The dependency on information in consumers' willingness to buy cultured meat.

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Index

Abstract

The demand for meat is estimated to reach 470 million by 2050. This demand forms a challenge for conventional meat production. Conventional meat production has come under pressure from the negative externalities it brings forth. Cultured meat is seen as a potential solution to meet the demand while avoiding these externalities. The biggest challenge for cultured meat is consumer acceptance. Consumer acceptance is crucial for a successful market integration. Literature shows that several factors within consumer acceptance rely on the level of information. This paper seeks to identify the influence of information on the willingness to try and buy cultured meat in the Netherlands. The effect of information was investigated by interviewing Dutch students. During the interviews, they were given information in the hope of increasing their awareness and knowledge about cultured meat. From these interviews can be observed that several factors were actively influenced by the information consumers have. At the same time, they showed that dependency on information differs per the content of the information. Information on product properties could show a more distinctive effect on consumers' willingness to buy cultured meat than information on the production process and the regulatory framework.

1. Introduction

1.1 Meat production and its effects

The global population is set to grow to ten billion by 2050. This demand would mean that meat production will increase by 70% since the demand is expected to reach 470 million tonnes by then (Food and Agriculture Organization, z.d.). However, at the same time, the livestock sector has come under pressure. This pressure is created due to its negative externalities such as its unsustainability and animal suffering. Regarding the environmental impact of the production, there are four main concerns. These concerns are greenhouse gas emissions, phosphorus transfer, and water and land use Reportedly, livestock is on average responsible for around 18 percent of greenhouse gas emissions (Steinfield et al., 2006). This share is even bigger than the share of transport. Regarding water usage, global meat production accounts for 27 percent of our total water footprint. Of this total 98 percent is just for animal feed (Water Footprint Network, 2018). To keep the livestock fed, the land use for feed production exceeds the agricultural land use for all other purposes (Post et al., 2020). Besides the water and land usage, phosphorus transfer to the soil due to overuse has a big impact on the environment. Animal feed production uses excessive use of pesticides, which in turn causes health concerns.

The current ethical values also push for an increase in animal welfare. The animal welfare problems associated with meat production are the high percentage of lame livestock, neonatal mortality, and pre-slaughter stress. Hoof-related lameness can be found in around a quarter of all cows (Grandin, 2018). This lameness is caused due to a lack of pasture access as most of these livestock are raised on bare concrete. Neonatal mortality is the number of deaths during the first 28 days of life per 1000 live births in a given year or other period. Neonatal mortality for piglets averages 10 to 15 percent and happens mostly on the second day of life (Velarde et al., 2015). The pre-slaughter stress in livestock is induced by food deprivation, handling, duration of transport, and the

novelty of the situation (Terlouw et al., 2008). The stress causes the quality of life and meat quality to decrease significantly. To avoid or reduce these externalities, production alternatives are needed.

1.2 Alternatives and their challenges

Currently, there seem to be four prominent alternatives to conventional meat. These four alternatives are plant-based, insect-based, single-cell protein(SCP) based, and cultivated meat. Plant-based meat is the oldest alternative of these alternatives. Plant-based meat can be made of soy, pea, wheat, gluten, or even jackfruit. Plant-based meat does not require antibiotics in comparison to conventional meat. This lack of antibiotic usage helps address the overuse of antibiotics in meat production (Mount, 2023). However, one of the disadvantages of plant-based meat is, that it does not have a meat-like taste organically. To generate a meat-like sensory appeal, artificial colours, flavours, and processing aids are needed (Clec,2024). Thus plant-based meat can be heavily processed and has higher sugar and sodium contents than regular meat (Prudential, z.d.).

The production of insect-based meat brings the benefit of producing a useful by-product: frass. Frass can be used to enhance soil fertility. The need for chemical fertilizers is decreased. The main problem with insect-based meat lies in the lack of familiarity and cultural barriers. At the moment, only four insect species (yellow mealworm, migratory locust, and house cricket) and lesser mealworms, have been classified as novel foods in the EU (Rehman et al., 2024). However, they are not classified as food in all countries. Due to cultural taboos, there is a certain stigma associated with eating insects. Another disadvantage of insect-based meat is that insects require specific conditions to thrive such as humidity, temperature, and light. To maintain these conditions on a large scale, will be quite expensive (Achard, 2024).

Single-cell protein (SCP) based meat is made from edible microorganisms such as algae and fungi. These organisms can be cultivated using various substrates. These substrates can be agricultural waste and industrial by-products. Thus reducing the pressure on traditional agricultural practices and mitigating issues related to land and water usage (Li et al., 2024). However, the extraction process of the proteins is done with great difficulty. The organisms have complex and sturdy cell-wall structures, making it difficult to access and extract proteins. As a result, SCP protein is expensive and energy-consuming. In the end, this expensive procedure reduces its economic sustainability.

The last of the alternatives is cultivated meat. Also referred to as cell-grown, in-vitro, cultured, clean, nano-pastured, artificial, synthetic, and lab-grown meat. Cultivated meat is a complex food product grown by cultivating in-vitro animal stem cells. Currently, tissue engineering is regarded as the way to produce cultured meat. Through tissue engineering, the most similar product to conventional meat is produced. Structured cultured meat is grown by placing the cells on scaffolds or through bioprinting. Tissue engineering is normally used for regenerative medicine. In comparison, there are not many changes between the two. The biggest change is that the goals aimed for are different. The goal has shifted to creating affordable and sustainable nutritional properties from cell survival and biological functionality (Kirsch et al., 2023). A challenge that is not seen in regenerative medicine is the material the scaffolds are made of. The scaffolds can help with the texture, so the meat could take on more different types of meat. To realize this, the scaffolds must be edible. Due to the anticipated societal benefits of this way of growing, cultured meat could be a sustainable option for consumers who want to take action against the problems related to conventional meat production but are hesitant to change their diet. Although all alternatives mentioned above are seen as promising, this work primarily focuses on cultured meat. From the

alternatives, only cultured meat is still theoretical. All three other alternatives can already be found in the market.

2. Consumer Acceptance

2.1 Generalities

The market integration of novel food products depends on a considerable amount of favourable consumer response to these products. Novel food fails due to a lack of consumer acceptance or even an active consumer rejection. The success of cultured meat is no different. Current examples that demonstrate what to avoid for cultured meat are food irradiation and genetically modified organisms (GMOs). GMOs failed in Europe because they were perceived as risky, morally unacceptable, and not having enough usefulness (Gaskell et al., 2006). However, it is important to note that consumer acceptance seems to have two similar definitions in different disciplines. In marketing, consumer acceptance indicates that the product is already available and in use by several early adopters. This definition means that the product is already profitable and started to be adopted by larger groups of users. However, in the public understanding of science and risk analysis literature, consumer acceptance indicates whether a product or technology has not been categorically rejected and people are willing to consider the product or technology (Fischer & Reinders, 2016). In this definition, the product is not yet sold to anyone. It merely implies that consumers are willing to buy the product, so the product has a chance for market integration and that societal protest against it will most likely not happen. Due to the current theoretical nature of cultured meat, this report will use the latter definition for consumer acceptance.

