier that was identified most frequently from the media analysis, or in 58% of the articles. This was mostly apparent through latent content that highlighted the Malthusian argument, framing it as a healthy and sustainable alternative to meat that needs to be adopted into diets if we want to be able to feed the 9 billion inhabitants of the Earth in 2050 (Pedersen, 2017). Thus, the media often framed this exotic protein alternative as a necessary addition to the Danish cuisine for utilitarian reasons with phrases such as: “it is difficult to cook using mealworms and grasshoppers, but we have to learn how to for the sake of the environment”² (Ritzau, 2016b) being commonly used. Many articles even went as far as indicating that the phenomenon was being pushed upon Danes by the UN and the European Union: “Both the UN and the EU want us to eat grasshoppers, mealworms and other insects”³ (Arnsberg, 2016).

² Danish: Det er svært at lave mad med melorme og græshopper, men vi skal lære det for miljøets skyld.

³ Danish: Både FN og EU vil have os til at spise græshopper, melorme og andre insekter.

Nine articles (19%) mentioned **regulations** as a barrier, some covering the topic at an international level, with a couple of articles covering cases where insects were called back from stores in Denmark due to regulatory issues of the products not meeting certain standards or not having been tested adequately, this was before the regulatory framework became clearer on what was allowed and what was not (Dahlager, 2015b; Ritzau, 2016c).

Accessibility was only mentioned in three articles (6%) as a problem as there were few distributor and sellers, which thus led to prices that were sometimes higher than the price of a steak (Melander, 2017). No article mentioned the **lack of knowledge of how to prepare** insects as a barrier.

4.2.1.2 Cultural Barriers

Quite a large proportion, or 15 (31%) of the articles stated that insects were not **culturally appropriate** as food in Denmark and in Western countries in general. Some articles stated that insects would never be a replacement for meat as meat is so engraved in the Danish food culture and insects are not seen as food, let alone a meat replacement (Straka, 2016). Once the Danish grocery store Irma started selling frozen mealworms and grasshoppers, many people asked if the insects were sold as a fishing bait (Haar, 2015), demonstrating how far away they were from seeing it as food for humans.

This view of insects not being seen as food by Danish people was reflected in a large portion of the images that went along with the news articles. Out of the 70 images, 26 (37%) images were of people or neutral non insect related things, 15 (21%) showed insects mixed into food or in a way that Westerners would relate more to (given that presentation matters), and 29 (41%) showed insects in the opposite way, reflecting the cultural inappropriateness of insects as human food (see Figure 7).



Figure 7. 10 of the 29 images from the news articles that represent insects as human food as culturally inappropriate (B.T., 2018; From, 2016; Gjerris, 2015; Lund, 2013; Melander, 2017; Nielsen, 2013; Olsen, 2018; Paludan, 2015; Ritzau, 2016b).

However, a few articles found that it is not impossible to get the Danes to eat insects, but if it happens, it will take a long time until it becomes mainstream. **Diets changing slowly** was thus added as a new category as from an environmental sustainability perspective, we cannot afford to wait for too many years to transition towards more sustainable diets. The categories **social acceptance** and **westernization of diet** only came up as a barrier in one article each.

4.2.1.3 Personal Barriers

The personal barrier of **negativity** was frequently mentioned, or in 18 articles (38%). Both directly and indirectly, insects were described as dirty or disgusting animals that do not belong on the dinner plate. Ekstra Bladet’s journalist described her thought process as she was sat at a French bar having received her food, bamboo worms and grasshoppers “On the plate are the thin, white bamboo worms. My hand shakes. I put the fork in one. It is soft on the inside and harder on the outside, and I can still see its head”

(Paludan, 2015). She knew the health and environmental benefits of eating insects, but the emotional barrier could not be reasoned away:

I simply can't get myself to eat the bamboo worms, instead I grab the grasshopper with my fingers. It feels like the dry spice crayfish you get in New Orleans. Eating shellfish doesn't seem as daunting as eating something that has once been a worm (Paludan, 2015).

4.2.2 Opportunities

4.2.2.1 Structural Opportunities

Accessibility was the most frequently mentioned structural opportunity, appearing in 22 articles (46%). More and more supermarkets in Denmark, especially in Copenhagen, now have insects on their shelves or in their fridges or freezers (Straka, 2016). The first insect farm opened in Denmark in 2018 (Olsen, 2018), and more restaurants have started experimenting with insects (From, 2016), thus it is becoming more accessible overall for consumers to eat insects.

Tasting was mentioned in 11 articles (23%) as an important opportunity for the Danes to normalize insects as many people that were interviewed reported to have become more positive about eating insects after having tasted them, and were more likely to eat insects again once they had already tried them once.

Although they were not many, some articles **communicated** about insects in a hedonic way, describing the delicious flavor rather than only focusing on the necessity of eating insects due to population growth, health or the environment.

A new category that emerged from the media analysis was **government support**, with 4 articles noting the immense amount of support that the edible insects field has received from the Danish government, the most recent one mentioned being the DKK 15.9 million received by the company ENORM from the Danish Ministry of the Environment to open up Denmark's first insect farm (Bramming, 2018). Denmark was also named as one of the most favorable countries in Europe when it comes to regulation of producing, selling and marketing insects as food (Melander, 2017).

4.2.2.2 Cultural Opportunities

Social acceptance was rated as an important opportunity with articles either stating directly how highly influenced people's food choices are by social situations or indirectly as many articles covered how other people, celebrities, or trusted people in government for example have a positive outlook on eating insects, with one article stating how Jamie Oliver, Stephen Hawking, and Stella McCartney all ate at Noma's pop-

up restaurant in London that served ants as one of the appetizers (Politiken, 2012). On a broader level, social acceptance between culturally similar countries can be seen as an opportunity. **The acceptance of insects by other Western countries** was thus a new category that emerged from the media analysis as several articles referred to Western countries such as the Netherlands, Finland, Belgium and the USA as countries that have come a long way in accepting insects as food (Straka, 2016). Many articles referred to these countries as a way of proofing trustworthiness and safety of the practice of eating insects.

17 articles (35%) found that there is an opportunity in insects becoming a **luxury** food item in Denmark with Noma being regarded as a frontrunner in labeling insects a trendy luxury product (Ravn-Pedersen, 2018). Several articles compared the possibility of insects becoming trendy to the success of sushi in Denmark as sushi was unheard of a couple of decades ago, and now there are over sushi restaurants on every street corner (Frank, 2016).

Lastly, 15 (31%) of the articles noted the **presentation** of edible insects to be an important opportunity as people are more willing to eat familiar products made out of insect flour or simply products that the insects are not visible to the eye in as it prevents people from getting disgusted by the sight of insects. One article stated that by framing insects as a protein powder or food supplement instead of mealworms and grasshoppers, the disgust factor goes away as people do not see protein powder as something disgusting even though it is made out of something they find disgusting (Olsen, 2018). As mentioned earlier, 15 images (21%) showed a more appealing presentation of insects mixed into dishes, or in a familiar environment as seen in Figure 8.



