



LUND UNIVERSITY

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# Complementing the multi-level perspective with the coevolutionary framework to conceptualise barriers to sustainable transitions in agro-food industries

Insights from business strategies and user practices on the challenges facing plant-based milks in the UK

by

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## Abstract

Sustainable transitions are essential to ensure climate and land systems do not go beyond their tipping points; however, these transitions are complex, and barriers to their success are difficult to conceptualise. The Multi-Level Perspective (MLP) is the dominant framework for conceptualising how industries transition to using green innovations. Despite the effectiveness of the MLP, it has weaknesses, particularly when applied to agro-food industries, which render it unable to always uncover the barriers to green innovations. Scholars argue that the MLP can combine with frameworks from other disciplines to address its weaknesses, such as the coevolutionary framework (CF). This thesis explores the potential of combining the MLP with other frameworks, by applying it in tandem with the CF to plant-based milk (PBM) innovations in the UK. The research approach was abductive with constant reference between literature, and qualitative data collected via interviews with PBM brands and a survey of UK consumers. The main findings of this thesis were that the MLP failed to explicitly link the dairy regime to the ecosystems that it impacts, struggled to grasp the depth of user-practice embeddedness, and failed to fully conceptualise a loss-leader pricing strategy. However, the CF was able to make these linkages and conceptualisations, revealing barriers to PBM. These findings indicate that the CF has significant potential to complement the MLP in conceptualising agro-food industries and that combining interdisciplinary frameworks with the MLP could benefit policymakers seeking to facilitate sustainable transitions.

Keywords: Sustainable transitions; Multi-level perspective; Coevolutionary framework.

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# 1 Introduction

## 1.1 Background

Anthropogenic disruption of the Earth system is the greatest challenge humanity currently faces (Steffen, Richardson, Rockström, Cornell, Fetzer, Bennett, Biggs, Carpenter, de Vries, de Wit, Folke, Gerten, Heinke, Mace, Persson, Ramanathan, Reyers & Sörlin, 2015). The Earth system consists of the processes and cycles among the atmosphere, hydrosphere, cryosphere, geosphere, anthroposphere and biosphere, both spatially and temporally, which determine the environmental state of the planet (Rockström, Steffen, Noone, Persson, Chapin Iii, Lambin, Lenton, Scheffer, Folke, Schellnhuber, Nykvist, de Wit, Hughes, van der Leeuw, Rodhe, Sörlin, Snyder, Costanza, Svedin, Falkenmark, Karlberg, Corell, Fabry, Hansen, Walker, Liverman, Richardson, Crutzen & Foley, 2009). The limitations of these processes are known as planetary boundaries. The consequences of exceeding these boundaries' tipping points are often catastrophic. Biodiversity and the nitrogen and phosphorus cycles are already beyond the zone of uncertainty (Rockström et al. 2009). Within the biosphere, land system change and climate change are approaching their tipping points.

Energy and transport systems tend to receive the greatest focus when discussing greenhouse gas (GHG) emissions (Markard, 2011). Yet Agriculture, Forestry and Other land use contribute to 24% of global GHG emissions (IPCC, 2014). The dairy industry alone is estimated to contribute to 4% of GHG emissions and 52% of global methane emissions, which is significant as atmospheric methane traps 25 times more heat than carbon dioxide (Gerber, Vellinga, Opio & Steinfeld, 2011). Technological innovations are the most common solutions developed for high carbon societies (Anadon, Chan, Harley, Matus, Moon, Murthy & Clark, 2016). In this vein, the multi-level perspective (MLP) has become the leading framework for conceptualising industries (Geels, 2020). This conceptualisation is vital in uncovering the barriers to transitioning industries to be more sustainable and alleviating pressure on land systems, and the climate (Loorbach, Frantzeskaki & Avelino, 2017).

## 1.2 Research Problem

Sustainable transitions are too complex to be fully conceptualised by one framework. Indeed, despite its undisputed value, the MLP has been subjected to valid critiques. Scholars have argued that it is too focused on technology as a driver (Geels, 2019), struggles to distinguish between institutions and agency (Smink, Hekkert & Negro, 2015), lacks vital sociological understandings (Bui, Cardona, Lamine & Cerf, 2016), discounts direct interactions with ecosystems (Røpke, 2016) and is not a proper fit for agro-food industries (El Bilali, 2019). These shortcomings in the MLP lead to incomplete conceptualisations of industries. As land system change and climate change near their tipping points, it is of utmost importance to uncover all the barriers to successful sustainable transitions. In response to the shortcomings of the MLP, scholars have suggested combining frameworks from various disciplines with the MLP (El Bilali & Probst, 2017; Meelen & Farla, 2013). A promising suggestion is Foxon's (2011) Coevolutionary Framework (CF). This suggestion has been applied successfully to energy and transport systems (e.g. Foxon, 2014; Foxon & Steinberger, 2013; Pearson & Foxon, 2012) but has thus far not been applied to agro-food industries.

An agro-food industry in the United Kingdom in need of attention is dairy, as one of the major contributors to land systems change, GHG emissions, and climate change. Plant-based milks (PBM), referring to milk alternatives produced from seeds, nuts, legumes, grains and soy, are a promising technical solution. Poore and Nemecek (2018) showed the drastically lower impact PBM have on land use and GHG emissions. Despite the promise of this technical solution, PBM only make up 4% of volume sales and 8% of value sales of the combined industries as of 2018 (Mintel, 2019) and applications of the MLP have been unable to fully account for what is hindering a transition to PBM (Mylan, Morris, Beech and Geels, 2019). These hindrances must be uncovered for sustainable transitions away from dairy to be successful, aiding in the effort to avoid land systems change and climate change reaching their tipping points.

## 1.3 Aim

This thesis aims to explore the use of other frameworks to complement the MLP for agro-food industries. In order to achieve this aim, the following research question is addressed:

RQ: What is the potential of the CF as a complementary framework of the MLP for agro-food industries?

This thesis applies both the MLP and the CF to qualitative data from the UK dairy and PBM sectors, focusing elements that are focal in the CF but neglected in the MLP: business strategies and user practices. Achieving this aim will be a significant theoretical contribution to sustainable transition literature in showing that combining frameworks from other disciplines can better conceptualise barriers to transitions in different industries. In addition, by showing the combined MLP and CF method can be successfully used in agro-food industries, this thesis is a useful contribution for policymakers seeking to facilitate sustainable transitions.

## 1.4 Outline

This thesis has six chapters. Following this introduction, Chapter 2 is a comprehensive review of relevant literature. Chapter 3 presents the theoretical framework. Chapter 4 describes the research methodology. Chapter 5 presents the results of the data collection and a discussion. Chapter 6 concludes the thesis with the implications of the findings and suggestions for further research.

## 2 Literature review

### 2.1 Sustainable transitions and transformations

Human society cannot continue within the safe operating space of the planetary boundaries. This has led to calls for change which has motivated sustainable ‘transition’ and ‘transformation’ research (Hölscher, Wittmayer & Loorbach, 2018). Transition approaches are most often employed to understand central institutional, technological, economic and social change from one regime to another within subsystems (transport, energy, agro-food) (Rotmans, Kemp & Van Asselt, 2001; Loorbach, Frantzeskaki & Avelino, 2017). Transformation approaches are often used to examine biophysical and human interactions and feedbacks (Brand, 2014) such as transformative adaptation (O’Brien, 2012) and climate resilience (Olsson, Galaz & Boonstra, 2014).

Some scholars argue that transition and transformation should be more clearly delineated. For example, Geels and Schot (2007) categorise transformation as a potential transition pathway (see section 2.3). Other have argued that transitions are technocratic and meso-level, whereas transformations are large-scale, long-term and radical (Hölscher, Wittmayer & Loorbach, 2018). There is certainly some difference in their etymologies as transformation means ‘to change shape’ (Folke, Carpenter, Walker, Scheffer, Chapin & Rockström, 2010) and transition means ‘to go across’ (Brand, 2014). In this sense, transformations seek to highlight *what* changes and what the *outcomes* are, whereas transitions seek to understand *how* systems change and what *hinders/helps* this change. This has informed the frameworks developed within each (e.g. transformations’ panarchy framework (Allen, Angeler, Garmestani, Gunderson & Holling, 2014) and transitions’ MLP (Geels, 2002)).

