Food in Transition:
The Role of Food Culture in Niche Innovation Success

MSc Thesis

MSc Sustainable Development, Utrecht University

Track: Earth System Governance

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Word Count:

Abstract

Sustainability transitions theories are a set of theories that emerged to understand how long-term processes of radical and structural change towards more sustainable societal systems come about. Since their first application in the mobility and energy domain, these theories have been applied to a variety of sectors, among which the food one. However, criticisms have been expressed towards the application of transitions theory to the food sector. The main point of contention is that culture appears to be a much more determining factor in food transitions than in other sustainability transitions.

To improve the applicability of transitions theory to food transitions, this research will investigate the role that food culture plays in these dynamics. It will do so by putting in relation sustainability transitions theory, particularly the multi-level perspective and strategic niche management, with food culture theory. By granting a space to food culture in the landscape of the innovation system, this research will try to understand how food culture influences niche innovation success. In order to answer the research question, a comparative case study of the development and diffusion of plant-based meat substitutes in Italy and the Netherlands was conducted. This case study serves as the perfect vehicle to understand the role of food culture in food transitions, as the two countries are similar on several control variables, while showing different levels of development of PBMSs and different food cultures. For this purpose, 10 semi-structured interviews with 10 experts were conducted in the two countries.

The research has found that the differences in the development and diffusion of PBMSs in the two countries depend on landscape-regime-niche interactions, where food culture plays a role as part of the landscape. Firstly, the level of niche-regime compatibility was assessed. PBMSs were found to me more compatible to the Dutch protein regime, more than to the Italian one. At the landscape level, the two countries seem to be subject to similar political and economic pressures. However, food cultures in the two countries present significant differences, with one providing a more favorable context for PBMSs to develop and diffuse. It concludes that food culture plays a role in shaping food transitions in at least two ways: by influencing what niches can emerge, and by influencing niche-regime dynamics. Given the exploratory nature of the study, further research can provide extra detail and structure to these concepts and frameworks to improve theory.

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Table 1

List of Abbreviations

PBMSs	Plant-based meat substitutes
MLP	Multi-level Perspective
SNM	Strategic Niche Management
GHG	Green-house gases
TIS	Technological Innovation Systems
HLPE	High level Panel of Experts on Food Security and Nutrition
STRN	Sustainability Transitions Research Network
FAO	Food and Agriculture Organization
WHO	World Health Organization

1. Introduction

1.1 Food in Transition Theory: An Ill-suited Framework?

Food production worldwide is responsible for a third of global greenhouse gases (GHGs) emissions, and requires substantial land, energy and water resources (Tilman & Clark, 2014). These impacts are only set out to increase, in the face of a growing global population, posing our current systems with a double challenge: the need to feed an increasing population with nutritious food, while remaining within planetary boundaries (Aiking & de Boer, 2020). The pressure on current food systems has encouraged scholars and practitioners alike to think about agro-food transitions towards a more sustainable state (Kampers & Fresco, 2017). Agro-food sustainability transitions refer to "fundamental changes necessary to move towards sustainable agriculture and food systems" (El Bilali, 2019, p.353).

Given that agri-food systems transformations have gained societal momentum, food transitions have received much attention in scholarly literature (Hebinck et al., 2021). Food systems "gather all the elements and activities that relate to the production, processing, distribution, preparation and consumption of food and the outputs of these activities, including socio-economic and environmental outcomes" (HLPE, 2014, p. 29). Given their complexity, food systems transitions have often been studied from a systemic perspective (Beddington et al., 2012; Foresight, 2011; Garnett, 2014; Godfray et al., 2010; HLPE, 2014). One set of theories commonly applied is transition theory, a set of theories that emerged out of the need to understand how sustainability transitions come about (Markard et al., 2012). Sustainability transitions are a set of processes that lead to a fundamental shift in the functioning of the dominant system, allowing a sustainable innovation to develop and diffuse in society (Markard et al., 2012). Many examples exist in the literature, which have applied transitions theory to the study of food systems transformation (Audet et al., 2017; Belz, 2004; Mehrabi et al., 2022; Saari et al., 2021; Spaargaren, 2013; Tziva et al., 2020). For example, Tziva et al. (2020) have applied a technological innovation systems (TIS) framework to understand the factors behind the growth of plant-based meat substitutes in the Netherlands. Similarly, Saari et al. (2021) have studied the sustainability innovation journeys in the plant-based meat industry in Europe, from a multi-level perspective on socio-technical transitions.

However, the application of transition theories to food transitions has recently been subject to criticisms (Beverland, 2014; El Bilali, 2019; El Bilali, 2020). Sustainability transition theories were born to understand transitions of the mobility and energy systems (Hinrichs, 2014; Markard et al., 2012; STRN, 2010; Truffer & Markard, 2017). These theories were later applied to a diversity of sectors, including the food one (El Bilali, 2019; El Bilali, 2020). But according to El Bilali (2019), the peculiarities of food systems require new concepts and frameworks to add explanatory power to traditional transition theories. The author explains how culture has a much more prominent role in food transitions than in energy transitions. For example, the shift of energy supply from fossil fuels to a renewable source does not have much of a direct impact on the consumer, who will receive in the end the same end-of-service product. Instead, in the food sector, a change of production and consumption practices can have an enormous impact on the consumer which might be influenced by strong cultural factors. This idea has been supported by numerous scholars, who have expressed strong criticisms to the tendency of disregarding cultural factors in the study of food transitions (Aiking & de Boer, 2020; Burlingame & Dernini, 2012; Graça et al., 2019; Yin et al., 2020). Consequently, El Bilali (2019) calls for a new importance to be given to spatiality and geography of food transitions, as this allows to understand transitions in a specific cultural context, rather than in general universal terms.

1.2 The Role of Food Culture in Transitions: A Complementary Perspective

Transition studies have highlighted the importance of studying food transitions from a systemic level of analysis. However, as the field of research was born to study energy and mobility systems, it has

overlooked some of the concepts and ideas which are relevant to the food sector specifically. As Beverland (2014) argues, “the sociocultural meaning associated with diets has often been downplayed”, both in academic research and policymaking. Many academic studies on the topic have focused on the global level, formulating universal recommendations and guidelines for action, without giving attention to different socio-cultural contexts (Garça et al., 2019; Gonera et al., 2021). This tendency is also observable in policy reports and recommendations (Yin et al., 2020). For instance, the FAO (2010), WHO (2021) and EAT-Lancet Commission (2019) all formulate universal dietary guidelines for sustainability and provide universal recommendations for accelerating the transition.

This is an issue as food transitions are arguably much more influenced by culture than other sustainability transitions, such as the energy one (Aiking & de Boer, 2020; Burlingame & Dernini, 2012; El Bilali, 2019; El Bilali, 2020; Graça et al., 2019; Yin et al., 2020). Cultural norms and traditions are central to food production and consumption practices and turning a blind spot to them might limit the ability to conceive useful governance strategies to accelerate dietary transitions (Aiking & de Boer, 2020; Graça et al., 2019; Yin et al., 2020). As Yin et al. (2020) argue, food culture, “which is informed by a certain country's or region's population, agricultural production, food processing and trade practices, purchase level, eating habits and cultural tradition” has a significant influence on food choice (p.2). Thus, studying agro-food systems' transformations without investigating the broader cultural context, might result in one-size-fits-all strategies, that are unlikely to work across different socio-cultural environments. Thus, different scholars have called for further research and attention to the influence of food cultures on food transitions (Aiking & de Boer, 2020; Béné et al., 2020; Graça et al., 2019).

1.3 Research Aim and Goals

To address the lack of attention to socio-cultural factors in food sustainability transitions, this research will investigate the role that food culture plays in agro-food sustainability transitions. The aim of this research is three-fold:

1. To understand the factors explaining the differences in how food transitions unfold in different contexts.

2. To add explanatory power to transition theories in the food sector, by giving food culture more importance.

3. Highlight the need for policymakers to pay attention to the local context when formulating recommendations.

In response to the shortfall in research on protein transitions to regard socio-cultural factors, this research will study food transitions by integrating notions and concepts from transitions theory with theory on food culture. It will do so at the country level, by adopting a comparative perspective and by focusing on a specific food transition. It is important to note that according to transition theory a transition comes about when interactions at three levels (landscape, regime and niche) allow a sustainable niche innovation to develop and diffuse in society (Geels, 2002; Geels, 2011; Markard et al., 2012). The niche innovation which will be used as a case study for this research is plant-based meat substitutes (PBMSs). PBMSs are defined as “products that take the place of meat in the human diet and have an appearance, texture and taste similar to meat products” (Tziva et al., 2020, p. 218). PBMSs provide an excellent case study to understand the role of food culture in transitions, for two main reasons. Firstly, their rate of development and diffusion seems to vary greatly between countries with different food cultures (Smart Protein, n.d.; White, 2022). Thus, they provide an excellent case to understand why protein transitions are unfolding differently in different contexts, with countries who present staggering differences in their level of PBMSs growth compared to others. Secondly, as innovation theories were born to study technological innovations, PBMSs are well suited as they are technological innovations themselves (Markard et al., 2012). It is important to note that the development and diffusion of PBMSs is only one of the possible transition pathways to a sustainable

protein transition, but for the reasons above it provides an optimal case study to answer the research question.

In sum, this research wants to explore the role that a country's food culture plays in food transitions, by using plant-based meat substitutes as a case study. To fulfil these research objectives, the following research questions will be addressed:

RQ: *How does a country's food culture influence the development and diffusion of plant-based meat substitutes in protein transitions?*

1.4 Scientific and Societal Relevance

1.4.1 Scientific Relevance

Sustainability transition theories were born to study transitions in the energy and mobility sector. These theories have later been applied also to studies of sustainability transitions in the food domain. However, according to different scholars, the food sector is different from others, mainly because of the fundamental importance that food culture has (Aiking & de Boer, 2020; El Bilali, 2019). To date, studies of societal shifts to more sustainable sources of protein have often disregarded the role that food culture plays in protein transitions, generating universal recommendations for accelerating sustainable change. By researching the role of food culture in protein transitions, this research aims at introducing concepts and frameworks of food culture theory to transitions theory, to better understand the dynamics of change in the food sector.

1.4.2 Societal Relevance

The climate crisis and an increasing global population require a shift to more sustainable food systems. In such a context, agro-food transitions are gaining societal momentum in order to guarantee transition is human and planetary health. However, universal policy recommendations have so far failed to deliver the desired results. By providing a deeper understanding of the role cultural norms play in food transitions, this research aspires to inform better governance practices to accelerate food system change.

2. Theory

2.1 Transition Theory

2.1.1 Main Elements of Transition Theory

Transition theory is a set of theories that emerged out of the need to understand how technological transitions come about (Markard et al., 2012). Technological and societal innovations have always occurred throughout history, and transition theory has helped explain the dynamics behind them, for example the development in transport systems from sailing to steam ships to automobiles (Geels, 2002). The current environmental issues our society is facing have called for a revival of transition theory, which is being applied by scholars studying sustainability transitions in different sectors, ranging from energy, mobility, to food (Köhler et al., 2019; Markard et al., 2012). Thus, introducing a transition perspective might help make sense of the dynamics behind them (Tziva et al., 2020).

Socio-technical transitions are a set of processes that lead to a fundamental shift in socio-technical systems, allowing an innovation to develop and diffuse in society (Markard et al., 2012). When such socio-technical transitions involve long-term and fundamental changes towards more sustainable modes of production and consumption, they may be referred to as sustainability transitions (Markard et al., 2012). Transition processes aim at "society-wide change that goes beyond single sectors and involves fundamental and interrelated changes in technology, organizations, institutions and culture" (Van den Bergh & Kemp, 2008, p. 81).