Figure 8. A sample of the images of insects from the media shown in a more presentable way as food that Westerners are more used to (Dahlager, 2015b; Fogsgaard, 2017; Jønsson, 2017; Pedersen, 2016; Straka, 2016).

4.2.2.3 Personal Opportunities

An overall **curiosity** for eating exotic food such as insects was covered by 13 articles (27%). One article noted how fast the Danish food culture has changed and how many new food items have been introduced to one generation, so why should insects be any different (Lund, 2013). Stores that have started selling insects have reported that there has been a steady growth in the sales and a lot of curious customers that have asked questions (Straka, 2016). In addition to Videbæk and Grunert's (2017) study showing that 28% of Danes are interested in eating insects, the research consultancy Megafon conducted a survey that showed that 40% of Danish people would be willing to try insects (Melander, 2017). The younger generations are especially interested in eating insects, and even more so are children. **Children's acceptance** of insects was added as a new category under personal opportunities as three different articles mentioned the opportunity of teaching children to eat insects as they tend to be more accepting of edible insects than adults (Giese, 2016; Queitsch, 2016; Ritzau, 2016b).

4.3 Expert Interviews

The following section provides the results from the six interviews taken with industry experts, representing both the private and the public sector. Each interview varied in length from 30 to 60 minutes as some participants went through the questionnaire more quickly and with less comments than others. Although the experts were given the chance to name barriers and opportunities before being exposed to the collected list of barriers and opportunities from the literature and the media, no new opportunities or barriers emerged that were not already covered by the existing categories. Table 6 below shows the mean ratings of each barrier and opportunity from the six interviews based on the interviewees answers to the questions shown in Appendix C. Although it provides an overview of the factors people most strongly agreed or disagreed with, it does not show the variance in answer between participants or the less extreme answers which were then explained verbally by the interviewees which is why the following sections will go through each barrier and opportunity based on the answers and explanations provided by the interviewees.

Table 7. An overview of the means of the answers from the six interviews, with 1 representing strongly agree and 5 representing strongly disagree.

INTEGRAL THEORY	BARRIERS	μ	OPPORTUNITIES	μ
STRUCTURAL	Communication	3.5	Tasting	1.8
	Regulations	2.3	Communication	2.3
	Accessibility	1.7	Accessibility	1.3
	Knowledge on How to Incorporate into Diet	2.0	Government Support	2.0
CULTURAL	Westernization of Diet	3.5	Social Acceptance	2.7
	Social Acceptance	3.0	Luxury Food	2.7
	Cultural Appropriateness	3.0	Presentation	1.7
	Diet Changes Slowly	3.0	Acceptance of Insects by Other Western Countries	2.7
PERSONAL	Negativity	1.8	Curiosity	2.5
			Children	1.5

4.3.1 Barriers

4.3.1.1 Structural Barriers

The interviews revealed an overall concern over structural barriers, as the barriers **accessibility** and **knowledge on how to incorporate insects into diets** were seen as important barriers to increase insect eating in Denmark by all six interviewees. People stated that **accessibility** was important as being exposed to the products is important for people to accept insects as food. Which products are accessible can also matter as although there are a lot of options available for insect snacks, there is only so many snacks that people will eat. There needs to be higher accessibility of products that can be a meal in itself.

The **knowledge of how to incorporate insects into diets** turned out to be closely interlinked with accessibility. To be able to incorporate insects into their diets, people need to have access to food items

that resembles what they already know. One interviewee mentioned that by selling insects in a form comparable to minced meat, as has been done with vegetarian meat alternatives, people would more easily know how to incorporate that as they know how to cook with minced meat. Thus, until such products are readily available, people will not know how to incorporate insects into their diets. However, some mentioned that younger people had an easier time incorporating insects into their diets, whereas other people often needed to be taught what to do with the insects. Malene Engell, marketing director at Kalu⁴, described what an eye opener it was for her when Nina Askov, who runs the blog www.buglady.dk, became a part of the Kalu team for a few months as she taught her how to incorporate insects into familiar dishes such the traditional Danish dish, smørrebrød. Whether it is offering more recipes to people as in Malene Engell's case or having insect-based meat-like product be readily available, the consensus was that the lack of knowledge on how to incorporate insects into diets was an important barrier to increase insect eating in Denmark.

The **regulations** on producing, selling and marketing insects were seen by some as not being clear and the participants noted the importance of the regulations being clear both for producers and for consumers. However, interviewees did state that a lot of progress had been made in the last few years and that Denmark had come a long way in a short time, with one interviewee seeing the Danish Government as having now become a frontrunner in the field as they adopted the needed regulations relatively quickly and became open to starting and facilitating a dialogue at the national and European level.

Focusing **communication** on utilitarian arguments was overall not seen as a barrier to increase insect eating in Denmark and was even seen as an opportunity specially to reach the younger generations who put importance into eating healthy and environmentally consciously. However, an interviewee did note that this style of communication might work better for some consumers than others:

We already tell people what is healthy to eat, and people still don't adhere to it so it could be a barrier for some consumers to only talk about the utilitarian reason. At the same time for some consumers I think that it is a big advantage that these food products are so good for the environment and might thus win over at least some consumers (P.N. Videbæk, personal communication, April 16, 2019).

⁴ Kalu imports and distributes food in Denmark, including insects.

4.3.1.2 Cultural Barriers

The interviewees rated the cultural barriers the lowest out of the three. **Westernization of diet** was overall not seen as an important barrier as people stated that Danes travel a lot to countries like Thailand and therefore see insects more as an exotic food item rather than primitive. Furthermore, Denmark has picked up a lot of food from other cultures and managed to make it into a culinary experience that is rather luxurious than primitive.

In terms of **social acceptance**, some of the interviewees did recognize that it does matter to a certain extent, however it was not perceived as an important barrier by anyone and some stated that the social acceptance of eating insects in Denmark has risen over the past few years, due to increased media coverage and exposure. Some also stated that Danish people were quite independent thinking and were not as influenced by fear of low social acceptance as some other countries might be.

Similarly, **cultural appropriateness** was not seen as an important barrier and again it was mentioned that the positive coverage of the media has helped in making people see insects as food. In addition, one interviewee mentioned that Danish people trust that what is sold in the supermarkets as food has gone through the required process set by the government and thus if people see something being sold in supermarkets, they see it as food.

Lastly, people did not feel strongly about **diet changing slowly** being an important barrier although two people did agree and found that such drastic dietary shifts do not happen overnight, the others stated that Denmark had come a far way in a short time and with the amount of innovation and new products popping up, this is not likely to be a big problem.

