



CULTURED MEAT AND ITS DISRUPTIVE POTENTIAL FOR THE DUTCH MEAT INDUSTRY: HOW TO DEAL WITH THE EFFECTS OF DISRUPTION?



Sources: Labgrownmeat.com (n.d.) and Time (2017) from top to bottom.

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Abstract

The Dutch meat industry is a lucrative industry which provides employment to over 12.000 people. However there are some issues with current methods of production such as: sustainability, health and safety, or growing ethical concerns. Cultured meat is a novel food product in development by a number of companies which could alleviate these issues. presently little is known about how a market introduction of cultured meat could affect existing stakeholders in the Dutch meat industry though. This and related issues are investigated through interviews with a variety of different experts/stakeholders including: Retailers of meat, cultured meat companies and partners, but also public sector actors. Results identify a number of factors that directly influence the disruptive potential of cultured meat. Additionally results show that there is a potential for stakeholders to make a transition towards cultured meat, although it's not expected that disruption will take place on a large scale. Finally attention is spent on issues pertaining to what can be done to manage or stimulate effects of disruption. Some conclusions can be made based upon these obtained results, however a large amount of uncertainty still remains.

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1. Introduction

1.1. The meat industry in the Netherlands & global trends

Although a relatively small country, The Netherlands is the second-largest exporter of agricultural products worldwide in terms of value (Humboldt, 2018). A significant portion of this value is derived from the production and export of meat products: Responsible for about 18% of all agricultural exports, providing employment to over 12.000 people and accruing roughly €10,4 billion worth of profit yearly (Centrale Organisatie voor de Vleessector [COV], 2020). In addition to this, exports related to food processing and livestock feed were also worth approximately €4.7 billion in 2019 (Centraal Bureau voor de Statistiek [CBS], 2020). According to expectations, the global demand for meat products will steadily continue to rise for the foreseeable future (Goodwin & Shoulders, 2013; Kadim et al., 2015; Kearney, 2019). Based on these observations, one could argue there should be little concern for those involved in the Dutch meat industry.

However, a large group of international researchers argue that continuation of conventional meat production methods are at the end of their capacity in addition to being highly problematic. Issues such as environmental pollution and degradation, animal welfare, food security, and health and safety benefits are often cited as reasons to cut down on livestock production or to look for alternatives (Bhat & Fayaz, 2011; Goodwin & Shoulders, 2013; Hocquette, 2016; Moritz, n.d.; Sharma, Thind & Kaur, 2015; Stephens et al., 2018; van der Weele & Driessen, 2013; Zhang et al., 2020). Awareness of this finiteness of resources and the negative consequences associated with traditional meat production have led to a rise in the production and popularity of various forms of meat replacements intended to tackle problems associated with the traditional meat industry. Increasingly more so, consumers are starting to be more aware of their meat consumption and governments are tightening regulations to ensure good conditions (Kearney, 2019, p. 4-18).



Figure 1: Large scale farm in the Netherlands.
Source: Wakker Dier (n.d.).

It appears that these observed trends largely align with the situation in The Netherlands: The popularity of traditional meat products seems to be on the decline. The sale of plant-based alternatives increased by 40% in the last two years, consumers are more concerned about the well-being of animals, and consumers eat less meat compared to 2009 (Gremmen, 2020; Groeneveld, 2019; RTL Nieuws, 2019) Similarly political action has been taken in an attempt to cut down on environmental pollution caused by nitrogen emitted by livestock. In 2019 a governing party suggested a controversial plan to cut the current amount of livestock by 50%, sparking a series of government negotiations and large-scale protests among farmers which were dubbed the “Nitrogen crisis” (Winterman, 2020). Finally, other issues such the recent worldwide Corona crisis have caused meat production, consumption and prices to plummet. Worldwide meat prices dropped by 2.7% in April 2020, after also experiencing decline in the previous 3 months (Oussoren, 2020).

1.2. A new competitor on the meat market

Despite the increase in popularity of meat alternatives and awareness of the problems associated with traditional meat production, researchers worry that plant-based meat replacements mostly appeal to niche markets and won't convince the average consumer. As such, further action is required in order to meet future meat demand projections. A novel product still in development could prove to be the perfect solution: cultured meat (Kearney, 2019, p. 4-18). Cultured meat - also known through a variety of other names such as: in-vitro, artificial, synthetic, or lab-grown meat - refers to the process of recreating skeletal muscle tissue of animals through use of a number of animal cells and tissue engineering technology. In order to achieve this different techniques can be applied, and the process runs through a number of separate stages (Chikri & Hocquette, 2020; Post, 2012; Zhang et al., 2020). However these methods are far from fully developed yet, and some researchers argue that the technology is still in its early stages. Besides solving existing technological problems relating to matters such as costs, resources, scale, sustainability, and safety, researchers also worry about matters such as consumer acceptance and regulations (Kadim et al., 2015; Stephen et al., 2018; Zhang et al., 2020).



Figure 2: Artist impression of cultured meat product. Source: Vegconomist (2020).

Despite these lingering technical problems and marketability issues, the aforementioned researchers remain very positive about the prospective potential of cultured meat. In particular they note that if these technical issues can be solved cultured meat could have a number of advantages relative to traditional meat such as: More efficient use of resources (land, energy & water), lower greenhouse gas production, better animal welfare, improved nutritional values, and being less prone to biological risk and disease (Kadim et al., 2015; Stephen et al., 2018; Zhang et al., 2020). When all these benefits are taken into account, some researchers predict that cultured meat could become a serious competitor of traditional meat in the future (Alexandre, 2020; Kearney, 2019, p. 16-18; Zhang et al., 2020, p. 449).

Even though the technology behind cultured meat products isn't fully developed yet, companies such as the Dutch start-ups Mosa Meat and Meatable already expect to have a product ready for markets by 2021, or to be producing thousands of kilograms of cultured meat by 2025 respectively (Rodríguez Fernández, 2018; Shieber, 2019). Recently, the Dutch government acknowledged the potential of cultured meat and announced their support for the further development of cultured meat on the 30th of January 2020 (Meij, 2020). Despite this endorsement by the Dutch government and an approaching market entry, little is currently known about how the market introduction of cultured meat will affect existing systems. Will the Dutch meat industry experience disruption due to the commercialisation of cultured meat products?

1.3. Paradigm shifts in meat production?

This term - disruption - is commonly used to describe innovations that make existing business models inefficient or irrelevant (Mouat & Prince, 2018, p. 325). As such, disruption is often associated with large technological shocks which can cause labour-markets to become maladjusted for years and thus can cause large-scale unemployment or underemployment. Also related to this is the concept of “smoothing”, which refers to the practice of trying to prevent or alleviate labour market shocks due to disruption. Despite this, disruption is often noted as having a positive effect on wealth and labour markets in the long run (Bughin et al., 2019).

This research attempts to investigate if similar developments could take place in the Dutch meat industry. Will the over 12.000 people employed in the Dutch meat industry be at risk of seeing their occupation change or disappear, or will cultured meat not be able to become a serious competitor to traditional meat? What are the factors influencing this, how are different stakeholders affected, and what can be done to smoothen potential disruption in order to prevent a possible loss of employment? Finally, it is also investigated how disruption could be stimulated in the case this would be desirable because of the associated long term benefits of disruption.



Figure 3: Concept for future meat production method. Source: Techcrunch (2019).

A small body of scientific literature on the possible disruptive effects of cultured meat on the traditional meat industry does exist, however scientific literature has largely focused on a variety of other issues related to cultured meat (Fernandez et al., 2020; Stephens et al., 2018, p. 156). Regardless, no specific case-study appears to exist which attempts to analyse the potential for, and solutions to disruption of the Dutch meat industry due to the introduction of cultured meat products. It is for this reason this research intends to explore this research gap, and create a nuanced, in-depth and state-of-the-art perspective for a future of the Dutch meat industry after the introduction of cultured meat. Through an explorative and qualitative research approach primarily based on in-depth, semi-structured interviews with a variety of stakeholders/experts, it will be attempted to further theory in this relatively untouched field of research.

1.4. Main research question & sub-questions

Taking all of the above into account, this has resulted in the following main research question:

“How can potential disruption of the traditional Dutch meat industry due to the commercialisation of cultured meat products be smoothened or stimulated?”

In order to realise an answer to this main research question, a number of sub-questions have been identified as well:

1. What factors influence the disruptive potential of cultured meat?
2. How will the introduction of cultured meat products affect stakeholders in the Dutch meat industry?
3. What can be done to prevent negative consequences of disruption, and stimulate positive consequences of disruption within the Dutch meat industry?

All of the above mentioned sub-questions will be answered through the combination of an exploration of available scientific literature, alongside information gathered from experts/stakeholders during interviews and written communication. Each of the sub-questions have been set-up with a particular goal in mind. By answering the first sub-question, it is expected to gain deeper insight into issues that are critical in explaining and predicting the disruptive potential of cultured meat for the Dutch meat industry. The second sub-question aims to identify how different groups within the Dutch meat industry could potentially be affected by disruption due to cultured meat, be it positively or negatively. Finally the third sub-questions attempts to provide a window into opportunities deriving from disruption, mentioning solutions to negative consequences of disruption of the Dutch meat industry due to cultured meat or how to influence positive consequences of disruption. Using the information gathered by answering these three sub-questions, it will be attempted to provide in an answer to the main research question.

2. Theoretic framework

2.1. Introduction to cultured meat

In order to be able to comprehend the potentially disruptive qualities of cultured meat it is essential to have a basic understanding of what cultured meat is, how cultured meat is produced, and what the potential benefits of cultured meat are. For this reason, this part of the theoretical framework will be dedicated to establishing a basic understanding of cultured meat. Challenges to cultured meat will be discussed in the following part of the theoretical framework.

2.1.1. What is cultured meat, and how is it made?

As mentioned in the introduction, cultured meat – or in-vitro, artificial, synthetic, or lab-grown meat – refers to the process of recreating skeletal muscle tissue of animals through use of a number of animal cells and tissue engineering technology (Chikri & Hocquette, 2020; Post, 2012; Zhang et al., 2020). In particular 3 technologies have been key to the development of cultured meat: stem cell isolation and identification, ex vivo cell culture, and tissue engineering. Stem cell isolation and identification refers to the practice of identifying, selecting and modifying stem cells most suitable for the culturing of meat. Ex vivo cell culture is the process of growing cells outside of a living organism. Finally, tissue engineering refers to the study of improving or replacing biological tissues through a variety of methods. Although developments in these fields have made the creation of cultured meat possible, further developments are needed in order to optimize the process and techniques which are currently used could change based on new developments (Post, 2012, p. 299-300).

The previous paragraph describes what techniques are used in the process of creating cultured meat, however provides little insight on how it is actually made. Scientific articles such as those by Bhat & Fayaz (2011), Mattick et al. (2015) or Zhang et al. (2020) seem to be mostly explorative in nature, focusing on different methods of producing cultured meat. This is reaffirmed by the work of Arshad et al. (2017) who have reviewed scientific literature on production methods of cultured meat and compose a list containing a variety of different production methods and explorable options. Because this research intends to focus on the Dutch (cultured) meat industry, the method currently used by one of these companies will be discussed in the next paragraph.