Patterson, Schulz, Vervoort, Van Der Hel, Widerberg, Adler, Hurlbert, Anderton, Sethi and Barau (2017) argue that transitions and transformations have identical sustainable objectives; however such objectives depend on values and perceptions. Due to this, actors play a significant role in determining what outcomes are desirable through governance and agency (Hölscher, Wittmayer & Loorbach, 2018). Therefore, the wide variance in actors leads to

disagreement and conflict in the best ways to achieve sustainability. Transition becomes more prominent in the debates of how to achieve sustainability (Farla, Markard, Raven & Coenen, 2012) yet transformation is as important with the tools to understand values and perception that inform these debates (e.g. transformative agency (O'Brien, 2012)).

## 2.2 A background of sustainable transitions

This thesis specifically concerns a change in the UK dairy industry, and thus primarily concerns sustainable transitions in agro-food. Loorbach, Frantzeskaki and Avelino (2017) distinguishes three types of system in sustainable transitions: socio-technical systems including energy, agro-food and transport; socio-economic systems such as education, finance and labour; and socio-ecological systems.

Solving such system problems requires a profound systemic change involving rearranging all parts of the whole system including consumer practices, policy, markets, infrastructure, cultural significance and technology (Grin, Rotmans & Schot, 2010, p.12). These parts are “reproduced, maintained and transformed by actors such as firms and industries, policymakers and politicians, consumers, civil society, engineers and researchers” (Geels, 2011, p. 24). To reiterate, the main aim of sustainable transitions research is to conceptualise and explain how such radical changes can happen while also still providing for society.

Sustainable transitions differ from historical systems transitions that have happened in the past in a few ways (Geels, 2011). Firstly, as sustainability is for the **collective (often indirect) benefit**, it may not be able to provide individual users with direct benefits. Indeed, more sustainable products often **struggle to be competitive in terms of price and functionality**. This means that the framing of these products may require substantial changes either by policy or economic support (e.g. subsidies) and, more radically, reviewing what constitutes value (Geels, 2011). Requiring a change in underlying values shows the value of transformations literature (e.g. O'Brien's (2018) three spheres).

Secondly, sustainability transitions are **goal-oriented** towards environmental issues, whereas previous transitions emerged organically or were pushed by entrepreneurs and novel technologies (Smith, Stirling and Berkhout, 2005). The private sector is not incentivised to transition to sustainability, as the goal is of collective benefit, which implies tragedy of the

commons, prisoner’s dilemmas and free-rider problems. This means the public sector and civil society are vital for successful transitions (Elzen, Geels, Leeuwis & Van Mierlo, 2011).

The third way that sustainable transitions are different is due to specific characteristics of the industries in which they are most needed (Grin et al. 2010, p.17). These industries are usually controlled by large firms (e.g. supermarkets) that have ‘complementary assets’ (Rothaermel, 2001, p.1235). Such complementary assets mean incumbent firms are in influential positions compared to small innovators that often are the first to create sustainable innovations. Therefore, as these large incumbents are embedded in the status quo, they are expected to be resistant to change (Rothaermel, 2001). Conversely, if they can be persuaded or incentivised, the incumbent firms can use their complementary assets to **accelerate** the progress of environment innovations (Geels, 2011, Geels, Kern, Fuchs, Hinderer, Kungl, Mylan, Neukirch & Wassermann, 2016).

Sustainable transitions’ scholars have offered a range of frameworks. Figure 1 shows the four key theoretical frameworks that have emerged from transitions research. Although all four have provided significant insights into the field using their difference strengths and areas of focus, the MLP has emerged as the dominant framework (Markard, Raven & Truffer, 2012).

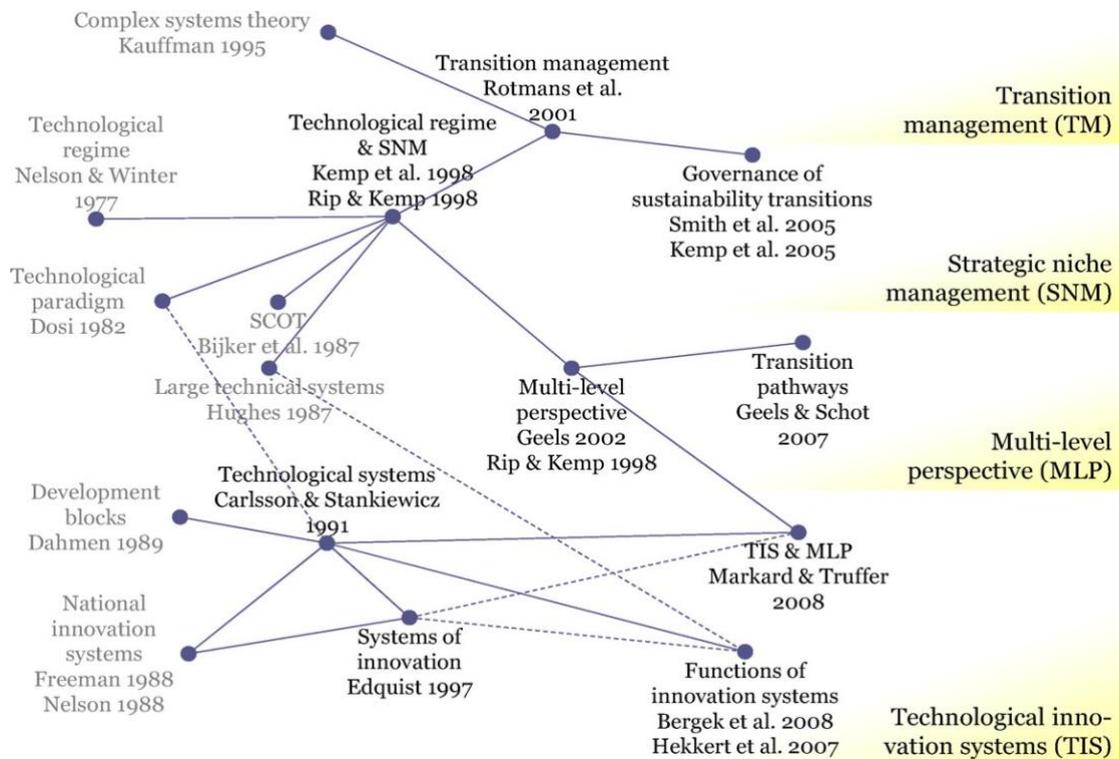


Figure 1: Map of main contributions in the field of sustainability transition studies. (Adapted from Markard et al. 2012, p.597)

## 2.3 The MLP

The MLP reaches further into individual technologies, crucially accounting for both the structural change and multi-dimensionality elements fundamental to sustainable transitions (Geels & Schot, 2010).

The MLP outlines three areas within socio-technical systems: the niche, the socio-technical regime and the landscape (see Figure 2). The **niche** provides protected spaces for experimentation and the development of radical technical, grassroots social, business model and infra-structural innovation (Geels, 2002). PBM are radical technical innovations (Geels, 2019). The **landscape** is the exogenous environment, including both external shocks and gradually-changing developments, which influences the regime and the niche (Geels, 2002).

The **socio-technical regime** is the “locus of established practices and associated rules that enable and constrain incumbent actors in relation to existing systems” (Geels, 2014, p.23) and it defines “appropriate, legitimate and conceivable means-end rationalities in a given sector” (Fuenfschilling & Binz, 2018, p.735). Existing regimes are characterised by lock-in and path dependence, which result from stabilising mechanisms (Verbong & Geels, 2010).

These include (Geels, 2019) (1) techno-economic mechanisms such as low cost and high-performance characteristics of existing technologies due to years of learning-by-doing improvements and economies of scale, and sunk investments that cause vested interests to not change. (2) Social and cognitive mechanisms such as shared routines, social capital, mind-sets, user practices and lifestyles embedded around particular technologies. (3) Institutional and political mechanisms such as existing regulations, standards, and governance favouring incumbents and their access to policy networks to dilute regulatory change (Geels, 2019, p.189).