4.3.1.3 Personal Barriers

All six interviewees either agreed or strongly agreed that a bulk of the Danish population still sees insects as dirty or disgusting, with the younger generation being more accepting. However, some were hopeful that this would change over time as the disgust is cultural but not biological:

It is not a part of culture and hence abnormal, and abnormal being disgusting. Culture is not rational, it is just a group thing you could say of a certain number of people that have decided that this is how good music sounds, this is what cool clothing is. That is also why there is hope that we can change these attitudes because if it was generically a biological thing that we would be disgusted by insects then I should start looking for a new job as I would not be able to change

that. Right now, we are getting subgroups to accept it and those subgroups will divide and become a part of the majority as time goes by (L.H.L. Heckmann, personal communication, April 12, 2019).

4.3.2 Opportunities

4.3.2.1 Structural Opportunities

All six experts saw **tasting** as an important opportunity to increase insect eating in Denmark. However, three people noted the importance of the tasting experience being enjoyable as a bad tasting experience could turn people away from insect eating whereas a pleasant experience could be an eye opener. Thus, if the experience is good and tasty it is a tremendous opportunity.

Hedonic **communication** was overall not seen as an important opportunity although some interviewees did recognize that so far the focus has mainly been on the utilitarian aspects and perhaps to reach a larger customer segment there needs to be more focus on the hedonic aspects as most people do not select what they eat purely from environmental reasons, but also because of the taste and appearance.

The six interviewees all either strongly agreed or agreed that **accessibility** was an important opportunity and were convinced that if people are exposed to seeing insects on a regular basis in stores and restaurants, they get used to thinking about insects as food and start to expect seeing it on the shelves.

Furthermore, as mentioned before, Danes trust that the products that make it to the shelves of the supermarkets have undergone the necessary safety testing and regulations and therefore trust that the food they find in the supermarkets is approved by the government and safe to consume. In line with that, **government support** was also seen as an important opportunity and although some said that it did take the Danish government a bit of time to understand how to deal with insects as food, they did eventually get on board as some interviewees stated that now the Danish government is a frontrunner in the field, creating the right conditions and stability for startups and innovation to flourish.

4.3.2.2 Cultural Opportunities

The cultural category was overall the one that was seen the least important although people were quite positive that there is a potential for some cultural opportunities. People did recognize the importance of **social acceptance** both from family and friends, but also from nationally known people, with two interviewees mentioning the princess of Denmark having eaten a grasshopper at a festival and the significance of that at the time. However, it was noted that insects are different from other food in the

way that if people have an internal barrier of disgust (personal barrier), social acceptance or even social pressure will not be enough, thus it is only an opportunity up to a certain extent.

The interviewees did not strongly favor marketing insects as **luxury food** similar to sushi as they were concerned that by doing so the prices would stay too high and insects would not serve the purpose of being a sustainable food item as it would stay at the niche level. With that being said, it was mentioned that it is important to change the image of insects as food and that this could be done by at first presenting it as luxury but being aware and willing to change this later on as this would not be the way forward to get the masses on board.

Presentation was the cultural factor that people agreed the most on being an important opportunity. Danes are overall not ready to eat whole insects or even see insects in their food and thus we need to start with processed insects for people to accept them before we try to normalize bigger parts of insects or whole insects, although that is an important next step. One person mentioned that the pictures shown in the media often show a Western person eating a whole insect and does not present insects in the way that they think it should be presented. A couple of people did mention that if we were to compare insects with meat, this would not be a discussion as we never eat the whole animal when we eat meat in Western countries or as put by Pernille Videbæk:

I don't see the need to eat insects as whole insects. We don't eat other things whole like that so I don't see why we should do that with insects, I don't see a problem with incorporating it into another product as an ingredient (P.N. Videbæk, personal communication, April 16, 2019).

The interviewees were overall not convinced by the importance of the **acceptance of insects by other Western countries** being such a big opportunity as some people stated that Denmark saw itself as a frontrunner and therefore wanted other countries to look to them but not vice versa. One interviewee noted that this could be linked to Denmark's strong identity

Food is so closely related to culture and personal identity. I think that we still have a long way to go to reach widespread cultural acceptance of insects in Europe. Right now, the consumption of insects like crickets is still relatively niche when compared to other alternative animal protein sources. We're still in a phase of edible insect innovation 1.0 (A. Halloran, personal communication, April 8, 2019).

However Malene Engell noted that at her job at Kalu when they were first deciding to start selling insects they did so with the belief that it would work well as other Western countries were already doing it, later

finding out that they were at the forefront, but finding the acceptance of other countries although somewhat only perceived to be comforting when bringing insects to the Danish food market.

4.3.2.3 Personal Opportunities

The interviewees saw important opportunities within the personal category. **Curiosity** was seen as an important opportunity by some with the interviewees experiencing that people always seem to be looking for the next food trend and are exciting to try new foods. However, it was also noted that this is not black and white as curiosity goes hand in hand with tasting. People can be curious about something without tasting it, therefore if the curiosity does not lead to tasting, it does not necessarily lead to an increase in consumption. Therefore, it was noted that curiosity and what it can generate needs to be explored further. Furthermore, one interviewee stated that this curiosity was higher for the younger part of the population and those that are highly educated and financially well-off.

All six interviewees either agreed or strongly agreed that presenting insects to **children** was an important opportunity to increase insect eating in Denmark as children are open minded and as food habits are formed early on it is important that if we want insects to become normalized as food that they are introduced to children.

5 Discussion

Table 6 below lists the top three opportunities and barriers identified across the three research questions. Although there is a lot of overlap between the top three opportunities and barriers, there is only one barrier and one opportunity that appears in the top three across all three research questions; negativity as the barrier and presentation as the opportunity. The following sections will answer the three research questions and then answer the overarching research question.

Table 8. An overview of the most frequently mentioned opportunities and barriers across all three research questions. The highlighted opportunities and barriers are the ones that appear in the top three list of all three methods.

TOP 3 OPPORTUNITIES AND BARRIERS IDENTIFIED ACROSS ALL 3 METHODS				
RESEARCH QUESTION	BARRIER	INTEGRAL THEORY	OPPORTUNITY	INTEGRAL THEORY
1. LITERATURE	1. Negativity	Personal	1. Presentation	Cultural
	2. Communication	Structural	2. Tasting	Structural
	3. Social Acceptance	Cultural	3. Luxury Food	Cultural
2. MEDIA	1. Communication	Structural	1. Accessibility	Structural
	2. Negativity	Personal	2. Luxury Food	Cultural
	3. Cultural Appropriateness	Cultural	3. Presentation	Cultural
3. INTERVIEWS	1. Accessibility	Structural	1. Accessibility	Structural
	2. Negativity	Personal	2. Children	Personal
	3. Knowledge on how to incorporate into diet	Structural	3. Presentation	Cultural

5.1 Opportunities and Barriers in the Literature

The top three barriers identified in the literature were negativity, communication, and social acceptance. These three categories happen to cover all three domains of integral theory. However, in line with integral theory's statement that academia tends to prioritize structural factors, the structural category had overall the highest number of barriers. And although in terms of numbers, the personal area was the most

neglected one, due to it only covering the category of negativity, it ended up being rated as the most important barrier within the literature. Communication being rated as such a strong barrier within the literature indicates the need to rethink the focus on communicating utilitarian arguments for eating insects in the way that the FAO and other organizations have been doing as education alone will not increase insect eating if people cannot think about the topic rationally due to fear or disgust (Berger et al., 2018). With that being said, structural barriers such as communications may be the ones that are the easiest to change.