On their website, the company Mosa Meat (n.d.-a) shares a video which shows a simplified version of how they produce their cultured meat. First of all, muscle tissue is harvested from a living organism through a harmless procedure. Next, this muscle tissue sample is cut into miniscule pieces to separate the muscle fibres inside of them. The muscle cells within these fibres are isolated and dissected in order to select individual cells. These cells can be fed nutrients so that they will begin to divide, and in this manner a single cell can turn into a trillion muscle cells. The cultivated muscle cells merge naturally into strings of cells called myotubes, which are placed together in a ring. Because of the innate tendency of muscle tissue to contract, they start to bulk and grow into a small piece of muscle tissue. This small piece of muscle tissue can then be used to create a trillion new pieces of muscle tissue, which can be layered together in order to recreate a piece of meat. For reference, one quarter pounder burger requires about 10,000 of these strands of muscle tissue (Mosa Meat, n.d.-b).



Figure 4: Cultured meat burger developed by Mosa Meat. Source: Mosa Meat (n.d.).

2.1.2. Why cultured meat?

The potential benefits of cultured meat is a topic that has been widely discussed in scientific literature. Most of the researchers approach the topic as a possible solution to issues caused by traditional livestock farming. The benefits of cultured meat compared to livestock farming mentioned by articles can be loosely categorised into 4 themes: environmental issues, animal welfare, food security, human health and safety benefits (Bhat & Fayaz, 2011; Goodwin & Shoulders, 2013; Hocquette, 2016; Moritz, n.d.; Sharma, Thind & Kaur, 2015; Stephens et al., 2018; van der Weele & Driessen, 2013; Zhang et al., 2020). Bibliometric analysis and reviews of the available scientific literature largely coincide with these same topics (Fernandes, 2019, p. 61; Kadim et al., 2015). As such, these 4 categories will summarily discussed in the rest of this section.

Out of these 4 themes often mentioned when discussing the benefits of cultured meat, the benefits to solving environmental issues is perhaps most often noted. In the introduction its already mentioned that approximately 70% of the earth's fresh water is currently already used to maintain agriculture (Kearney, 2019, p. 7). Concurrently approximately 70% of all agricultural land is related to some aspect of livestock production (Bonny et al., 2015, p. 256). Further intensification could cause a number of issues such as soil compaction and erosion, resistances to agricultural chemicals for plants or antibiotics for animals and social issues such as zero-tolerance on animal harm are gaining more traction (Kearney, 2019, p. 7). Additionally, some researchers estimate that livestock is responsible for 18% of all greenhouse gas emissions and 20% of all energy usage by mankind (Bhat & Fayaz, 2011; Bonny et al., 2015, p. 256; Sharma et al., 2015, p. 7604). Cultured meat could make a large difference in these areas, as early optimistic expectations suggest that compared to conventionally produced European meat cultured meat uses approximately 7-45% less energy, has 78-96% lower greenhouse gas emission, 99% lower land use and 82-96% lower water use (Tuomisto & Teixeira de Mattos, 2011).

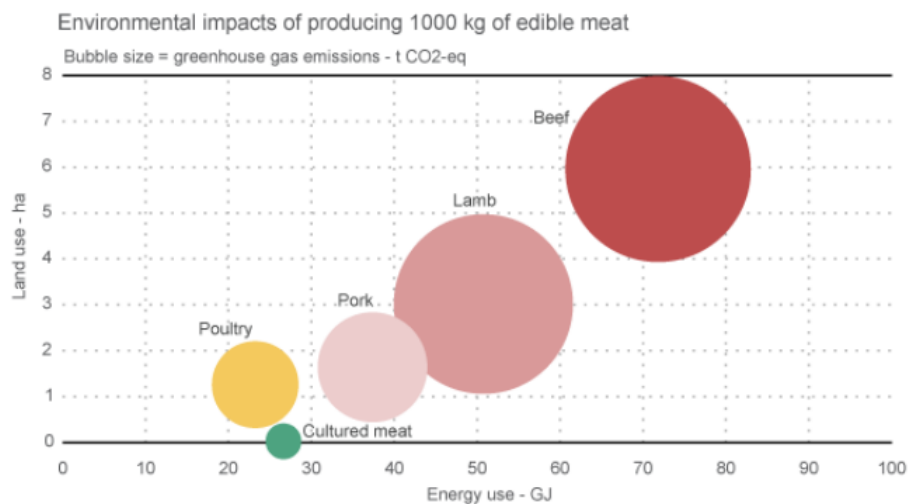


Figure 5: Environmental impacts of cultured meat compared to traditional production methods. Source: Tuomisto & Teixeira de Mattos (2010).

Another theme that has started to cause an increasing concern among consumers is the issue of animal welfare (Bonny et al., 2015; Bryant & Barnett, 2018; Chikri & Hocquette, 2020; Gokirmakli & Bayram, 2017; Goodwin & Shoulders 2013; Kadim, 2015; Post, 2012; Sharma et al., 2015; Stephens et al., 2018). Especially in developed countries consumers are increasingly looking for products which are more animal-friendly and consider the suffering experienced by animals as a certain evil, even though a large part of these are unwilling to change their consumer behaviour (Bonny et al., 2015; Bryant & Barnett, 2018; Hocquette, 2016; Sharma et al., 2015) Cultured meat could proof to be a

solution to this issue as it could drastically reduce the number of animals required to be slaughtered in order to meet global demand, as well as giving consumers the chance to buy a “victimless” product that closely resembles traditional meat without the association to animal welfare problems (Bonny et al., 2015; Chikri & Hocquette, 2020). Perspectives like these could convince people like vegetarians or those that want to be more responsible but don’t want to change their diet to try cultured meat (Arshad et al., 2017; Chikri & Hocquette, 2020; Moritz, n.d.; Stephens et al., 2018; van der Weele & Driessen, 2013)

Food security is the third theme that is often mentioned in scientific research on cultured meat. A large group of researchers mention that it is expected that demand for meat or comparable protein products will continue to rise significantly over the next decades as the world population continues to grow (Arshad et al., 2017; Bhat & Fayaz, 2011; Bonny et al., 2015; Chikri & Hocquette, 2020; Gokirmakli & Bayram, 2017; Goodwin & Shoulders, 2013; Hocquette, 2016; Kadim, 2015; Moritz, n.d.; Post, 2012; Sharma et al., 2015; Stephens et al., 2018; van der Weele & Driessen, 2013; Verbeke et al., 2015; Zhang et al., 2020). It is expected that annual global meat production will double by the year 2050 when compared to the year 2000, or increase by 70% compared to more recent estimations (Bhat & Fayaz, 2011; Bryant & Barnett, 2018; Chikri & Hocquette, 2020; Gokirmakli & Bayram, 2017; Moritz, n.d., Sharma et al., 2015). Researchers fear that we will eventually run out of production capacity as large portions of arable land are already dedicated to livestock feeding and management, in fact about 30% of all arable land is currently already used for livestock purposes (Arshad et al., 2017; Bhat & Fayaz, 2011; Chikri & Hocquette, 2020; Gokirmakli & Bayram, 2017; Hopkins, 2015; Moritz, n.d.; Post, 2012; Stephens et al., 2018; Tuomisto & Teixeira de Mattos, 2011). As a production technique that is expected to require much less land in order to produce larger amounts of meat, cultured meat could provide an appropriate solution to this problem of traditional agriculture (Goodwin & Shoulders, 2013; Sun, Yu & Han, 2015; Tuomisto, 2010; Tuomisto & Teixeira de Mattos, 2011; Zhang et al., 2020).

Finally, the last advantage of cultured meat over traditional meat often mentioned by researchers is the idea that cultured meat could be both healthier and safer than traditional meat. Cultured meat production techniques allow for the nutritional content of meat to be enhanced, being able to adjust fat ratio’s or adding additional useful nutrients (Arshad et al., 2017; Bhat & Fayaz, 2011; Bonny et al., 2015; Chikri & Hocquette, 2020; Edelman et al., 2005; Hopkins, 2015; Kadim et al., 2015; Kearney, 2019; Mattick et al., 2014; Moritz, n.d.; Post, 2012; Sharma et al., 2015; Stephens et al., 2018; Tuomisto, 2010; Tuomisto & Teixeira de Mattos, 2011; van der Weele & Driessen, 2013; Zhang et al., 2020). In addition to this cultured meat production methods allow for a safe and controlled environment, in sterile laboratories without contact with living organisms. This should reduce the need for costly vaccines or antibiotics needed to combat the risk of disease or infection which are common problems associated with livestock. In particular the growing resistance against antibiotics among livestock has become a growing problem for food safety (Arshad et al., 2017; Bhat & Fayaz, 2011; Chikri & Hocquette, 2020; Kadim et al., 2015; Moritz, n.d.; Kearney, 2019; Sharma et al., 2015; Zhang et al., 2020).

2.2. Challenges of cultured meat

Despite the previous part of the theoretical framework mostly mentioning possible positive effects of a transition to cultured meat, there are also a number of considerable challenges to overcome before such a transition could take place. Because these challenges are equally important to comprehending the disruptive potential of cultured meat for the Dutch meat industry, these challenges are discussed at length in this part of the theoretical framework.

2.2.1. Technological development

In the introduction it is already summarily mentioned that methods of producing cultured meat are far from fully developed yet. In fact, most researchers seem to unanimously agree with the characterisation that developments and research surrounding cultured meat are still in a nascent state of development (Bryant, 2020; Chiles, 2013; Fernandez et al., 2020; Gaydhane, Mahanta & Sharma, 2018; Mattick & Allenby, 2013; Stephens et al., 2018; Vernon, 2019). Regardless of this nascent state, many of the technical challenges associated with cultured meat are highly complex in nature. In order to make sure that this section of the theoretical framework is still comprehensible for a general populace, the technical challenges associated with cultured meat will only be described through concise and basic descriptions without delving into detail too much.

Most commonly, researchers mention that the costs and resources required for production of cultured meat products are currently still absurd compared to conventional prices for traditional meat. As such researchers also currently express some doubt in the sustainability of this form of meat production if no progress can be made in these regards. However it is expected that advances in the technical aspects of cultured meat production will greatly improve efficiency and lower costs significantly. The primary issue preventing such a development is the problem of finding a way to scale up production, to pave the way for mass-production of cultured meat products (Bodiou, Moutsatsou & Post, 2020; Gaydhane et al., 2018; Edelman et al., 2005; Zhang et al., 2020). To solve these issues breakthroughs in a wide variety of fields of study would be required. Examples include: Finding appropriate cell resources, finding more effective ways of cell proliferation and differentiation, or engineering production facilities such as bio-reactors on a larger and more effective scale (Zhang et al., 2020). As such, researchers largely seem to agree that more time for development is needed.