While different theories exist in the literature, all of them recognize transitions as long-term processes that involve complex dynamics that occur at different levels and amongst different actors (Markard et al., 2012). This research will use some of the main concepts and ideas of the multi-level perspective (MLP) and of strategic niche management theory (SNM). MLP has been chosen as it is one of the most prominent theories in transition studies, that has been substantiated by a plethora of empirical studies to confirm its usefulness (Hermwille, 2016; Ingram, 2015; Li et al., 2013; Roberts, 2017; Rosenbloom et al., 2016; Zwartkruis et al., 2020). Secondly, compared to other transition theories, which are more rigid, MLP is an open framework, which has often been integrated with other theories, such as social practice theory or actor-based approaches (Hermwille, 2016; Ingram, 2015; Li et al., 2013; Roberts, 2017; Roberts & Geels, 2018; Rosenbloom et al., 2016; Rosenbloom, 2018; Zwartkruis et al., 2020). Given that the objective of the research is to integrate understanding of food cultures in transitions theory, MLP is well-suited. Finally, SNM will be used as it allows to zoom in niche-regime interactions, and how they influence niche innovation success.

2.1.2 A Multi-level Perspective (MLP) on Transitions

Some elements of MLP are hereby introduced, which provide the basic framework for understanding how transitions take place. The MLP understands socio-technical transitions as the outcome of interactions among three levels: the niche, the regime, and the landscape (Geels, 2002; Geels, 2011). The landscape refers to the exogenous cultural, environmental, economic and political context (Geels & Schot, 2007). The landscape forms the external context for interaction of actors and includes factors such as level of economic growth, environmental problems, wars, broad political coalitions and cultural norms. It is very stable and slow to change (Geels & Schot, 2007). Landscape pressures, such as climate change or ideologies, play a role in sustainability transitions, as they push the dominant regime to change, thus opening a window of opportunity for niches to emerge (Geels, 2002; Geels & Shot, 2007).

The term socio-technical regime refers to the predominant constellation of actors, rules and institutions, routines and beliefs, technologies, and infrastructures, present in a specific socio-technical system (Geels, 2002; Geels, 2011). The socio-technical regime encompasses six different dimensions, which are listed and explained in the following table.

Table 2

Socio-Technical Regime. Content adapted from Geels (2002).

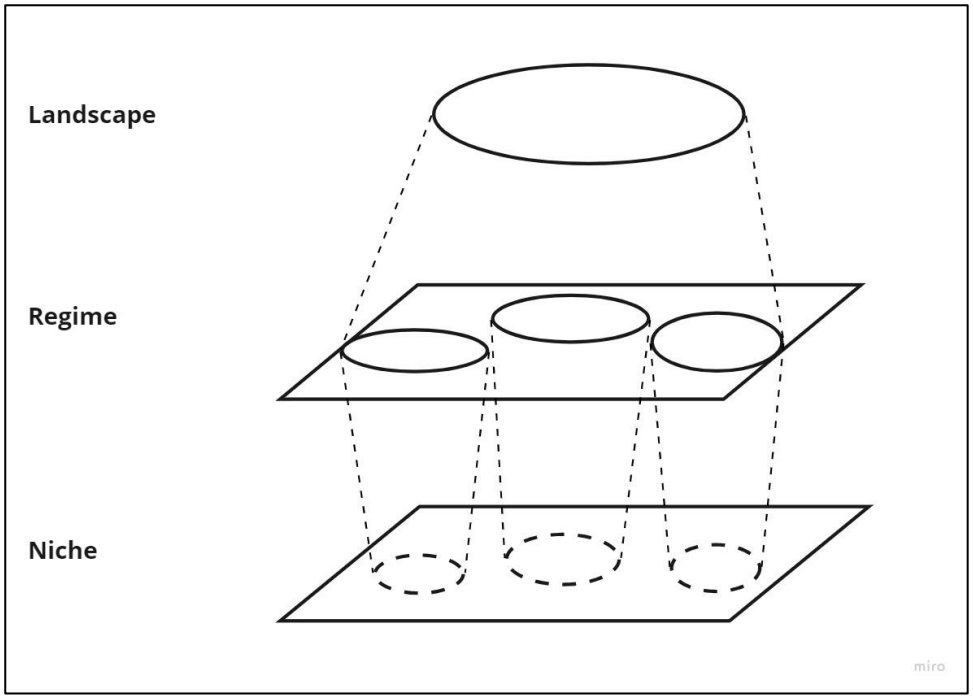
Regime	Explanation
Industry Structure	Constellation and power of different actors involved in production
Policy	Policy measures that reinforce current modes of production and consumption
Technological infrastructure	Current infrastructure for production and state of technology
Media Attention and Awareness	Cultural and symbolic representation of technology in the media
Market and User Preferences	Market and user preferences in regards to the technology
Scientific Knowledge Base	Perspective on the technology promoted by research and education

The regime is usually stable and path-dependent, as these elements interact in unchanging ways for economic, social and political reasons (Geels, 2002; Geels, 2011). The stability of socio-technical regimes poses a challenge for sustainability transitions to take place (Geels, 2011). Consequently, often sustainable innovations emerge in niches - less stable constellations of rules, technologies and actors (Geels, 2002). **Niches** are spaces that are protected from the regime's pressures, thus permitting changes and innovations

to emerge (Smith & Raven, 2012). Radical sustainability innovations can emerge in this space. Whether or not the niche will emerge and influence a sustainability transition depends on the interactions between landscape, regime and niche (Geels, 2011; Smith & Raven, 2012).

Figure 1

Niche-Regime-Landscape Interactions. Adapted from Geels (2002)



2.1.3 Conditions for Niche Innovation Success

While MLP offers a general framework to understand how transitions come about, strategic niche management theory offers a more practice-oriented perspective on the role of niches in sustainability transitions (Kemp et al., 1998; Raven et al., 2010; Schot & Geels, 2008). According to SNM, sustainability transitions come about by successfully building niche innovations, which have broader potential for developing and diffusing in mainstream society (Kemp et al., 1998; Raven et al., 2010; Schot & Geels, 2008). Niche building, development and diffusion happen at different stages (Raven, 2012). The first three stages are niche-building processes, which happen within the niche (Kemp et al., 1998). Once a niche is successfully created, for a niche to develop further and diffuse, it must also experience favorable external conditions in regimes and landscapes (Raven, 2012; Schot & Geels, 2008).

Thus, the potential for a niche innovation to develop and diffuse in society depends on the way it interacts with two levels: the landscape and the regime. On the landscape level, the socio-economic-cultural context must be favorable. Changes in the landscape level must be present, which put pressure on the regime, creating windows of opportunity for niches to exert their power (Raven, 2012). Thus, the niche must experience a favorable and compatible landscape to have hopes to grow and diffuse (Smith, 2006). If such windows of opportunities are present, it's the niche-regime interactions that determine whether the niche innovation will be able to grow and diffuse (Smith, 2006). The breakthrough of niche innovations in the regime usually depends on its potential alignment to the regime. The commonly agreed idea in SNM is that the likelihood of a niche innovation to breakthrough depends on the degree of congruence between the existing regime and the niche innovation (Raven, 2012). Successful niches should not be too radically different from the incumbent regime. Rather, a high degree of compatibility with the assumptions, practices and rules of the regime eases niche growth, allowing the innovation to develop and diffuse (Smith, 2006). Contrarily, when compatibility is low, niches usually are unable to grow, and enter the

mainstream (Smith, 2006). This characteristic of niches is also referred to as linking potential (Smith, 2006). In sum, the hypothesis formulated by MLP and SNM is that niches are more likely to develop and diffuse in society when they:

(a) Experience a favorable landscape context
(b) Show a degree of compatibility with the incumbent regime, which is defined as the "degree of consensus over assumptions, practices & rules" (Ingram et al., 2015).

2.1.4 Transitions Theory for the Food Sector: Debates and Controversies

Sustainability transitions theory is a well-established theory that has emerged to explain transitions in the energy and mobility domains. While these theories have proven useful in understanding the dynamics of change in some domains, some scholars have criticized its application to other sectors, in particular the food one (Audet et al., 2017; Davidson et al., 2016; El Bilali, 2019; Feyereisen et al., 2017; Lutz & Schachinger, 2013; Vlahos et al., 2017). Scholars have pointed out that the blind application of transition theories to the food sector disregards its peculiarities compared to other domains, in particular the central importance of social practices and norms (El Bilali, 2019; El Bilali, 2020). To illustrate this, El Bilali (2019) makes a simple comparison of the effect on end-users of transitions in the energy and food domains: while the end user is barely influenced by a switch of their energy providers from fossil fuel to renewable energy, transitioning away from meat products has a great influence on the end user, which will need to revise his eating habits, cooking practices, traditions and cultural influences. While culture is not that central in sectors such as the energy one, it is paramount in the food domain, such that food culture is a rich field of study in anthropology (El Bilali, 2019; El Bilali, 2020).

To accommodate the complexity of sustainability transition processes and the peculiarities of the agro-food system, scholars are calling for an integration of MLP with different theories and concepts (El Bilali, 2019; El Bilali, 2020). Multidisciplinary and transdisciplinary research is required to improve the applicability of MLP to sustainability transitions in agri-food systems to better understand and foster change (El Bilali, 2019; El Bilali, 2020). By researching the role of food culture in food transitions, this research aims at doing precisely this: introducing concepts and frameworks of food culture theory to transitions theory, to better understand the dynamics of change in the food sector.

2.2 Food Culture Theory

2.2.1 What is Food Culture?

Food culture theory emerged in the fields of anthropology and sociology (Anderson, 2014). Scholars view food consumption not as the simple act of nutrition, but as a practice filled with much deeper meaning (Anderson, 2014; Barthes, 2012). According to Anderson (2014) food consumption functions as an identity signal. People and groups signify their individual and group identities through food consumption, which is charged of socio-cultural significance (Anderson, 2014). Similarly, Barthes (2012), one of the most prominent scholars of food culture theory, describes food as a way of communication, a protocol of usages, situations, and behavior. Food is not solely a source of nutrition, but a cultural institution that communicates values, images, lifestyles, and ideologies (Barthes, 2012). It follows logically that patterns of food consumption change depending on the social, cultural, or religious context, and cannot be understood without references to it (Douglas, 1972). As geographical boundaries are often used to ascribe a certain social, cultural, or religious context, scholars usually refer to food culture as belonging to a certain country or region of the world (Yin et al., 2020).

It is important to note that while different definitions of food culture exist, all of them have two main characteristics in common: stickiness and complexity. Stickiness refers to the relative stability of food culture. Food cultures form over a long period of time and are usually very stable and difficult to change (Holm & Møhl, 2000; Williams et al., 2012 Yin et al., 2020). Consequently, they have a big role in facilitating

or opposing food transitions (Yin et al., 2020). Also, food culture is a complex concept as it is characterized by much more than solely the eating habits of a particular population (Barthes, 2012; Wahlqvist, 2007; Yin et al., 2020). As food culture is embedded in broader systems of production and consumption practices, the term encompasses many different dimensions. For example, Wahlqvist (2007), states that food culture is influenced by many different factors, such as community of belonging, natural resources, religious beliefs, education, ethnicity, technology and health care. Similarly, Yin et al. (2020) state that food culture is informed by "a certain country's or region's systems of agricultural production, food processing and trade practices, purchase level, eating habits and cultural tradition" (p.2). A useful and encompassing definition is provided by Sobreira et al. (2018), which encompasses both the stickiness and complexity of the concept: food culture is "the set of representations, beliefs, knowledge and practices inherited and/or learned that are associated with food and shared by individuals of a certain culture of social group" (p.2).