The results showed how interconnected the categories cultural appropriateness and social acceptance were and thus it can be concluded that social acceptance might have been rated as high as it was due to the literature largely covering Southern European countries that have a strong food culture. Countries with stronger food culture such as Italy are more likely to see insects as culturally inappropriate and thus it is less socially accepted within that culture to eat insects. These findings are less relevant for Denmark as their food culture does not have a long strong tradition as the Italian one. However, perhaps to prevent the possibility of low social acceptance, Denmark might want to consider using the opportunity of marketing insects as a luxury food to avoid low social acceptance right away.

The cultural opportunities luxury food and presentation made it to the top three along with the structural opportunity of tasting. Tasting and presentation being rated highly provides an opportunity to counter the top barrier as both have been shown to directly reduce the negativity barrier (Balzan et al., 2016; Caparros Megido et al., 2016; Cavallo & Materia, 2018; Hartmann et al., 2015; Hartmann & Siegrist, 2017b; Jensen & Lieberoth, 2019; Menozzi et al., 2017; Schösler et al., 2012; Sogari et al., 2018; Verneau et al., 2016; Wilkinson et al., 2018). Thus, it brings hope that by providing tasting, and presenting insects as grounded up or mixed with other ingredients, the barrier of negativity can be decreased.

5.2 Opportunities and Barriers in the Media

The high overlap between the top opportunities and barriers in the media and in the literature was unexpected given the fact that the literature covered articles that were not Denmark specific whereas the media articles analyzed were solely from Danish newspapers. The reason for communication having as many hits as it turned out to have might be because many of the news articles tended to dramatize the topic by communicating the Malthusian argument of population growth leading to the need of having to find another food supply.

Quite surprisingly and contradicting to the literature was how highly cultural appropriateness scored as a barrier in the media since if we were to take the results from the literature, we would think that due to the weak tradition of food culture, cultural appropriateness would not be such a strong barrier. A possible explanation for this could be the fact that although not having a strong food culture, meat is a staple in the Danish diet and the thought of replacing meat with insects might be unrealistic to the Danes. Thus, perhaps we need to rethink and reframe how people are presented with insects as food and ask ourselves if people will ever accept insects as a meat replacement? If that is not the case, is it still worth it to produce insects from an environmental sustainability point of view if it only adds to the diet without replacing meat. With that being said, even though we were to only present insects in a non-meat substitute form it could still encourage people to eat less meat if they mainly eat it because of the nutritional qualities as insects are highly nutritious and could in that way act as a good substitute.

In line with that, presentation was again rated as an important opportunity along with luxury food and accessibility. Accessibility being rated as the most important opportunity within the media was anticipated given the recent booming of the insect industry in Denmark as more stores have started selling insect-based products.

5.3 Opportunities and Barriers Identified by industry experts

The expert interviews resulted in two new barriers entering the top three list: accessibility and knowledge of how to incorporate insects into diets were seen as important barriers by the experts. The reason why accessibility made it into the top three is not exactly because the experts found that insects were very inaccessible in Denmark, but rather because they found the variety of available products low. It was noted that currently, the products that were available were mostly snack products, and that there was a lack of accessibility of products that can be a meal in itself. The experts found that if insect-based meals are not accessible, overall insect consumption will not rise enough to become a mainstream alternative to meat.

Furthermore, they found that this led to people not knowing how to incorporate insects into their diets as there are only so many snack products that one person will consume, and the lack of access of more meal friendly products can lead to a lack of knowledge on how to eat insects as a meal. Contributing to this factor was also the lack of available recipes of insect-based meals. It might sound contradicting that accessibility was also listed as being a top opportunity. However, the experts talked about the accessibility in more general terms here than for the barriers by discussing the increase accessibility of insect-based

products in restaurants and stores leading to people recognizing that the products had undergone the necessary inspections by the government to make it to the shelves.

An opportunity that was not rated as highly in the other methods but made the top three list of the experts was introducing insects to children. This topic was thoroughly covered in a recent master's thesis by Geertsen (2019) that came out after the literature review for this thesis was done. Her research explored the perception of edible insects by Danish children both before and after a lecture and a cooking and tasting experiment. The results showed that the children were for instance more open to insect eating if the insects were grounded up or invisible and reported the impact that tasting can have on perception and attitude towards eating insects depending on if the tasting experience is pleasurable or not. Furthermore, Geertsen (2019) did note that some factors influencing the children's perception of insects were interconnected and that in order to address them, a wholistic approach might be needed where several factors would be addressed at the same time. This is in line with my findings from using integral theory of the interconnectedness of the different factors influencing end behavior. Ultimately, by introducing insects to children early on and putting Geertsen's (2019) findings into practice, the barrier of negativity could be addressed from an early age and be less likely to be as prevalent as a barrier in adults.

Similarly to Geertsen's (2019) findings and In line with integral theory stating that behavior is influenced by a combination of structural, cultural and personal factors (Owens, 2005), the experts did note that many of the opportunities and barriers were dependent on each other for them to be an actionable opportunity to pursue or barrier to address. As an example, they noted that curiosity is not necessarily an opportunity unless it is addressed with tasting which if the tasting proves to be pleasurable could increase the likelihood of repeated consumption. Similarly, they stated that social acceptance would not be an opportunity if someone showed negativity of disgust as the emotional state of disgust could not be overcome by pressure by peers.

5.4 How to make insects mainstream in Denmark?

To answer the overarching research question, *what barriers does Denmark need to overcome and what opportunities can they take an advantage of to normalize edible insects as a meat substitute?* I looked at what barriers and opportunities were mentioned as important ones across all three datasets. There is only one opportunity (presentation) and one barrier (negativity) that appears in the top three across all methods (Table7). Although, I recognize their interconnectedness and the importance of addressing more

opportunities and barriers, I want to examine why these specific ones were as prevalent as they turned out to be and how they can be addressed.

The barrier **negativity** being the most common one across all three methods brings up a couple of concerns. Firstly, barriers within the personal category of integral theory might be the ones that are the most difficult to change as it can be difficult to explain what they are caused by and how they can be changed as often even when the right structural and cultural conditions are in place, there still remains a personal barrier (Owens, 2005). In that sense a personal barrier can be the final step that needs to be overcome to change a behavior. However, some studies have shown that the negativity barrier can be reduced through factors such as pleasant tasting experience and presentation (Balzan et al., 2016; Caparros Megido et al., 2016; Cavallo & Materia, 2018; Hartmann et al., 2015; Hartmann & Siegrist, 2017b; Jensen & Lieberoth, 2019; Menozzi et al., 2017; Schösler et al., 2012; Sogari et al., 2018; Verneau et al., 2016; Wilkinson et al., 2018), but this needs to be explored further within the Danish context to examine through implementation of which opportunities this barrier can be best countered. Secondly, as the negativity barrier is a personal one, it is the one that might be the most difficult one to generalize for, even within Denmark. As it is based on factors such as emotions and worldviews there might be vast variations within populations for how and if the barrier can be reduced amongst people and thus a thorough segmentation needs to be done to explore this further.