2.2 Factors in consumer acceptance

The willingness to try or buy cultured meat is affected by several factors. these factors were to be mapped out, to avoid consumer hesitancy hindering market integration. The factors affecting consumer acceptance were found by collecting consumers' reactions to cultured meat. The consumer reactions were collected mostly via surveys and focus groups. However, Laestadius (2015) collected them by analysing a collection of blog comments that were made on articles regarding cultured meat. Most studies found the same factors, but they could not agree on the effects these factors had on the willingness to buy. The results from the studies can be seen as contradictory. One of the factors that seem to have contradictory results is the consumers' education level. Hocquette et al. (2022) state that respondents with a higher degree such as a master's or PhD have the highest willingness to buy and this willingness to buy drops slowly when lowering the education degree towards a high school diploma. They concluded that more educated consumers have a higher willingness than less educated consumers. However, according to Wilks & Phillips (2017), the education level was not predictive of consumers' willingness to buy. Another study claimed that educated consumers have very little willingness (Hocquette et al., 2015). Moreover, the literature mentions that vegetarians

are more supportive and positive about cultured meat. They are more likely to acknowledge the advantages of cultured meat. However, regarding the consumption of cultured meat, their willingness to buy is significantly lower than individuals with high levels of conventional meat consumption (Faccio & Fovino, 2019). Their low willingness to buy shows that positive perceptions of novel foods, do not guarantee market success. Most literature shows that information provision would lead to positive effects on willingness.

Another contradictory aspect can be seen in the comparison with alternatives such as insect-based meat. Dupont & Fiebelkorn (2020) reported that cultured meat would be preferred over insect-based meat. However, Grasso et al (2019) state the opposite that among their respondents cultured meat was preferred the least. The age difference between the chosen respondents can perhaps explain this difference. As Dupont & Fiebelkorn questioned the youth, while Grasso the elderly. Thus age could be assumed predictive. However, Wilks & Phillips (2017) contradict this possible effect, since they believe age is not predictive.

Pakseresht (2022) has suggested that the found factors can categorized into 7 categories (Table 1). The seven categories are Risk-Benefit perception, Ethical and environmental concerns, Consumer awareness and knowledge, personal factors, product properties, emotions, alternatives, and availability. The first category, risk-benefit perception, contains the factors: food safety, safety concerns, framing effects, perceived risk, and perception of healthiness. These factors all deal with the perception and image of cultured meat. The perception of healthiness consists of the perceived health benefits, Food safety is the perception of whether cultured meat can keep food secure during outbreaks of famine and diseases. Safety concerns depict whether or not consumers view cultured meat as edible and safe to consume. The last factor, framing effects, is how consumers' perceptions of the risks and benefits can change rapidly by the way cultured meat is displayed. The second category, the environmental and ethical concerns, has the factors regarding the societal benefits and problems resulting from cultured meat compared to conventional meat. For the environmental concerns: how much reduction is there in resources such as land and water use and how big is the reduction in greenhouse gas emissions? For animal welfare, the question is whether cultured meat is slaughter-free. Furthermore, what are the living conditions of the animals like? The last factor in this category which is more seen as a negative, is the feeling of unnaturalness. This factor resembles the concerns consumers can have that the production process feels as tempering with nature. The third category, consumer awareness and knowledge, is the factors that tell how much information consumers have regarding the different aspects of cultured meat. Factors such as familiarity with the product, knowledge of the production process, and knowledge of the technological advances that are being made regarding cultured meat. The fourth category, Personal factors, combines all the characteristics of the consumers that would help shape their willingness. These personal factors range from biological characteristics such as gender and age to social characteristics such as diet, worldview, education level, and cultural view. The fifth category, Product properties, are the anticipated properties of the meat, such as taste, texture, and price. Other properties that have influence are shelf-life, nutritional values, and product type. However, most of these properties are that moment still unknown. The sixth category, alternatives and availability, shows the relationship between cultured meat and products that will compete within the market. These

alternatives are plant-based, insect-based, SCP-based meat, and conventional meat. This category also accounts for their availability. So technically, how accessible its competitor products are. The last category, emotions, are the factors that mostly resemble the emotional side of consumers: the fear of the unknown and how much they trust agencies. The factors in this category are trust, fear of the unknown effect, fear of the unfamiliar technology, and disgust sensitivity.

Table 1. Factors of consumer willingness categorized. The 5th column shows expected dependency on information, factors are divided into four groups. X: factor whose sole aspect is the knowledge of consumers; Yes: factor that is directly influenced and changed by information provision; Maybe: factor that is indirectly influenced and could change or not depending on the participants; No: factor that would not change.

Category	Factor	Description	Prompts	Influenceable
Risk-Benefit perception	Perceived risk	Risks associated with cultured meat	Which risks do you associate with cultured meat?	Maybe
	Framing effects	The effect of certain phrasing, labelling, and imagery of cultured meat	Does the way cultured meat is presented trigger how you view cultured meat?	Yes
	Perception of healthiness	Positive side effects for health: Nutritional values and fat content	Which health benefits do you associate with cultured meat?	Maybe
	Safety Concerns	Regulations, safe for consumption no negative side effects	Which health risks do you associate with cultured meat?	Maybe
	Food safety	The availability of food: shortages, diseases	Which food safety benefits do you associate with cultured meat?	Maybe
Ethical and environmental concerns	Environmental concerns	Greenhouse gas emissions, land & water usage	Which environmental benefits do you associate with cultured meat?	Yes/ Maybe
	Animal welfare	Living conditions of animals or slaughter-free	Which animal welfare benefits do you associate with cultured meat?	Yes/ Maybe
	Unnatural production process (Feeling of unnaturalness)	The production process creates a sense of disgust and unnaturalness.	Which aspects of the production process create a feeling of unnaturalness?	Maybe
Consumer awareness and knowledge	Product awareness and familiarity	The knowledge the consumer has of cultured meat	How familiar are you with cultured meat?	X
	Knowledge of the production process	The knowledge the consumer has of the production of cultured meat	How familiar are you with the production process of cultured meat?	X
	Knowledge of the technological advantages	The knowledge the consumer has of the advances made regarding cultural meat	How familiar are you with technological advances regarding cultured meat?	X
Personal factors	Preferences (diets)	Consumer's diet like flexitarian or vegetarian	Does your diet preference influence your view on cultured meat?	Maybe
	Gender	Gender of the consumer	-	No
	Intercultural differences	Cultural aspects such as halal., kosher	Do your cultural beliefs influence your view on cultured meat?	No
	Worldview	How the consumer looks at the world	Does your worldview influence your view on cultured meat?	Maybe

	Age	Age of the consumer	-	No
	Education level	Level of education of consumer (MBO, HBO, WO, or high school diploma)	Does your education level influence your view on cultured meat?	no
Product properties	Price	How affordable is it.	How affordable must it be to buy it?	Yes
	Taste	Perceived flavour sensation	Must the taste be the same or better to buy it?	Yes
	Texture	Perceived mouthfeel	Must the texture be the same or better to buy it?	Yes
	Effect of product type/ technology type	Is the product used in ground beef, steak, hamburgers, or frozen fast food	What type of meat would you buy if it is made of cultured meat?	Yes
	Nutritional values	Perceived amount of nutrients	Must nutritional values be the same or better to buy it?	Yes
	Shelf-life	Life before the product expires	Does the length of shelf-life matter?	Yes
Alternatives and availability	plant-based alternatives	The concurrent plant-based alternatives	Are alternatives more attractive?	Yes
	Insect-based alternatives	The concurrent insect-based alternatives	Are alternatives more attractive?	Yes
	SCP-based meat	The concurrent SCP-based alternatives	Are alternatives more attractive?	Yes
	Conventional meat	Meat that is produced the traditional way	Is conventional meat more attractive?	Yes
	Availability	Whether the products available?	Are products deliverable?	Yes
Emotions (neophobia)	Disgust sensitivity	Feelings of disgust are easier made than those of appeal	What about cultured meat gives you a sense of disgust?	Maybe
	Fear of unknown effects	Unknown long-term effects of technology create neophobia	What frightens you from buying cultured meat?	Maybe
	Fear of unfamiliar technology	Neophobia due to unfamiliarity	What frightens you from buying cultured meat?	Maybe
	Trust	The trust consumers have in regulations & corresponding agencies	Have you any trust in regulations regarding cultured meat?	Maybe

2.3 Dependency on information

From these seven categories of factors, it could be gathered that several factors of consumer willingness are affected by the level of information. In other words, the consumer awareness and knowledge factors seem to have quite a big influence. Zhang et al. (2020) showed that by giving consumers just a small amount of positive information, their willingness increased significantly. It appears that many people have certain misconceptions regarding cultured meat. The big influence of consumer awareness and knowledge can be deduced easily from the factors descriptions. For example, consumers tend to have a lesser feeling of unnaturalness for cultured meat if they are given positive information on the production process. The information would clear up the misconceptions that the meat would not stem from real animals. By giving consumers access to more information, their familiarity with cultured meat will increase, therefore their neophobia for cultured meat will lessen. However, the increase in

willingness to buy seems to be only the case if the provided information is positively framed (Rolland, 2020). All this seems to suggest that there is a big dependency on information provision and the way the information is framed. This paper aims to identify the influence of information on the willingness to try and buy cultured meat in potential Dutch consumers.