2.2.2 Why Does Food Culture Matter in Transitions?

According to different scholars, these two characteristics of food culture – complexity and stickiness - makes it an important element to consider in studies of food transitions (Yin et al., 2020; Holm & Møhl, 2000; Williams et al., 2012). If we consider food culture to go beyond eating patterns and informing a whole country's systems of beliefs, knowledge and practices when it comes to food, it is going to have an important place in the dynamics of change of food systems. As Counihan and Van Esterik (2013) argue, the transformation of food systems cannot be understood without understandings of food culture, as the broader socio-cultural meaning of food shapes the system itself. Furthermore, if food cultures are usually stable, and difficult to change, they can also represent an important barrier for food transitions to happen (Yin et al., 2020).

Despite the importance recognized by some scholars of cultural factors in food transitions, food culture has often been ignored in research (Graça et al., 2019; Macdiarmid et al., 2016; Yin et al., 2020). To respond to the need to introduce cultural consideration in studies of sustainable food transitions, this research will integrate transition theory with food culture theory. Integrating these two strands of research serves the explorative aim of this research - generating new understandings of how food culture influences niche innovation success in food transitions.

2.3 An integrated framework

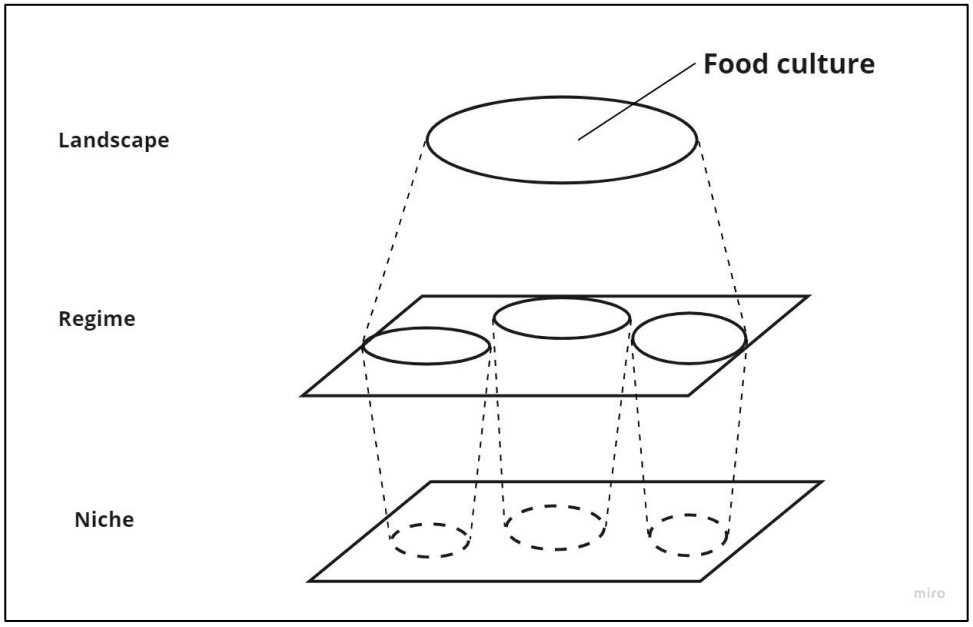
Different scholars emphasize that food culture is worth considering in transformations of food systems transitions, as food consumption and production patterns are heavily shaped by socio-cultural factors (Aiking & de Boer, 2020; Béné et al., 2020; Crivetis & Paredis, 2013; Graça et al., 2019; Yin et al., 2020). This peculiarity of agri-food systems requires an integration of socio-cultural elements in transition theory (El Bilali, 2019). As explained earlier, a multi-level perspective on transitions views innovation systems as resulting from the interactions between three levels: landscapes, regimes, niches. For niche innovations to develop and diffuse in society two conditions need to be fulfilled: (1) niches must experience favorable landscape conditions, (2) niche-regime compatibility must be high. Thus, one of the necessary conditions for niche innovations to develop and diffuse, is a favorable landscape context. As previously explained the landscape refers to the exogenous cultural, environmental, economic and political context, which forms the external context for the interaction of actors (Geels & Schot, 2007). It influences the regime, creating windows of opportunities for niche innovations to emerge (Geels & Schot, 2007).

Where exactly does food culture factor in these dynamics? The definition of landscape in and of itself includes a cultural dimension. However, in practice, the cultural dimension of the landscape is often underplayed in applications of the MLP framework (El BIlali, 2019; El Bilali, 2020). The reasons are mainly two: often the theory has been applied to contexts where culture mattered less, such as the energy one; secondly, culture is a difficult concept to measure and is consequently often understudied (El Bilali, 2019; El

Bilali, 2020). However, cultural factors are part of the broader landscape context in which transitions happen and are of primary importance in a domain so dominated by culture as the one of food (El Bilali, 2019; El Bilali, 2020, Yin et al., 2020). If one of the conditions for a niche innovation to be successful is that they experience a favorable landscape context (Geels, 2002; Geels, 2011; Geels & Schot, 2007), and food culture is central to the exogenous context (El Bilali, 2019, El Bilali, 2020), it follows that one of the conditions for niche innovation to develop and diffuse is that they experience a favorable food culture. As part of the landscape, food culture influences niche innovation development and diffusion in at least two ways. Firstly, it might provide or not a favorable context for some niches to emerge. Niches innovations are likely to emerge and diffuse only if the landscape presents a window of opportunity, thus creating a new need that niches can fulfill. Secondly, food culture as part of the landscape has a role in the structuring and restructuring of the regime. By influencing the regime structure, food culture also influences niche-regime dynamics. In sum, as part of the landscape of the innovation system, food culture has an important role in creating a window of opportunity for relevant niches to emerge and influencing niche-regime dynamics.

Figure 2

The Role of Food Culture in Niche-Regime-Landscape Interactions. Adapted from Geels (2002)



3. Research Design

3.1 Sample Strategy and Case Selection

3.1.1 Most-Similar-System Design: Italy and the Netherlands

A qualitative comparative case study has been selected for the purpose of this research. Studying the role of food culture in niche innovation success, requires in-depth, detailed knowledge, that a small comparative case study allows for (Bennett, 2004). In fact, studying interactions between landscape, regime and niches, and the role of food culture therein, involves studying assumptions, practices, rules and discourses at different levels, which require a qualitative analysis. For this reason, generally transition theories have been applied to single-case studies or small comparative studies (Roberts, 2017; Roberts & Geels, 2018; Rosenbloom et al., 2016; Smith, 2006). While still providing for in-depth, detailed knowledge, a

small-N comparative study provides with a better ability to contextualize compared to single case studies (Bennett, 2004).

A most-similar system design is applied, meaning that the two cases presented here are similar along several different control variables, while differing on the main variables under study. Following this reasoning, the Netherlands and Italy have been selected. The two countries are subject to similar landscape pressures to reduce their consumption of animal-derived sources of protein. Both countries are pressured by the climate crisis to change their dietary trends and are subject to similar supranational regulatory pressures. For instance, they are both urged by the European Union's Farm to Fork strategy, which governs the European transition towards fair, healthy and environmentally friendly food systems, to reduce their meat and dairy consumption (European Commission, 2020). Furthermore, they are both signatories to the Paris Agreement, and therefore have commitments to reduce their national aggregate GHG emissions (UNFCC, 2015). Finally, they are both signatories of the European Soya Declaration of 2017, with which the countries commit to reduce imported soy in favor of growing more plant-based protein crops (Zero Waste Scotland, 2020). The two countries also have similar levels and rates of economic growth, which are factors that are found to strongly influence dietary changes (Gandhi & Zhou, 2014; Nelson et al., 2018). The two countries also exhibit similar characteristics at the regime level. Both countries have a large livestock industry. Consequently, the actors of the livestock sector also have a strong influence on shaping institutional and market changes (Bos et al., 2013; Coderoni et al., 2015).

The countries, however, differ in their food culture, as well as in the growth of a PBMSs market. In Italy, food culture is informed by long-lasting local traditions, a strong attachment to local knowledge, and food quality and taste considerations. The Made in Italy logo in the agri-food sector is a symbol of attention to quality and traditional knowledge (Benini, 2018; Montanari, 2013). Compared to Italy, the Dutch food culture is more innovative and less attached to local traditions (Otterloo, 1990). The colonial history of the country has influenced the food culture of the Netherlands, which is influenced by different world cuisines and is more open to change. The innovative stamp of Dutch food culture is also visible in the attention to innovation in the food sector, where high-tech knowledge and infrastructure is often employed for food production (Otterloo, 1990).

The two countries are both on the path of reducing the amount of animal protein in the country's dietary patterns (Our World in Data, n.d.). However, the two pathways taken by the Italy and the Netherlands seems to differ: the level of development and diffusion of PBMSs in the two countries is strikingly different. The Netherlands is considered a frontrunner in plant-based meat substitute innovation (Tziva et al., 2020), with one of the biggest and rapidly growing markets for meat substitutes in the world, with an estimate of market size of €174 m (Changing markets foundation, 2018; Smart Protein, n.d.). The size of the market for plant-based meat substitutes in the Netherlands is valued almost double than in Italy, where it stops at around €100 m (Smart Protein, n.d.). If the size of the two countries is also accounted for, the difference in market share is quite striking. Finally, conducting research about the two countries is feasible for the researcher, who has extensive knowledge of the countries, a good command of the languages spoken in both contexts, and accessibility to people active in the sector.

3.1.2 Plant-based Meat Substitutes as Niche Innovation

The research studies what factors determine the differences in the paths taken by Italy and the Netherlands in the protein transition, and the role of food culture therein. Many different niche innovations could serve as a case study for the protein transition, as it is not characterized by a unique product or practice. Here, PBMSs will be used as a case study. There are four main reasons for this choice. Firstly and most importantly, they provide the perfect case to understand the importance of food culture in protein transitions. In fact, it allows to show how and why in an attempt to move towards a protein transition, the pathway privileging PBMSs seems to be taken in one country but not in the other. Secondly as it is a

product, it is easy to measure its success and growth compared to innovation in practices, such as dietary changes (Schaltegger & Wagner, 2011). Thirdly, PBMSs are a product that is receiving much attention in the Global North as a radical innovation driving the protein transition, which has enormous potential to reduce overall meat consumption by proposing a convenient, ready-to eat plant-based source of protein (He et al., 2020). Finally, as innovation theories were born to study technological innovations, PBMSs are well suited as they are technological innovations themselves (Markard et al., 2012)

3.2 Operationalization

3.2.1 Food Culture

The concept of food culture, and how it is relevant to sustainability transitions in the food sector, has already been introduced in the theoretical section. An operational definition of the term food culture will be provided here, to avoid misunderstandings of the term. Different definitions exist of the term, but all of them have in common two aspects: complexity and stickiness. The stickiness of food culture refers to its relative stability, meaning that food cultures change slowly over a very long period (Barthes, 2012; Counihan & Van Esterik, 2013; Yin et al., 2020). Secondly, all definitions of food culture view it as a complex concept, which encompasses much more than solely eating habits of a particular population (Barthes, 2003; Wahlqvist, 2007; Yin et al., 2020). For example, Barthes (2003), one of the most prominent scholars of food culture theory, describes food as a cultural institution, as it is based on routines, behaviors, ideas and meanings. The breadth of the concept is also understood through the words of Wahlqvist (2007), who states that food culture does not refer only to eating habits, but to the whole systems of production and consumption of food in a certain region, as well as the cultural dynamics that uphold it.