Presentation was the only opportunity that was rated amongst the top three opportunities across all three methods. This is perhaps not too surprising, given the fact that presentation is highly linked to and can counter many barriers. By presenting insect mixed with familiar dishes or grounded up in familiar snacks, it counters barriers from all three segments of integral theory; the personal barrier of negativity, the cultural barriers of cultural appropriateness and social acceptance, and the structural barrier of knowledge on how to incorporate into diets. If people do not see the whole insects, they are less likely to be disgusted by it, and by mixing them into familiar dishes they do become less foreign to people and thus more culturally appropriate and are more likely to be more socially accepted. Lastly, by presenting insects in this familiar way, people are more likely to know how to prepare them in the same way they would prepare their traditional food and thus the barrier of knowledge on how to incorporate into diets can be countered too through presentation.

However, it needs to be kept in mind that although this is a promising opportunity, we must make sure that insects still serve as a meat replacement whether that is directly or as a nutritional supplement that

helps people step away from meat. Else, it does not serve much purpose to eat insects from an environmental sustainability point of view.

5.5 Limitations

In terms of limitations of this thesis, there are three main limitations that I want to address. Firstly, although the six interviews represent a response rate of 21%, the interviews should not be seen as a generalization of the opinions of Danish experts within the field as the field represents a variety of occupations that were not all represented within the six interviews. Secondly, a paywall prevented me from being able to represent all of the 11 national newspapers in Denmark and thus the newspapers that were included only represent the readership of the population that does not pay for news media, which might skew the overall representation of insect eating in Denmark. Thirdly, although the purpose of using integral theory was to try to be as inclusive as possible in collecting opportunities and barriers, due to the scope of the thesis, the criteria of three examples representing a category was set. However, this means that there were more opportunities and barriers that came up that were not included as they were only mentioned once or twice and thus it was not possible to be completely inclusive of opportunities and barriers.

5.6 Future Research

Given my results, there are several aspects that could be expanded on in future research. Firstly, integral theory recognizes that the personal sphere is often the one that remains the least studied one out of the three (Esbjörn-Hargens, 2005). Although many studies have measured negativity within their studies to see if people with high food neophobia or feelings of disgust are less likely to want to eat insects, there is a lack of studies that measure the origins of the barriers and different ways of how these emotions can be controlled and overcome specifically when it comes to eating insects. Secondly, taking a further look at how the opportunity of presentation could be utilized within the Danish context is important to maximize the impact of simply presenting insect-based products in a different way. Following that, it is important to measure if the most favorable form of presentation in terms of increased consumption in Denmark also promotes sustainability in terms of reduced meat consumption. Thirdly, given that some of the interviewees mentioned the positive role of the media in enhancing acceptability of insects as food in Denmark, it would be interesting to look at what barriers can be countered through exposure to positive media attention of the topic.

6 Conclusion

With complex sustainability issues stemming from our current food system, insects have shown potential to be a healthy and sustainable alternative to meat heavy diets that are dominating the Western world. This thesis set out to explore the opportunities and barriers for Denmark to increase insect eating. By utilizing integral theory to categorize the opportunities and barriers collected from the literature, media, and interviews, I collected structural, cultural and personal factors that might affect the end behavior of whether people eat insects or not to get a wholistic understanding of the topic.

Although the three methods brought in different perspectives of different opportunities and barriers, they jointly answered the overarching research question as they all had one opportunity and one barrier in common as being amongst the top three most frequently mentioned ones, with presentation being the most important opportunity and negativity the most important barrier to increase insect eating in Denmark. However, the results highlighted the interconnectedness of the opportunities and barriers, pointing out the appropriateness of integral theory when looking at an environmental problem as the complexity of the problem cannot be overcome by capitalizing on a single opportunity. A holistic approach needs to be taken as one barrier might need to be overcome before addressing the “main” barrier and several opportunities might need to be exploited to address a single barrier.

There is a lot of research that still needs to be done on the topic of how insect eating can be increased to accelerate a sustainable food system in Denmark. This thesis has mapped out the main barriers and opportunities to do so and highlighted the importance of a holistic approach of future research on the topic.

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8 Appendices

8.1 Appendix A Literature Review

An overview of the final opportunities and barriers identified in the literature review (only opportunities or barriers that made the final cut by being mentioned in three or more articles are shown below) Each color represents one category of opportunity or barrier as shown in the color-coding table. Each color was then assigned to the structural, cultural or personal category under integral theory in line with the guiding questions of the methodology.

Color		Barrier	#	Integral Theory
	=	Communication	8	Structural
	=	Regulations	4	Structural
	=	Accessibility	4	Structural
	=	Knowledge on how to incorporate into diet	3	Structural
	=	Westernization of Diets	4	Cultural
	=	Social Acceptance	6	Cultural
	=	Cultural Appropriateness	5	Cultural
	=	Negativity	15	Personal
		Total Barriers	49	

Color		Opportunity	#	Integral Theory
	=	Tasting	9	Structural
	=	Communication	3	Structural
	=	Accessibility	5	Structural
	=	Social Acceptance	5	Cultural
	=	Luxury Food	8	Cultural
	=	Presentation	11	Cultural
	=	Curiosity	7	Personal
		Total Opportunities	48	

	Author	Article	Year	Barrier	Opportunity
1	Doberman, Swift, Field	Opportunities and hurdles of edible insects for food and feed	2017	Possible allergen as research has shown that people with shellfish allergies are also allergic to insects.	Insects are sometimes eaten as a delicacy in Japan
				EFSA regulations and similar regulations in US are hindering the growth of the insect business.	
				Western consumers see insects as dirty, dangerous, and disgusting	