2.2.2. Consumer acceptance of cultured meat

Several studies have already done research on the topic of consumer acceptance of cultured meat and have come to the conclusion that despite the potential benefits of cultured meat consumer attitudes towards cultured meat products are mixed. There is still a large group of consumers who maintain a negative attitude towards cultured meat products. There is a general consensus among researchers that these negative attitudes are mainly derived from ideas about cultured meat products as being “unnatural”. Consumers which reacted negatively often mentioned being disgusted by the idea of meat grown in laboratories or were afraid of unidentified risks or consequences of this form of meat production (Bryant & Barnett, 2018; Goodwin & Shoulders, 2013; Siegrist & Sütterlin, 2017; Siegrist, Sütterlin & Hartmann, 2018; Slade, 2018; Verbeke et al., 2015).

At the same time however some researchers observe a trend among consumers towards alternatives to traditional meat, including cultured meat. Similarly a continuously larger group of people is also becoming more aware of the negative impacts of traditional meat production. The fact that cultured meat has a less harmful impact on environment and ethical matters compared to traditionally produced meat could entice people that are inclined follow this trend (Alexandre, 2020; Kadim et al., 2015; Kearney, 2019; Mancini & Antonioli, 2019; Verbeke, Sans & van Loo, 2015). Finally, some

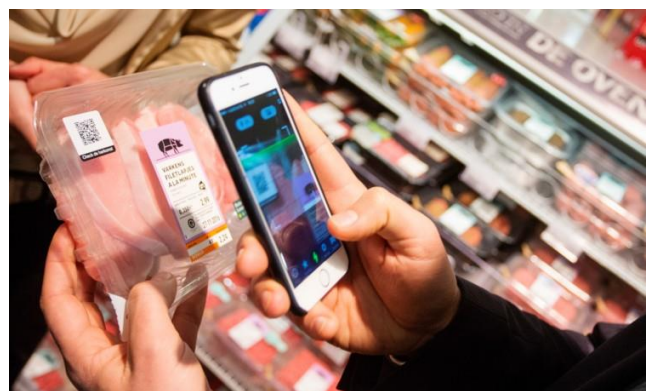


Figure 6: Dutch consumer scanning a QR code for detailed information about the meat product. Source: Food Navigator (2016).

researchers note that behaviour, preferences and social norms in regards to food commonly change over time, leading to situations where particular food becomes acceptable in the perception of the consumer after long periods of rejections. This could also be the case for cultured meat (Alexander et al., 2017, p. 2)

Research which attempts to explore these differences in attitude towards cultured meat identify a number of possible explanatory variables such as socio-demographic attributes like age, sex or education, but also lists a number of other factors such as price, taste, attitudes towards food technology or cultural background (de Boer, Schösler & Aiking, 2014; Hartmann & Siegrist, 2017; Mancini & Antonioli, 2019; Slade, 2018). Some research even suggests that consumers worry about the disruptive potential of cultured meat technology, and the loss of farming traditions and agricultural jobs (Verbeke et al., 2015). At the same time however, a large body of other research denies the relevance of a number of these variables in regards to attitudes towards cultured meat-consumption (Clonan et al., 2015; Hartmann & Siegrist, 2017; Tobler, Visschers & Siegrist, 2011). As such, scientific research remains inconclusive on the causes of these differing attitudes on cultured meat.

2.2.3. Ecomodernism: A dividing force in the traditional meat industry

Issues regarding consumer acceptance of cultured meat can be tied into the debate on ecomodernism, as the concept of cultured meat has often been associated with the philosophy of ecomodernism (Jönsson, 2020, p. 6; van der Weele, n.d., p. 8). One of the central principles of ecomodernists is that they embrace the idea that humans have become the most prominent geological force, affecting nearly all of the earth's systems and their composition to a degree. In opposition to more traditional environmental schools however, they are convinced that this influence is not a fundamentally negative phenomenon (Anthos, 2018, p. 16). Instead ecomodernists argue that ecological problems arising due to the activity of humans are simply the result of nature not being subsumed enough (Carlton, Jönsson & Bustos 2017, p. 792). They regard solving these ecological problems through technological means as a sort of opportunity, mentioning prospects of "saving the whole world", reaching a certain "extraordinary new frontier", or leading to a "brave new world of transhumanists" (Jönsson, 2020; van der Weele, n.d.). In this sense ecomodernists are convinced of the responsibility of humans to direct and shape nature into good directions (Anthos, 2018, p. 16).

As such, this group of thinkers are often dubbed as techno-optimists as they are certain that technological developments and human ingenuity will be able to solve every problem and lead to a form of utopian world (Jönsson, 2020; van der Weele, n.d.). In direct opposition to this school of thought are more traditional schools of environmentalism which focus on pristine wilderness untouched by human interference, even if the intentions are good (Anthos, 2018, p. 16). These more traditional schools of environmentalism aim to achieve this by embracing small scale labour-intensive agriculture or pursuing sustainable lifestyle choices rather than relying on technological innovation. This dichotomy displays a clear discrepancy between two parties that both aim to solve ecological issues caused by humans (van der Weele, n.d.).

2.2.4. Legislation & regulation

A small but important body of literature within the discourse on cultured meat focuses on the regulation and legislation of cultured meat (Chikri & Hocquette, 2020). In order to introduce products onto the European market and thus by extension the Dutch market, a number of obstacles need to be overcome. This includes regulation that's intent to ensure that new foods are safe to consume, labelled properly, do not mislead consumer, and are not nutritionally disadvantageous compared to existing foods they seek to replace. Further issues are related to the question if cultured meat will be able to be marketed as meat, as European guidelines on what defines meat are relatively strict. Because of this, it's also unsure what kind of regulations or legislations cultured meat would be subjected to. Regardless of this classification in European Union regulations, cultured meat would also be subject to national legislation (Bryant, 2020, p. 3-4). Hence, other authors argue that the success of cultured meat is also highly dependent on the support of governments to help pass legislation or regulations that would allow for a market introduction of cultured meat (Stephens et al., 2018, p. 163).

2.3 Defining disruption and the relation to cultured meat

The previous sections of the theoretical framework have been dedicated to discussion on the benefits and issues of cultured meat in order to gain an understanding of the disruptive potential of cultured meat. However, little attention has been spent on the topic of disruption itself. As comprehension of the term is essential in order to be able to answer the main research question, the following part of the theoretical framework has been dedicated to an exploration of scientific literature on disruption and its relation to cultured meat.

2.3.1. Defining disruption & how to deal with effects of disruption

Originating in 1995, the term disruption describes an idea that has affected business sustainability for a long time and hence quickly became a popular topic among academics. Since it's rise in popularity, there has been a lot of discussion within the scientific community on the exact definition of the word. In recent years there are two main variants which are applied, which contain a numerous variety of different interpretations each (Gobble, 2016; Montoya & Kita, 2018, p. 75; Nady, Schuessler & Dubinsky, 2016; Tellis, 2006). One definition states that the term can be used to describe a predictable pattern in all sectors where start-ups use new technology to make it possible for "something new and small" to penetrate "something existing and big" in a short span of time (Veuger, 2018). An addition to this is that innovations derived from this new technology causes existing business models to become obsolete or "counterperformative", essentially meaning they become less efficient when compared to the new innovation (Mouat & Prince, 2018, p. 325).



Figure 7: Concept art disruption. Source: Medium (2019)

In order to prevent any confusion in regards to differing definitions, this research chooses to interpret disruption as the process imagined by Steven Sinofsky. In his framework, Sinofsky identifies four separate phases of disruption which can be used to interpret and predict disruptive developments through the perspectives of both the disruptor (start-up) and the established order (Veuger, 2018):

1. Disruption: A disruptor introduces a new product with a distinctive approach. This product does not yet meet all the needs of the existing market but is an improvement over previous technology/business. Because this development does not affect the market of the established order yet, they take no action.
2. Evolution: The disruptor quickly adds features and capabilities, adding to their value proposition. At this point the established order starts to realise the downsides of their own product.
3. Convergence: The disruptor continues to evolve and broaden their customer base, attracting slow movers, improving their product, and essentially becoming the new established order. This causes the previously established order to consider taking over some of the core values of the disruptor.
4. Re-imagination: At this point the disruptor reaches a decision point, as newcomers in the market will start to imitate their product. Do they continue to try and innovate, or do they stick to what they have? Meanwhile the previously established order essentially starts to become a niche market.

This framing of disruption was deemed appropriate, as it clearly displays the process of disruption as a process of gradual change. This aligns with the expectations of some researchers that disruption of the meat industry due to cultured meat will be a similar gradual process (Kearney, 2019, p. 16-18; Rischer et al., 2020).

Because of the characteristics of disruption mentioned in the previous sections, disruption is also commonly associated with large labour-market shocks which can cause labour-markets to be maladjusted for years. Due to the substitutive nature of disruption, previous occupations become obsolete and are replaced with new types of employment. As an effect, disruption can be responsible for large-scale unemployment or underemployment as the skillset required for the obsolete form of employment and the new form of employment are unlikely to match. At the same time however, researchers observe that effects of disruption lead to an increase of wealth over the long-term and as such may be desirable. In any case, a number of methods in which disruption might be shaped or dealt with can be highlighted. Government action formed a primary role in these methods of dealing with disruption. Examples include practices common in classical labour market policy such as: informing, retraining, labour mobility, financial access, and so on. Aside from this governments can also use their powers to directly influence disruptive processes through regulation and legislation, an aspect that was previously already identified as a challenging factor for cultured meat. Finally, the importance of the role of businesses was also emphasized as they should keep in close coordination with governments in order to make sure these are informed on recent developments (Bughin et al., 2019). The consequences of this relation between processes of disruption and employment and wealth are more elaborately discussed for the case of cultured meat in one of the following sections.

2.3.2. Exploration of scientific literature on disruption & cultured meat

Initial exploration of the available scientific literature seemed to indicate that although there is a sizeable amount of scientific literature on cultured meat available, only a small number of it investigates the possibly disruptive effects cultured meat could have on the traditional meat industry. Figure 2 shows the results of bibliometric analysis on the output of scientific articles on cultured meat, which indicate a strong positive trend starting in 2008 and peaking in 2015 (Fernandez et al., 2019, p. 59). Despite this increase systematic review of this scientific literature shows that research broaches a wide array of topics related to cultured meat, and disruption isn't one of the most commonly mentioned (Fernandez et al., 2020). Comparable analysis by Stephens et al., (2018, p. 156) similarly concludes that most scientific literature has focused on issues such as ethics and consumer acceptance, and the authors even call for a need to differentiate research in order to explore other issues related to cultured meat. An explanation for these findings could be rooted in the previously mentioned fact that several authors state that developments and research surrounding cultured meat are still in a nascent state (Bryant, 2020; Chiles, 2013; Fernandez et al., 2020; Mattick & Allenby, 2013; Stephens et al., 2018; Vernon, 2019).

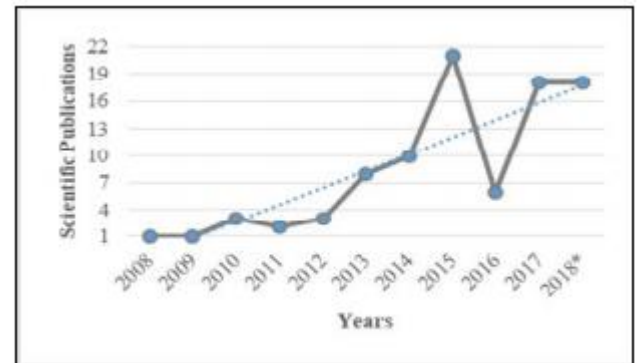


Figure 8: Publications on cultured meat (Fernandez et al., 2019, p.59).