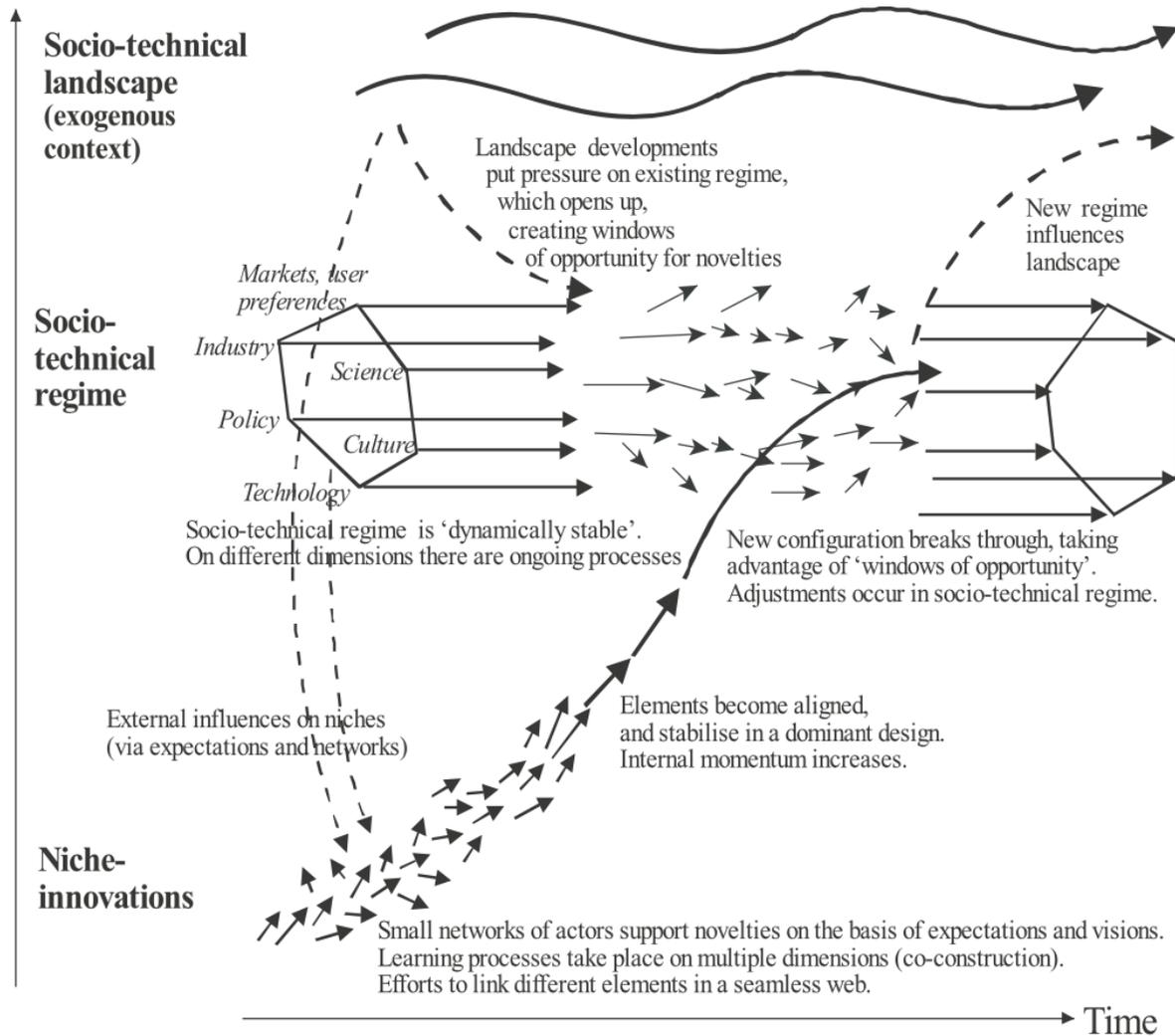


Figure 2: Multi-level perspective on transitions (Adapted from Geels & Schot, 2007, p.401).

A sustainable socio-technical transition is only successful when the regime changes to another more sustainable one (Fuenfschilling & Binz, 2018). If no pressure is exerted on the regime from the landscape or niche, the regime will **reproduce** itself. Geels (2002) argued that change within the regime comes from a combination of pressure from the landscape and suitable innovations from the niche, but the timing and nature of these pressures are important. The landscape fluctuates from fortifying to disrupting the regime. In other words, the niche, regime and landscape need to be **aligned** for a transition to happen (Geels, 2011). The variation in the nature and timing of the landscape pressure and maturity of niche innovations results in different transitional pathways outlined by Geels and Schot (2007):

- 1) **Transformation**: characterised by gradual external pressure from the landscape on the regime which creates opportunities for broader change. However, niche innovations are inadequately developed, so change is largely performed by regime actors, who reorient existing development trajectories.
- 2) **Reconfiguration**: similar landscape pressure to transformation, but here the niche has more developed innovations, and a more substantial technical change is possible, which in turn gradually reconfigures the regime both socially and technically.
- 3) **Technological substitution**: landscape pressure is greater and so are opportunities, and the niche innovations are so developed that they directly compete with existing actors leading to a replacement of the existing regime.
- 4) **De-alignment and re-alignment**: widespread significant landscape change leads to loss of faith and the complete collapse of the regime.

## 2.4 Gaps in the MLP

The MLP certainly provides an essential understanding of how technological changes happen within an industry. However, it is not without critics.

### 2.4.1 Overemphasising the technology-push

Despite the MLP being exceptionally effective at conceptualising niche-innovations (Smith, Voß & Grin, 2010) a significant critique is that there has been too great a **focus on the role of the technical niche** to instigate change (Berkhout, Smith & Stirling, 2004; Geels & Schot, 2007), particularly with regards to the **food industry where technical innovations are rarely sufficient to drive change** (El Bilali, 2019). There are certainly cases where new technology alone can push an industry to be more sustainable: Anderson and Tushman (1990) outlined technological discontinuity, and Christensen (1997) presented cases of disruptive innovation. However, technologies that have done this with more sustainable results tend to be favoured by market forces first (e.g. more efficient) and sustainability as a **bonus**.

The over-focus on technology-push has also led to discounting **social innovations** (McGowan, Westley & Tjörnbo, 2017). El Bilali (2019) argues that the MLP's current construction is not fully appropriate to consider social innovation processes, particularly in

the agro-food industry. Social innovations are integral to successful transitions as they embody the reconfiguration of networks between actors and institutions that create the conditions for successful change (Avelino, Wittmayer, Pel, Weaver, Dumitru, Haxeltine, Kemp, Jørgensen, Bauler, Ruijsink & O’Riordan, 2019; Westley, 2017, p.240). A potential reason that they might be discounted thus far is that their agency is broadly distributed (Olsson, 2017, p.60). No single social innovation can catalyse change and therefore, scaling up efforts to enable system transformation is difficult.

#### 2.4.2 Lack of inter-level and inter-system institutional agency

Scholars have critiqued the MLP for struggling to distinguish between the institutions and agency across the levels. A lot of research using the MLP reviews the agency of a powerful regime stabilising incumbent institutions (Lawrence & Suddaby, 2006, Meadowcroft, 2009, 2011; Smith, Stirling & Berkhout, 2005; Stenzel & Frenzel, 2008). For some time, this research was focused on institutional regime **inertia** (Berggren, Magnusson & Sushandoyo, 2015) but recent scholarship has highlighted proactive strategies such as incentives, organised pressure, lobbying and reframing (Fuenfschilling & Truffer, 2016; Penna and Geels, 2015; Rosenbloom, Berton & Meadowcroft, 2016; Smink, Hekkert & Negro, 2015). These strategies are often understood as institutional and political lock-in mechanisms (Lockwood, Kuzemko, Mitchell and Hoggett, 2017) The incumbent **corporations** in energy, fuel, automotive and agro-food industries often have numerous political connections and significant economic resources which can hamper, delay or dilute environmental regulations (Roberts and Geels, 2019). Testa, Boiral and Iraldo (2018) shows how such corporations react to pressure on the regime by widely publicising their intentions to change but only making relatively minor adjustments, sometimes referred to as ‘green washing’. While this research is important and insightful, there has not been corresponding research for the institutional agency that does not have this regime centric definition.