For this thesis, the definition by Sobreira et al. (2018) will be used, which encompasses both the stickiness and complexity of the concept: food culture is "the set of representations, beliefs, knowledge and practices inherited and/or learned that are associated with food and shared by individuals of a certain culture of social group" (p.2). Firstly, this definition requires specifying a certain culture or social group. In this research, the social groups or cultures which will be taken into consideration are respectively the Italian and Dutch food cultures. Thus, the country level is the level of analysis. Why these two countries have been chosen is explained in the case selection section. Relevant questions will be asked to capture the different elements of this definition. The table below provides some examples of the questions that might be asked to understand important elements of food cultures in the countries under study.

Table 3

Operationalization of Food Culture

Dimensions of food culture	Examples of questions
Beliefs and representations	What are the representations and beliefs surrounding meat in your own country? What are the representations and beliefs regarding PBMSs in your country?
Knowledge	Is there any knowledge of recipes and products that include plant-based protein in your own country?
Practices	Is meat consumed often, in what quantities and on what occasions? What sort of practices exist in your own country around food consumption and preparation?

3.2.2 Protein Socio-Technical Regime

In Multi-level Perspective theory, the term socio-technical regime refers to the predominant constellation of actors, rules and institutions, routines and beliefs, technologies, and infrastructures, encompassing a specific socio-technical system (Geels, 2002; Geels, 2011). It is important to note that the regime is

constituted by a patchwork of different regimes, including for example the policy one or the technological one. In the theory section the different elements characterizing the socio-technical regime have been identified and defined. The definitions previously identified for food socio-technical regimes are here operationalized for the specific case of the protein socio-technical regime. This allows the researcher to ensure validity during data collection and data analysis. The figure below indicates and explains the different sub-regimes of the protein socio-technical regime.

Table 4

Protein Socio-Technical Regime

Regime	Explanation
Industry Structure	The constellation and power of animal farming companies, and their openness to change towards a protein transition.
Policy	Policy measures that reinforce or undermine current modes of protein production and consumption, for example subsidies schemes for protein production, emissions standards for protein production, dietary standards for protein consumption.
Technological infrastructure	Current infrastructure and state of technology for protein production, for example existing production plants, machinery and technologies
Media Attention and Awareness	Cultural and symbolic representation of animal and plant-based protein in the media.
Market and User Preferences	Market and user preferences regarding proteins sources.
Scientific Knowledge Base	Perspective on the protein transition promoted by research and education, for example the level of importance given to the protein transition.

3.2.3 Regime-Niche Compatibility

Regime-niche compatibility can be defined as the "degree of consensus over assumptions, practices & rules" (Ingram et al., 2015). The degree of compatibility between niche and regime varies on a spectrum from compatible to oppositional. The framework by Ingram et al. (2015) on niche-regime compatibility will be adopted, as it's one of the few studies that clearly operationalizes niche-regime compatibility. By using the framework by Ingram et al. (2015), subjectivity in evaluating results can be minimized and validity of results can be ensured.

Table 5

Operationalization of Degree of Regime-Niche Compatibility. Adapted from Ingram et al. (2015)

Degree of compatibility	Operationalization
Compatible	Common assumptions, practices & rules
Complementary	Some shared assumptions, practices & rules
Emergent	Some shared assumptions, practices & rules but some differing values. New rules, languages, paradigms emerging
Divergent	Limited sharing of assumptions, practices & rules. New rules, languages, developing
Oppositional	No shared goals, values, practices, rules & guiding principles. Contrasting paradigms

3.2.4 Niche Innovation Development and Diffusion

The level of niche innovation development and diffusion is operationalized as the size of the market of plant-based meat substitutes, which are the niche innovations under study. Plant-based meat substitutes are defined as "products that take the place of meat in the human diet and have an appearance, texture and taste similar to meat products" (Tziva et al., 2020). The size of the market share of a niche is a measure commonly used in innovation studies to operationalize the level of success of a niche innovation in entering the mainstream (Schaltegger & Wagner, 2011).

3.3 Data Collection

In order to answer the research question, primary data will be analyzed. Data will be collected through semi-structured interviews. The primary reason for this choice is that semi-structured interviews allow to maintain focus on the main topic of research, while being flexible enough to let the interviewee's ideas and understanding of the process emerge freely (Bryman & Bell, 2015; Sreejesh et al., 2014). Furthermore, semi-structured interviews usually generate detailed data, which is useful for a small-n comparative study aiming at generating in-depth knowledge of the cases (Bryman & Bell, 2015). Finally, semi-structured interviews allow for new information to emerge, which can be useful for a study that is more of an exploratory nature, rather than hypothesis testing (Bryman & Bell, 2015).

The reliability of the results was ensured by interviewing ten experts from the two countries working in different types of companies. Interviewees were selected from a population of interviewees, working in the niche development of plant-based meat substitutes. This includes food retail companies, PBMSs companies, and food tech consultancy. Interviewees were selected amongst this population according to purposive sampling. In purposive sampling, the researcher chooses the interviewees based on who is thought to be able to answer the research objective (Henry, 1990). This type of sampling is often used when expert knowledge on a specific topic is required, thus it is useful to select experts who are involved with plant-based meat substitutes (Henry, 1990). The interviewees were asked about the protein innovation system and dynamics in their own countries and the role of food culture therein. The interviews were conducted primarily online through video calls. Compared to interviews administered by telephone, they have the advantage to let body language and vocal cues emerge and are better for open-ended questions and to generate in-depth knowledge (Lo Iacono et al., 2016; Weller, 2017). Compared to face-face, they have the advantage of saving time and costs for travel (Lo Iacono et al., 2016; Weller, 2017). Interviews were conducted in English in the Netherlands, and in Italian in Italy. Furthermore, to improve the reliability of the results, the information collected in the interviews was fact-checked through secondary sources.

3.3.1 Ethical Considerations

Ethical issues related to data collection, handling and storage were handled according to General Data Protection Regulations (GDPR). Before each interview, the interviewee was informed by the interviewer on what interview participation entails, the reasons for the data collection, as well as high rights and duties. As the interviews were performed by videocall, the information was shared orally.

3.4 Data Analysis

The data emerging from the interviews will be analyzed by means of a qualitative content analysis. Qualitative content analysis is an interpretive form of analysis which aims at uncovering meaning and motives in text (Berelson, 1952; Hsieh & Shannon, 2005; Krippendorf, 2018). Its main advantage is that it allows to analyze in-depth, rich data in a valid and reliable way by coding (Berelson, 1952; Krippendorf, 2018; Elo et al., 2014). As innovation processes are complex phenomena, using a method of analysis that allows for the analysis of rich information is paramount. Furthermore, it provides valuable cultural insights (Berelson, 1952), which are given great importance in the context of this research.

The content analysis was conducted on the NVivo software, which is a software for qualitative content analysis. The analysis was guided by a coding sheet informed by the main elements of the conceptual framework, which have been conceptualized and operationalized in the previous section. The coding sheet, which can be found in the Appendix (mention section), includes the different elements of the regime in the MLP (policy, industry, technological infrastructure, scientific knowledge base, market and user preferences, media representation). It also includes the categories Italian food culture and Dutch food culture (beliefs and representations, knowledge, practices) as well as the influence of food culture on niche emergence and on the regime. Following the framework, the themes previously identified will be searched for in the text, and paragraphs and sentences will be coded accordingly. The interviews will be coded manually on the NVivo software by the researcher, as machine-assisted content analysis is more indicated for quantitative types of research (Elo et al., 2014).

4. Results

4.1 Niche-Regime Compatibility and Niche Innovation Success

4.1.1 The Protein Regime in Italy

4.1.1.1 Policy

Four out of five experts agreed on the fact that currently in Italy the plant-based meat industry is not supported by governmental policy, while one of them declared that he did not know enough about policy developments. According to all four respondents, no public funds are available for research in the plant-based industry sector, leaving the sector with little state-funded financial resources. The same goes for plant-based meat production, as there are no available subsidies and grants that start-ups and companies can apply for to increase capacity and infrastructure. This is confirmed by the official documents of the Italian Government on the strategy for innovation and research in the food sector (InnovaRurale, n.d.). This seems to represent a significant barrier: one respondent explained that because production of such products is still low and economies of scale cannot be achieved, production costs are very high. Furthermore, three interviewees referred to the lack of policies in the country supporting innovation and early start-up enterprises in general. Such policies don't favor a flourishing start-up ecosystem, where innovative plant-based meat companies might be able to emerge more easily.

According to one respondent "*In Italy, sectoral policy on PBMS is characterized by an absolute state of immobilization, where no policy is made neither in favor nor against PBMS".* Two other respondents also pointed out that the Italian policy regime strongly favors the incumbent meat industry. According to them, many subsidies exist supporting animal agriculture – information that is confirmed by official governmental sources (Ministero delle Politiche Agricole Alimentari e Forestali, 2021). This subsidy system allows the meat industry to drive the price of products down and make them more competitive on the market. According to one respondent, the true cost of meat should amount to 3 to 5 times more than current prices.

4.1.1.2 Industry

According to four out of the five experts, meat companies in Italy are strongly opposing a protein transition towards plant-based meat substitutes. Italian meat companies are hardly making any effort to develop a plant-based line of products in their company. This trend is quite different to what is happening in other countries – two interviewees explained that in many other countries, such as the Netherlands, big meat companies are diversifying their risks by starting to produce themselves plant-based meat substitutes. No transformation from the inside is seen in Italian meat companies, who are showing a high level of resistance to the development of such products.

Furthermore, two of the experts explained that Italian meat companies are also showing resistance to PMBS in their external relations. Strong lobbying has been carried out by the meat sector against the rise of

the plant-based meat sector, with the meat industry opposing any political discussion on a protein transition. In particular, the interviewees referred to two big national associations in Italy, Coldiretti and Assocarni, representing respectively the agriculture and meat industry sectors of the country, which are strongly opposing any transition away from animal meat. An example of the strong opposition of the meat industry is the campaign led by Coldiretti and other organizations in Italy against the public statements by the Minister of the Ecological Transition about the need to reduce livestock emissions in the country (dell'Orefice, 2022). Their campaign, called "Carni Sostenibili", aims to convince readers of the health benefits of eating meat and the fact that meat can be produced sustainably (Carni Sostenibili, 2016).

4.1.1.3 Technological Infrastructure

According to one of the experts, the CEO of a plant-based meat substitutes company in Italy, the technology for PBMS is developing fast. The first commercially successful plant-based products were developed in the United Kingdom around thirty years ago, and since then much has been done to increase their quality. Nowadays, compared to the past, taste, texture and other characteristics of PBMS have improved. The CEO of one of the biggest plant-based meat substitutes company in Italy, as well as a food-tech consultant working on PBMS, mentioned that the technology in question is not revolutionary in food processing. They stated that the most common technology used to create PBMS is high moisture extrusion technology, which is a food processing technology used for many other common food products, such as pasta. This is confirmed by literature on the topic (Akdogan, 1999). The fact that the technology used is very similar to the one used to produce pasta, constitutes an advantage in terms of technological infrastructure for Italy: the technological infrastructure needed to produce plant-based meat substitutes are like the ones used to produce one of the main food products produced in Italy.