Closer inspection of the available scientific literature does seem to confirm that the topic of disruptive effects of cultured meat for traditional meat industries is a topic that is barely or fleetingly mentioned, as was suggested in the previous section. There are just a handful of scientific articles that really make a dedicated effort to discuss the matter, such as the works by Bonny et al. (2015 & 2017), Duncan & Bailey (2017), Katz-Rosene & Martin (2020, p. 178), Rischer, Szilvay & Oksman-Caldentey (2020), Sebo (2018). A comparable amount of articles dedicates most or the entirety of the research to this particular topic, such as the papers by Alexandre (2020), Johnson (2019), Jönsson (2020), Kearney (2019), Mouat & Prince (2018), Norman & Shad (2018), and Stephens et al. (2018). This small collection of research will serve as the primary foundation for the theory discussed in the following section.

2.3.2. How will disruption due to cultured meat take shape?

Estimations on the disruptive potential of cultured meat in scientific literature vary wildly. Some authors doubt that much disruption will take place, if any at all. Stating that they believe the conventional system is simply too big to be disrupted (Johnson, 2019; Katz-Rosene & Martin, 2020, p. 178). Other researchers seem convinced that (eventually) cultured meat will become a serious threat to traditional meat production and will take over a significant share of the market (Kearney, 2019; Rischer et al., 2020). Even others reside by the notion that more research is needed in order to be able to come to conclusions (Duncan & Bailey, 2017; Mouat & Prince, 2018; Sebo, 2018; Stephens et al., 2018). As such, a number of authors also mention that their estimations are merely predictions or that making certain estimates is virtually impossible (Alexandre, 2020; Jönsson, 2020; Kearney, 2019).

Regardless of this dispute on the scale and range of disruptive effects caused by market introduction of cultured meat, a number of abstract ideas on how disruptive effects of cultured meat could take shape are imagined by researchers. For illustration, Jönsson (2020) envisions a future of meat production that is not tied to particular spaces anymore. Because adjacency to agricultural land or waters are expected to be factors that are less important for determining ideal locations for the

production of cultured meat, it is theorised that cultured meat could essentially be made anywhere. They also envision a future in which production of cultured meat can be decentralized and specialized, allowing small-scale farmers to apply cultured meat production techniques to exclusive animals to produce rare and expensive meats without having to harm these animals. Other researchers mention the possibility of small-scale local factories that will be shared by communities or contrasting perspectives of large-scale industrial production sites (Allen, De Bank & Ellis, 2019; van der Weele & Tramp, 2014). Even other research mentions the possibility of 3D printing cultured meat in the future (Bonny et al., 2017). It becomes apparent that a wide range of ideas exist among researchers on how future disruption of the meat industry will take hold. However they all note that these are merely expectations that aren't based on observed facts and are dependent on factors influencing disruption as mentioned in previous parts of this theoretical framework. As such, scientific literature remains largely inconclusive.



Figure 8: Concept art future meat production. Source: Netherlands Study Centre for Technology Trends (2016).

3. Methodology

In this chapter the methodical choices made in order to be able to answer the main research question will be discussed. First of all there will be a short reflection on the choice for explorative, qualitative oriented research, which links back to the availability of academic literature and the nascent state of development of cultured meat. Next the methods used in order to collect data are described in detail, focusing on interview methods and choices for research units and the resulting research group. After this attention is spent on the primary method of data-analysis applied in this research; analysis of the data obtained from interviews through use of coding. Some attention will also be spent on matters such as ethical concerns and the validity and reliability of the research. Finally, some other matters like the assignment behind this research and the timespan during which this research was conducted are also discussed.

3.1. Research methods

The explorative, qualitative nature of this research has been briefly touched upon in the introduction. The reason for this approach is rooted in the fact this research aims to provide a nuanced, in-depth and state-of-the-art perspective of the potentially disruptive impact of cultured meat on the traditional meat industry in the Netherlands. In this part of the methodological chapter, the choice for this explorative and qualitative approach will be justified further.

3.1.1. Choice for explorative research

As mentioned in the theoretic framework, only a small body of scientific literature touches upon the subject of disruption of the traditional meat industry due to cultured meat developments. This body of work has been used as the foundation for the theoretic framework of this research, but realistically offers relatively little in terms of concrete and verified theory. In particular, no scientific research could be found that attempts to address this issue for The Netherlands specifically. For this reason, an explorative approach has been chosen to further attempts at formulating and shaping theory on this specific subject. According to Boeije, Scheepers & Tobi (2016) conducting explorative research is perfectly suited to realise theory in new fields of study. In fact, the authors mention that explorative research is almost a requirement when attempting to research aspects of the social reality that have barely been researched yet.

3.1.2. Choice for qualitative research

Likewise, qualitative research methods are mentioned as an appropriate medium to formulate new theory. In addition to this, qualitative research methods should provide powerful tools to acquire more in-depth information about topics and to investigate processes of change (Boeije et al., 2016, p. 299; DiCiccio-Bloom & Crabtree, 2006; Schmidt, 2004). In this manner a deeper understanding of the subject matter should become attainable (Niglas, 2000). These descriptions fit the intent of this research to provide a nuanced, in-depth and state-of-the-art perspective of a future of the Dutch meat industry that incorporates cultured meat. Further details on how this is done will be provided in the following parts of this chapter.

In comparison, it is argued that quantitative research methods are more appropriate for finding explanations for readily identified phenomena (Niglas, 2000). As mentioned previously, research in the field of cultured meat is still in a nascent state of development. In case of a choice for quantitative methods such as a survey, this could have caused issues with the accuracy and relevance of the research as theory in this field of research is still developing (Boeije et al., 2016). In addition to this, realistic capability constraints also have to be considered. Doubt exists if a large enough population fit for statistical analysis could be attracted for methods such as surveys. For example, there are currently only 2 producers of cultured meat in the Netherlands. Similarly, little to no

relevant secondary quantitative data sources could be found related to the subject of the possible disruptive effect of cultured meat on the Dutch meat industry.

3.2 Data collection

In this part of the methodology chapter, a number of methodological decisions relating to the collection of data will be discussed. Primary attention is given to the choice for conducting in-depth, semi-structured interviews with stakeholders/experts. In addition to this attention is also spent on matters such as the choice and selection of research units, the composition of the final research group, and response rates.

3.2.1. Choice for interview methods

Because of the relative lack of available scientific literature, the primary method of data-collection chosen for this research will consist of semi-structured interview with experts. An example of a semi-structured interview prepared for one of the respondents is included as Appendix 1. The semi-structured interview format is the most frequently used research method in qualitative research because of its versatility and flexibility, enabling the interviewers to improvise follow-up questions and allowing space for the participants individual expression. In case of a lack of concrete scientific literature or knowledge - as is the case for this research as previously established - semi-structured interviews with experts can be of particular use in order to complement and deepen existing theories (Kallio et al., 2016, p. 2955-2959). Bogner, Littig & Menz (2009, p. 220) define experts as individuals with specialist knowledge that is not available to everyone but is gained through specific training or experience, which they can share to provide clarification or to resolve specific issues or problems. The selection of these experts/stakeholders, and some possible associated concerns in regards to integrity and reliability will be discussed more elaborately in the following sections of this chapter.

Initially, the intention existed to conduct face-to-face interviews as this is generally the norm for qualitative researchers that choose to conduct interviews. Conducting interviews through other methods such as by telephone is typically only seen as appropriate for short, structured interviews or in very specific situations (Sturges & Hanrahan, 2004, p. 108). However, the Corona crisis early in 2020 has proven to be one of these very specific situations that made the choice for face-to-face interviews undesirable. Despite the existing preference for face-to-face interviews, Sturges & Hanrahan (2004) argue that telephone interviews can provide a suitable replacement to face-to-face interviews without having to result in a loss of data quality. In fact, the authors observe some potential benefits to telephone interviews over face-to-face interviews: Respondents might be more willing to share sensitive information because of a heightened sense of anonymity, hard-to-reach respondent groups might be contacted more easily, and travelling costs are reduced.

In a couple of cases however, respondents noted a preference to conduct a written interview instead of a telephone interview. In addition to this, some respondents gave remarkable responses to interview invitations by e-mail while simultaneously expressing that they don't want to be interviewed any further. According to Schiek (2014) the value of written interviews and web-based communication has too often been marginalized in the history of qualitative research. In fact, the author argues that this form of communication could lead to more in-depth information that can't easily be verbalized in face-to-face conversation. These methods of gathering information might be slightly unconventional by traditional qualitative research standards, but because the success of this research is highly dependent on the cooperation of a number of essential respondents and because pieces of written communication proved to be informative it was decided to actively incorporate these interview methods as well.

3.2.2. Choice for research units

The choice for research units has already been briefly mentioned in the previous section. Experts are chosen as research units as they are individuals which possess specialist knowledge that is not readily available to everyone else, which they can share to provide clarification or to resolve specific issues or problems. However because these experts are employed in fields which are related to the subject of research, these experts also automatically become stakeholders as they could have a special interest in the results of research (Bogner, Littig & Menz, 2009, p. 220 & 236). Because of the intention of this research to provide a nuanced perspective of the possible disruptive effects of cultured meat on the Dutch meat industry, a broad collection of several vastly different groups of these experts/stakeholders were approached.

The following groups of Dutch experts/stakeholders were asked to participate: developers of cultured meat products and their partners, those involved with the retail of meat (including farmers, butchers, but also hunters or marketeers), groups oriented towards those that retail meat such as farmer associations or advisory agencies, government representatives, and academics. These groups were selected based on the fact that their core business consists of selling (cultured) meat, or because of their linkages with such businesses. For example: Actors such as the government or farmers associations and advisory boards may not be directly related to the retail of meat, but were included because they can play a role in shaping discourse surrounding cultured meat. Finally some academics were approached for an interview for the simple reason that they had performed prior research on the topic of cultured meat, and therefore could potentially provide state-of-the-art insights on the topic. The final research group and response rates are discussed in the following section of this chapter.

3.2.3. The research group & response

The results of data collection culminate in 10 semi-structured interviews with the aforementioned expert/stakeholder groups. The length of these recordings range from approximately 10 to 50 minutes. It became apparent that most of the interviewed experts/stakeholders had resolute and concise opinions on the subject matter, which caused most interviews to be shorter in length than expected. Aside from the semi-structured interviews, 2 written interviews and 4 written reactions were also incorporated into the results. Table 1 displays the final research group corresponding to the applied method of data collection:

Groups	Telephone interview(s)		Written interview(s)		Written reaction(s)		Total per group (and % of total)	
	N	%	N	%	N	%	N	%
Directly involved in the retail of meat	7	70,0	-	-	1	25,0	7	46,7
Farmer associations & advisory groups	1	10,0	-	-	3	75,0	4	26,7
Cultured meat companies	-		1	50,0	-	-	1	6,7
Partners of cultured meat companies	-		1	50,0	-	-	1	6,7
Government representatives	1	10,0	-		-		1	6,7
Academics	1	10,0	-		-		1	6,7
Total per data collection method (and % of total)	10	62,5	2	12,5	4	25,0	16	100,0

Table 1: The research group. Source: Own work.