The value of focusing on other types of institutional agency is apparent in the advocacy coalition framework (Hess, 2014; Markard, Suter & Ingold, 2016) which shows the political struggle is between dominant regime coalitions vs the new coalitions who seek to champion the policies to support niche-innovations. Building on this, Hassink, Grin and Hulsink (2018) argue that the MPL requires more attention on other types of agency, especially in terms of intersystem system and inter-regime interactions. More radically, scholars have called for

agency to be more prominently incorporated in a heuristic framework (Hassink, Grin & Hulsink, 2013; Isgren & Ness, 2017; Lawhon & Murphy, 2012; Stahlbrand, 2016; Vivero-Pol, 2017).

Finally, more empirical research is required on the possibility of incumbent institutions accelerating sustainable transitions if they can be convinced to re-orientate their complementary assets. This is rare, as it is contrary to Schumpeter's gale (incumbents do incremental innovation and entrants do radical innovation) but can happen if there are profitable opportunities or regulations (Geels et al. 2016).

### 2.4.3 Sociology and users

MacKenzie (1998) was one of the first to argue that evolutionary and sociological approaches to technological change were complementary. For transitions research, 'interpretative flexibility' (Doherty, Coombs & Loan-Clarke, 2006) is an essential sociological insight. It means that various social actors can have different understandings of the same concept. New technologies have a high degree of interpretative flexibility, and therefore, sociological research has indicated that social networks only gradually come together in accepting what is appropriate (Doherty, Coombs & Loan-Clarke, 2006). This quickly translates into economics as these new technologies having a correspondingly high degree of uncertainty with regards to performance and profitability, which in turn becomes a manifestation of 'technological trajectories', as per Dosi (1982).

When research using the MLP does account for a sociological perspective (see section 3.6) it usually looks at socio-technical aspects and discounts socio-economic aspects. Certainly, the role of consumers and market forces should never be understated, particularly for agro-food (Spaargaren, Oosterveer & Loeber, 2013). Hargreaves, Longhurst and Seyfang (2013), Isgren and Ness (2017) and Stahlbrand (2016) all emphasise the essential role civil society organisations play in championing sustainable transitions and how users' daily practices deserve more recognition and theory. Bui et al. (2016) argue that **combining the MLP with some core concepts of sociology** allow scholars to fully utilise the MLP's advantages while accounting for its weakness in user practices and social networks. Similar efforts have been made by Hassink, Hulsink and Grin (2014), combining organisational ecology, the MLP and social movement theory, and Elzen et al. (2011), combining the MLP, social movement theory and political science research.

Focusing on this disregard for users, a significant insight from sociology concerns the subject of how users behave. Spurling, McMeekin, Southerton, Shove and Welch (2013) argue, compellingly, that ‘**social practices**’ are a more effective target of sustainable transition intervention than ‘behaviour’, or technical innovation alone. Users consume resources as part of the practices that make up everyday life such as showering, driving, cooking and **drinking milk**. This is termed *ordinary consumption*. Shove and Spurling (2013) explain that, although users have a degree of choice on how to perform such practices, this choice is constrained by institutional organisation, social norms, access to economic, cultural and social resources, and infrastructure. Furthermore, as users perform these practices, they are reproducing socially learnt skills, cultural meanings, and shared technologies and products, making these practices a social phenome. This reframing moves the focus of analysis away from technologies and individuals and on to social practices. “After all, ‘behaviours’ are largely individuals’ performances of social practices.” (Spurling et al. 2013, p.4).

#### 2.4.4 Socio-ecological

Olsson and Galaz (2012) and Røpke (2016) argue that although the insights unearthed by the MLP are enlightening, social-ecological systems have been discounted. Technology effects social-ecological systems’ resilience both negatively and positively, and social-ecological and socio-technical systems share some of the complex adaptive systems sensibilities. Yet, social-ecological systems garner far less attention (Folke et al. 2010, Røpke, 2016).

Furthermore, Folke, Biggs, Norström, Reyers and Rockström (2016) argue that social-ecological systems “operate within, and as embedded parts of the biosphere and as such coevolve with and depend on it.” In turn, the biosphere is a fundamental part of the Earth system (Rockström et al. 2009), which means socio-ecological systems must be an essential part of any sustainability-concerned research. As Boons and McMeekin (2019, p.13) say of the MLP, “most work in this area applies social scientific approaches to questions of sustainable system transition, rather than engaging **directly** with the relationship between socio-technical and ecological systems”.

To highlight how directly related social-ecological systems are with sustainable transitions, Gordon, Bignet, Crona, Henriksson, Van Holt, Jonell, Lindahl, Troell, Barthel and Deutsch (2017) using the social-ecological framework, illustrates how changes to food systems during

the Great Acceleration have allowed a huge increase in the volume of food but at the cost of nutrition, safety and numerous boundaries of the biosphere. This underlines the problem that sustainable transitions are trying to overcome and the central role played by the agro-food industry.

Scholars have made attempts to rectify this gap in research. Bush and Marschke (2014) maintain that agrarian change and the MLP's transitions theory can be used in complement to ecological resilience thinking. Järnberg, Kautsky, Dagerskog and Olsson (2018) draws from institutional entrepreneurship, social-ecological transformations, and the MLP to better understand the transformation of Ethiopian agriculture. Hassink, Hulsink and Grin (2014) bring together organisational ecology, social movement theory, and the MLP to interpret care farming in the Netherlands. Durua, Faresa and Theronda (2014) construct a conceptual framework of farming systems, socio-ecological systems, and socio-technical systems. The social practice understanding has been applied to ecological economic issues (Ropke, 2009).

#### 2.4.5 Unique characteristics of agro-food

Sustainability transitions research has tended to overlook agro-food systems, as noted in other critiques. Moreover, the MLP has rarely been comprehensively used for agro-food systems, and therefore, its appropriateness has never been truly tested (El Bilali, 2019). Hargreaves, Longhurst and Seyfang (2013) argue that the MLP in its current form makes it difficult in distinguishing between the niche and regime of agro-food. For example, Audet, Lefèvre, Brisebois and El-Jed (2017) show that seasonal food markets evolve at the intersection of niche and regime. Of particular relevance to this thesis, Mylan et al. (2019) recently examined the UK dairy and PBM industries using the MLP and found that in addition to the niche influencing the regime through interactions, incumbent regime actors influence the regime through similar interactions. As Lutz and Schachinger (2013) argue:

food networks are characterised by specific practices, technologies, and actors analytically situated outside or peripheral to the dominant food regime, creating their own inherent structures and rules. Nonetheless, niche-innovations do not develop and evolve isolated from and untouched by the regime's and landscape's dominant practices, technologies, rules, and structures. Rather, socio-technical regimes, landscapes and niche-innovations can be seen as **coevolving and potentially**

**competing or even colliding into one another** (Lutz and Schachinger, 2013, p.4783).

Additionally, the dairy industry has a specific structure in which farmers or primary producers are disconnected from the consumers of milk by food-processing and retail corporations (Mylan, Geels, Gee, McMeekin & Foster, 2015). This structure means that power is further concentrated amongst a few actors (Carolan, 2016).

Cultural aspects that influence consumption are more likely to be a factor in dairy transitions as the end product is slightly different, compared to renewable energy transitions where the end product, electricity, is often the same (Fourat & Lepiller, 2017). One of the values of the MLP is that it theoretically values consumer culture (Markard, Hekkert & Jacobsson, 2015). However, it has been described as having breadth but lacking depth in its cultural element (Isgren & Ness, 2017). This also shows the value in turning to transformations research where research such as O'Brien (2018) have better conceptualised the role that culture, identity, values and worldviews play.

Mylan et al. (2019) found that for UK dairy regime, consumer culture plays a vital role in sustainable transitions by mediating change. Furthermore, it was found that transitioning to PBM requires both distribution through existing businesses and retail chains and a fundamental revaluation of the cultural meanings of milk.