3. Production Processes

3.1 Conventional meat

In the conventional way of meat production, first feed grains are grown. Shortly after the grain is processed into animal feed. Next, the animal feed is used to fatten up the livestock. If the livestock is fattened up enough, they will transported to slaughterhouses. After being slaughtered, the carcasses are hanged for one to three days for full rigor mortis to set in. The meat, specifically beef, will be left to age for up to another 14 days. Once the aging is done, the carcass will be cut each time in half until the desired end size is reached (Van Driel, 2024).

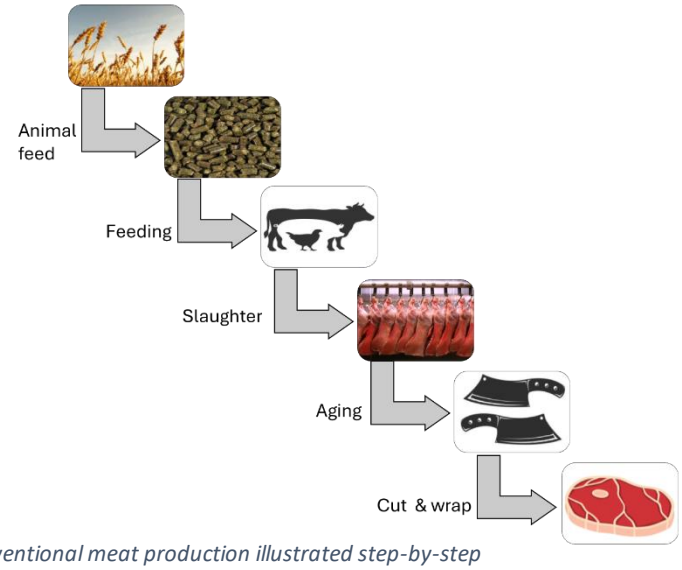


Figure 1. Conventional meat production illustrated step-by-step

3.2. Plant-based meat

For the first step in the production of structured plant-based meat, plant protein sources such as wheat are ground to powder after being grown. Through twin-screw extrusion, the protein powder is transformed into a continuous semi-solid (Imran &Liyan, 2023). To complete the process, a screw system within a barrel hard presses through a die, while exposed to a combination of heat, mechanical energy, pressure, and moisture (Kinney et al., 2019). The output is classified as wet textured vegetable protein (TVP) if there is no dryer post-extrusion and fats are incorporated during the process. Otherwise, it is

classified as dry TVP. Afterward, TVP goes through a marination step in which additional components such as functional additives are incorporated. Functional additives change the texture, taste, or colour of foods or extend their shelf life. Dry TVP is first hydrated before the marination. Optionally, all TVP can be coated with spices, flour, or bread crumbs if desired to create additional flavour.

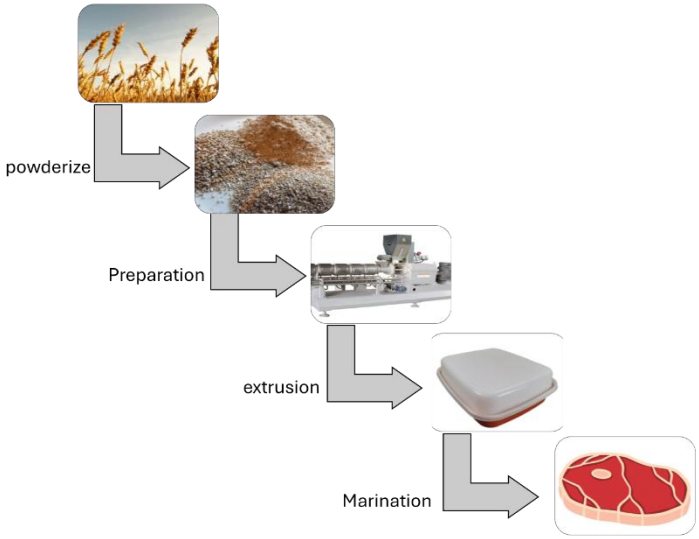


Figure 2. Plant-based meat production illustrated step-by-step

3.3 Cultured meat

Structured Cultured meat is made through tissue engineering or bioprinting. The process begins by taking a biopsy from an animal. From the biopsy the stem cells are isolated. During the biopsy, the livestock will be numbed at the place of the biopsy. The acquired stem cells can be grown into structured meat in three methods (Guo et al., 2023). The first method is to place them on edible scaffolds and let them grow. The second is to mix them with other biological elements to create bioinks. Then the bioinks are 3D printed to make certain structures that imitate regular meat. Or a combination of the two methods, cells are 3D printed on top of scaffolds. The cells on the scaffolds are nurtured and grown in bioreactors at high densities and volumes. Similar to what happens inside an animal, the cells are fed an oxygen-rich cell culture medium of basic nutrients such as amino acids, glucose, vitamins, and inorganic salts, and supplemented with growth factors and other proteins (Swartz, 2023). Changes in the medium composition, often in tandem with cues from a scaffolding structure, trigger immature cells to differentiate into the skeletal muscle, fat, and connective tissues that make up meat. The differentiated cells are then harvested, prepared, and packaged into final products. The controlled culturing method ensures that cultured meat is not contaminated with bacteria and diseases. Moreover, cultured meat contains no antibiotics or hormones and is not genetically manipulated.