From Table 1 it can be deduced that the bulk of the data collected is obtained from interviews and communication with experts directly involved in the retail of meat, forming the largest group of respondents. For the most part this was intentional, as it is likely that this is the group that will be affected the most in case of disruption due to the introduction of cultured meat and thus form a primary group of stakeholders. This choice is also related to practical constraints though. For example, there currently are only 2 cultured meat companies operating in the entirety of The Netherlands. As a consequence, the number of companies partnered to cultured meat companies are limited as well. Similarly, the number of Dutch academics that have experience with research on cultured meat are sparse as well. Combined with the fact that response rates overall were low – which can be read from Table 2 - accounts for the low number of responses in these categories. In the discussion section of this research, the possible effects of this observed low response will be debated.

	Response received*	Non-response	Total
N	12	73	85
% of total	14,1%	85,9%	100,0%

Table 2: Response rates (*written reactions are not included in total response received, since these technically did not want to participate in the research despite giving permission to use the written communication). Source: Own work.

3.3 Data analysis

The data collected from the selected experts/stakeholders discussed in the previous sections was analysed and coded through use of the computer programme Nvivo 12. Coding was performed in an elaborative or “top-down” manner, which means that certain theoretical constructs were already preconceived before the start of coding. Usually this is done when research forms a continuation of previous research, and intends to develop theory on the topic further (Auerbach & Silverstein, 2003, p. 104). Considering the aim of this research to provide an addition to existing theory on the topic of disruption in the meat industry caused by the introduction of cultured meat, this method of coding fit the intent of this research.

As mentioned in the previous section, typical for elaborative coding is that initial analysis is made based on research concerns and existing theoretical constructs. As such the initial pieces of raw text obtained from interviews with respondents were first globally divided into different sections which could provide insight into the established sub-questions, since existing theory surrounding these sub-questions were also directly related to the main theoretical constructs identified in scientific literature. In addition to this, pieces of text that pointed towards potential new theory were also selected for further analysis. These pieces of text were carefully identified until repeating ideas could be found which hinted towards potential new theoretical constructs (Auerbach & Silverstein, 2003, p. 105-111). It has to be noted that it was impossible to identify repeating ideas for some pieces of text which were deemed relevant, as they were only mentioned by a single respondent. It was considered that this was a result of the fact that some groups of respondents were underrepresented as discussed in the part of this chapter which details on the research group. As such instead of disregarding these ideas, they were still taken into final consideration.

This consideration eventually resulted in the coding scheme listed in Appendix 7.2. It was considered to further divide these themes relating to sub-questions into more specified themes. However, considering there appeared to be quite some overlap between some of the more specified themes this made analysis of results slightly confusing. For this reason it was decided to leave the results of coding as is.

3.4 Ethical concerns, validity & reliability

Respondents that participated in the research did so on a voluntary and independent basis, without any form of external influences. Respondents which were invited to take part in the research were guaranteed complete anonymity, both for themselves as well as their employer. No attempts have been made by the researcher to influence the opinion of interviewed respondents, nor has it been attempted to steer the conducted interviews into a particular direction. In addition to this the researcher has attempted to not let personal convictions colour the results of the performed research, assuming a non-biased stance for the duration of the research.

It is unknown if the same can be argued for the interviewed experts/stakeholders that participated in this research. Because they are employed in the field related to the subject of research, it is very possible that they have a special interest in the results of the performed research. This raises some concern for the validity & reliability of the performed research, as it could be possible that respondents tried to steer results in their own favour (Bogner, Littig & Menz, 2009, p. 220 & 236). However considering that it is virtually impossible to verify if this actually happened or not, it is assumed that the interviewed experts/stakeholders shared their honest and genuine thoughts and opinions.

3.5 Assignment & global timespan

The performed research has been executed in assignment of the University of Groningen as part of the master's programme Economic Geography. The total timespan of the performed research ranges from original idea and concept in spring 2019 to completion in the summer of 2020. Near the completion of research, weekly meetings were held with the supervisor of this research in order to ensure a smooth process and to give feedback on penultimate results. Literature study was performed virtually throughout the entire process. As the research field of cultured meat is still in development and new scientific articles appear regularly, it was deemed important to keep up with recent developments. Respondents were reached out to in early 2020, with most interviews being conducted in the spring and summer of 2020. The final product was handed in for review on 17-08-20.

4. Results

In this chapter, the results obtained from the performed research are presented. Insights obtained from interviews and communication with respondents are synthesized and compared to expectations set up by exploration of the available international scientific literature. These have been organized in accordance to the relevant sub-questions they attempt to answer. First, factors influencing the disruptive potential of cultured meat will be discussed. Next it will be examined how stakeholders in the Dutch meat industry are affected by possible disruption. Finally, By providing an answer to these sub-questions, it will be attempted to answer the main question of this research question in the next chapter.

4.1. What factors influence the disruptive potential of cultured meat?

Generally speaking, results show that factors deemed as important by international scientific literature were also considered as critical by the interviewed experts/stakeholders. However just as within the scientific community, results remained largely inconclusive or subject to further debate. In some cases, responses also raised a number of new questions or pointed towards bottlenecks in developments. All of these findings in regards to factors deemed important to the disruptive potential of cultured will be the described in this part of the results chapter. First of all the technological issues surrounding cultured meat will be discussed, mainly based on information received from the interviewed cultured meat company. Next the topics of commercial success & consumer acceptance will be examined. Finally attention is spent on the influence of the role of the public sector largely based on information obtained from the interview with a government representative.

4.1.1. Further development of technology

One of the primary issues of the disruptive potential of cultured meat often mentioned in scientific literature is the issue of further development of the technology. Issues such as the costs, resources, scale, sustainability and safety of cultured meat are often mentioned in scientific literature as problems preventing the commercialisation of cultured meat. Because only the interviewed cultured meat company can truly be considered an expert on this particular topic, this part of the results chapter will predominantly consist of information provided by this party.

The biggest problem in regards to further development of the technology according to the interviewed respondent are related to the issue of scalability:

The next big scientific and engineering challenge for us is creating a scalable production system. We are now working on designing this and implementing it in our first pilot factory. It takes about 10 weeks to make a hamburger. But this doesn't mean we can't produce at industrial scale in the future. Because cell growth is exponential, it takes 10 weeks to produce one quarter pound hamburger, but only about 12 weeks to produce 100,000 hamburgers.

- CULTURED MEAT COMPANY

In particular, the interviewed employee singled out engineering suitable equipment and designing efficient processes as the most challenging tasks in their effort to increase scalability. The respondent also noted that these issues form particularly tough obstacles because of their intent to realise them in a sustainable manner, without the use of any fossil fuels. They argued that if the

cultured meat company would be able to resolve these particular issues, then issues related to costs and efficiency of resources would be alleviated as well.

Aside from this the interviewed employee brought up the topic of safety concerns in regards to cultured meat products on their own initiative, commenting that it's a topic they're currently investigating:

“One current topic relevant to what we are working on is the human disease and illness relating to meat, and why cultured meat may be able to reduce likelihood and severity of this.”

- CULTURED MEAT COMPANY

The respondent seemed convinced that cultured meat products should become safer than conventional meat products. Their primary argument seemed to consist of the fact that cultured meat is produced in a sterile and controlled environment which is less prone to bacterial contamination when compared to for example farms or slaughterhouses. In addition to this, the respondent also commented on the huge quantity of antibiotics used in traditional meat production which over time will cause bacteria to become increasingly resistant to antibiotics. Cultured meat could instead be produced without any or trace amounts of antibiotics use.

Unfortunately, the respondent emphasized that the most important thing required for further developments in the technology surrounding cultured meat is simply additional time. They believed that it was more of issue of when these existing technological problems will be solved, rather than if they will be solved and didn't elaborate much further on this topic. The interviewed researcher highlighted that asking for detailed information on these kind of topics could form a problem:

Something that's a huge handicap for our research (on cultured meat) is that the technology is being developed by these companies, and they're keeping it a secret. Companies will tell you almost nothing about that, how it works, and how far they

- RESEARCHER

However to conclude, the interviewed cultured meat company does not expect technological issues to be a problematic factor preventing disruption due to cultured meat in the future. Unfortunately no concrete expectation of when these issues will be resolved was given, and as such it's virtually impossible to make any valid predictions about when this future will take place. Until this expected technological breakthrough takes places or until cultured meat companies are willing to share more information about their technology, estimating how technological issues related to cultured meat will influence the disruptive potential of cultured meat will remain somewhat of a mystery.

4.1.2. Commercial success & consumer acceptance

The issue of consumer acceptance was mentioned as an important factor in explaining the disruptive potential of cultured meat within international scientific literature. However interviews with experts/stakeholders lead to slightly differing results, as it became apparent that rather than consumer acceptance these respondents regarded the commercial success of cultured meat to be the most critical factor in explaining the disruptive potential of cultured meat. Because by nature the concepts of commercial success and consumer acceptance are intermittently linked to one another (no acceptance means no commercial success) both of these topics will be discussed in conjunction in this part of the results chapter.

Despite these topics being interlinked with one another, there is a nuance to be made here. Primarily that respondents did not seem particularly concerned over the fact that consumers could possibly outright reject buying cultured meat. Especially those that had experiences with the retail of other alternatives to traditional meat - which were previously introduced into the market and had similarly suffered problems with low consumer acceptance - appeared to be very positive about the commercial prospects of cultured meat. This became evident as interviewed experts/stakeholders made comparisons to other meat alternatives as a way of providing a rationale for their expectations of future developments surrounding cultured meat:

“If you hire a good marketing agency for the job, then I think you can eventually manage to convince consumers. That’s how it went with the vegetarian hamburger, and the vegetarian smoked sausage. (...) The market (for meat alternatives) is growing! It’s not a market that’s stabilizing, it’s a huge shift in consumer choice.”

- **MARKETEER, HUNTER & RETAILER OF MEAT**

“It could be interesting to start a dialogue with these cultured meat companies. (...) There’s a lot of opportunity there right now, if you see for example how well those vegetarian burgers by Burger King or McDonald’s are doing. It appears to be a rapidly growing market”

- **ADVISORY GROUP FOR FARMERS**

“It (cultured meat) may be a nice alternative next to the regular meat, but it will definitely not replace it. Just take a look at the wealth of vegetarian products available now.”

- **FARMER**

Based on their experience with these meat alternatives these respondents had come to the conclusion that cultured meat would become accepted by consumers as well, despite possible

negative initial reactions. These respondents explained that according to them a shift in consciousness had taken place among consumers which urged an increasingly larger group of consumers to be more aware of their meat consumption and hence more open to meat alternatives or more sustainable forms of meat production, an observation that was also suggested by some of the international scientific literature.