4.1.1.4 Scientific Knowledge Base

Two of the interviewees talked extensively about the lack of attention devoted in Italian education and research to the protein transition. One of the interviewees, who has recently graduated and joined a PBMS company as a food technologist, has talked in this regard about her experience in research institutes and universities in Italy. The protein transition was not a topic that was discussed and researched during her university education, nor in food technology research centers. The impression of the interviewer was that university professors and researchers in the sector always downplayed the effects of animal agriculture on the environment and human health, and rather considered more important other issues, such as agricultural methods.

The lack of attention to the protein transition in education and research is also visible in the lack of skilled workers and researchers in the sector. The CEO of a plant-based meat company in Italy has stated that they usually need to call experts from other countries to work on product design, as well as on research and development. Often food technologists are called from third countries, such as the Netherlands, Germany or Israel, where people with expertise in the PBMS sector are easier to find. The lack of attention to the protein transition and PBMSs in Italian education and research, creates a barrier in the Italian context, as a strong scientific knowledge base and expertise are consequently lacking.

4.1.1.5 Market and User Preferences

According to two of the Italian interviewees, flexitarians are usually the targeted consumers for plant-based meat products. Vegetarians and vegans have already found plant-based alternatives to meat and are usually not keen to eat products with similar texture and taste to animal products. On the other hand, these products are usually targeted at people that want to reduce their meat consumption. However, compared to other European companies, the flexitarian trend is still relatively low. It is starting to become more common, especially among young consumers living in big cities, but it's still a small part of the population. These ideas are confirmed by data on flexitarians in Italy, which suggests that only 12% of the population identifies as such, which places Italy below the European average (Statista, 2021).

4.1.1.6 Media Attention and Awareness

Three out of five of the interviewees have referred to the blindness of broadcast Italian media to the issue of animal farming. One interviewee explicitly said that *"if you read the Guardian or the BBC the most mentioned causes of climate change are fossil fuels and intensive farming. But when you read an Italian newspaper, intensive farming is never mentioned".* According to the interviewees, the lack of attention in national media on the link between intensive farming and climate change is at the root of the lack of awareness of the general Italian population of the negative impact of animal agriculture. Furthermore, three of the interviewees raised the issue that there is a negative depiction of vegetarians and vegans in broadcast media, which are often portrayed as making harmful choices for their own health or for their families. For example, one the interviewees recalls reading in on one of the main national newspapers that *"a child, son of vegan parents, had died of malnutrition"*, establishing extremely negative depictions of people who choose to follow vegan diets. Thus, while many scientific articles argue for the health benefits of vegetarian or vegan diets, or for reducing the intake of meat, this is not always the picture that comes across in Italian media, which tends to be skeptical of such food choices.

Another interviewee exemplified the issue by referring to the fact that plant-based meat substitutes in Italy are usually referred to by the media as fake meat, thus contributing to a negative connotation of the product. In sum, most interviewees agree that Italian media is not attentive to the environmental impact of animal farming, and negatively depicts vegetarianism and vegetarian products, thus creating a symbolic negative imaginary of PBMSs. These ideas are confirmed by studies on Italian media coverage on vegetarianism (Almiron & Zoppeddu, 2015).

4.1.2 The Protein Regime in the Netherlands

4.1.2.1 Policy

Four out of five interviewees acknowledged that there are many policies in the Netherlands that are stimulating the growth of the PBMS market. The National Protein Strategy was mentioned as the overarching policy strategy the Dutch Government has put in place to support the growth of the plant-based market. With this strategy, the Dutch Government has publicly recognized the issue of continued production of meat protein and formulated several goals and actions to move towards plant based. According to two interviewees, such a strategy includes measures to stimulate innovation and R&D in the sector, for example in the form of investment funds. Another policy that was mentioned was the plan of the Dutch Government to buy out big animal farms, to cut livestock numbers to reach GHG emissions reduction goals.

Two of the interviewees also mentioned the importance of Dutch policy to favor entrepreneurship and innovation in the plant-based sector, for example through the availability of investment capital. These ideas were fact-checked through official governmental sources (Minister of Agriculture, Nature, and Food Quality of the Netherlands, 2019). One interviewee talked about the pivotal role governmental policy has taken already 15 to 20 years ago in incentivizing the PBMS market. Around 20 years ago the Ministry of Agriculture forwarded an important array of policies, incentivizing many research programs into plant-based protein alternatives. This allowed young companies to enter the market 10 to 15 years ago. At the same time, three out of five interviewees, seem to recognize that the position of the Dutch Government is some-what ambivalent. While on the one hand, some policies are incentivizing the plant-based niche, others seem to continue to support traditional animal agriculture. In particular, subsidies were mentioned as the main governmental policy that continues supporting animal farming, making plant-based meat substitutes less competitive on the market because of higher costs.

4.1.2.2 Industry

Four out of five respondents seemed to agree that many big meat companies in the Netherlands are beginning to embrace change. Such companies are slowly coming to the realization that there is no way out

of the protein transition, so they are starting their own lines of plant-based meat products. Two of the interviewees mentioned the example of one of the biggest plant-based Dutch companies, Vivera, who was born as a spin-off of a meat company. Dutch meat companies seem to think that investing in plant-based substitutes might help them reduce financial risks associated with the protein transition. The overall opinion is that meat companies are starting to produce some plant-based products themselves to secure competitive advantage and long-term sustainability of the company. These ideas are confirmed by literature on the topic (Aan den Toorn et al., 2018).

On the other hand, two of the interviewees mentioned that even though animal farming companies have started producing plant-based products, they are also slowing down policy development through lobbying. This is confirmed by data on lobbying by the Dutch Meat Association, published by lobby facts, according to which a range of 100,000€ - 199,999€ was spent in 2019 by the meat industry to favor their own interests in animal farming (LobbyFacts, n.d.).

4.1.2.3 Technological Infrastructure

Three of the interviewees, amongst which the CEO of one of the biggest PBMS companies in the Netherlands, attribute part of the success of PBMS production in the country to existing infrastructure. The Netherlands is an agri-food tech powerhouse, with many laboratories, innovation hubs and food production plants. This has favored the growth of PBMS production in the country, as many R&D and innovation establishments were already present in the Netherlands, favoring the creation of such new products. Furthermore, at the production level, many factories and existing machinery for food production and processing can be repurposed for PBMS production. This facilitates PBMS production, as lower costs and shorter times must be borne for building up infrastructure. These ideas are substantiated by Omta and Folstar (2005), who state that the Dutch agri-food system is at the frontier of food tech, and its flourishing entrepreneurial ecosystem is where many innovative products are created.

4.1.2.4 Scientific Knowledge Base

One of the interviewees, a PhD student researching the dynamics of the protein transition in the Netherlands, has talked about the importance given to the study of the protein transition in Dutch education and research. Much research is devoted in Dutch universities to the topic of the protein transition, highlighting why a plant-based diet can help reduce the environmental impact of our food systems. In particular, the interviewer has talked about the focus on technological solutions to environmental problems in the Dutch context. For example, in the case of the protein transition, much research in the Netherlands is focused on the development of plant-based meat substitutes, a technological solution to the environmental consequences of animal farming. Less attention is devoted in the Dutch context to other perspectives in the protein transition, such as a more systemic ecological vision on circular farming which places humans as part of a broader ecosystem. The focus on technological solutions is usually encouraged in the Dutch context, as it requires less systemic changes, and it allows to maintain the current lifestyle and society with little disruption. Furthermore, the success and profit of technological solutions are easier to measure, as the market growth of a sustainable technology is quantifiable, in comparison to cultural and behavioral interventions.

The focus on technological solutions to the protein transition in Dutch research and education provides a favorable context for PBMS to emerge and develop. In fact, research done in the academic environment is usually shared with the private sector. As the CEO of one important PBMS company in the Netherlands has referred, the Dutch innovation system is characterized by the “DNA of collaboration” - the Netherlands is characterized by a process of open innovation and technology, where universities and companies collaborate and innovate together, sharing knowledge and technology with each other. These ideas are confirmed by an article by Omta and Fortuin (2013), who talk about the open innovation strategies of the Dutch Food Valley, and its advantages for food innovation.

4.1.2.5 Market and User Preferences

According to three of the interviewees, a general trend is seen amongst Dutch consumers towards a reduction of meat consumption. While the number of people following vegetarian and vegan diets is still low, a big part of consumers is trying to cut down their meat consumption and resorting instead to plant-based meat substitutes. This constitutes a favorable condition for the development of PBMSs, as the market segment they prioritize is the one of flexitarians. In fact, vegetarians and vegans are already used to not eating meat and consuming other sources of plant-based protein and are less likely to buy products which resemble meat in the first place. Instead, flexitarians are often targeted as they are seeking alternatives to eating meat, while still looking for products that resemble it in terms of taste and texture.

These trends which were talked about during the interviews are confirmed by data on trends on flexitarians in the Netherlands. According to study by the European Smart Protein Project (n.d.), the Netherlands has the highest number in Europe of flexitarians, with 42% of Dutch people identifying as such. The country also had the fewest omnivores with 48%, as well as 5% vegetarian and 2% vegan.

4.1.2.6 Media Attention and Awareness

Four of the interviewees have talked about the growing awareness shown in public discourse and media, that animal farming is connected to negative environmental outcomes and poor animal welfare. Two interviewees talked about the strong stance on animal welfare in the Netherlands, which has begun already in the first 2000s. Social movements for animal rights, public media and political discourse, already at the time, were pointing out the damage to animal welfare imposed by animal farming. This idea is confirmed by the fact that the Party for the Animals, a Dutch party advocating for animal welfare, is the first successful political party in the world with a strong animal welfare stance, having won 5 seats in the Dutch Parliament in 2017 (Party for the Animals, n.d.). Furthermore, Dutch media is quite careful to the environmental effects of meat-eating on climate change. Many Dutch public figures have also gone plant-based, drawing awareness on the consequences of meat eating and leading by action.

On the other hand, while discussion on environmental impacts and animal welfare is present in media, there are still some barriers to the protein transition in the mediatic representation of meat. For example, one of the interviewees has highlighted how there still exist in the Netherlands a representation of animal farming as the backbone of the country. Sometimes in the media, positive health effects are attributed to meat, and a false image of animal farming as ethically and environmentally sustainable is still presented.

4.1.3 Summary of Results

Based on the expert interviews, whose ideas have been fact checked through secondary sources, it is possible to assess the compatibility of PBMSs to the Italian and Dutch protein regimes. As explained already in the research design section, to avoid subjectivity the framework by Ingram et al. (2015) will be followed, which established five degrees of compatibility going from oppositional to compatible. The following table presents a summary of results, indicating the degree of niche-regime compatibility for all the six sub-regimes, as well as an explanation of it.

Table 6

Summary of Results: Niche Regime Compatibility in Italy and the Netherlands

	Italy		Netherlands	
Policy	Oppositional	No policies supporting PBMSs: no support for R&D and innovation in the sector, no subsidies	Emergent	Protein Transition Strategy includes policies to stimulate innovation and R&D, buying out livestock farms. Some degree of ambivalence, as

		to encourage production. Support for incumbent regime through subsidies.		some subsidies still support the incumbent animal farming industry.
Industry	Oppositional	No development of PBMSs in incumbent meat companies. Strong lobbying against PBMSs.	Emergent	Many actors in the incumbent animal meat industry have started producing their own PBMSs, to secure competitive advantage. Some ambivalence, as they are still lobbying against some policies for the protein transition.
Technological Infrastructure	Emergent	The technology used for PBMSs is the same used for many other products in Italy. Technological machinery and processes can be repurposed.	Emergent	The Netherlands is an agri-food tech powerhouse. The existing infrastructure can easily be repurposed, lowering time and costs of infrastructure building.
Scientific Knowledge Base	Oppositional	Lack of research and education on PBMSs both in universities and research institutes	Compatible	A lot of research and education on the protein transition. Scientific paradigm focused on technological solutions to the protein transition.
Market and User Preferences	Divergent	12% of flexitarians	Emergent	42% flexitarians
Media awareness and attention	Divergent	Little attention to the negative environmental impact of meat. Negative connotation of vegetarianism and veganism.	Emergent	High attention in the media to the environmental effects of animal farming and animal welfare. Still, a limited part of the media presents meat as a sustainable and healthy option.