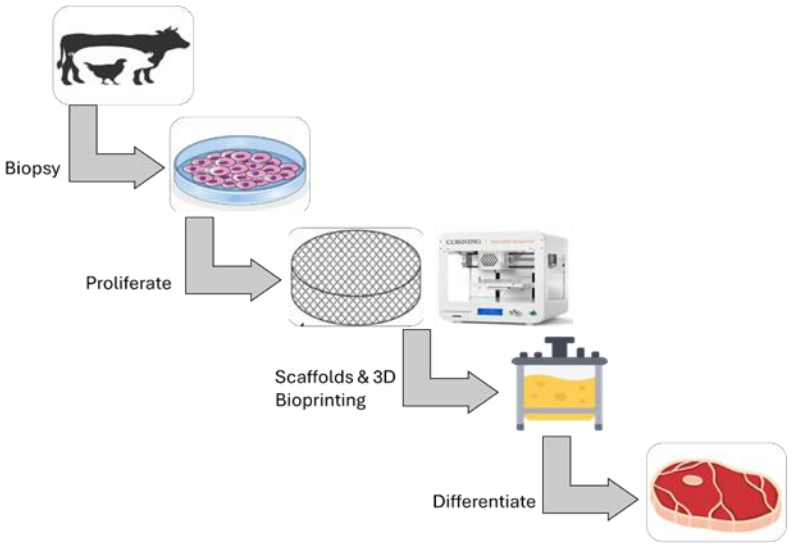


Figure 3. Cultured meat production illustrated step-by-step

4. Regulatory Frameworks

As with all novel foods, there is the possibility of potential safety hazards (Wang et al., 2024). Thus European Food Safety Authority (EFSA) has given out several regulations to avoid or minimize these potential hazards. When the EFSA assesses novel foods that seek approval, they look at seven categories (Turck et al., 2024): the identity of the novel food, steps in the production process, the composition of the novel food, its usage, its toxicity, its allergenicity, and its nutritional information. For the novel food's identity, the ingredients' source must be known. The production process description must be detailed enough to ensure an understanding of the critical parameters and steps involved. This understanding enables the identification of all potential food safety hazards. For the composition, the stability and chemical parameters of the novel product must be provided. To conduct risk characterization estimates of novel food intake by the EU population are necessary. Thus information on the target population, proposed uses and use levels, and precautions and restrictions of use, with cross-referencing to relevant safety data should be provided. The toxicity is tested on ADME, genotoxicity, and repeated dose. Allergenicity must be tested or if derived from products with known allergens, it must have the same allergenicity labelling of these allergens. The impact of its nutritional values must be investigated. This investigation is more thorough if the novel food is meant to be used as a replacement for already existing products.

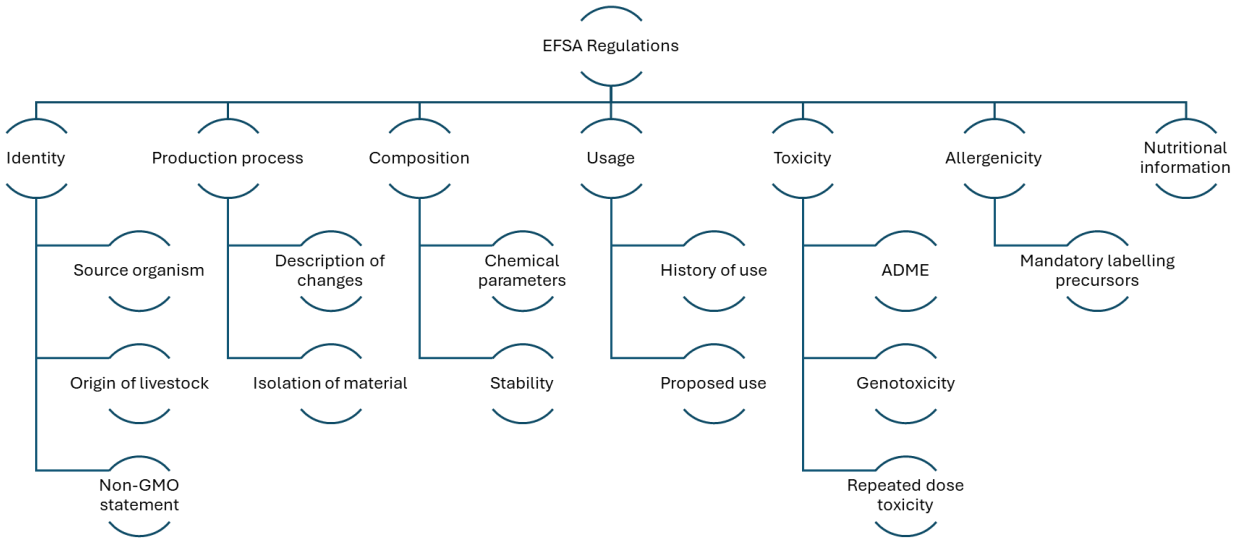


Figure 4. The seven categories of EFSA regulations on novel foods and their respective subcategories.

5. Interview Design & Methodology

5.1 Interview design & procedure

Semi-structured interviews were conducted to investigate the relation between the factors and the level of information provision. The proposed interview setup with in advance prepared questions is included in the appendix. Semi-structured interviews were chosen as the method since current studies are more survey-based. Due to the theoretical nature of the subject and the desired information, a focus group or interviews would give a better in-depth image. A better in-depth image is formed if the option to ask follow-up questions ad hoc exists. This option is possible with focus groups and interviews. In interviews or focus groups, the level of information provision can also be more regulated. Interviews were preferred above a focus group, due to the possibility of a lack of responses. For a focus group, it is essential to have at least six respondents to make sure a dialogue is started. The interview schedule and setup were designed using Breen (2006) and Spencer (2024) as guidelines. The interview would consist of two scenarios (Tables 2 & 3). Each scenario was designed to be around fifteen minutes. The only difference between the scenarios would be using different product types. One scenario would be about structured meat and the other unstructured meat. In between the scenarios, information regarding the production processes of all three options and regulations for novel foods was provided. The three options were regular, plant-based, and cultured meat. The reactions to the two scenarios were compared to see if the same circumstance scenarios were now seen from a different perspective.

The content of the information was chosen to be the production process and regulatory network. Thus this study would not be replicating and would fill in possible knowledge gaps. Rolland et al. (2020) used a similar approach. They researched “if specific information on societal or personal benefits or information about the quality of the food product affects consumer acceptance and sensory perception of cultured meat in a general population”. They gave participants specific information on three topics: societal benefits, personal benefits, and meat quality & taste. To avoid repeating a part of this

research and filling in knowledge gaps, the information provided in this study would concern the production process and the regulatory network.

A comforting environment was created to encourage interviewees to give honest and candid explanations regarding their answers. This environment was created by explaining to the participants how the interview would be set up beforehand. The interviews were performed in Dutch, so interviewees could speak in their native language. By conducting the interviews in their native language, interviewees could articulate their arguments freely without the hindrance of language barriers. Another attempt to make the environment more encouraging was to ensure the interviewees that their responses would be made confidential and anonymous.

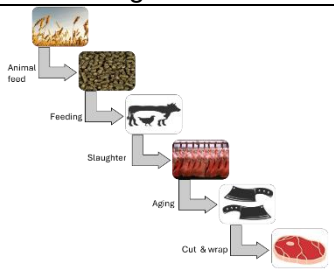
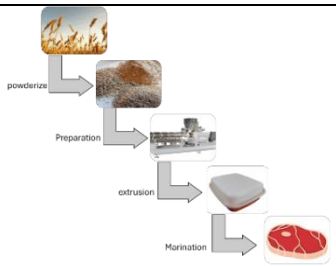
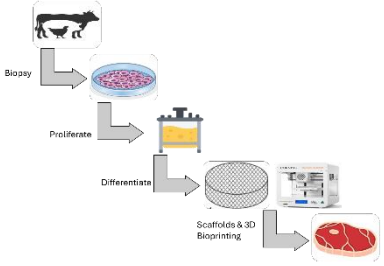
5.2 Design scenarios

As mentioned above, in the given scenarios interviewees were given the same circumstance and the option to choose between three options. These three options would consist of cultured meat, conventional meat, and plant-based meat (Tables 2 & 3). To be able to analyse the effectiveness of information provision, it was determined which factors could be impacted by increasing consumers' knowledge of the production process of cultured meat. The result of this can be seen in the 5th column of Table 1. They were divided into four groups of factors: the factors whose sole aspect is the knowledge of consumers (X), the factors that are directly influenced and changed by information provision (Yes), the factors that are indirectly influenced and could change or not depending on the participants (Maybe), and the variables that would probably not change no matter what (No). With this division, we could conclude that between scenarios we should be able to analyse the changes in the factors of the third group (Maybe). However, a remark must be made about certain factors such as most product properties excluding price. They are now classified in the second group but normally could be classified in the fourth group. However, this is not the case since these factors are still theoretical for cultured meat. These factors are momentarily fictional and can be directly changed within our information provision.

Table 2. The 3 options presented in the first round of the interview.