#### 2.4.6 Other critiques

Scholars have also criticised the lack of: spatial focus (dynamics of the networks and geographical configurations) in transitions research (Binz, Truffer & Coenen, 2014; Coenen, Benneworth & Truffer, 2012; Hansen & Coenen, 2015; Murphy, 2015); social sustainability such as poverty and inequality (Jenkins, Sovacool & McCauley, 2018; Sareen & Haarstad, 2018); and global south focus (El Bilali, 2019).

## 2.5 Combining frameworks

Interdisciplinary approaches to complement the MLP can yield benefits from each approach's strengths and improve weaknesses (El Bilali & Probst, 2017; McMeekin & Southerton, 2012;

Meelen & Farla, 2013; Shove, 2003). This thesis has already mentioned examples from Bui, Cardona, Lamine and Cerf (2016), Bush and Marschke (2014), Durua, Faresa and Theronda (2014), Elzen et al. (2011), Hassink, Hulsink and Grin (2014), Järnberg et al. (2018), and Markard and Truffer (2008). Within transition research, scholars have argued for a complementary approach of strategic niche management and the MLP (Belmin, Casabianca & Meynard, 2018; Pitt & Jones, 2016; Slingerland & Schut, 2014).

Outside of transitions research, scholars have brought together the MLP with elements of the social practice approach (SPA) (Crivits & Paredis, 2013; Hargreaves, Longhurst & Seyfang, 2013; Hinrichs, 2014). Indeed, Geels (2011) suggested that the MLP's regime is similar to SPA's 'routinised practices'. Diaz, Darnhofer, Darrot and Beuret (2013) used the MLP with actor network theory. Zwartkruis, Berg, Hof and Kok (2018) incorporated ideas from initiative-based learning and integrated assessment modelling. O'Brien (2018) has suggested combining transformation and transitions research.

Certainly, such combinations can be enriching. As El Bilali (2019) concludes,

Integrative conceptualisation, framing and operationalisation of the MLP elements is required given the complexity of sustainability transitions processes and dynamics in the agro-food sector and should contribute to achieving the objectives of understanding and fostering transitions. Therefore, more multi- and trans-disciplinary research is required on the MLP's applicability in understanding, nurturing and managing transitions towards sustainability in the agro-food system (El Bilali, 2019, p.17).

One final framework is a central part of this thesis: Foxon's (2011) CF.

# 3 The theoretical framework

This chapter presents Foxon's (2011) CF and its similarities and differences to the MLP. Crucial to the MLP and the CF is the concept of coevolution from evolutionary economics.

## 3.1 Coevolution

Schumpeter (1942) argued for an evolutionary economic approach which rejects the neo-classic economic assumption that actors will behave with perfect rationality, and arguing they act with bounded rationality. During industrial change, this uncertainty triggers a complex range of consequences as radical innovations cause “waves of creative destruction” (Stein, 1997, p.265). Economists based in the neoclassical tradition have struggled to fully understand the impact of radical technical innovations, as the outcomes cannot be foreseen (Faber & Frenken, 2009). To account for this added complexity, numerous researchers have embraced evolutionary economics approaches (Faber & Frenken, 2009). Evolutionary economists hold the conviction that continuing change is a fundamental characteristic of modern capitalist economies, mainly driven by innovation (Nelson, 2018, p.2).

The term ‘evolution’ is defined as per ‘generalised Darwinism’ (Hodgson & Knudsen, 2012), which maintains that any population can evolve if it follows three procedures: (1) **variation** amongst the population; (2) **retention** of characteristics across generations; (3) **selection** of favourable characteristics with regards to the environment. Therefore an evolutionary analysis must explain how each of these processes occur (Hodgson & Knudsen, 2012; Kallis and Norgaard, 2010). This evolution does not necessarily indicate the advancement to a specific endpoint as the environmental conditions can change, as is the case with biological evolution. However, it can lead to greater complexity (Beinhocker, 2006).

The MLP is grounded in some of the core concepts of evolutionary economics (Schot, 1998), including the origins of the socio-technical regime, path dependence, and technological trajectories (Dosi, 1982; Nelson and Winter, 1982; Rip & Kemp, 1998). The concept of the

niche is derived from biological evolution, specifically, allopatric speciation theory (Mayr, 1963), which indicates that new species will evolve out of geographically isolated areas at the periphery of prevailing ecosystems. In terms of why and how change unfolds, MLP accepts the evolutionary economic concept of punctuated equilibrium (Geels, 2020) which suggests that change alternates between short periods of disruption and long periods of incremental change. Yet the MLP also accepts the possibility of change driven by external landscape pressures, which is external of evolutionary economics. Similarly, the MLP accepts evolutionary ideas at the macro level, including overthrow and disruption (Geels & Schot, 2007) as well as more gradualist transition pathways which are also external of evolutionary economics. In this sense, the social and technical aspects of the MLP **coevolve** in mutual dependence of each other.

In contrast, the CF considers each system to evolve under its own **dynamics**, based on Freeman and Louca (2001), but this process of evolution both influences and is influenced by the dynamics in the other systems through **causal interactions**. Two or more systems coevolve *if*, as they evolve, they have both have a substantial causal influence on each other's ability to continue (Murmann, 2003). Therefore the systems of the CF are endogenous, but none is considered to be more fundamental than the others, based on Norgaard's (1994, p.35) conceptualisations of coevolutionary systems. The causal influences occur by either: (a) altering selection criteria, for example, a new wind energy policy incentive (institution influencing technology); (b) changing the replicative capacity, for example, modern internet advertising renders techniques such as door-to-door sales less effective (technology influencing business strategy). Thus, a coevolutionary approach conceptualises change by identifying the causal interactions between coevolving systems (Foxon, 2011).

The CF expands on MLP's socio-technical coevolution with **technologies** as its first system (Foxon, 2011). From there, it identifies aspects of the MLP's regime into three further systems, with some differences in definition, as will be outlined in this chapter. Murmann (2003) shows that **business strategies** and **institutions** can coevolve with technologies. The social practices perspective (Shove & Spurling, 2013) substantiates the useful inclusion of the **user practices** as its own system. Finally, insights from socio-ecological research justify the inclusion of natural **ecosystems** (see Figure 3).

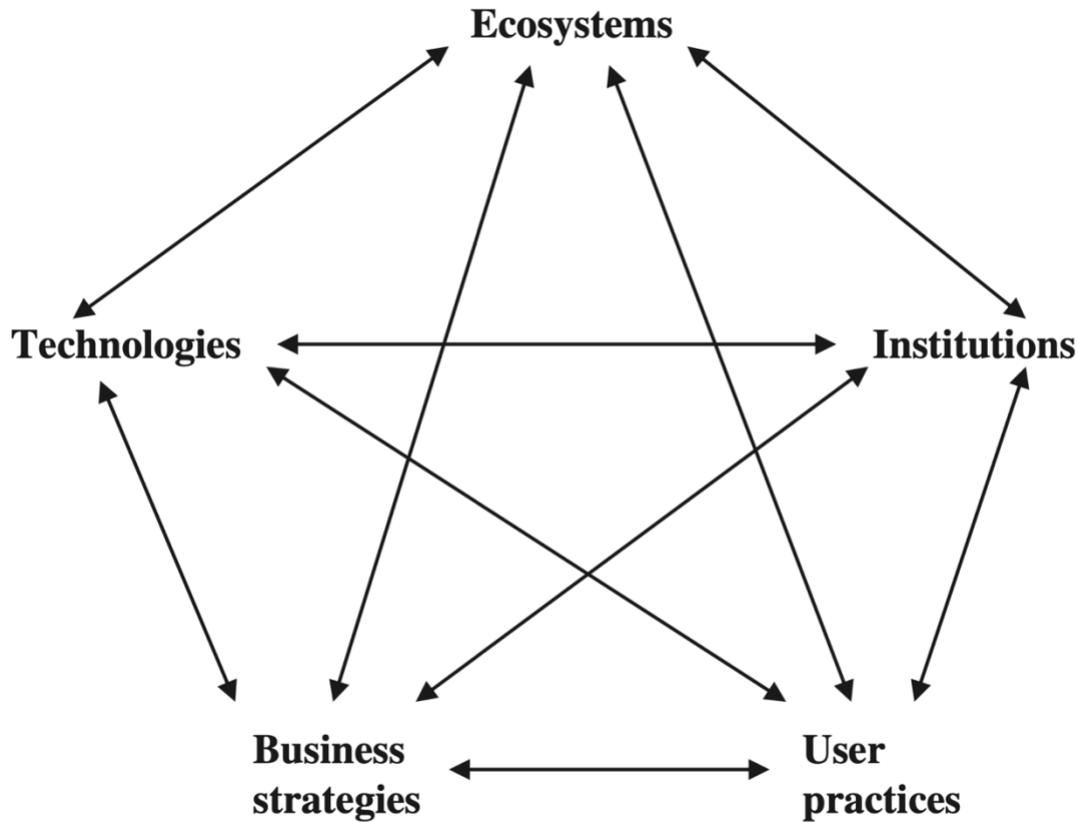


Figure 3: The Coevolutionary Framework. Adapted from Foxton (2011, p.2262)