4.2 Landscape: The Role of Food Culture in Niche Innovation Success

4.2.1 Factoring in Food Culture: Why Is It Necessary?

The above section on niche-regime compatibility individuates differences in the level of compatibility of PBMSs to the Italian and Dutch protein regimes. According to the results, PBMSs seem to be more compatible to the Dutch regime in five out of the six regimes, and equally compatible in one of them. The

differences in the level of compatibility already partially explains the different levels of development and diffusion of PBMSs in Italy and the Netherlands.

However, as already explained in the theoretical framework, transitions theory tells us that niche-regime compatibility is a necessary but not sufficient condition for niche innovations to develop and diffuse. The second necessary condition is a favorable landscape context, which influences what niches can emerge and the way the niche and the regime interact. Given that the Netherlands and Italy present many similar landscape factors, at the political and economic level, the two countries provide the perfect case to explain how food culture differences might play a role in explaining differences in the two countries. For this purpose, the results will present the different aspects of Italian and Dutch food culture, and explain how they influence niche emergence and niche-regime interactions.

4.2.2 Food Culture in Italy and Influence on PBMSs Success

4.2.2.1 Representations and Beliefs

When discussing representations and beliefs surrounding food in Italy, and their consequences for the development and diffusion of PBMSs, two main elements emerged. These elements were respectively representations and beliefs surrounding highly processed foods and about traditional diets. According to four out of five of the Italian interviewees, Italian food culture is based on the Mediterranean diet and although it has undergone change throughout time, many of its basic principles are still valued.

One of the main characteristics of Mediterranean food culture is the high importance it places on health concerns. Consequently, amongst its dietary guidelines, the Mediterranean diet suggests limiting highly processed foods, preferring whole raw ingredients to foods that have undergone extensive transformation. The reason behind this is that processed foods are often high in sodium, sugar, and fat, which have poor health outcomes. Thus, unprocessed or low processed foods are preferred as they represent a healthier option. These ideas are confirmed by literature on the Mediterranean diet (Poli et al., 2019; Simopoulos & Visioli, 2000). According to three of the interviewees, working either in food retail or PBMS companies in Italy, this is a significant barrier to the diffusion of PBMSs, which are highly processed foods and are consequently not considered as such a healthy option.

Another element that was mentioned by all the interviewees as an important characteristic of Italian food culture is its attachment to traditions. Italian food culture is highly regarded globally and is built on traditions and culinary knowledge that has been passed down generation to generation. There is a strong attachment to traditional products and preparations, making it hard for new products to be accepted. One of the interviewees, working as a food technologist in Italy, mentioned the Made in Italy logo as an example of this. The Made in Italy logo is a world-wide known sign of authenticity, of products that have been produced following traditional knowledge. Such attachment to traditions in Italian food culture is also shown in the little openness to foreign cuisine – as two of the experts working in food retail in Italy mentioned, foreign products, such as tofu or tempeh have little success on the Italian food market, which tends to be quite conservative. These ideas are corroborated by literature on the topic that distinguishes food cultures based on their strong or weak attachment to traditions (Verneau et al., 2016). Furthermore, some of the interviews explained how such a strong attachment to traditions makes it difficult for new innovative high-tech products to enter the market, idea which was corroborated by literature (Verneau et al., 2016).

4.2.2.2 Knowledge

As PBMSs are processed foods, which are discouraged in Mediterranean food culture, many Italians prefer other natural plant-based sources of protein. According to two of the interviewees, this is favored by the fact that the Mediterranean diet is rich in plant-based components. As there is shared cultural knowledge of recipes based on plant-protein, Italians wanting to decrease their meat consumption might rely on

naturally protein-packed vegetables they are already familiar with, rather than on new products such as PBMSs. Three of the interviews talked for example about the importance of legumes in Italian production and consumption, and as a possible competitor of PBMSs. These ideas are corroborated by data on legume production and consumption in Italy. According to Sepngang et al. (2020), production and consumption of legumes in Italy showed a decreasing trend after the post-WWII period but has in recent years increased again to respond to the need for sustainable sources of protein.

4.2.2.3 Practices

An important practice of Italian, and Mediterranean food culture more in general, according to one of the interviewees is conviviality. As meals are usually shared with other people, food is not only perceived as a source of nutrition, but as an important social signal. Eating is "a moment of social exchange and communication, an affirmation and renewal of family, group or community identity (UNESCO, n.d.). The symbolic meaning of food grows in importance in cultures where food is shared, compared to cultures where food is often consumed alone (Monaco & Bonetto, 2019). The food we eat is an important social signal and might create strong feelings of inclusion or exclusion to the social group we are consuming food with (Monaco & Bonetto, 2019). According to a product development expert in a PBMS company in Italy, this represents an important barrier for PBMSs and changes in diets more in general. When eating is a convivial matter, eating something which is not traditionally consumed by the group is often followed by social sanctioning. Examples of social sanctioning include shaming, ridiculing, sarcasm and criticisms, which might discourage people from eating novel foods such as PBMSs.

4.2.2.4 Food Culture in Italy and Influence on PBMSs' emergence: summary of results

Table 7

Food Culture in Italy and influence on PBMSs emergence

	Summary	Influence on PBMS emergence
Representations and beliefs	Convenient, ready to eat foods which are highly processed are deemed unhealthy, and cooking with raw ingredients is considered a healthier option.	As PBMSs are highly processed foods they are considered unhealthy and do not attract that many Italian consumers.
	Strong value placed on traditional foods, ways of preparing and consuming food.	A strong attachment to traditional food is usually pared with diffidence towards trying novel foods, especially ones that are considered high-tech.
Knowledge	Traditional knowledge has passed on a great variety of recipes using plant-based protein.	As recipes with alternative plant-based protein sources are already present in Italian cuisine, there is less of a need for a new product to fill in this gap.
Practices	High consumption of plant-based protein options, such as legumes.	Protein dietary recommendations are fulfilled already by unprocessed plant-based options, thus diminishing the need for an alternative.
	Food is often eaten together, as conviviality is an important element of Mediterranean food culture	When eating is a convivial matter, eating something which is not traditionally consumed by the group is often followed by social sanctioning, thus discouraging the adoption of novel foods.

4.2.3 Food Culture in the Netherlands and its Influence on Niche Success

4.2.3.1 Representations and Beliefs

According to three of the interviewers, in the Netherlands there is a weak attachment to traditions. Rather, according to a PhD student on the protein transition, Dutch consumers are often quite open to try different products. The CEO of one of the biggest PBMS companies in the Netherlands, explained the historical reasons behind this tendency. According to the interviewee, Dutch colonial history plays a big role in the ever-changing Dutch food habits, as it has exposed the country to many different cuisines and diets. Already after WWII, when levels of globalization were lower than they are today, the Dutch were consuming Indonesian food. Dutch eating habits have therefore been for a long time been influenced and fused with culinary cultures from different parts of the world, in Asia as well as in Europe.

The lack of a strong attachment to traditions is also reflected in the positive image of technological advancement in Dutch food culture. Technological advancements in food products or food production methods are often positively received by consumers. High-tech innovative foods, such as PBMSs have a higher chance in developing and diffusing in a context where an attachment to traditional ways of consuming and producing food is not so strong. This idea is also confirmed by Verneau et al. (2016), who have found that consumers in food cultures with a weaker attachment to traditions were more inclined to try out new foods than consumers in food cultures with a strong attachment to traditions.

4.2.3.2 Knowledge

Furthermore, according to two of the Dutch interviewees, Dutch traditional diets are heavily based on meat. According to them, this characteristic of Dutch food culture has paradoxically a positive effect on the growth of PBMSs. As PBMS are products that are similar in taste, texture and use to animal meat products, substituting them with meat does not require learning new recipes, making them easier to substitute in one's diet. As an example, one of the interviewees, talked about the great market success of the plant-based rot worst, a smoked sausage used to make a traditional Dutch meal called stamppot. These ideas are confirmed by the article by Schösler et al. (2012). According to the authors, in countries where meat is the base of traditional diets, consuming PBMSs might be easier because they are a direct substitute for animal meat. In this context, consuming PBMSs does not require learning new recipes and revolutionizing dietary habits.

4.2.3.3 Practices

Two of the interviewees, a PhD studying the protein transition and a food technologist from a PBMS company in the Netherlands, have also argued that meat analogues are popular in the Netherlands because they are a convenient, ready to eat source of protein. Dutch consumers spend little time on food preparation and tend to prefer products that do not require much effort to be prepared, preferring convenience over other characteristics, such as nutritional characteristics. Processed foods represent a big share of the shopping cart in the Netherlands, as they are products that are convenient, both for the short preparation time and for costs. These ideas were fact-checked in the latest reports by the Dutch Ministry of health, welfare and sport (RIVM) (Geurts et al., 2017).

According to the interviews, another common practice which might influence PBMSs success is the lack of conviviality when consuming food. In cultures where food is often consumed alone, consumers tend to be more open to change in their eating habits. This idea is also confirmed by Yates and Warde (2017), according to whom people who often consume food alone are more open to changing their eating habits. The reason behind this is that the symbolic meaning of food is less important in cultures where food is not shared, making novel foods more easily accepted (Monaco & Bonetto, 2019).

4.2.3.4 Food Culture in the Netherlands and Influence on PBMSs' success: a summary of results

Table 8

Food Culture in the Netherlands and Influence on PBMSs' success

	Responses	Influence on PBMSs success
Representations and beliefs	Weak attachment to traditional foods and culture, probably tied to the colonial history of the country and openness towards other cultures.	Food cultures that are less attached to traditional foods and cultures are more open to change, thus favoring new products such as PBMSs entering the market.
	Innovation in food is positively regarded, with Dutch consumers not shying away from high-tech products and methods in food production.	The positive regard of innovative high-tech food provides a favorable context for PBMS, which are an innovative high-tech food themselves.
Knowledge	Little knowledge of recipes including plant-based proteins, meat is a key ingredient to many existing and known recipes.	As PBMS are products that are similar in taste, texture and use to animal meat products, substituting them with meat does not require learning new recipes, making them easier to substitute in one's diet.
Practices	High consumption of ready-to-eat convenience food.	PBMSs are a ready-to-eat convenient source of protein.
	Lack of conviviality during food consumption.	People eating alone are less affected by the social sanctioning that might occur in social settings when trying out novel foods, thus making it easier for PBMSs to enter the market.

4.2.4 The Influence of Food Culture on Niche-Regime Dynamics

The previous section presented the results on the main elements of Italian and Dutch food culture. Furthermore, it explained how such characteristics of the two food cultures might provide or not a favorable context for PBMSs to develop and diffuse. However, this is only one of the mechanisms through which food culture influences PBMSs success. As set out in the theoretical framework, the landscape also influences the way the regime is structured, and consequently influences niche-regime interactions. Food culture influences the different elements of the protein regime: policy, industry, market and user preferences, the scientific knowledge base, and the way the media depicts the topic. As compatibility with the protein regime influences the success of niche innovation systems, food culture indirectly influences the success of food niche innovations. Below, it will be explained how each element of the food regime is influenced by food culture.