Option 1	Option 2	Option 3
		
		
Regular meat	Plant-based meat	Cultured meat

Table 3. The 3 options presented in the second round of the interview.

Option A	Option B	Option C
		
		
Regular meat	Plant-based meat	Cultured meat
		

5.3 Recruitment

Participants were recruited through the utilisation of the researcher's network. Recruitment was done through the utilisation of a personal network since possible participants were notified that there were no incentives. People from personal networks were seen as people who would be more ready to choose to participate without an incentive. Participants were given an informed consent form before the start of the interview.

5.4 Misinformation combat

The participants were asked how familiar they already were with cultured meat and what their initial knowledge of it was. Due to the high plausibility of participants having received misinformation from the media before joining the interview. Therefore, if their given answers seemed to tend to be extremely negative or positive, the participants were asked follow-up questions regarding the origin of this information. If the information given, differed from information from the literature review and their source was deemed unreliable, an attempt to rectify the information was made. This attempt was made to limit the misinformation's effect on the interviews' results.

5.5 Recording procedure

The chosen recording method was the usage of a smartphone that would store the recordings directly on the device itself. Recording methods using the cloud were excluded to protect the privacy of the interviewees. To optimize the sound quality, the recording device was placed within an equal distance from the interviewee and the interviewer.

5.6 Privacy/data management

The privacy of the respondents was secured by storing the recorded material and informed consent forms in a secure TU Delft project storage site, with controlled access. The controlled access entails that only a select few who work on this project can access it. In the transcripts of the recordings, the participants were anonymized. Significant comments used in the results were assigned to one or some of the participants. All participants were also asked to sign a consent form to use their data for research and these forms were provided at the beginning of the interview.

5.7 Data analysis

Due to privacy concerns, the data was transcribed and translated by hand. After transcription, thematic analysis was performed. With thematic analysis, patterns or themes within qualitative data are identified (Maguire & Delahunt, 2017). This analysis minimally organizes and describes your data set in detail. Braun & Clarke's (2006) 6-step framework was followed in this thematic analysis. However, in contrast with Braun & Clark, the used themes were more rigid and predetermined. In our thematic analysis, the themes used are characterized as the seven categories of factors found (Table 1) with the factors within these groups as subthemes.

6. Results

6.1 Characteristics interviewees

The first questions of the interviews were to establish the characteristics of the interviewees such as age, gender, diet, and education level (Table 4) All interviewees were Dutch students in the age range of 20-26 who are receiving higher education. Among the respondents, diet preferences varied.

Table 4. Demographic characteristics of interviewees.

	Interviewee A	**interviewee B**	**interviewee C**
Age	20-26	20-26	20-26
Gender	F	F	M
Education level	WO (bachelor)	WO (master)	WO (master)
Nationality	Dutch	Dutch	Dutch
Diet	Vegetarian	flexitarian	Meat eater

6.2 Initial response

The initial likelihood of buying cultured meat can be seen in Table 5. They gave their likelihood giving each option a score between one and five. one represented highly likely, three medium, and five not at all likely. These results mostly seemed to correspond with the diet preferences of the interviewees. The vegetarian gave the meatless option the highest likelihood and gave the meat options a negative likelihood. The flexitarian gave the alternative a high likelihood and regular meat a negative likelihood. And the meat eater did the opposite of the flexitarian. The given likelihoods were therefore not surprising.

Table 5. Likelihood to buy each option in the first scenario with 5: very likely, 4: likely, 3: medium, 2: not likely, 1: not at all likely.

Scenario 1	**Interviewee A**	**Interviewee B**	**Interviewee C**
Regular meat	1	2	5
Plant-based meat	4	4	1
Cultured meat	2	4	2

The interviewees' reasonings for their choices were thematized (Table 6) to the found factors and their categories in Table 1. All interviewees had given the product properties such as taste and texture as part of their main reasoning. However, the effect of taste and texture on their willingness to buy cultured meat is different. Interviewee A, as a long-time vegetarian, dislikes the meat-like taste and texture. Thus much so that they try to avoid all meat analogues. For interviewee C, the product properties are both negatively and positively influencing their willingness to buy. Cultured meat is seen to be better than plant-based, but probably lacking compared to regular meat. Interviewee C is sceptical if cultured meat can be used as a replacement for regular meat. As interviewee C stated: "I do not have the feeling that current plant-based alternatives are made to

imitate regular meat in stew recipes". Then to interviewee B, the willingness is positively influenced by the perceived taste and texture as they are not sceptical like interviewee C. They believe it will be like regular meat. Therefore, they believe cultured meat is the middle road option with the benefits of the taste of regular meat and the environmental benefits of plant-based meat. Besides product properties, the perceived ethical and environmental benefits are also a main reason for interviewee B to have a high likelihood of buying cultured and plant-based meat. However, their emphasis lies more on the environmental benefits than ethical benefits such as animal welfare. As a result of the emphasis, they opt to mix both products, since the environmental benefits of plant-based are higher. For interviewee A, these benefits are also part of their reasoning. However, animal welfare is her biggest reason as they would only eat food if there is a guarantee there is absolutely no animal suffering taking place. For interviewee C, it is important that the meat is not created in "the most polluting way possible", but is much less taken into account during everyday grocery shopping.

Furthermore, both interviewees B & C initially seemed to have some doubts about cultured meat. Despite interviewee B giving a positive likelihood for cultured meat. Interviewee B's doubts were because even if the mentioned prices and sensory appeal were the same, the interviewee still perceived cultured meat as more expensive than the other options. Thus the interviewee showed some more willingness to buy plant-based meat. However, when directly pressed to choose between the two options, the interviewee expresses difficulty choosing between the two options. For interviewee C, these doubts are why cultured meat receives a negative likelihood. Both interviewees feel that there are still too many uncertainties regarding the product properties. For interviewee C, this creates some feeling of unnaturalness as cultured meat is still different from regular meat. Thus this feeling of uncertainty could be possibly attributed to a mild form of food neophobia. Although, it is not an irrational fear with our interviewees. Interviewee B noted that this uncertainty could be taken away with information on how the technology advances and interviewee C said if the product properties were given. With this explanation, it can be more seen as rational fear than as irrational.

Table 6. The interviewees' responses to the first scenario were thematized to the factors in consumer willingness and their categories (Table 1) and order of importance from left to right. 1: risk-benefit perception; 2: Ethical and environmental concerns; 3: consumer awareness and knowledge; 4: Personal factors; 5: product properties; 6: alternatives; 7: emotions (neophobia).

Interviewee	Identified factors						
A	Ethical concerns (2)	Environmental concerns (2)	Texture (5)	Taste (5)	Diet (3)		
B	Environmental concerns (2)	Taste (5)	Texture (5)	Price (5)	Ethical concerns (2)	Diet (3)	Fear of unfamiliar technology (7)
C	Taste (5)	Texture (5)	Price (5)	Feeling of unnaturalness (2)	Diet (3)	Fear of unfamiliar technology	

						(7)	

6.3 Response after information provision

Similar to scenario one, the likelihood of buying cultured meat for the second scenario was analysed (Table 7) and reasonings were thematized (Table 8). There was a small change in the likelihood of buying cultured meat for the vegetarian. The biggest changes in likelihood were with the meat eater. In regards to the factor categories, the same categories were observed with the category product properties having one extra factor.

Table 7. Likelihood to buy each option in the second scenario with 5: very likely, 4: likely, 3: medium, 2: not likely, 1: not at all likely.