Foxon (2011) argues that a higher degree of analytical separation is required for the CF so as to focus attention on the causal influences between systems. The CF seeks to have the same mutual stability and dynamic interactions in all of the joint structures between five of its systems as is understood in the *socio-technical* regime (Rip & Kemp, 1998) Furthermore, as with the socio-technical regime, these structures can remain stable at the meso-level for various time periods, but they are vulnerable to disruption from dynamic interaction changes internally and at the macro and micro levels (Foxon, 2011).

## 3.2 Technologies

Socio-technical transitions research emerged from the field of innovation studies (Geels, 2019; (Smith, Voß & Grin, 2010). Socio-technical regimes were initially defined as a build-up of material structures (Hoogma, Kemp, Schot & Truffer, 2002; Rip and Kemp, 1998). The most prominent material is technology, therefore, the MLP draws heavily from Science and Technology Studies (STS) literature, specifically over three conceptions (Geels, 2002).

First, the MLP maintains that technologies are not developed by an internal technical logic but are rather socially constructed (Bijker, 1997, p.270). The MLP framework draws directly from Hughes (1993, p.2) who argued that innovation is a social construction of **aligning** various elements, which includes actors moving between spaces such as regulations, production, scientific research and markets. Second, the MLP is based on the argument that science and technology are ever-present in contemporary societies and have significantly contributed to broad changes in every industry and system (Geels, 2020).

Thirdly, a fundamental element of regimes and systems is that, due to lock-in mechanisms, innovation is usually path-dependent and incremental (Klitkou, Bolwig, Hansen & Wessberg, 2015, Ziman, 2000) as discussed in 2.3. These serve to stabilise and reinforce existing systems (Unruh, 2000). Therefore, a key puzzle of sustainable transitions to be solved is to **unlock existing systems**. If a technology is adopted, it experiences positive feedbacks via learning effects, network economies, scale economies and adaptive expectations (Arthur, 1989; Hughes, 1994).

Considering these conceptions, new technologies are effective entry points for the study of societal change (Rosenberg, 1995), which includes sustainability transitions. This does not mean that such studies should be biased to the supply of new technology. Instead, they must progress across invention, diffusion, societal embedding and use (Geels, 2020).

Technological systems in the CF are defined as “systems of methods and designs for transforming matter, energy and information from one state to another in pursuit of a goal or goals.” (Foxon, 2011, p. 2262). From this definition, it is clear that the CF shares a lot of the assumptions and understanding of how technology changes with the MLP, if at a more superficial level, and in particular the path dependent nature of such change, building on the

work of Ziman (2000). Given its evolutionary focus, it upholds the same conceptualisation on the coevolution of technological trajectories and technological paradigms (Dosi, 1982; Nelson and Winter, 1982) which evolve in social and economic contexts.

The CF, however, includes ideas from innovation system theory (Lundvall, 1993) which are not included in the MLP. The key argument is that entrepreneurs innovate as a response to drivers and barriers found within the wider innovation system, including suppliers, other businesses, networks, and regulators. (Foxon, 2011). However, this is not a criticism of the MLP. On the contrary, Markard and Truffer (2008) argue that this innovation system approach works in complement.

### 3.3 Institutions

In traditional institutional theory terms, the socio-technical regime represents the ‘rules of the game’ (North, 1990) as ways of structuring human interactions. This institutional understanding does not imply that the material aspect is irrelevant. Freeman and Perez (1988) noted how for new radical technical innovations benefits to be realised, they had to be significant social, industrial and institutional changes. This coevolution of social and industrial structures, institutions and technologies helped inform research about innovation systems at the meso-level (Nelson, 1994, 2002) and about economic growth at the macro-level (Nelson, 2005).

Nelson (2005) conceptualises institutions as a method of structuring human interactions and terming them ‘social technologies’. The dominant rules of the game evolve out these interactions and are “institutional and especially cultural-cognitive in nature” (Fuenfschilling & Binz, 2018, p.736). So the socio-technical regime can be conceptualised as the prevailing institutional logic of the system (Thornton, Ocasio & Lounsbury, 2012). Furthermore, interested actors are constantly battling for power so the regime rationalities are continually contested and socially reconstructed (Fuenfschilling and Truffer, 2016; Geels, 2014).

Institutions both restrict and encourage behaviour by laying out pre-agreed contexts for acting, through labelling socially desirable, appropriate or legitimate ways of acting within the socially constructed system of acceptable norms, beliefs and values. Thus, organisations are competitive and contend for ‘social fitness’ (Powell, 1991, p.184) as well as economic

strength. In this way, institutions are gatekeepers of change (Gliedt, Hoicka & Jackson, 2018). Building on this, the MLP is informed by neo-institutional theory (Larrinaga, 2007) which highlights that organisations also function in institutional environments, not only economic environments.

In the same vein, ideas from organisational fields have helped conceptualise actors within institutional environments. Field actors are firms, consumers, regulators, lobbyists, governments, organised public opinion, social pressure groups and trade unions (Beckert, 2010). Different positions with the field allow different institutional opportunities to actors. Those on the periphery may seek to instigate change, those in the middle mostly conform to the institutional pressure, and those in central power use that power to their advantage (Greenwood, Suddaby & Hinings, 2002). In this way, institutions influence actors' perceptions and preferences, and actors try to influence institutions for their own interest (Geels, 2020).

As incumbents, institutions favour stability and pursue strategies to defend their interests (Geels, 2010; Meadowcroft, 2009; Unruh, 2000). Innovations with sustainability benefits tend not to be incremental, thus pose a threat to incumbents whose practices are entrenched in the existing regime, with those that profit from the regime feeling most threatened (Smink, Hekkert & Negro, 2015). Challengers and social movements (e.g. lobbyists) often do not have access to institutional maintenance mechanisms (Van Wijk, Stam, Elfring, Zietsma & Den Hond, 2013), which in combination with institutional lock-in mechanisms and path-dependency, stabilise the regime (Verbong & Geels, 2010). Institutions experience positive feedbacks (North, 1990) in the same way technology does. This is most noticeable in energy systems where the process of cumulative causation results in high carbon techno-institutional systems being locked-in (Unruh, 2000), but holds true in other industries.

The CF mostly agrees with the MLP's understanding of institutions, but preferences and redistributes certain aspects. Namely, the CF agrees with North's (1990) 'rules of the game' although, (1) cultural and social elements such as individual behaviours, habits and routines, and (2) strategies of firms who seek to stabilise or disrupt the regime, are institutional in the MLP but are defined under user practices and business strategies respectively, in the CF. The latter adds considerable clarity to agency in relation to institutions, as the same actor can be understood as an institution, or a business or user, where necessary.

For example, research into the social context of technologies (Edgerton, 2006) outlines the various ways technologies become societally embedded, comparing the training of skilful installation and repair labour with the development of collective meanings about how technology is used. In the CF, the former is reflected in the institutions system and the latter is reflected in the user practices (Foxon, 2011).

### 3.4 Ecosystems

As discussed in 2.4.4, the Earth system depends on the biosphere, which depends on ecosystems (Folke et al. 2016), so ecosystems should be accounted for explicitly. Ecosystems are a main element of the CF but not of the MLP, which means **ecosystems are one of the ways CF can complement the MLP**. They are defined as “systems of natural flows and interactions that maintain and enhance living systems.” (Foxon, 2011, p. 2262).