In my experience a trend that has been going on for years is that a part of the population – I don't know the exact number – is becoming increasingly concerned with sustainability and animal wellbeing compared to 20 years ago.

- FARMER

I notice a growing consciousness about the consumption of meat (among consumers). People wonder: Why do I even eat meat? How important do I think meat is? How much meat should I even eat? (...) But this is mostly based on my own customers that tell me: We think it's important to contribute to a healthier ecosystem, that's why we consciously choose for your meat.

- FARMER

People are becoming increasingly aware. They check the packaging three times before they buy something. They want to know the nutritional value, if it contains allergens, if the packaging is sustainable, etcetera. This group is growing faster and faster and my expectation is that eventually they will consciously choose to eat cultured meat.

- MARKETEEER, HUNTER & RETAILER OF MEAT

The interviewed cultured meat company employee also acknowledged this trend and even boasted that their products might appeal to more groups of people than traditional meat, such as vegetarians or people who don't eat meat because of ethical or religious convictions. Other arguments for this line of reasoning include the idea that consumers simply have to get accustomed to new products, but would eventually become familiar with them:

"Predictions (about consumer acceptance of cultured meat) vary wildly, but in general you can state that results from market research has become more positive in nature. And I think that makes sense because people need to get used to these kind of things. Once it becomes more common, they won't have negative initial reactions anymore. (...) Around 2010 a lot of scientists said that cultured meat would never become popular because people think it's unnatural. My conclusion after some initial research was that this was an overreaction."

- RESEARCHER

Despite this positive outlook in regards to consumer acceptance, respondents also mentioned some concerns for the commercial success of cultured meat. Primarily they mentioned that the quality of cultured meat products needs to be high in order to attract consumers. As such, the quality of the product was deemed as an essential factor for the commercial success and acceptance of cultured meat by several of the interviewed experts/stakeholders. In many cases quality seemed to be used as an umbrella term covering a variety of different attributes of cultured meat such as: taste, smell, packaging, structure, and others. In other words, the expectation was that consumers would be willing to buy cultured meat provided it would give them the full experience of a traditional piece of meat. Reactions by the cultured meat company themselves align with this idea, adding that besides quality price is also considerable factor in attracting consumers:

“Imagine your average 30 year old male with a slightly too large stomach, that decides to barbecue with his friends. (...) As long as you give this man the full experience of a piece of meat. With a rind of fat, some nice packaging, same sound as it touches the grill, the same structure, the same colour, it’s all there it’s just like a piece of meat. (...) At the end he’ll burp, finish eating, takes a look at the packaging and it turns out to be cultured meat! He won’t care!”

- **MARKETEER, HUNTER & RETAILER OF MEAT**

“We are confident that when the product is of high quality and is competitively priced the benefits will appeal widely to consumers.”

- **CULTURED MEAT COMPANY**

Finally it’s worth mentioning that contrary to expectations set by exploration of international scientific literature, only a single respondent seemed to perceive problems relating to the topic of consumer acceptance of cultured meat:

“I don’t think that the people that buy meat from us would ever buy cultured meat. Just because they want to eat meat, or because they think it’s better for animals, or for the environment, or for themselves. I suspect they’ll have some fear and think: Hmm, cultured meat. How is that made, and how does my body respond to it? Is it healthy for me?”

- **FARMER**

All of the other respondents - regardless if they were in favour of developments surrounding cultured meat or not - mentioned that they do expect that there will be a sufficient market for cultured meat products in The Netherlands. These findings raise the suggestion that interviewed experts/stakeholders expect consumers in The Netherlands to be decidedly more prepared for a

market introduction of cultured meat than international scientific literature suggests. However, based on the performed research it is unclear if these expectations of experts/stakeholders will be reflected in the behaviour of consumers.

4.1.3. Role of the government

For the case of the public sector group, it is often argued in scientific literature that they play an essential role in regards to the disruptive potential of cultured meat. For example, government facilitation and support is deemed critical in order to introduce cultured meat into the market. In addition to this it is mentioned that governments can control developments surrounding cultured meat and therefore directly influence its disruptive potential. Finally it's also often mentioned that this group can play an important educational role in regards to cultured meat, which conversely can also play a role in the disruptive potential of cultured meat. Results from the interviews with expert/stakeholders will be synthesized with these hypotheses on the importance of the role of the Dutch government for the disruptive potential of cultured meat, will be discussed in this part of the results chapter.

One of the primary topics that was mentioned in the scientific literature as an important factor for the disruptive potential of cultured meat, and which was confirmed through interview with a government representative is the issue of legislation & regulation. In particular procedures such as for example the safety approval by the European Food and Safety Authority (EFSA) hinted towards a potential bottleneck in legislation & regulation, as becomes apparent from the following quote:

"I doubt they'll be able to get their product on the market by 2021, it depends on the procedures. And those two (cultured meat) companies know very well that if they don't follow procedures and don't do the required safety checks they won't be able to introduce their product on the market. Everyone that wants to introduce a novel food onto the European market is required to do so, those requirements are the same for everyone."

- **GOVERNMENT REPRESENTATIVE**

However, further information obtained from this interview with the government representative indicates that the Dutch government actively offers a variety of different forms of assistance in order to help cultured meat companies pass similar procedures or comply to regulations. The government representative noted that because the Dutch government sees a lot of potential in cultured meat, if cultured meat companies would need any help in making sure they are able to pass existing regulations and legislation they would be willing to assist them. The government representative even noted that they would be willing to change or adapt existing legislation or regulations in order to accommodate them if necessary. However the government representative emphasized that the reason this hasn't happened yet is because they haven't received any requests from culture meat companies to do so. Similarly, the government representative noted that cultured meat companies need to start procedures required for market entry on their own initiative, and they haven't done so yet.

“For every novel food its required that the producer takes the initiative to start a procedure with the EFSA. That’s just part of the business, they have to do that. (...) It’s not the responsibility of the government to investigate the safety of products that companies make. Every company needs to be able verify the validity and safety of their own products.”

- GOVERNMENT REPRESENTATIVE

The fact that cultured meat companies haven’t taken these steps yet raises some questions and concerns. Why haven’t cultured meat companies taken the initiative to start procedures yet if they plan to release a commercial product by 2021? Standard EFSA procedures required for market entry can take over 1.5 years to complete, and as of the time of writing it is already half-way past 2020. Are cultured meat companies less aware of the steps required for market introduction than as stated by the interviewed government representative? Will it take cultured meat companies longer to make their product ready for market introduction than they initially thought? Unfortunately, the cultured meat company employee that was interviewed as part of this research was unable to provide insight into this issue and hence these questions remain unanswered.

Regardless of all the previous, the interviewed researcher stresses that it’s important for the government to take a leading role in order to avoid a potentially disastrous scenario of disruption taking place:

“What you can imagine if nothing happens, is that these (cultured meat) companies start to take over small companies or become big themselves and become the main producers of cultured meat. So if you would like to see different results – for example if you would like to see cultured meat be produced on a small scale by farmers – action has to be taken. (...) At the moment I’m performing research on cultured meat as an option for farmers, what’s necessary to make this a reality. And I don’t believe this is a very realistic scenario, because it would require an immense amount of government intervention to make this possible. (...) But if you’re talking about the social impacts of cultured meat, then of course it would be a disaster for farmers and owners of livestock if cultured meat would exclusively be made in a number of factories!”

- RESEARCHER

In their opinion the role of the government in this development was still too vague, calling for more action and transparency. Despite this, the interviewed researcher also admitted that at this time they are not sure what the best solution to this potentially disastrous scenario is. They primarily suggest the need for more focus on public research on the topic as well as that additional funding could provide assistance. In any case it appears that the Dutch government is willing to stimulate developments surrounding cultured meat, mentioning that they are actively promoting a variety of alternative protein sources. In any case all of the information mentioned in this section points to the suggestion that the Dutch government does not intend to hinder the disruptive potential of cultured meat, in fact the opposite could be argued.

4.2. How will the introduction of cultured meat products affect stakeholders in the Dutch meat industry?

In this part of the results section, ideas, stances and expectations on how stakeholders in the Dutch meat industry will be affected by disruption due to commercialisation of cultured meat products will be discussed. These viewpoints will be divided into several categories of respondents in order to gain a clear picture of how each group of interviewed experts/stakeholders regards this issue. It becomes apparent that perspectives among groups of respondents on how stakeholders in the Dutch meat industry will be affected by disruption due to the introduction of cultured meat products vary greatly, with each of the groups providing their own rationale, arguments, and concerns. These differing groups will be discussed in the following order: Retailers of meat, cultured meat companies & their partners, and the public sector.

4.2.1. Retailers of meat

The group of experts/stakeholders employed in the retail of meat forms the largest and most diverse group of respondents in this research. Scientific literature predicted that this group would be affected by the introduction of cultured meat products the most of all. For these reasons it is perhaps not surprising that a clear dichotomy between eco-modernist and traditionalist values could be observed among respondents, as was also suggested by literature. Nonetheless, respondents from this group unanimously seemed to agree that their livelihood is not at stake. These expectations and viewpoints among retailers of meat on the disruptive effects of cultured meat are explored in this section of the results chapter.

Regardless of their stance in regards to cultured meat, none of the respondent claimed to be worried that they would see their occupation change or become obsolete due to the introduction of cultured meat onto the Dutch meat industry. Even though the interviewed experts/stakeholders remarked that they expected that there will be a market for cultured meat and that consumption of traditional meat could diminish, they seemed convinced that their occupation would not be at risk:

Look I personally believe in high quality authentic meat, and that's what I'll keep focusing on. I'm familiar with the development that meat is artificially being created or cultured, I know that. And that development will continue to take place. But it's not my goal to be involved in that, I think there's a market for both.

- FARMER

I think that everyone shouldn't be too concerned. I think that for the next who knows how many years, we'll just continue to consume incredible amounts of meat. As long as some terrible pandemic doesn't come into our path, or a third world war, and everyone is comfortable with their work and the economy is booming. People will just continue to spend huge amounts of money on food and thus meat. (...) I don't think a lot will change in that regard.

- MARKETEER, HUNTER & RETAILER OF MEAT

Cultured meat will without a doubt have a place alongside “regular” meat. However it won’t replace it. (...) People may start to eat less, but will still continue to consume regular meat.

- FARMER

At times these statements felt slightly contradictory, as a number of respondents also acknowledge that current systems of operation would have to change in order to meet sustainability targets. Comments include:

I think that farmers that are currently producing (at a large scale). They need to investigate if they can let their animals roam outside again. So they definitely have to cut their amount of livestock to 50%, or even worse reduce it to 20%.

- FARMER

I have to say: I’m a farmer and I don’t think I’m really doing a great job either (in terms of sustainability). There are many ways to do it much better.

- FARMER

In fact virtually every respondent in this group commented that many aspects of the current system of meat production is highly unsustainable in some way or form. A variety of causes were mentioned for this, mostly related to consumer behaviour and commercial motives such as the large amount of imports and pollutants required for intensive livestock production or the fact that the average consumer eats meat on a daily basis.