Scenario 2	**Interviewee A**	**Interviewee B**	**Interviewee C**
Regular meat	1	2	5
Plant-based meat	4	4	2
Cultured meat	3	4	4

The reason behind the small changes or no changes at all by interviewees A & B is that the initial consumer awareness and knowledge were already on the higher side. Interviewees A & B did not know many details of the production process, but they were familiar with the process in broad terms. The given information on the production processes was more confirmation of their assumptions than a revelation. However, the small change in likelihood for interviewee A was thanks to the surprise that local anaesthesia was used during the biopsy. This detail supports that there is no animal suffering, the likelihood of buying cultured meat went from not likely to medium. A remark with this is that due to their dislike for the meat-like taste, it stays unlikely. However, interviewee A stated regarding the likelihood of buying cultured meat: “If I also would have loved to eat meat. Then I would go for cultured meat”. So her willingness to buy plant-based instead of cultured meat hinges on her dislike for the product itself. The likelihood would also be higher if asked if they would buy it for others such as her potential family in the future.

For interviewee C, the initial consumer awareness and knowledge were also not low. However, the information provision did lessen the feeling of unnaturalness a little. As the production seemed to be more natural. For example, the interviewee gave examples of products that are grown naturally from fungi. This reasoning makes the feeling of unnaturalness less for cultured meat than for plant-based meat. Interviewee C felt like “the producers will just throw some powder and spices with the TVP and call it good”.

Although, this is not the biggest reason for the change in likelihood. The biggest reason is the difference in the type of product. In the first scenario, the meat type was

blade steak, and in the second scenario ground beef. Interviewee C's doubts regarding product properties were lessened. He believed that ground beef or other simplistic structured meat would be more easily imitated by cultured meat. This belief does not mean that the end product of processed meat with a complicated structure is deemed difficult to imitate. The doubts only exist with types of meat where the complicated texture was already there before preparation. Meat where in its preparation its structure is taken out, cultured meat will become more preferable than with structured meat. Interviewee B seemed to agree with this statement. However, their likelihood of buying cultured meat stays the same. However, now they would minimalistic prefer cultured meat over plant-based meat, which was the reverse for scenario one. For interviewee C, the production information enforces his belief that ground beef and other simplistic structured meat are more easily imitated. The information gives him more confidence that unstructured meat such as sausages and ground beef is more imitable. The production information gives him the impression that the cultured meat's composition, such as the fat content, would be similar to regular meat. Despite this positive change, hesitancy to buy cultured meat remains for interviewee C. They may want to try it elsewhere first before buying it themselves.

Table 8. The interviewees' responses to the first scenario were thematized to the factors in consumer willingness and their categories (Table 1) and order of importance from left to right. 1: risk-benefit perception; 2: Ethical and environmental concerns; 3: consumer awareness and knowledge; 4: Personal factors; 5: product properties; 6: alternatives; 7: emotions (neophobia).

Interviewee	Identified factors							
A	Ethical concerns (2)	Environmental concerns (2)	Texture (5)	Taste (5)	Diet (3)			
B	Environmental concerns (2)	Taste (5)	Texture (5)	Type of product (5)	Price (5)	Ethical concerns (2)	Diet (3)	Fear of unfamiliar technology (7)
C	Taste (5)	Texture (5)	Type of product (5)	Price (5)	Feeling of unnaturalness (2)	Diet (3)	Fear of unfamiliar technology (7)	

The regulatory information did not affect the likelihood. The interviewees had strong trust in the regulations of the EU. Interviewee B found them maybe even too strict when looking at how there are no big problems currently with products such as GMOs in the United States. In contrast, interviewee C had a question as to its classification. He hoped that this classification would not mean that certain EU regulations for regular meat are not circumvented. Interviewee C worried whether regulations that forbid "American practices such as pumping regular meat full of hormones" are also made for cultured meat. However, they felt this might be a needless worry as this may already be covered by the chemical parameter regulations for the composition of novel foods.

Most interviewees showed that if they had more money, they would try to buy more cultured meat to support this industry. They want to ensure that this technology will become more resource-efficient and overall better. They see it as the solution to

replacing a part of the meat industry, as “plant-based alternatives are not cutting it” (interviewee B).

6.4 Factors affected by information provision

With the factors identified in both scenarios, it can be seen that with the information provision the effects of factors on the willingness to buy changed (Table 9). Three of the four identified categories were found positively changed due to the information. For the category of ethical and environmental concerns, the willingness to buy cultured meat of interviewee A increased since the effect of ethical benefits changed. At first, it influenced the willingness to buy negatively as cultured meat was not perceived as animal cruelty-free. However, with the information about the biopsy process, this factor had a positive effect on the willingness as it was now perceived as cruelty-free. For interviewee C, this category had a more positive effect than before as the negative effect of the feeling of unnaturalness was lessened. In the same way, the negative effect of the uncertainties the interviews perceived was lessened, therefore the emotions category effect was more positive. Although, the effect of the product properties did not change, due to the content of the information provided. The interviewees’ responses showed that the effect of the product properties would change if given information on these properties.

Table 9. Impact information on the identified factor categories effect on willingness to buy. +: factor’s impact increased; -: factor’s impact decreased; “+”: factor’s impact increased if information was given; x: No impact.

Factor	Interviewee A	Interviewee B	Interviewee C
Ethical and environmental concerns	+	x	++
Product properties	X	“+”	“+”
Personal factors	X	x	x
Emotions (neophobia)	x	-	-

6.5 Discussion

The generalisability and representativeness of the data must be considered since there are some limitations. Although the respondents varied regarding diets and their views on cultured meat, all interviewees have followed or are following study programs in the field of bioindustry. Therefore, the sample views on certain aspects may be more favourable than the general population in the Netherlands. Their respective initial knowledge of the concept of cultured meat may be higher. Also, the sample size is very small due to the low number of interviewees. Thus, the generalizability may be on the low side.

This study is one of the few that investigate consumer willingness through semi-structured interviews. Most studies thus far have been either focus group studies or questionnaire-based surveys. Despite all these differences, our findings seem to align with previous research. The willingness to buy cultured meat from vegetarians is the same as mentioned in Faccio & Fovino (2019). The observed higher willingness to buy unstructured cultured meat in interviewees B & C aligns with what Bryant et al (2019)

found. Rolland (2020) already found that information had a positive effect on the willingness to buy. This study confirmed that third-party information has more impact than company-provided information. In our findings, this impact can be seen from interviewee C who stated they “would believe information regarding the product properties easier if it is told to him by friends than the companies producing cultured meat”. However, Rolland (2020) viewed the content of the information as of lesser importance. Our findings suggest that the content of information is not of lesser importance. As for the information to affect the consumer's willingness to buy cultured meat, the content must related to the consumer’s perceived benefits and concerns of cultured meat. The information must be confirming or contradicting their beliefs regarding cultured meat. The willingness to buy of interviewee A only changed due to biopsy information that ensured no animal suffering. This was only a small detail of the whole process. If this specific detail was not mentioned it would not have changed. Similarly for interviewee B, as no extra information was given on the main reason for their willingness to buy meat alternatives, the environmental benefits, and her willingness to buy cultured meat did not change.

As stated by Heiskanen & Ryynänen (2024), flexitarians are the most potential consumer group. If using their terms, the vegetarian and flexitarian are both optimists of technology and the meat consumer can be seen as a moderate sceptic. The flexitarian considers herself even as one of the targets for cultured meat, but also the persons in their surroundings. So our flexitarian perfectly fits the optimists sketched in the research of Heiskanen & Ryynänen. The meat eater partly fits the sketched sceptic. He is partly indifferent to environmental benefits. However, Heiskanen & Ryynänen describe the sceptics as individuals who are not familiar with cultured proteins. However, this is where our sceptic differs as he is quite familiar with cultured protein and even uses cellular agriculture studies to back up his perception of cultured meat.