Natural ecosystems have and continue to be significantly harmed and inhibited by their interactions with rapidly growing human systems (Steffen et al. 2015). Despite this clear importance, evolutionary economic conceptions have only recently started to be combined with ecological economics (van den Bergh, 2014). van den Bergh et al. (2006) outline ‘lock-in, diversity, selection, path dependency, innovation, bounded rationality, and coevolution’ as six concepts important when applying evolutionary economic thinking to ecological economics. Indeed, ecological economics and MLP have similar overarching objectives, but they are framed differently (De Jesus & Mendonça, 2018; Siebenhüner, Rodela & Ecker, 2016).

Social-ecological systems are increasingly being conceptualised as complex adaptive systems (Levin, Xepapadeas, Crépin, Norberg, De Zeeuw, Folk, Hughes, Arrow, Barrett, Daily, Ehrlich, Kautsky, Mäler, Polasky, Troell, Vincent & Walker, 2013), which varies greatly from neoclassical understandings (Beinhocker, 2006). This conceptualisation yields key complex adaptive system insights, such as the significance of the interactions of economic agents within networks. Ignoring these insights can mislead efforts to understand how these systems work (Levin et al. 2013).

### 3.5 Business strategies

Since Penrose (1959) resource-based view of the firm, business strategies have been a core focus of evolutionary economics. Key with business strategies are firms' 'dynamic capabilities', which are distinctive combinations of competencies and resources that are not easily transferred (Winter, 2003).

In the CF, business strategies are defined as "the means and processes by which firms organise their activities so as to fulfil their socio-economic purposes." (Foxon, 2011, p.2262). Indeed, the main objective for most commercial businesses is to generate a profit and returns to owners and/or shareholders, although bounded rationality (Simon, 1972) means that businesses tend to actually be profit-oriented and not profit-maximising. The supply of goods and services to customers are the activities used in achieving this objective while social factors, such as reputation, effects their ability to perform these activities (Foxon, 2011).

The existing literature on business strategies in the sustainability field has predominantly focused on external drivers (Verbong & Geels, 2010) and firms' technical innovation processes (as discussed in 2.4.1) (e.g. the MLP). Firms' other **internal factors** (in-house resources, firm characteristics, capabilities) have received relatively little attention, yet the work that has been done indicates that they are significant drivers of business strategies (del Río, Carrillo-Hermosilla, Könnölä & Bleda, 2011). For example, Beinhocker (2006) proposes that the coevolution of social technologies, physical technologies and business strategies has been a key driver of wealth in western developed countries. In this regard, Foxon (2011) argues that clearly delineating business strategies is this **one of the ways that the CF is more flexible** than the MLP.

### 3.6 User practices

In the CF, user practices are defined as "routinised, culturally embedded patterns of behaviour relating to fulfilling human needs and wants." (Foxon, 2011, p. 2263). The CF relies on the conceptualisation of social practices, where individuals have agency, but are constrained by social structures, as described in 2.4.3. As consumption patterns and domestic practices coevolve with production and supply chains, certain practices may be constrained or

promoted by systems of technologies, institutions and business strategies, and therefore will coevolve with them (Ropke, 2009).

The agro-food system is a suitable example of a system where actions are the product of facilitating routines, conditions and behavioural intentions, as consumers' decisions are normalised by everyday practices (Triandis, 1989). Kuokkanen, Uusitalo & Koistinen (2019) elucidate a practiced-based view of user practices in terms for food systems, defining them as consumption preferences, expectations and demands. Indeed, "disruption cannot be reduced to a single event of 'adoption' but is a more subtle change of citizen-consumers' daily practices" (Kuokkanen, Uusitalo & Koistinen, 2019, p.752).

### 3.7 Applying the CF alongside the MLP

With these differences and definitions clarified, the CF contends that sustainable transitions may occur through any combination of technological advancements, revisions of institutional construction, re-evaluations to business strategies, changes in user practices, and the interaction of these four actions with fluctuating natural ecosystems (Foxon, 2011). When an actor sets change in motion, it is known as path creation (Garud, Kumaraswamy & Karnøe, 2010) can come from actors from any of the five systems. The consequences of path creation will be unclear due to the complex interactions within the CF, but through its application, what is hindering actors creating more sustainable paths may become clear. In this regard, the CF more explicitly accounts for the role of agency.

To gain explanatory authority, the CF must be accompanied by empirical content to explore the particular causal influences (Foxon, 2011). There have been more recent successful applications of the CF which primarily focus on transitions to low-carbon energy systems (e.g. Bale, Varga and Foxon 2015; Edmondson, Kern and Rogge, 2019; Foxon and Steinberger, 2013; Hall and Foxon, 2014; Hannon, Foxon, and Gale, 2013; Pearson and Foxon, 2012; Taylor, Bolton, Stone and Upham, 2013), so this paper seeks to contribute to CF literature through an agro-food industry focus.

The empirical content used in this exploration is from: (1) issues raised by UK PBM brands in the efforts to compete with dairy milk, understood as part of the business strategies system;

and (2) descriptions from UK consumers on their milk drinking habits, preferences and reasonings, understood as user practices. It is beyond the scope of this thesis to gather empirical content relevant to ecosystems; however, the fundamental role that ecosystems have in the biosphere (Rockström et al. 2009) make them an inherent focus of this thesis.

# 4 Methods

## 4.1 Research approach

This thesis utilises an abductive approach. Abduction is about converting social actors' activities and way of life into technical and social scientific explanations (Blaikie, 2004, p.1). This conversion happens by either observing or gathering a description of these activities and then deriving meaning and themes that can form the basis of an understanding of the problem at hand - similar to a detective finding explanations from whatever clues are available (Blaikie, 2004, p.1). In this way, abduction is often associated with interpretivism. Based on this, abduction has clear similarities to induction. However, with abduction, researchers use a selective process to examine how the data supports **existing theories** and how the data may call for **modifications** in existing understandings (Tavory and Timmermans, 2019, p.540).

This allows for the use of pre-existing theories, not to develop a hypothesis test as with deduction, but rather as a source of inspiration and guidance for patterns uncovered (Kennedy & Thornberg, 2018, p.52). Abduction thus necessitates **iterative interplays** between data and theory, in which researchers draw on previous theoretical knowledge; and data collection and analysis, in which ongoing analysis of data suggests plausible explanations to investigate further (Kennedy & Thornberg, 2018, p53).

There are limitations to an abductive approach. Firstly, it is possible to fit many explanations to a small set of clues, therefore triangulation is of additional importance to protect against pursuing themes based on 'wild guesses' (Paavola, 2004, p. 271). Thus, with more clues, fewer explanations fit. The second limitation concerns the potential existence of more than one strongly plausible explanation (Lipscomb, 2012). This is not a concern in this thesis as the aim is not to conclusively explain what the missing barriers to a sustainable transition to PBM are, or even provide a hypothesis for others to test.

## 4.2 Research design

There are numerous research designs in qualitative research, including phenomenological research, discourses analysis, ethnography, action research, narrative studies, grounded theory and case studies (Creswell & Creswell, 2018, pp. 54-55; Flick, 2018, pp. 57-59), each with advantages and disadvantages.

The data sources, informed by the research approach and research question, are the interviews and surveys (with open-ended questions) with consumers and business representatives. Such data would indicate the use of classic grounded theory, developed by Glaser and Strauss (1967). As this thesis has an abductive approach, a purely inductively orientated grounded theory is not appropriate, but the abductive analysis can be enriched by making use methodological elements of grounded theory such as the sampling and coding process in the more inductive phases of the analysis (Reichertz, 2019 p.269; Tavory & Timmermans, 2019, p.538).

## 4.3 Data collection method

Creswell & Brown (1992) suggest that qualitative research should mirror how things operate in real life and gaining more holistic picture will more closely mirror the real world. This involves reporting multiple perspectives, so this thesis utilises multiple sources of data and consequently, different data collection methods (see Table 1).