This is where a clear dichotomy in regards to the eco-modernism versus traditionalism became apparent. A number respondents welcomed the introduction of cultured meat and noted that they would like to learn more about the topic. They saw the possibility of cultured meat not only as an investment opportunity or a chance to improve upon inefficient production methods, but also as an opportunity to bridge the gap with consumers and get rid of the stigma of farmers as polluters or being cruel to animals. On the other side of the spectrum are experts/stakeholders which are averse to the idea of cultured meat, and argued that the meat industry doesn’t have to rely on technological innovations in order to become sustainable. These respondents insisted that if meat producers scaled down their capacity and became more self-reliant the Dutch demand for meat could easily be met in a sustainable manner. However respondents admitted that this would likely inflate the prices of meat significantly and would require consumers to eat drastically less amounts of meat. Ironically, international scientific literature suggests that such a scenario might become more viable through use of cultured meat technology. Despite this fact, this group of interviewed experts/stakeholders did not seem convinced that an orientation towards cultured meat would be desirable.

4.2.2. Cultured meat companies & their partners

Because the cultured meat companies and their partners are the ones entering the Dutch meat industry and are therefore directly responsible for possible disruption within the Dutch meat industry, it makes little sense to evaluate how they will be affected by disruption. However considered that these parties are very likely to possess the most knowledgeable on the topic of cultured meat itself, their ideas and vision of the future can be critical in understanding how disruption of the traditional meat industry could take shape. In their line of reasoning, it is possible that a solution can be found to the eco-modernism versus traditionalism debate as mentioned in the previous parts of the results section. Aside from this, respondents also have ideas on new possibilities within the Dutch meat industry made possible by developments surrounding cultured meat. These issues and ideas will be discussed in this section of the results chapter.

From the previous sections it becomes apparent that the introduction of cultured meat has caused a dispute on the desirable future direction of the Dutch meat industry among retailers of meat. The interviewed cultured meat company however had very clear expectations for the future of the Dutch meat industry:

Our vision is that cultured meat can replace large parts of the meat industry that are a source of animal suffering, greenhouse gas emissions, environmental degradation and human illnesses. We believe that these are entirely avoidable with the help of cultured meat, and that the planet and people would benefit greatly from this. (...) If it is widely adopted, cultured meat will change the way that meat production is organised, and make some farming jobs obsolete.

- CULTURED MEAT COMPANY

The cultured meat company employee mentioned a number of arguments for this line of reasoning, most of which already discussed in the previous parts and sections of the results chapter. Examples include comparative advantages to traditional meat and trends relating to increasing consumer awareness and changing preferences. Because of these reasons, they argued that there might be a decline in the need for farming jobs. However, respondents also mentioned that new opportunities might arise for these displaced groups:

In the future we would also like to work with farmers who are already well-placed and know the industry to supply us with cell biopsies from small farms with healthy and happy animals, and farmers who can be involved with decentralised production of our products.

- CULTURE MEAT COMPANY

From this quote it becomes apparent that the cultured meat company employee envisions a future in which small-scale farms will still play an essential role, regardless of widescale adoption of cultured meat or not. This could provide a solution to issues surrounding the eco-modernism versus traditionalism debate, as the cultured meat company appears to be in favour of a dualistic system which incorporates both. Farmers that are interested in investing into cultured meat will be able to

do so, and there will also be a need for farmers that want to continue more traditional ways of meat production.

For those that are interested in making a transition to cultured meat, the interviewed expert/stakeholder mentions a number of possibilities in regards to how future decentralisation of cultured meat production could take shape.

Theoretically it would be possible to have meat production decentralised, just as some people have community vegetable gardens. However, it probably isn't a very realistic scenario. (...) On a slightly bigger scale, however, we can imagine communities sharing a local production system. We could have community farms in the middle of the city with a couple of animals that are cared for by the locals together. Every now and then, they would take some stem cells from the animals - using a biopsy under anaesthesia - which would be used to farm meat for the community in a small building nearby. This could potentially be very advantageous for communities that don't have ready access to meat. We can even imagine having self-supporting "meat factories" carried around in vans that could deliver meat to areas that are completely cut off, such as refugee camps and disaster zones.

- CULTURED MEAT COMPANY

The notion seemed to exist that meat production in the future would be less restricted in terms of space and place, providing a variety of different decentralisation opportunities such as shared cultured meat production facilities or mobile meat production facilities. Besides these options, the respondent also named other options such as co-operation with meat production companies that are looking to diversify their offer. Finally they mentioned that in case large scale disruption of the current system does take place – which they don't expect - retraining displaced employees to work in future cultured meat labs would also become a possibility. The interviewed cultured meat company and one of their partners also mentioned that they foresee new opportunities for parts of the Dutch meat industry not directly related to the retail of meat. A market for the provision of cell biopsies by small farms for the production of cultured meat was already mentioned in one of the previous sections. Another example that was mentioned by both respondents are opportunities related to providing feed for cell growth:

Fortunately, those working in livestock industries may be well positioned to take advantage of new market opportunities from cultured meat. For example, farmers already producing feed for animals may have an advantage in transitioning to producing feed for cells, which will be a large new market.

- CULTURED MEAT COMPANY

Ultimately, this partnership (with a cultured meat company) provides <Name omitted> with a strategic opportunity to advance our mission of feeding the future. Future opportunities may include possibly becoming an ingredient supplier to the cell-based protein industry.

- PARTNER OF CULTURED MEAT COMPANY

To conclude, the interviewed cultured meat company and their partner envision a variety of ways in which stakeholders in the Dutch meat industry could be affected. Although they admit that a large part of the current meat industry could become replaced, they aren't particularly concerned that large-scale disruption will take place as they see possibilities for a dualistic system. In addition to this, they envision an array of new possibilities for those who do become displaced which could absorb a shock to employment.

4.2.3. Public sector

In the section on the role of the government and their possible influence on the disruptive potential of cultured meat, it already became apparent that the Dutch government is willing to take up an actively facilitating role in regards to developments surrounding cultured meat. They admit their interest in the technology and state that they try to stimulate developments as much as reasonably possible. Despite this positive attitude towards cultured meat, the interviewed government representative admits that they're currently also not sure on the disruptive effects cultured meat could have on stakeholders in the Dutch meat industry. However, they're cautiously optimistic that the introduction of cultured meat won't have disastrous effects on these stakeholders:

What will be the market share (of cultured meat)? You honestly can't make concrete predictions about that right now, you could try to make a guess but can these be backed up by facts? Because it's just a new form of produced food and we don't know when it will be introduced to the market, for what price, what consumers will think. (...) And will it displace (the traditional meat industry)? I don't know, but I think displacement won't happen for a long time. But that's a feeling and definitely not based on numbers, because those number don't exist. But it's not like suddenly half or three quarters of the farmers or owners of livestock won't have a job anymore because the consumer is only buying cultured meat in masses instead of traditional meat. That's not the scenario that I imagine happening very quickly

- GOVERNMENT REPRESENTATIVE

Contrary to this, it can also be read in the section on the role of the government that the interviewed researcher is under the impression that a lack of government action could have potentially disastrous consequences for stakeholders in the Dutch meat industry. Their main concern is that if cultured meat is not regulated properly, cultured meat companies could establish a sort of monopoly on cultured meat products which would leave other stakeholders disenfranchised. However, the interviewed researcher is similarly unsure in making any concrete predictions on what the future of the Dutch meat industry might look like. Both the interviewed government representative as well as the interviewed researcher also observe that some cultured meat companies are open to the idea of decentralized production of their products or see some

possibilities for a smoother transition, as was also confirmed by the cultured meat company that took part in this research.

“What I have noticed is that some of these companies such as <Names omitted> are open to the idea of selling licences at any imaginable scale, so also on a small scale. They state that bio-reactors wouldn’t have to be too large for such an operation, a medium-sized bio-reactor would be able to contain about 2000 litre. A 2000 litre bio-reactor is exactly what dairy farmers would typically have on their estate, they already own a 2000 litre bio-reactor. So that’s how a transition could take shape, in that sense it wouldn’t be weird at all.”

- RESEARCHER

“It appears that there are also farmers who are interested – but that probably won’t be hundreds – in making a transition towards cultured meat. In that situation you won’t have any displacement or loss of employment, just a transition to another form of business.”

- GOVERNMENT REPRESENTATIVE

This quote exemplifies that in some ways farmers could actually already be reasonably well-equipped or prepared to make a transition towards production of cultured meat. However the researcher noted that making additional similar comparisons is tough because of the previously established fact that cultured meat companies and their partners aren’t willing to openly share detailed information on their technology. This made the respondent wonder about how serious cultured meat companies are in their commitment to decentralisation of their production.

In any case, it can be concluded that both parties are similarly unsure about how stakeholders in the Dutch meat industry will be affected by potential disruption caused by the market introduction of cultured meat. The interviewed researcher however is worried that the Dutch government perhaps wasn’t doing enough to protect stakeholders in the Dutch meat industry from potentially disastrous scenario’s. It can be argued that it is perhaps too early for the Dutch government to take serious action as future directions and developments are still very unclear, nonetheless it’s an important possibility to take into consideration.

4.3. What can be done to prevent negative consequences of disruption, and stimulate positive consequences of disruption within the Dutch meat industry

In the previous parts of this results chapter, factors influencing the disruptive potential and the different ways in which stakeholders might be affected by them have been discussed at length. Despite the fact that a lot of insecurity and discussion continues to shroud these topics, the performed research also has provided a number of insights into the Dutch meat industry and how disruption due to the introduction of cultured meat might take shape. It will be attempted to synthesize these insights with existing literature on disruption in this part of the results chapter. By doing this it is the aspiration of this research to form a brief “best practices” guideline in regards to potential disruption of the Dutch meat industry due to the commercialisation of cultured meat products, providing information on how related actors could smoothen the effects of disruption or how to stimulate transition. First it will be discussed how negative consequences of disruption can be prevented, followed by a discussion on how positive consequences of disruption can be stimulated.

4.3.1. Preventing negative consequences of disruption

Both scientific literature as well as the results from this research indicate that the negative consequences of possible disruption of the Dutch meat industry through the introduction of cultured meat are mostly related to a possible loss or forced change of employment. Results however show that virtually all respondents seem relatively optimistic over the fact that such an event will not take place. In fact, only one respondent made an argument for a potentially disastrous scenario for the Dutch meat industry. Nonetheless, it's still largely unclear what direction the future of the Dutch meat industry will take. And as such, it's important to consider what could be done in order to prevent or alleviate negative consequences of disruption.

Most importantly, it becomes evident from the obtained results that the Dutch government is probably the most deciding factor in preventing any negative consequences of disruption. This is because they are the only party that can actively control the actions of cultured meat companies through legislation and regulation. In case a scenario with potentially disastrous consequences for the Dutch meat industry does take place, the Dutch government would be the only party able to intervene in the process as long as they recognise it happening. In this sense, it's important that government officials continue to closely follow and stay informed on developments surrounding cultured meat. Even though based on the performed research it does not seem like cultured meat companies have any ill intent, precaution still has to be taken as harmful developments could also unfold unintentionally.