The interviewees also did not perceive any big safety concerns. This response can attributed to their trust in EU regulations or their education level. All interviewees also have due to their studies a background in biotech. This background could also help them be less judgemental about cultured meat. These responses are all in line with the findings from Rehman (2019). Rehman found that individuals with higher education perceived cultured meat as safer. They also stated that specifically, women with a higher education strongly preferred plant-based alternatives. In our case, the female interviewees also exhibit this preference. Thus although our data cannot be used to generalize our results, our findings about our interviewee's willingness to buy fit with the overall literature. The only difference found is regarding the effectiveness of the type of information.

7. Conclusion

This study investigated the dependency on information for the willingness to try and buy cultured meat in some potential Dutch consumers. The results found in this study were in line with previous research regarding the consumer acceptance of cultured meat. Positive attitudes to cultured meat were mostly due to ethical and environmental benefits. The obstacles were mostly related to its product properties such as taste and price. The willingness to buy increased by providing information ad hoc because the more knowledge people have about cultured meat, the fewer uncertainties they perceive. However, in contrast with previous research, the content of the information is of importance. If the information provided contains details that support or contradict the

consumer's view on cultured meat, it affects the likelihood of the willingness to change. The changes in the interviewees' willingness to buy cultured meat reflect this argument. Each interviewee who changed their willingness between scenarios, only said certain parts of the information provided, affected their willingness. These responses also highlighted that information on the product properties is crucial to getting positive attitudes on cultured meat, while it is still theoretical. Thus the willingness to buy or try cultured meat depends on the level of information. This dependency becomes higher if the content of the information is related to the perceived concerns of each consumer. Thus this study can be seen as an indication that providing information related to the prevalent consumer's concerns with cultured meat, could increase the willingness of Dutch consumers.

8. Future Work

Due to time constraints and lack of responses, few interviews were held. The results could not be generalised, because of the low number of interviewees. Thus performing the same interviews on a larger scale should be considered. Furthermore, the interviews gave more in-depth individualistic perspectives on cultured meat. However, the societal perspective was slightly touched upon by the interviewees. This perspective was not the main focus. To receive this perspective, it is beneficial to use the setup used in this study in a focus group. As a debate, could provide some insights.

9. References

- *Achard, S. (2024, 20 August). Insect Farming's Role In Food Production: Growth, Challenges & Perspectives. iGrow News. https://igrownews.com/insect-farmings-role-in-food-production-growth-challenges-perspectives/#:~:text=Insect%20farming%20offers%20a%20sustainable,for%20more%20research%20and%20development.*
- *Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77-101. https://doi.org/10.1191/1478088706qp063oa*
- *Breen, R. L. (2006). A Practical Guide to Focus-Group Research. Journal of Geography in Higher Education, 30(3), 463–475. https://doi.org/10.1080/03098260600927575*
- *Bryant, C. J., Anderson, J. E., Asher, K. E., Green, C., & Gasteratos, K. (2019). Strategies for overcoming aversion to unnaturalness: The case of clean meat. Meat Science, 154, 37-45. https://doi.org/10.1016/j.meatsci.2019.04.004*
- *Clec, L. M. M. R. L. (2024, 17 July). Is Plant-Based Meat Healthy? Here's What a Dietitian Has to Say. EatingWell. https://www.eatingwell.com/article/7993257/is-plant-based-meat-healthy-heres-what-a-dietitian-has-to-say/#:~:text=Meat%20products%2C%20like%20beef%2C%20bacon,gluten%2C%20pulses%20or%20even%20jackfruit.*
- *Dupont, J. & Fiebelkorn, F. (2020). Attitudes and acceptance of young people toward the consumption of insects and cultured meat in Germany. Food Quality and Preference 85, 103983. https://doi.org/10.1016/j.foodqual.2020.103983*

- *Faccio, E., & Fovino, L. G. N. (2019). Food Neophobia or Distrust of Novelties? Exploring Consumers' Attitudes toward GMOs, Insects and Cultured Meat. Applied Sciences, 9(20), 4440. https://doi.org/10.3390/app9204440*
- *Fischer, A. R. H., & Reinders, M. J. (2016). Consumer Acceptance of Novel Foods. In Innovation Strategies in the Food Industry (pp. 271–292). Elsevier. https://doi.org/10.1016/b978-0-12-803751-5.00014-3*
- *Food and Agriculture Organization. (z.d.). How to Feed the World in 2050. Executive Summary. https://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf*
- *Gaskell, G., Stares, S., Allansdottir, A., Allum, N., Corchero, C., Fischler, C., Hampel, J., Jackson, J., Kronberger, Mejlgaard, N., N., Revuelta, G., Schreiner, C., Torgersen, H., & Wagner, W. (2006). Europeans and Biotechnology in 2005: Patterns and Trends: Report to the European Commission, DG Research. European Commission.*
- *Grasso, A.C., Hung, Y., Olthof, M.R., Verbeke, W., Brouwer, I.A. (2019) Older Consumers' Readiness to Accept Alternative, More Sustainable Protein Sources in the European Union. Nutrients 2019, 11(8), 1904. https://doi.org/10.3390/nu11081904*
- *Grandin, T. (2018). Welfare Problems in Cattle, Pigs, and Sheep that Persist Even Though Scientific Research Clearly Shows How to Prevent Them. Animals, 8(7), 124. https://doi.org/10.3390/ani8070124*
- *Guo, X., Wang, D., He, B., Hu, L., & Jiang, G. (2023). 3D Bioprinting of Cultured Meat: A Promising Avenue of Meat Production. Food And Bioprocess Technology, 17(7), 1659–1680. https://doi.org/10.1007/s11947-023-03195-x*
- *Heiskanen, A., & Ryynänen, T. (2024). Optimists, moderates and sceptics – identifying consumer groups and their willingness to consume cultured proteins in Finland. British Food Journal, 126(13), 658–671. https://doi.org/10.1108/bfj-03-2024-0268*
- *Hocquette, E., Liu, J., Ellies-Oury, M., Chriki, S., & Hocquette, J. (2022). Does the future of meat in France depend on cultured muscle cells? Answers from different consumer segments. Meat Science 188, 108776. https://doi.org/10.1016/j.meatsci.2022.108776*
- *Hocquette, A., Lambert, C., Sinquin, C., Peterolff, L., Wagner, Z., Bonny, S.P.F., Lebert, A., & Hocquette, J. (2015). Educated consumers don't believe artificial meat is the solution to*
- *the problems with the meat industry. Journal of Integrative Agriculture 2015, 14(2): 273–284. https://doi.org/10.1016/S2095-3119(14)60886-8*
- *Imran, M., & Liyan, Z. (2023). Production of plant-based meat: functionality, limitations and future prospects. European Food Research and Technology, 249(9), 2189-2213. https://doi.org/10.1007/s00217-023-04287-w*
- *Kinney, M., Weston, Z. & Bauman, J. (2019). Overview of Plant-Based Meat Manufacturing. GFI. The Good Food Institute. https://gfi.org/wp-content/uploads/2021/01/Plant-Based-Meat-Manufacturing-Guide-_GFI.pdf*
- *Kirsch, M., Morales-Dalmau, J., & Lavrentieva, A. (2023). Cultivated meat manufacturing: Technology, trends, and challenges. Engineering in Life Sciences, 23(12). https://doi.org/10.1002/elsc.202300227*
- *Laestadius, L. I. (2015). Public Perceptions of the Ethics of In-vitro Meat: Determining an Appropriate Course of Action. Journal of Agricultural and Environmental Ethics, 28(5), 991-1009. https://doi.org/10.1007/s10806-015-9573-8*
- *Li, Y. P., Ahmadi, F., Kariman, K., & Lackner, M. (2024). Recent advances and challenges in single cell protein (SCP) technologies for food and feed production. Npj Science Of Food, 8(1). https://doi.org/10.1038/s41538-024-00299-2*
- *Maguire, M. & Delahunt, B. (2017). Doing a Thematic Analysis: A Practical., Step-By-Step Guide for Learning and Teaching Scholars. AISHE-J. All Irel. J. Teach. Learn. High. Educ. 9, 3351–33514.*