2	Wilkinson, Muhlhauser, Motley et al.	Australian Consumers' Awareness and Acceptance of Insects as Food	2018	Providing information about the benefits of eating insects (such as sustainability and nutritional value) to consumers is not beneficial	Providing opportunities for people to actually taste insects might be the best way to go about convincing people to eat them in the future
					Consumers are more likely to eat insects when they are either mixed into a dish or "unrecognizable" in a product
					"Indeed, convincing consumers that insects can be pleasurable to eat may yet prove to be the most effective strategy in promoting the adoption of entomophagy"
3	Fischer & Steenbekkers	All insects are equal, but some insects are more equal than others	2018	People with higher neophobia were less likely to have had experienced eating insects.	Those that have tried eating insects before are more likely to eat them again.
4	Clarkson, Miroso, Birch	Consumer acceptance of insects and ideal product attributes	2018	In countries such as NZ, where agriculture and meat consumption is a part of the culture, this culture is seen as a barrier.	Increasing large scale production worldwide will not only improve availability, but also decrease price, helping improve the diffusion of innovative insect products, like the ones designed in the present study
				If there is a lot of meat, why are alternatives needed? (NZ)	When asked about the future possibilities of insects as food, some people said that they thought it might become "superfood".
				People (and especially women) find insects disgusting and dirty	Celebrity endorsement helps people trust such a novelty product
				Lack of knowledge of how to incorporate insects into food (no recipes). This increases complexity for people and further hinders adoption of innovation.	
5	Shelomi	The meat of affliction: Insects and the future of food as seen in Expo 2015	2016	Very few countries promoted insects as food at the Expo and those that did (Belgium and the Netherlands) did so in a very bad way. Instead of promoting it as good food for all they painted a Malthusian picture of people having to turn to eat insects in the future for food security reasons, especially in Africa.	
				Countries such as Thailand and Mexico where insects are a traditional dish did not mention a word about insects at their pavilion at the Expo. In these countries it is started to be seen as a social stigma related to	

				poverty as Westernization increases.	
6	Sogari, Menozzi, Mora	Sensory-liking Expectations and Perceptions of Processed and Unprocessed Insect Products	2018		Neophobic attitude decreases after tasting if the person has a positive sensory experience during the tasting.
					"Approval" of family and friends could be the most important factor in the rise of entomophagy
7	Cavallo & Materia	Insects or not Insects? Dilemmas or Attraction for Young Generations: A Case in Italy	2018	EU regulation is currently quite bad for the consumption of insects.	Exposure to food increases acceptability and therefore there needs to be more exposure.
				Some religions might not be too open to consider insects as food.	Insect flour instead of whole insects is more appealing to people, thus invisibility increases acceptability
				Cultural barriers of insects not being considered as food and being disgusting or carrier of pests.	
				Difficulty to establish a new novel food item in an already established European food routine	
8	Tan, Verbaan, Stieger	How will better products improve the sensory-liking and willingness to buy insect-based foods?	2017	Willingness to buy products for trial consumption is higher than for regular consumption. Regular consumption requires both structural and socio-cultural considerations.	
9	Sogari	Entomophagy and Italian consumers: an exploratory analysis	2015	Negative attitude of others (for example friends and family) matters when it comes to acceptance of insects as food	Curiosity is an important factor in getting people to eat insects.
				Lack of clear EU legislation throughout the supply chain	
10	Cicatiello, De Rosa, Franco, et al.	Consumer approach to insects as food: barriers and potential for consumption in Italy	2016	Insects are not culturally a traditional food was mentioned as a barrier as well	People that are familiar with food from other countries and go to a lot of ethnic restaurants are more attracted to the idea of eating insects

11	Looy & Wood	Imagination, hospitality, and affection: The unique legacy of food insects?	2015	There's a negative Malthusian framing in Western countries which points out that we might reach a desperate point when it comes to food security due to increased population and NEED to start eating insects.	There's an opportunity to use words differently similarly to how it is done with meat, whereas pigs are alive, pork is the food you eat, we do not have the same for insects currently, but there might be an opportunity to do so (also a barrier as language is very difficult to change)
				Each generation teaches the next one to fear, avoid and destroy insects (in Western culture)	
				Insect related language in English is very negative and often are used to describe very negative traits.	
				Availability - markets must have good quality insects readily available.	
12	Deroy, Reade, Spence	The insectivore's dilemma, and how to take the West out of it	2015	Stating sustainability and nutritional values of insects as has been done by the UN and media is not going to be a successful strategy to change people's diets. "rational" discourse doesn't work. Same goes with arguing that insects are eaten in many countries across the world	By re-naming frog legs something more appealing, a French chef made them accepted by many. The same has been done with other ugly looking species.
				Categorizing all insects as same and therefore species that are traditionally seen as disgusting due to often being found in not so clean environment such as coach roaches and worms.	
13	Looy, Dunkel, Wood	How then shall we eat? Insect-eating attitudes and sustainable foodways	2014	People see "bugs" as a homogeneous group in many ways and therefore see them all as disgusting and dirty. "Bugs" also do not often get any attention when it comes to species extinction, despite playing a crucial role in many ecological circles.	If adults would be convinced of the benefits of eating insects to the extent that they would feed them to their children, a big victory is won as food behavior is socially learned by children from parents.
				Those who eat insects are often seen as primitive, barbaric and desperate.	Changing the language is important in the same way as people do not say they are eating raw fish but sushi.
				Food is a part of our cultural identity - we are what we eat, and therefore to belong to a certain group you eat a certain way. If we think insects are primitive and disgusting we would not eat them as we were then that.	Westerners have over the past decades been obsessed with food and nutrition, an opportunity to make insects the latest trend. Therefore targeting those who are early adopters in society might be the way to go.

				Lack of availability and knowledge on how to prepare it.	
]Insects are rarely served in restaurant and never in fast food restaurants. This maybe decreases acceptability even further.	
14	Megido, et al.	Edible Insects Acceptance by Belgian Consumers: Promising Attitude for Entomophagy Development	2014		There was curiosity and desire to try the insects even though some people had a negative attitude towards them.
					high acceptance measured in Belgian consumers (however maybe a bit biased as the people were already interested in insects)
15	Balzan, et al.	Edible insects and young adults in a north-east Italian city an exploratory study	2016	Food neophobia	Most people were willing to try to eat insects.
				The social aspect is extremely important in acceptance as several people stated that they would only eat insects privately and that people would think they are crazy if they ate insects	Some people stated that if they wouldn't see the insects they could eat it.
				Lack of instructions on preparations and recipes	People stated that they would prefer to have their first tasting experience at a restaurant than to prepare it themselves.
					Participants identified sushi and sashimi as a comparable food criteria being a niche and then going global in very few years.
					Participants suggested pricing similar to take-away sushi as pricing it too low might seem suspicious.
16	Jensen & Lieberoth	We will eat disgusting foods together – Evidence of the normative basis of Western entomophagy -disgust from an insect tasting	2019		Meals with invisible insects were rated much higher than those with visible insects
					27.5% of people that said that they did not eat insects were willing to try them
					Social context mattered which might indicate that availability could be a good intervention for mitigating disgust away.
					Opportunity of changing social norms by broadcasting an insect accepting role model.
17	Berger, Bartsch, Schmidt, et al.	When Utilitarian Claims Backfire: Advertising	2018	The current commonly used strategy of emphasizing environmental and health benefits of insects is not working	The authors believe that large-scale behavior change in favor of insects as food may come for example from the historical development of lobster as a luxury product.