In case of the scenario that some scale of disruption might be take place regardless, both the government as well as businesses could play a large part in smoothening issues through a variety of ways. First of all it would be wise to identify which members of the Dutch meat industry would be interested in a potential transition towards cultured meat technology. Results showed that there was a large group of respondents interested in cultured meat technology, as well as a similarly large group of interviewed experts/stakeholders that resented the idea of changing their business model. Correctly identifying these individuals and assisting the ones who are willing to transition if necessary could be a simple way of preventing large-scale resistance among those employed in the Dutch meat industry, as both eco-modernistic and traditionalistic oriented individuals would be able continue their operations in their preferred way.

Other options follow along the lines set by classical active labour market policy: Alleviating transition costs, retraining programmes, publicly available information, increased labour mobility, talent matching, and so on. In the case of disruption of the Dutch meat industry due to introduction

of cultured meat retraining programmes could prove to be particularly effective. Respondents interested in developments surrounding cultured meat mentioned that they wish they could find more concrete information about the topic. As such, it could be possible that these individuals would be interested in forms of retraining. In addition to this, it became apparent that some of the farmers are currently already reasonably well-equipped for a potential transition. This could entice this group of farmers to make a transition to cultured meat technology.

4.3.2. Stimulating positive consequences of disruption

The positive consequences of possible disruption of the Dutch meat industry through the introduction of cultured meat have been discussed at length throughout this entire research paper. Increased sustainability, more efficient use of resources, food security, health and safety, ethical reasons, a plenitude of reasons are mentioned on why a transition to cultured meat would be beneficial. In this regard, it would make sense that it is preferred to promote and incentivize adoption of cultured meat technology as much as possible especially because of the associated long term benefits. The contradiction here is that rapid adoption of cultured meat technology could in fact cause negative consequences as this would leave no time for a gradual transition among those that are interested in doing so. As such this section is mostly written from a perspective in which a slow and gradual form of disruption takes place which allows for transitioning time. In another hypothetical scenario, adoption to cultured meat is sluggish and/or the desire exists to accelerate developments because of the perceived benefits of cultured meat compared to traditional meat.

Just as in the case for negative consequences of disruption, it is likely that the Dutch government is the most important actor in this regard. There are several ways in which the government could decide to stimulate developments surrounding cultured meat. One of the most often mentioned and obvious methods of doing so is by simply increasing the amount of funding available for the topic. Because it is assumed that cultured meat will be a more sustainable alternative to meat production, financial incentives such as tax exemption or subsidies were also mentioned by respondents. Similar to what was argued in the case of negative consequences, an information campaign aimed at informing people in the Dutch meat industry and Dutch consumers about cultured meat could also be a valid option to inspire them to transition.

Other options are more focused on initiative from cultured meat companies. One respondent noted that besides information, a marketing campaign featuring adverts, commercials, posters, or others could also be useful in attracting consumers to purchase more cultured meat or to give it a try. In this case it was also recommended to emphasize the sustainable and ethical benefits of cultured meat, as this fits the increasing trend that has been observed among consumers in recent years. Finally, this respondent commented that it would be wise for cultured meat companies to engage in partnerships with established businesses well-known for their high quality standards in order to instil trust in regards to the quality and safety of their product among consumers.

5. Conclusion & discussion

5.1. Conclusion

The goal of this explorative and qualitative research is to provide a nuanced, in-depth and state-of-the-art perspective of potential disruption of the Dutch meat industry caused by the introduction of cultured meat products. In particular, attention has been spent investigating factors influencing disruption, how stakeholders are influenced by possible disruption, and what can be done to influence effects of disruption. This was done through a combination of an exploration of available scientific literature and a series of interviews and communication with a variety of experts/stakeholders employed in or connected to the Dutch meat industry. In this manner, it was attempted to provide an answer to the main research question of this research:

How can potential disruption of the traditional Dutch meat industry due to the commercialisation of cultured meat products be smoothed or stimulated?

Results related to the first sub-question indicate that most of the factors deemed as important by scientific literature for explaining the disruptive potential of cultured meat were confirmed by participating experts/stakeholders. Technological issues still appear to be a large problem for realising the disruptive potential of cultured meat. Especially the issue of finding scalable solutions was mentioned as a large obstacle that had to be solved for cultured meat to truly become disruptive. Similarly, the interviewed respondents emphasized the importance of the role of the government in determining the disruptive potential of cultured meat. Through government intervention or facilitation effects of disruption could either become disastrous or possible. Finally a divergence from scientific literature could be observed, as it became apparent that virtually all of the interviewed experts/stakeholders didn't consider consumer acceptance to be much of an issue or one that would be solved over time. Their reasoning for this was largely related to observed changes in consumer awareness, and instead argued for the importance of topics such as product quality and experience.

These findings provide some rationale for understanding how the disruptive potential of cultured meat might be influenced, but give little insight into how stakeholders in the Dutch meat industry will be affected. This issue was explored through the second sub-question. From the results it became clear that those employed within the Dutch meat industry saw little concern for a potential loss or change of employment. Despite acknowledging flaws of the current system, the interviewed experts/stakeholders were largely convinced that there would be market for both traditional as well as cultured meat. It became apparent this would be a desirable scenario, as some respondents mentioned to be interested in the idea of a possible transition while others noted an adversity to this idea. This would also suit expectations set by the interviewed cultured meat company and their partner as they do expect some degree of disruption to take place. However they expect that this disruption would be accompanied by new opportunities and markets as well, smoothing out negative consequences of disruption. Finally, in line with observations from scientific literature the public sector group of respondents remained largely inconclusive on the topic but however did recognise there could be valid options for a smooth transition.

Statements made in the previous section already give some insight on how smoothing of disruption could take place, but only graze upon the subject of what could be done by actors related to the Dutch meat industry to either prevent or stimulate disruption. The role of the government is particularly pronounced in this case, as they offer a variety of ways of directly influencing how disruption could be prevented or stimulated. Primarily they are the only party which holds the power to actively intervene in case of the development of a potentially disastrous scenario through

legislation & regulation. Other options focus on dealing with consequences of disruption, such as identifying and informing individuals which are interested in transition or classical active labour market policies. In case it would be desirable to encourage disruption, the Dutch government could explore a number of options such as: increased funding and research, informing consumers, or providing financial incentives for transition. Cultured meat companies themselves could also play a role in this by investing in marketing campaigns or partnerships with well-respected companies.

To conclude, despite the fact that a lot of uncertainty remains on the topic of the disruptive potential of cultured meat on the Dutch meat industry some convergence and divergence from existing theory could be identified. Based on the results obtained from the interviewed experts/stakeholders It appears that it's more of a matter of when disruption of the Dutch meat industry due to the introduction of cultured meat, rather than if disruption will take place. However while doing so respondents expressed their conviction that disruptive effects will be moderate, allowing time and opportunity to transition for those interested without an associated loss or forced change of employment. In case the direction of the developments surrounding cultured meat would turn undesirable, a number of different possibilities were identified in which actors could dampen or stimulate the disruptive consequences of the introduction of cultured meat into the Dutch meat industry. Nonetheless as stated before, these results are largely inconclusive and more time and research are essential to further concretize theory on the subject.

5.2. Discussion

5.2.1. Time of research & further research

As could be read in the conclusion, virtually all of the experts/stakeholders confirmed that additional time was needed in order to be able to realize a palpable verdict on the main research question of this research. As such it could be argued that the performed research was slightly pre-emptive, as it will still take some time for developments to crystallize. Nonetheless, some divergence from existing theory was found along with some information that hinted to potential new theory. For this researcher this raised the suggestion that it's important to keep following developments surrounding cultured meat closely, especially considering the potentially disastrous negative consequences disruption could have for the Dutch meat industry or the possible benefits of a gradual form of disruption. Further research could focus on topics that are currently met with the most uncertainty. For example: Theory on how to deal with the effects of disruption is already relatively developed compared to

5.2.2. Issues related to low response & commercial sensitivity

Based on the obtained results from the performed research, it becomes apparent that the observed low response rate had a negative impact on the quality of the obtained data. As mentioned previously, a large number of invited experts/stakeholders from different groups responded to either be unwilling or unavailable to take part in the research. This has led to categories within the overall research group consisting of merely 1-2 actors. This affects the quality of the research data in the sense that a lot of the data on certain topics is fairly one-dimensional, meaning that they are based on the opinion or observations of a small number of research units. Especially in the case of groups such as cultured meat companies and their partners which possess specialized expert information considered essential for this research, refusal to participate meant that a significant part of the potential research population and therefore available information was lost. This is because very few cultured meat companies exist and they also have a limited amount of partners, so any reduction in this number reduces the available pool of respondents significantly.

In addition to this, the commercially sensitive nature of the subject of cultured meat had proven to become an obstacle during the course of the research as well. This issue was also touched upon in the results chapter, but deserves some further explanation. Despite being open to an interview, both the interviewed cultured meat company as well as their partner mentioned not being able to provide detailed answers to a number of questions because answering them could have economic consequences for themselves or their partners. This further hurt the quality of the data collected because as mentioned previously these groups are limited in numbers and are essential in order to provide insight into some of the topics central to this research. Examples of topics that were deemed too commercially sensitive to provide extensive answers on include: decentralisation of the production of cultured meat, partnerships and supply chains,

Finally, another issue related to the issue of low response rates that has to be taken into account is the possibility of participation bias among respondents. Especially within the group of meat retailers, many respondents that declined interview invitations did so with the added remark that they were not interested in the topic of research. In comparison, most of the respondents that did take part in the research appeared to be relatively enthusiastic about the topic of cultured meat. It's worth considering if this had an effect on the final results of the research, as it appears that most respondents that took part in the research had a positive disposition towards cultured meat.

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7. Appendix

7.1 Example semi-structured interview

Semi-structured interview with farmer topic list

- **Familiarity with cultured meat**
 - o Does respondent need or want more information?
 - o Is the topic of cultured meat a discussion point among or mentioned by colleagues or customers?
- **Knowledge of cultured meat**
 - o Is respondent familiar with the supposed benefits of cultured meat? What are their thoughts on this
 - o Is respondent familiar with the supposed challenges of cultured meat? What are their thoughts on this?
- **Stance in regards to cultured meat**
 - o Would respondent like to invest in/transition to cultured meat?
 - o Is respondent adverse to cultured meat?
 - o In case of adversity to cultured meat, what development would respondent prefer?
- **Expectations of cultured meat**
 - o Does respondent expect cultured meat to be successful?
 - o Does respondent expect to experience disruption?
- **Concluding question**
 - o What are any other additional doubts or concern the respondent has?
 - o Is there anything the respondent would like to add that they consider as important for this issue?

7.2 Example coding scheme

Coding scheme:

Factors influencing the disruptive potential of cultured meat?

- Technological issues
- Commercial success & consumer acceptance
- Role of the government

How will stakeholders in the Dutch meat industry be affected?

- Meat retailers
- Cultured meat companies & their partners
- Public sector

What can be done to prevent negative consequences of disruption?

- Government intervention
- Voluntary transition

What can be done to stimulate positive consequences of disruption?

- Government stimulation
- Marketing