- *Mount, H. (2023, 30 November). What is plant-based meat? | The Good Food Institute. The Good Food Institute. https://gfi.org/plant-based/#science*
- *Paksersht, A., Kaliji, S.A., Canavari, M. (2022). Review of factors affecting consumer acceptance of cultured meat. Appetite 170, 105829. https://doi.org/10.1016/j.appet.2021.105829*
- *Post, P. M., Hogerwerf, L., Bokkers, E. A., Baumann, B., Fischer, P., Rutledge-Jonker, S., Hilderink, H., Hollander, A., Hoogsteen, M. J., Liebman, A., Mangen, M.-J. J., Manuel, H. J., Mughini-Gras, L., van Poll, R., Posthuma, L., van Pul, A., Rutgers, M., Schmitt, H., van Steenbergen, J., … de Boer, I. J. (2020). Effects of Dutch livestock production on human health and the environment. Science of The Total Environment, 737, 139702. https://doi.org/10.1016/j.scitotenv.2020.139702*
- *Prudential, O. (z.d.). four-individuals-four-different-visions-with-one-common-goal. https://www.prudential.com.sg/priority-programme/opus/articles/pros-and-cons-of-plant-based-meat-alternatives#:~:text=Con%20%231%3A%20Plant%2Dbased,%2C%20sodium%2C%20and%20added%20sugar.*
- *Rehman, N., Edkins, V., & Ogrinc, N. (2024). Is Sustainable Consumption a Sufficient Motivator for Consumers to Adopt Meat Alternatives? A Consumer Perspective on Plant-Based, Cell-Culture-Derived, and Insect-Based Alternatives. Foods, 13(11), 1627. https://doi.org/10.3390/foods13111627*
- *Rolland, N. C. M., Markus, C. R., & Post, M. J. (2020). The effect of information content on acceptance of cultured meat in a tasting context. PLOS ONE, 15(4), e0231176. https://doi.org/10.1371/journal.pone.0231176*
- *Spencer, E. L. (2024, 6 August). 53 Focus Group Questions for Better Insights. Blog. https://www.revuze.it/blog/focus-group-questions/#conducting_a_focus_group_vs._a_survey*
- *Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M. & de Haan, C. (2006) Livestock's Long Shadow: Environmental Issues and Options. Food and Agriculture Organization of the United Nations (FAO). https://www.europarl.europa.eu/climatechange/doc/FAO%20report%20executive%20summary.pdf*
- *Swartz, E. (2023, 5 juli). The science of cultivated meat | GFI. The Good Food Institute. https://gfi.org/science/the-science-of-cultivated-meat/*
- *Terlouw, E., Arnould, C., Auperin, B., Berri, C., Bihan-Duval, E. L., Deiss, V., Lefèvre, F., Lensink, B., & Mounier, L. (2008). Pre-slaughter conditions, animal stress and welfare: current status and possible future research. Animal, 2(10), 1501–1517. https://doi.org/10.1017/s1751731108002723*
- *Turck, D., Bohn, T., Castenmiller, J., De Henauw, S., Hirsch-Ernst, K. I., Maciuk, A., Mangelsdorf, I., McArdle, H. J., Naska, A., Pentieva, K., Siani, A., Thies, F., Tsabouri, S., Vinceti, M., Gómez, M. A., Cubadda, F., Frenzel, T., Heinonen, M., Neuhäuser-Berthold, M., . . . Knutsen, H. K. (2024). Guidance on the scientific requirements for an application for authorisation of a novel food in the context of Regulation (EU) 2015/2283. EFSA Journal, 22(9). https://doi.org/10.2903/j.efsa.2024.8961*
- *Velarde, A., Fàbrega, E., Blanco-Penedo, I., & Dalmau, A. (2015). Animal welfare towards sustainability in pork meat production. Meat Science, 109, 13–17. https://doi.org/10.1016/j.meatsci.2015.05.010*
- *Van Driel, L. (2024, May 14). Meat Processing explained: from harvest to packaging. Friesla. https://friesla.com/blog/meat-processing-explained-harvest-packaging/*
- *Wang, Y., Zhao, J., Jiang, L., Zhang, L., Raghavan, V., & Wang, J. (2024). A comprehensive review on novel synthetic foods: Potential risk factors, detection strategies, and processing technologies. Comprehensive Reviews in Food Science And Food Safety, 23(4). https://doi.org/10.1111/1541-4337.13371*
- *Water Footprint Network. (2018, October 20) "The Water Footprint of Food." Water Footprint Network. https://foodprint.org/issues/the-water-footprint-of-*

food/#:~:text=Worldwide%20consumption%20of%20meat%20and,percent%20and%200.03%20percent%2C%20respectively.

- *Wilks, M. & Phillips, C. J. C. (2017). Attitudes to in vitro meat: A survey of potential consumers in the United States. PLoS ONE 12(2): e0171904. doi:10.1371/journal.pone.0171904*

10. Appendix

For the record, I will ask several questions to establish the general background of the interviewees.

First, are you between 20 and 26 years of age?
Are you male or female?
Is your education level at WO (bachelor/master) level?
Do you have any diet preferences such as vegan, vegetarian, or flexitarian?
Are you familiar with cultured meat?
What do you already know about cultured meat?
What do you already know about its production process?
What kinds of thoughts do you have about cultured meat?
Where do look at first when buying protein?

Now, you will be given a scenario.
You just left work or the university late. You need blade steak for tonight's dinner. When you arrive at the supermarket, you find the meat aisle mostly empty. You only have three options to choose from. Your three options are conventional, plant-based, and cultured meat. Now I want you to give each option a score on a scale from 1 to 5 how likely would you buy each of the product options? With a 5 being Very likely, a 4 Likely, a 3 Medium, a 2 Not likely, and a 1 Not at all likely.

Since you have chosen a low likelihood for cultured meat, what frightens you not to buy cultured meat?
Since you have chosen a high likelihood for cultured meat, what entices you to buy cultured meat?
What made you choose plant-based over cultured meat?
What made you choose conventional over cultured meat?
What made you choose cultured over plant-based meat?
What made you choose cultured over conventional meat?
What makes the alternatives more attractive?

What situation would make you reach for cultured meat, as opposed to conventional/ plant-based meat?
What does cultured meat lack in comparison?
What are your concerns with cultured meat?
What are your biggest concerns with [option]?
When you see [product], what stands out most to you?
You gave as a reason [found factor], does [other factor] also weigh in?
Do your cultural beliefs influence your decision to not choose cultured meat?
Do your cultural beliefs influence your decision to choose cultured meat?
Do you expect the same product properties? And what if properties are all equal, will that change your decision?

So now I will give you a description of all three production processes and the regulations. [information is given to interviewee]

Does this information confirm your initial answers?
Now you are in the same circumstance as the previous scenario. However, this time you are in need of some ground beef. In this instance will you choose the same likelihoods for the given options?
I see your answer is changed. What is your reasoning?
I see now you have chosen [option A/B/C]. Instead of [option B/C/A]. What is your reason?
What made you now choose plant-based over cultured meat?
What made you now choose conventional over cultured meat?
What made you now choose cultured over plant-based meat?
What made you now choose cultured over conventional meat?
I see your answer is unchanged. What is your reasoning?
I see you chose other likelihoods, Is the difference in the scenarios a part of this reason?

Has your perception of cultured meat in comparison with the other alternatives changed?
Do details of the production process lessen or worsen your feeling of unnaturalness?
Does the regulatory framework lessen your concerns about cultured meat?
Do you have anything you would like to add?