4.2.4.1 Food Culture and Policy

According to one of the Italian interviewees, one of the reasons why little funds are available for research and innovation in the plant-based meat sector is the attachment to traditions characteristic of Italian food culture. This idea is confirmed by scholars of food policy, who argue that food culture influences food regulations (Echols, 1998). For example, Echols (1998) uses the case of safety regulation of genetically modified organisms (GMOs) in the European Union and the United States to exemplify this statement. While the USA left the GMO market unregulated, the opposite has happened in the European Union.

According to Echols (1998) the reason is food culture in the respective countries: while in the US change and experimentations with respect to new technologies are highly valued, in the EU there is a tendency for caution as there is a higher attachment to food which is considered close to nature. As policy responds to public support because to be re-elected politicians need the support of the broader public, food policy responds to general ideas and values of the predominant food culture (Echols, 1998).

4.2.4.2 Food Culture and Industry

According to one of the interviewees in the Netherlands, the dominant companies in the food regime reflect the dominant food culture. As an example, the interviewee mentioned the case of milk and the dairy industry in the Netherlands. Milk has been long been considered the backbone of Dutch food culture, as it is a product highly utilized by consumers in the country. Reflecting such dietary trends, companies in the dairy sector have great influence on political power in the country, as they have strong lobbying power.

4.2.4.3 Food Culture and Market & User Preferences

According to a food technologist in Italy and one in the Netherlands, whether people buy and consume plant-based meat substitutes is not an individual choice, but one that is shaped by social and cultural expectations. This idea is confirmed by a cross-cultural study by Weinrich (2018), consumer preferences of meat-substitutes are highly influenced by food culture. The study compared Germany, the Netherlands, and France, which have three food cultures. They vary in the degree of openness to new foods, the motives behind food choices (respectively naturalness of food, convenience, or enjoyment) and eating patterns and times (the extent to which eating is considered a social event). The study finds a relationship between food culture and consumer preferences, showing that individual preferences do not exist in a vacuum but are related to broader cultural patterns (Weinrich, 2018).

4.2.4.4 Food Culture and Media Attention and Awareness

According to a food technologist in Italy, the negative mediatic representation of plant-based meat products in Italian news, is related to an attachment to traditional foods characteristic of Italian food culture. Maintaining culinary traditions is key to Italian food culture, which values authenticity above all, and this is reflected in the media depiction of new foods as a possible threat to existing ones. The relationship between food culture and mediatic representation is confirmed by scientific literature. For example, according to Sehgal (2021), media representation of food is intimately related to food culture, and the social and cultural understandings of food of a particular context.

4.2.4.5 Food Culture and Scientific Knowledge Base

During the interview with a Dutch PhD student studying the protein transition, the link between food culture and the way research is made was discussed. According to her, issues with food systems in the Netherlands are mostly studied from a technological solutions' perspective. According to her, the acceptance of food innovation in Dutch food culture is related to this way of researching issues in food systems. This idea is confirmed by literature on the topic. According to authors in the field of nutrition science, nutrition science does not exist in isolation from local food culture (Wahlqvist, 2007). This has sometimes been a reason for considering nutrition science "less pure", as social and cultural drivers are very influential. An example of this is how despite the Mediterranean diet is recognized as one of the healthiest in the world, its dietary guidelines are only used in the Mediterranean region (Wahlqvist, 2007).

4.2.4.6 Food Culture and Technological Infrastructure

The technological infrastructure that is used in a country's food production is intimately related to a country's food culture. As on the of the Dutch interviewees said, the Dutch food ecosystem is characterized by a broad availability of modern technology for food production and processing, and advanced technological ways of doing agriculture. This is possible because Dutch food culture has historically been open to innovation and the use of technology in food production. The same cannot be said of Italy, where according to one of the interviewees, a substantial share of food is produced by small-holder farmers, using

more traditional and organic agricultural methods. This is in line with Italian food culture, which is strongly attached to traditions and gives importance to the naturalness of food and its quality. The ideas of the interviewees are confirmed by food historian Pilcher (2016). The infrastructure includes both material components (such as transportation, refrigeration, and communication technologies) and immaterial or embodied expressions of knowledge (such as quality certifications and health regulations), and is embedded in local food cultures.

4.2.4.7 The Influence of Food Culture on the Regime: Summary of Results

Table 9

The Influence of Food Culture on the Regime

Food culture and regime	Explanation
Food culture and policy	Because of the election cycle, policies need to have a certain degree of public support. Thus, food policy reflects the predominant food culture.
Food culture and industry	The dominant constellation of actors is tied to dietary and cultural factors.
Food culture and market and user preferences	Consumer and market preferences are not solely individual choices but are usually grounded in cultural patterns.
Food culture and media representation	The media representation of food is intimately related to the social and cultural understandings of food of a particular context.
Food culture and scientific knowledge base	Research and education of food is influenced by social and cultural drivers.
Food culture and technology	The material infrastructure to produce food is influenced by immaterial cultural factors and beliefs on the way food should be produced and consumed.

4.2.5 Summary of Results

This research has studied the factors behind the differences in the development and diffusion of PBMSs in different countries and the role of food culture therein. In order to do so it has combined elements of transition theory with food culture theory. Firstly, the compatibility of the niche (PBMSs) with the regime was assessed in the two countries. It was found that niche-compatibility was higher in the Netherlands than in Italy, partially explaining the differences between the level of development and diffusion of PBMSs in the two countries. However, as transitions' theory suggests, for the successful development and diffusion of niche innovations, a high niche-regime compatibility is a necessary but not a sufficient condition. For niche innovations to develop and diffuse in mainstream society, the landscape must present a favorable environment. At the landscape level, Italy and the Netherlands seemed to be subject to similar political and economic conditions. However, from a cultural perspective, the two countries differed greatly, with the Dutch food culture providing a more favorable environment for PBMSs to emerge. The results show how different elements of food culture had an influence on the emergence of PBMSs, as well as on the structuring of the regime, consequently influencing niche-regime interactions.

5. Discussion

5.1 Contributions to Theory: The Role of Food Culture in Sustainability Transitions

As many authors have pointed out, innovation theory has emerged to explain sustainability transitions in domains such as the energy and mobility domains (Hinrichs, 2014; Markard et al., 2012; Sustainability Transitions Research Network, 2018; Truffer & Markard, 2017). However, food systems have their own specificities compared to other innovation systems. In particular, the role of culture is much stronger than in other more technical domains, and strong cultural changes are usually needed in food transitions (El Bilali, 2019; El Bilali, 2020). Furthermore, studying culture brings a set of challenges related to measurement and conceptualization, which often leads it to be excluded from transitions studies (El Bilali, 2019).

The fact that transitions theory often lacks a strong cultural perspective, might pose an issue for the applicability of transitions theory to food transitions (El Bilali, 2019; El Bilali, 2020). As culture is so central to our food systems, traditional sustainability transitions theory on its own might be ill-suited to understanding food transitions (El Bilali, 2019). In order to further such understanding, this research has brought two literatures into dialogue, trying go beyond the separation of innovation theory and food culture theory and establish a link between the two. While food culture has been studied as a factor at the individual level influencing the adoption of novel foods (Verneau et al., 2016), to the knowledge of the researcher no earlier study has studied it as a systemic factor which both shapes and is part of the innovation system. Giving a place to food culture in the innovation system at the landscape level has improved the understanding of how food transitions come about, and the factors that explain differences in food transition pathways taken in different countries. By combining transition theory with concepts from the food culture literature, this research has expanded the applicability of sustainability transitions theory to the agri-food sector as well as furthered the understanding of how food transitions come about.

While the contribution of this research is mostly to scientific theory, this research wants to also produce insights for practitioners working on designing a protein transition. By giving importance to food culture in innovation theory, this research suggests that well-designed policy strategies for a protein transition need to seriously consider the cultural context in which they are embedded. Universal recommendations might fail to deliver the expected results, if local food culture is not kept in mind. As Noack and Pouw (2015) also state on the topic of food security intervention strategies, understanding food culture is paramount to ensure political acceptability of any food intervention. User acceptance of new food products is closely linked to food culture, as food consumption is not solely an individual choice, but it is mostly shaped by our cultural surroundings (Noack & Pouw, 2015). Food culture theory teaches that how people eat and consume food, and how food is produced, is fundamentally connected to cultural identities and knowledge, and is at the base for our understanding of food systems (Anderson, 2014; Barthes, 2012). This must be kept in mind by practitioners; as food culture is sticky and difficult to change (Anderson, 2014; Barthes, 2012), designing solutions appropriate to the local context could be the road to success.

5.2 Limitations and Avenues for Further Research

The results present some limitations. Firstly, it has limited generalizability potential. While small-case studies are useful to generate hypothesis, they are not equally strong in producing generalizable results. However, the exploratory nature of the study required the researcher to delve deeper into the case study to collect thick descriptive data. A large-N study would not have been suited for the objective of the research of generating new theoretical insights. Secondly, most of the interviewees are from the business sector, and their understanding of the innovation system is limited to a business perspective. While it

would have been insightful to interview other experts, involved for example in policymaking or academia, the limited scope and time of the thesis did not allow the researcher to reach a greater variety of interviewees.

In terms of reliability, the interviews are not easily replicable, as they are semi-structured in their format. Some changes in the order of the questions, or in the questions themselves, have been made across interviews. While the semi-structured nature of the interviews makes it harder to replicate the study, it was the most indicated for an exploratory study. In fact, it allowed the researcher to go deeper into the topic and gather new rich insights from the interviewees.

In terms of validity, some issues have been encountered with developing interview questions that would properly capture the concepts in all their dimensions. This critique has generally been made about the multi-level perspective theory on innovation. Some of the concepts are fuzzy and clearly defined and are consequently hard to operationalize and measure (Geels, 2011). While improving the conceptualization of MLP theory was beyond the scope of the research, this thesis points out the need to work further on clearly defining concepts in further applications.

5.3 Implications

5.3.1 Academic Implications

Until now, the literature on innovation science and food culture have developed independently of each other. This research has put into dialogue sustainability transitions and food culture theories, in order to deepen our understanding of how food transitions come about and expand the applicability of sustainability transitions theory to agri-food systems. However, the theoretical insights generated from the research are only a starting point. Given the exploratory nature of the study, there is room for improvement and further structuring of the framework and its concepts. Further detailing of the main concepts and elements of the theory could be helpful for avoiding misuses and subjectivity in research. Additionally, structuring the framework further could help generate useful hypotheses that could be applied to real case studies. For this purpose, single and small-N case studies should be conducted, in order to further the structuring and detailing of such a framework.

Secondly, given the exploratory nature of the study, the generalizability of the results is still limited. While Italy and the Netherlands provide a useful case study for exploring the role of food culture in food transitions, a small-N case study cannot ensure generalizability. To improve generalizability, many more case studies need to apply this framework, to view whether its theories apply to different contexts also. Another vehicle in order to improve generalizability are large-case studies- These could be conducted to verify empirically the relationship between food culture and the development and diffusion of PBMSs. For example, a statistical analysis could be used to test the relationship between food culture, using nations as a proxy, and the market share of different food innovations.