		Content and the Uptake of Insects as Food		If insects are seen as disgusting, utilitarian claims will not work at all	A shift to hedonic advertising campaigns might be better suited to get people to accept insects as food
					When insects were marketed beforehand as hedonic, the participants found them more tasty.
18	Megido, Gierts, Blecker, et al.	Consumer acceptance of insect-based alternative meat products in Western countries	2016	Food neophobia is the biggest personal factor that holds people back from trying meat substitutes.	A first step in reducing neophobia is to present the substitute in a meal context to increase familiarity with the product
					Wording and framing should be changed to overcome psychological barriers linked with words such as worms or crickets.
					Tasting sessions are important as people that "have already taken the first step" are more likely to eat insects again.
19	DeFoliart	INSECTS AS FOOD: Why the Western Attitude Is Important	1999	We may unconsciously label insect eating as primitive by connecting it to the hunting-gathering stage of human development	
				There is an overall widespread negative attitude towards eating insects.	
20	Hartmann, Shi, Giusto, et al.	The psychology of eating insects: A cross-cultural comparison between Germany and China	2015	People with high food neophobia were unlikely to want to eat insects in both China and Germany	The Germans showed higher willingness to eat insects if they were processed rather than whole
				Low social acceptance is a barrier for people eating insects	If insects are introduced in traditional food they are more likely to reduce neophobia and be accepted.
				People are likely to not become more accepting of insects as food until they are more exposed to it in restaurants, delicacy shops, or supermarkets.	"Instead, consumers need to be convinced by the hedonic characteristics and social acceptability of insects as food, and marketing strategies should focus on taste education and public image modelling."
21	Hartmann & Siegrist	Consumer perception and behavior regarding sustainable protein consumption: A systematic review	2017	A minority of people are willing to reduce meat consumption for environmental reasons.	Nudging people towards a certain dish by simply offering it among other choices.
				When there is a choice, people prefer non-insect products over insect products	
22	Hartmann & Siegrist	Insects as food: perception	2017	Insects seen as primitive	Positive taste experience of insects as food can reduce negative attitude toward it.

		and acceptance. Findings from current research		Insects seen as dirty, disgusting	Consumption of processed insects can create a positive experience that leads to the consumption of unprocessed insects.
23	House	Consumer acceptance of insect-based foods in the Netherlands: Academic and commercial implications	2016	Low availability of insect products prevents regular consumption	
				Low variety of insect products prevents regular consumption: The store in the Netherlands had insect burgers but interviewees said that it would be nice if they had a larger variety of products.	
				People that lived alone or cooked only for themselves reported more frequently that insects fit into their diet than if people lived with someone else. This emphasizes the social aspect of eating and what food is socially accepted.	
24	Lähteenmäki-Uutela, Henault-Ethier, et al.	The impact of the insect regulatory system on the insect marketing system	2018	There are no EU regulations on marketing and breeding insects for human consumption but insects fall under novel food items.	
25	Leensvelt & Steenbekkers	Exploring Consumer Acceptance of Entomophagy : A Survey and Experiment in Australia and the Netherlands	2014	Some participants saw insects as unhygienic and were afraid of diseases or bacteria that might come with it.	Trustworthy information on insects as food comes from the government, scientists, people who use the product and relatives but not from food producers or famous people.
					Letting people try insects is way more powerful than simply providing information on it (my comment: but also more expensive)
					People who had eaten insects before had a significantly more positive attitude towards insect eating and were more likely to eat it again than people who had never eaten insects before.
26	Menozzi, Sogari, Veneziani, et al.	Eating novel foods: An application of the Theory of Planned Behavior to predict the consumption of an insect-based product	2017		Participants' intentions and attitudes significantly improved after tasting the product.
					Mixing insects with familiar food by for example using insect flour in cookies increases the familiarity with the "novel ingredient" and increases the likelihood of a repeated consumption in the future.

27	Schosler, Boer, Boersma	Can we cut out the meat of the dish? Constructing consumer-oriented pathways towards meat substitution	2012		Findings from their study show that it is recommended to rather offer insects in the form of flour than as a whole. People did not seem to be bothered by or have anything against the insect flour pizza. The authors see this as a great opportunity for insects to substitute meat in convenience products.
28	Verbeke	Profiling consumers who are ready to adopt insects as a meat substitute in a Western society	2015	Food neophobia scored as the highest barrier to adopt insects as food.	Study found that one out of five people are ready to adopt insects into their diet as a meat substitute.
				Health interest of food choice did not have an effect on readiness to eat insects.	Convenience oriented food consumers had a higher score of readiness which indicates that snacks or convenience food might be the best way to go.
29	Verneau, La Barbera, Kolle	The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy	2016		People that are already familiar with insect eating are more positive to it.
					The high level of people that actually ate the chocolate bar with insects that they were given might be due to the fact that it is processed and insects are not visible.
30	Videbaek & Grunert	Forbrugerintresse I At Spise Insekter Litteraturstudie Og Surveyundersøgelse	2017	1. Vegetarians found insect eating disgusting	There is a relatively big segment that is open to eat insects or 28%.
				It didn't matter whether people were given environmental, health, or taste information on what attitude they had toward insect eating.	Those who had already tried insect eating were more open to it.
				Food neophobia and disgust were the biggest barriers to insect eating.	
				If the people closest to you are not open to insect eating you are more likely to be reluctant to it as well.	
				Participants were more open to products made out of insect ingredients than whole insects, but in general not very interested in neither. The study says that maybe the choices of options available were not the best as they were all snacks and no convenience food or actual meals given as an option.	
23% of participants were segmented under "against insect eating"					

8.2 Appendix B Media Articles

A list of all the 48 new articles that were analyzed for the media analysis:

- Arnsberg, C.B. (2016, September 20). Vi bør spise myrer, larver og orme i stedet for kalv og flæsk. *Kristeligt Dagblad*. Retrieved from <https://www.kristeligt-dagblad.dk/danmark/en-flue-i-suppen-er-ingen-revolution>
- Bramming, F. (2018, December 2). Virksomhed vil have insekter på spisebordet: - Et spørgsmål om tilvænning. *Ekstra Bladet*. Retrieved from <https://ekstrabladet.dk/kup/fodevarer/virksomhed-vil-have-insekter-paa-spisebordet-et-spoergsmaal-om-tilvaenning/7419947>
- B.T. (2018, October 5). Hvis andre spiste insekter, så ville du også gøre det. Retrieved from <https://www.bt.dk/viralt/hvis-andre-spiste-insekter-saa-ville-du-ogsaa-goere-det>
- Dahlager, L. (2015a, February 9). Nej, vi gider ikke dræbe kaniner og spise cikader. *Politiken*. Retrieved from <https://politiken.dk/mad/klummer/art5565119/Nej-vi-gider-ikke-dr%C3%A6be-kaniner-og-spise-cikader>
- Dahlager, L. (2015b, March 20). En proteinbar lavet på fårekilling? Så gerne!. *Politiken*. Retrieved from <https://politiken.dk/mad/art5570059/En-proteinbar-lavet-p%C3%A5-f%C3%A5rekilling-S%C3%A5-gerne>
- Duedahl, M. (2017, September 1). Iværksætter vil lære danskerne at spise insekter. *Jyllands-Posten*. Retrieved from <https://jyllands-posten.dk/aarhus/kultur/ECE8965312/ivaerksaetter-vil-laere-danskerne-at-spise-insekter/>
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8.3 Appendix C Interview Guide

The interview guide used includes a background question, questions about the opportunities and barriers to increase insect eating in Denmark and then the questionnaire created from the descriptions of the opportunities and barriers in a Danish context with a 5-point Likert scale.

1. What do you do and how have you been associated with the edible insects field in Denmark?
2. What do you see as the most important opportunities and barriers to increase insect eating in Denmark?
3. We will go over the opportunities and barriers that I have collected as the most frequently mentioned ones in the literature and the media in the following questionnaire. Please mark the

most accurate answer from strongly agree to strongly disagree and walk me through your thought process while doing so.

Name: _____

Barriers	Description	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Communication	Focusing communication on utilitarian reasons (health, environment) for people to eat insects is an important barrier to increase insect eating in Denmark.					
Regulations	The regulations around producing, selling, and marketing insects not being clear enough is an important barrier to increase insect eating in Denmark.					
Accessibility	Not having enough insect-based food readily available in stores and restaurants is an important barrier to increase insect eating in Denmark.					
Knowledge on how to incorporate into diet	People lacking knowledge of how to incorporate insects into their diets is an important barrier to increase insect eating in Denmark.					
Westernization of diet	People viewing insect eating as a primitive practice that does not fit the Western diet is an important barrier to increase insect eating in Denmark.					
Social Acceptance	There being low acceptance of insect eating by friends, family, or nationally known people is an important barrier to increase insect eating in Denmark.					
Cultural Appropriateness	It being culturally inappropriate to eat insects as insects are not perceived as food is an important barrier to increase insect eating in Denmark.					
Diet Changes Slowly	Drastic dietary shifts happening slowly is an important barrier to increase insect eating in Denmark.					
Negativity	Danish people seeing insects as dirty or disgusting is an important barrier to increase insect eating in Denmark.					
Other						

Name: _____

Opportunities	Description	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Tasting	Having people taste insects is an important opportunity to increase insect eating in Denmark.					
Communication	Focusing communication on hedonic reasons (taste, appearance) for people to eat insects is an important opportunity to increase insect eating in Denmark.					
Accessibility	Having insects be readily available as an option at restaurants and in stores is an important opportunity to increase insect eating in Denmark.					
Government support	The Danish government being supportive of innovations within the edible insects field is an important opportunity to increase insect eating in Denmark.					
Social Acceptance	There being high acceptance of insect eating by friends, family, or nationally known people is an important opportunity to increase insect eating in Denmark.					
Luxury Food	Marketing insects as luxury food similar to sushi is an important opportunity to increase insect eating in Denmark.					
Presentation	Presenting people with food items containing invisible insects is an important opportunity to increase insect eating in Denmark.					
Acceptance of insects by other Western countries	Other Western countries increasingly adopting insects into their diets is an important opportunity to increase insect eating in Denmark.					
Curiosity	Danish people being curious towards trying new food is an important opportunity to increase insect eating in Denmark.					
Children	Introducing insect as food to children is an important opportunity to increase insect eating in Denmark.					
Other						

8.4 Appendix D Consent Form

The consent form signed by the interviewees that were interviewed in person. The interviews that were done via Skype, gave a verbal consent.

Interview for master's thesis by Selja Snorraddottir for Lund University International Masters' Programme in Environmental Studies and Sustainability Science (LUMES)

The working title of the research is: "Opportunities and barriers to increase insect eating in Denmark".

My aim is to understand the opportunities and barriers to increase insect eating in Denmark from cultural, structural and personal perspectives. The objective of the thesis is to analyse and understand what opportunities and barriers are presented in the literature, the media, and by industry experts.

Consent to take part in research described above:

- I..... voluntarily agree to participate in this research study.

- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
- I have had the purpose and nature of the study explained to me in writing, and I have had the opportunity to ask questions about the study.
- I understand that I may not benefit directly from participating in this research.
- I agree to my interview being audio-recorded for the sole purpose of being transcribed.
- I understand that extracts from my interview may be quoted in the thesis or related research article.
- I understand that I am entitled to access the information I have provided at any time while it is in storage.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

 Signature of participant Date

I believe the participant is giving informed consent to participate in this study

 Signature of researcher Date

Contact: Selja Snorraddottir, Tel. +46 73-710 69 08, E-mail: seljasnorraddottir@gmail.com

8.5 Appendix E Description of Categories

Description of opportunities and barriers apparent in the literature review and the media analysis. The grey shaded cells represent opportunities or barriers that were added from the media analysis.

Barriers	Integral Theory	Description
Communication	Structural	Focusing communication on utilitarian reasons (health, environment) for people to eat insects is a barrier to increase insect eating.
Regulations	Structural	The regulations around producing, selling, and marketing insects not being clear enough is a barrier to increase insect eating.

Accessibility	Structural	Not having enough insect-based food readily available in stores and restaurants is a barrier to increase insect eating.
Knowledge on how to incorporate into diet	Structural	People lacking knowledge of how to incorporate insects into their diets is a barrier to increase insect eating.
Westernization of diet	Cultural	People viewing insect eating as a primitive practice that does not fit the Western diet is a barrier to increase insect eating.
Social Acceptance	Cultural	There being low acceptance of insect eating by friends, family, or nationally known people is a barrier to increase insect eating.
Cultural Appropriateness	Cultural	It being culturally inappropriate to eat insects as insects are not perceived as food is a barrier to increase insect eating.
Diet Changes Slowly	Cultural	Drastic dietary shifts happening slowly is a barrier to increase insect eating.
Negativity	Personal	People seeing insects as dirty or disgusting is a barrier to increase insect eating.

Opportunities	Integral Theory	Description
Tasting	Structural	Having people taste insects is an opportunity to increase insect eating.
Communication	Structural	Focusing communication on hedonic reasons (taste, appearance) for people to eat insects is an opportunity to increase insect eating.
Accessibility	Structural	Having insects be readily available as an option at restaurants and in stores is an opportunity to increase insect eating.
Government support	Structural	The government being supportive of innovations within the edible insects field is an opportunity to increase insect eating.
Social Acceptance	Cultural	There being high acceptance of insect eating by friends, family, or nationally known people is an opportunity to increase insect eating.
Luxury Food	Cultural	Marketing insects as luxury food similar to sushi is an opportunity to increase insect eating.
Presentation	Cultural	Presenting people with food items containing invisible insects is an opportunity to increase insect eating.
Acceptance of insects by other Western countries	Cultural	Other Western countries increasingly adopting insects into their diets is an opportunity to increase insect eating.
Curiosity	Personal	People being curious towards trying new food is an opportunity to increase insect eating.
Children	Personal	Introducing insect as food to children is an opportunity to increase insect eating.