5.3.2 Societal Implications

The intention set out at the start of this research was not to formulate practical recommendations for practitioners, but rather to give a role to food culture in theories of transitions. However, understanding the role that food culture has in food transitions might be useful for practitioners wishing to further sustainable food transitions.

Three plausible suggestions can be given to practitioners working on designing sustainability transitions:

1. In order to be successful, food transitions need to be in line with local food culture and context. Food cultures are relatively stable and take decades to undergo changes. Thus, without an accommodating food culture, niche innovations might have a hard time further developing and

diffusing in society, ultimately halting a transition to take place. As Noack and Pouw (2015) suggest, successful food interventions consider the local cultural context.

2. It follows from the first suggestion that simply transposing one strategy for furthering food transitions from one country to another might result in failure. Formulating universal strategies for fostering sustainable food transitions might not be helpful, as countries differ greatly in their food cultures. When designing food transitions, differentiated strategies in accordance with the local context and culture might be more successful than universal ones. As also Noack and Pouw (2015), universal food intervention strategies are unlikely to be successful if they don't recognize the need for differentiation based on the cultural context.
3. This case study focused on protein transitions driven by PBMSs as niche innovations. However, it is important to note that there is not one and only pathway for a protein transition to take place, but several one. While the route driven by PBMSs might work well in the Dutch context, low-tech alternative proteins might drive markets and transitions elsewhere. As Schösler et al. (2012) argues, there are several pathways to protein transitions, that can be different from existing eating habits and patterns and might or might not involve novel foods. Their degree of success depends on the consumers they are targeting, who belong to different food cultures and consequently have different levels of willingness and readiness to change their eating patterns. As culinary practices and beliefs regarding protein products are extremely heterogeneous, protein transitions are more likely to succeed if they are heterogeneous themselves (Schösler et al., 2012).

6. Conclusion

This research tried to understand what factors explain the role of food culture in the development and diffusion of PBMSs. It did so by carrying out a comparative case study of Italy and the Netherlands, based on theoretical understandings from the sustainability transitions literature and food culture theory. The two countries showed similarities on many different control variables but were characterized by very different levels of success of PBMSs, with the Netherlands being a front-runner in the sector. The different levels of development of PBMSs can be explained by looking at the interactions between landscape, regime and niche, which are influenced by food culture.

Firstly, differences can be explained by looking at niche-regime compatibility. PBMSs are more compatible with the Dutch protein regime, than with the Italian one. Policy, industry actors, research and education, infrastructure, market and user preferences and the media seem to be more supportive of PBMSs in the Dutch Context than in the Italian one. However, niche-regime compatibility is a necessary but not sufficient condition to explain niche innovation success. As transitions theory explains, the landscape must also present a favourable context. Without landscape developments putting pressure on the existing regime to change, there are no windows of opportunities for niche innovations to emerge.

Italy and the Netherlands are characterised by very similar political and economic developments at the landscape level, which were explained in the case selection section. However, the two countries differ at the landscape level, when looking at food culture. Dutch food culture provides a more favourable context for PBMSs to emerge compared to the Italian one for a variety of reasons. For example, Dutch food culture it is more open to innovative and high-tech products compared to Italian food culture, which is more anchored on traditions. Another example is the importance of convenience ready to eat foods in Dutch food culture, which make for an easy market for PBMSs. Furthermore, food culture influences the structuring of the regime. All the different sub-regimes (policy, industry structure, media representation, scientific knowledge base and technological regimes) are influenced by food culture and exist in relation to it.

Thus, food culture as part of the landscape plays a role in niche development and diffusion by influencing the innovation system. It influences what niche innovations are more likely to emerge, based on whether they are compatible with local food cultures. Furthermore, as part of the landscape it influences the structuring of the regime, thus influencing niche-regime interactions and compatibility. A particular food culture can thus constitute a barrier or a facilitator to food niche innovations' development and diffusion.

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Appendix

a. Table of Interviews

Type of Organization	Interview details (date)	Code (Country initial + Number)
Food Retail Company	Interview conducted in November 2021	Italy
Food Tech Consultancy	Interview conducted in November 2021	Italy
PBMSs Company (B2C)	Interview conducted in December 2021	Netherlands
PBMSs Company (B2C)	Interview conducted in December 2021	Netherlands
University	Interview conducted in December 2021	Netherlands
Food Retail Company	Interview conducted in November 2021	Italy
PBMSs company (B2C)	Interview conducted in December 2021	Italy
PBMSs company (B2C)	Interview conducted in December 2021	Italy
PBMS company (B2B)	Interview conducted in January 2022	Netherlands
Food Tech Consultancy	Interview conducted in Janaury 2022	Netherlands

b. Coding Sheet

Category	Sub-categories	Description
Regime	Policy	Policy measures that reinforce or undermine current modes of protein production and consumption, for example subsidies schemes for protein production, emissions standards for protein production, dietary standards for protein consumption.
	Industry Structure	The constellation and power of animal farming companies, and their openness to change towards a protein transition.
	Technological Infrastructure	Current infrastructure and state of technology for protein production, for example existing production plants, machinery and technologies.
	Scientific Knowledge Base	Cultural and symbolic representation of animal and plant-based protein in the media.
	Market and user preferences	Market and user preferences regarding proteins, for example product preferences.
	Media Attention and Awareness	Perspective on the protein transition promoted by research and education, for example the level of importance given to the protein transition.

Food culture	Beliefs and representations surrounding food	Ideas and attitudes towards meat, plant-based foods, and food innovation.
	Knowledge surrounding food	Knowledge of recipes with meat and plant-based protein.
	Practices surrounding food	Behaviors, routines and habits related to food consumption and purchase.
	Influence on niche emergence	Influence of cultural elements on the likelihood of PBMSs emerging and affirming themselves on the market.
	Influence on the regime	Influence of food culture on policy, industry structure, technological infrastructure, scientific knowledge base, market and user preferences, media attention and awareness.

c. Interview Guide

C1. Interview Sheet – Netherlands

Before the Interview
Hello, thank you for joining me today. How are you doing? My name is Susanna Potestio, and I am a master's student at Utrecht University, studying Sustainable Development. I am currently working on my thesis, which is investigating the role of national food culture on the development and diffusion of plant-based meat substitutes. - Food culture: "the set of representations, beliefs, knowledge and practices inherited and/or learned that are associated with food and shared by individuals of a certain culture of social group" - Plant-based meat substitutes: "products that take the place of meat in the human diet and have an appearance, texture and taste similar to meat products", e.g. Pea/soy protein-based burgers Before we start with the questions, I'll inform you about your rights as a respondent (go through Informed Consent Form). Do I have your permission to record this interview for research purposes?
Context questions
Can you tell me a bit about yourself, what you do, and how are you involved in the topic of protein transitions?
Niche-regime compatibility

Policy - Do you think that governmental policy is impeding or facilitating the development and diffusion of pbms? Do you think there is support for innovative start-ups in your country?

Industry - Do you think that the meat industry in the Netherlands is strongly opposing pbms or that it is accepting the change and transforming itself?

Scientific knowledge base - Do you think that research institutes and universities are placing importance on the protein transition in your country?

Technology - Do you think that the technology and science needed for pbms is already consolidated and widespread?

Market and user preferences – What are consumers' opinions on PBMSs?

Media attention and awareness – How are PBMSs treated in the media? Is there any attention given to the topic of a plant-based transition in your country?

Food culture and influence on the innovation system

Representations and Beliefs

What are the representations and beliefs surrounding meat in your own country
What are the representations and beliefs surrounding PBMSs in your country?
What are the representations and beliefs surrounding food innovation and traditions in your own country?
How do you think these representations and beliefs might influence the development and diffusion of PBMSs in your country?

Knowledge

What kind of recipes are transmitted in your own culture?
Are many of these recipes containing meat?
Are many of these recipes containing plant-based proteins?

Practices

Is meat consumed often, in what quantities and on what occasions?
Is it common to buy convenient, ready to eat foods in your country?
Is eating together a common practice in your own country?
How do you think these practices might influence the development and diffusion of PBMSs in your own country?

Conclusion

Apart from the reasons we already mention, do you think there is other reasons impeding/facilitating the development and diffusion of PBMS in your country?

C2 Interview Sheet – Italy

Prima dell'intervista

Salve, grazie per essere qui oggi. Come sta?

Mi chiamo Susanna Potestio e sono una studentessa di master all'Università di Utrecht, dove studio Sviluppo sostenibile. Attualmente sto lavorando alla mia tesi, che analizza il ruolo della cultura alimentare nazionale sullo sviluppo e la diffusione dei sostituti della carne a base vegetale.

- Cultura alimentare: "l'insieme di rappresentazioni, credenze, conoscenze e pratiche ereditate e/o apprese che sono associate al cibo e condivise dagli individui di una certa cultura o gruppo sociale".
- Sostituti della carne a base vegetale: "prodotti che sostituiscono la carne nella dieta umana e che hanno un aspetto, una consistenza e un sapore simili a quelli dei prodotti a base di carne", ad esempio gli hamburger a base di proteine di pisello/soia.Prima di iniziare con le domande, la informerò sui suoi diritti di intervistato (consultare il modulo di consenso informato).

Ho il suo permesso di registrare questa intervista a scopo di ricerca?

Domande di contesto

Può parlarmi un po' di lei, di cosa fa e di come è coinvolto nel tema delle transizioni proteiche?

Compabilità niche-regime

Politica - Pensa che la politica governativa stia ostacolando o facilitando lo sviluppo e la diffusione delle pbm? Ritiene che nel suo Paese ci sia un sostegno per le start-up innovative?

Industria - Pensate che l'industria della carne nei Paesi Bassi si stia opponendo con forza alle pbm o che stia accettando il cambiamento e si stia trasformando?

Scienza - Pensa che la scienza sia chiara sulla necessità o meno di abbandonare una dieta a base vegetale?

Tecnologia - Pensa che la tecnologia e la scienza necessarie per la pbms siano già consolidate e diffuse?

Mercato e preferenze degli utenti - Quali sono le opinioni dei consumatori sui PBMS?

Attenzione e consapevolezza dei media - Come vengono trattati i PBMS nei media? C'è attenzione al tema della transizione vegetale nel vostro Paese?

Cultura alimentare e influenza sul sistema d'innovazione

Rappresentazioni e credenze

Quali sono le rappresentazioni e le credenze che circondano la carne nel vostro Paese?
Quali sono le rappresentazioni e le credenze che circondano i PBMS nel vostro Paese?
Quali sono le rappresentazioni e le credenze che circondano l'innovazione e le tradizioni alimentari nel vostro Paese?
Come pensate che queste rappresentazioni e convinzioni possano influenzare lo sviluppo e la diffusione dei PBMS nel vostro Paese?

Conoscenze

Che tipo di ricette vengono trasmesse nella vostra cultura?
Molte di queste ricette contengono carne?
Molte di queste ricette contengono proteine di origine vegetale?

Pratiche

La carne viene consumata spesso, in quali quantità e in quali occasioni?
Nel vostro Paese è comune acquistare cibi comodi e pronti per il consumo?
Mangiare insieme è una pratica comune nel vostro Paese?
Come pensate che queste pratiche possano influenzare lo sviluppo e la diffusione dei PBMS nel vostro Paese?

Conclusione

Oltre alle ragioni già citate, pensate che ci siano altre ragioni che impediscono/facilitano lo sviluppo e la diffusione dei PBMS nel vostro Paese?

d. Interview transcripts and Coding File NVivo

For privacy reasons, the transcripts of the interviews and the NVivo Coding file are not included in the Appendix. However, they can be shared upon request for scientific purposes. e. Coding File NVivo