Table 1: Types of data collected for this thesis

<b>Principal Data Collection</b>	<b>Business Strategies</b>	<b>User Practices</b>
Face-to-face semi-structured interviews	2 PBM brand representatives	
Telephone semi-structured interviews	3 PBM brand representatives	
Online survey with open-ended questions	3 PBM brand representatives	148 UK consumers
<b>For Triangulation</b>		
Face-to-face semi-structured interviews	3 UK oat farmers	
Telephone semi-structured interviews	3 UK dairy farmers	
Consumer Market report		Mintel (2019)

The open-ended nature of these data collection formats were chosen as the entire qualitative research process concerns the meaning that the participants hold about the events or issues (Creswell & Creswell, 2018, p.297).

### 4.3.1 Sampling

#### **Interviews**

**Purposive sampling** is a form of non-probability sampling where the researcher does not seek to sample research participants at random. Rather, the objective is to sample the most relevant participants in a strategic way (Creswell & Creswell, 2018, pp.300). Purposive sampling was used in this thesis, informed by the framing of the problem statement and research question. The data collection phase used a form of purposive sampling known as **theoretical sampling** (Glaser and Strauss, 1967), as allowed by the research design, until **theoretical saturation** was reached. For example, there are approximately fifty UK-based PBM producing businesses, thus 50 potential candidates for interviews based on the criteria of the sample required. All fifty were contacted and eight were willing to participate. Theoretical saturation comes from grounded theory and is achieved when gathering fresh data no longer leads to new insights and therefore a sufficient sample has been achieved

(Bryman, 2012, p.420; Creswell & Creswell, 2018, p.301). The suggested sample size depends on the type of design being used but there is no definitive benchmark (Creswell & Creswell, 2018, p.303).

## **Survey**

UK consumers of dairy and PBM are a very large population, and gaining a representative sample is well beyond the scope of this thesis. Although this would have been ideal, it is not necessary as this thesis does not seek to prove the habits or preferences of UK consumers conclusively, so non-random sampling is acceptable. The request for participants and a link to the survey was shared on certain social media forums, such as “Buy and Sell UK” whose members are UK-based. These forums require members to be verified as legitimate UK-based consumers before joining. This is convenience sampling (Bryman 2012, p.201) as it is low-cost and most accessible to the research, whilst including a broad range of UK locations. This is also voluntary sampling as forum members are not required to participate.

These non-random sampling methods have limitations that can lead to bias (Bryman 2012, p.200). As it is voluntary, the survey may receive more responses from those who particularly favour either dairy or PBM, and less from those who are undecided. Additionally, convenience sampling through online surveys is only available to people with internet access and can reasonably be expected to participate. Although most of the UK has online access, it is more common amongst those educated, wealthier and younger (White & Selwyn, 2013), the latter of which was shown in the results. These biases do not inhibit answering the research question in this thesis as it does not concern conclusively proving UK consumer trends.

### **4.3.2 Interviews**

For the semi-structured interviews, the researcher listed questions on fairly specific topics in the form of an **interview guide**, with one each for farmers and businesses, respectively. The questions were asked broadly to allow the interviewee flexibility in replying. This flexibility is important to emphasise how the interviewee frames and understands events and issues (Bryman, 2012, p. 471; Creswell & Creswell, 2018, p.306). The questions were not asked in the same order in all interviews to prevent the interview bringing up a topic organically, but the wording of the questions remained consistent to ensure the most neutral line of enquiry.

The interview guide was constructed by outlining topics relevant to the literature section. The topics were formulated in questions and revised into a draft guide, which was used in a **pilot interview** with an oat farmer in the UK. The farmer in question was an ideal pilot participant because he sells his oats to an oat milk manufacturer, and so had some insight into both industries. The pilot interview revealed some issues which were rectified, and the questions were revised into a final guide (see Appendix A). Nevertheless, the data gathered during the pilot interview was fruitful and included in the final dataset as 'Farmer 1'.

The preference was for the interviews to take place face-to-face as this allows for additional information, such as body language, to be garnered. However, only five participants were available for face-to-face interviews due to the UK Covid-19 pandemic regulations. The remainder of the interviews were conducted via telephone. Both face-to-face and telephone semi-structured interviews allowed the researcher to control the line of questioning while allowing the interviewee flexibility in response.

Probing was an important technique utilised in the interview process (Bryman, 2012, p. 223). As the questions are open-ended, it relies on the participants to organically raise themes. However, they may not go into detail when mentioning a theme and therefore, a probe allows the researcher to gain more information or an explanation on a theme (Creswell & Creswell, 2018, p.310). With the consent of each interviewee, the interviews' audio was recorded by two devices to ensure against device failure. In addition, the interviewer took notes during the interview, which allowed early construction of rough ideas. On a few occasions, these ideas led to additional question topics in later interviews, as allowed by the abductive research approach.

There are some limitations to semi-structured interviews. Firstly, the interview takes place in a space away from a natural field setting (Creswell & Creswell, 2018, p.306), meaning the research relies on the participants perspective of events or actions, rather than a confirmed observation of such actions. However, as this research concerns how and why business and users make choices, rather than the choices themselves, this limitation is not of concern. Furthermore, not all people are equally articulate and perceptive, and the presence of the researcher may induce biased responses (Creswell & Creswell, 2018, p.307). It is, therefore, a fundamental task of the researcher to try to ensure no bias is created by maintaining objective neutrality and to try probe the interviewee where possible to extract as much information as possible.

A final limitation is that asking businesses about their own strategies may result in biased answers as they will likely phrase their answers to be more favourable. It is the job of the researcher to fully dissect these potentially tailored responses to gain the clearest possible understanding. However, this limitation was the motivation to also interview farmers as, although they may suffer from the opposite bias, the contrast provides triangulation.

The eight brands whose had representatives willing to participate in this study were Minor Figures, Rude Health, Plenish Drinks, My Dairy Free Dream, The Coconut Collaborative, M\*lkman, Koko and Oatly UK. For anonymity, these brands have been randomly labelled as Companies 1 to 8 (see Table 2). Table 3 shows the profiles of the farmers interviewed for triangulation.

*Table 2: The profiles of the 8 brands who were interviewed or filled in an online survey.*

<b>Name</b>	<b>Milk Produced</b>	<b>Method of Data Collection</b>
Company 1	Coconut	Online Survey
Company 2	Oat and Coconut	Online Survey
Company 3	Coconut	Online Survey
Company 4	Oat	Telephone Interview
Company 5	Oat	Telephone Interview
Company 6	Almond, Rice, Cashew, Oat, Tiger Nut, Soya, Hazelnut and Coconut	Telephone Interview
Company 7	Almond, Cashew, Soya, Hazelnut and Coconut	Telephone Interview
Company 8	Rice, Oat, Almond and Coconut	Telephone Interview

*Table 3: The profiles of the six farmers who were interviewed.*

Farmer 1	Arable including oats for milling	Face-to-face interview	1800 tons per year
Farmer 2	Arable including oats for milling	Face-to-face interview	1500 tons per year
Farmer 3	Arable including oats for milling	Telephone Interview	1250 tons per year
Farmer 4	Dairy - New Zealand Grazing System	Face-to-face interview	380 hectares 500 cows
Farmer 5	Dairy - New Zealand Grazing System	Telephone Interview	500 hectares 800 cows
Farmer 6	Dairy - New Zealand Grazing System	Telephone Interview	460 hectares 650 cows

### 4.3.3 Online survey

Online surveys are a respectable alternative when interviews are not possible. Two online surveys were utilised in this thesis, one for business representatives who were unable to do an interview, and one for UK-based consumers or users as it was not practically within the scope of this thesis to interview a sufficient number of users. Online surveys allow the option for open questions, which is a crucial aspect of qualitative research. Moreover, they allow full anonymity to the participants if names are not required, and IP addresses are not tracked. Online and email surveys are relatively low cost, garner faster response than most other methods, and are unrestricted in terms of geographical coverage (Bryman 2012, p.671), which was an important strength for this thesis in analysing users UK-wide.

The survey was divided into three parts. First were multiple-choice questions about the participants' profile asking about: gender; approximate age; location in terms of UK region; and location in terms of urban, suburban or rural. Next, two checklist questions about users' dairy consumption habits, namely which milks or PBM they consume and where/how they obtain dairy/PBM products. The format of these questions made the process faster and more

straightforward for the participant and more efficient for the researcher to manage using management tools on SurveyMonkey. This automation also removed any likelihood of data entry errors by the researcher.

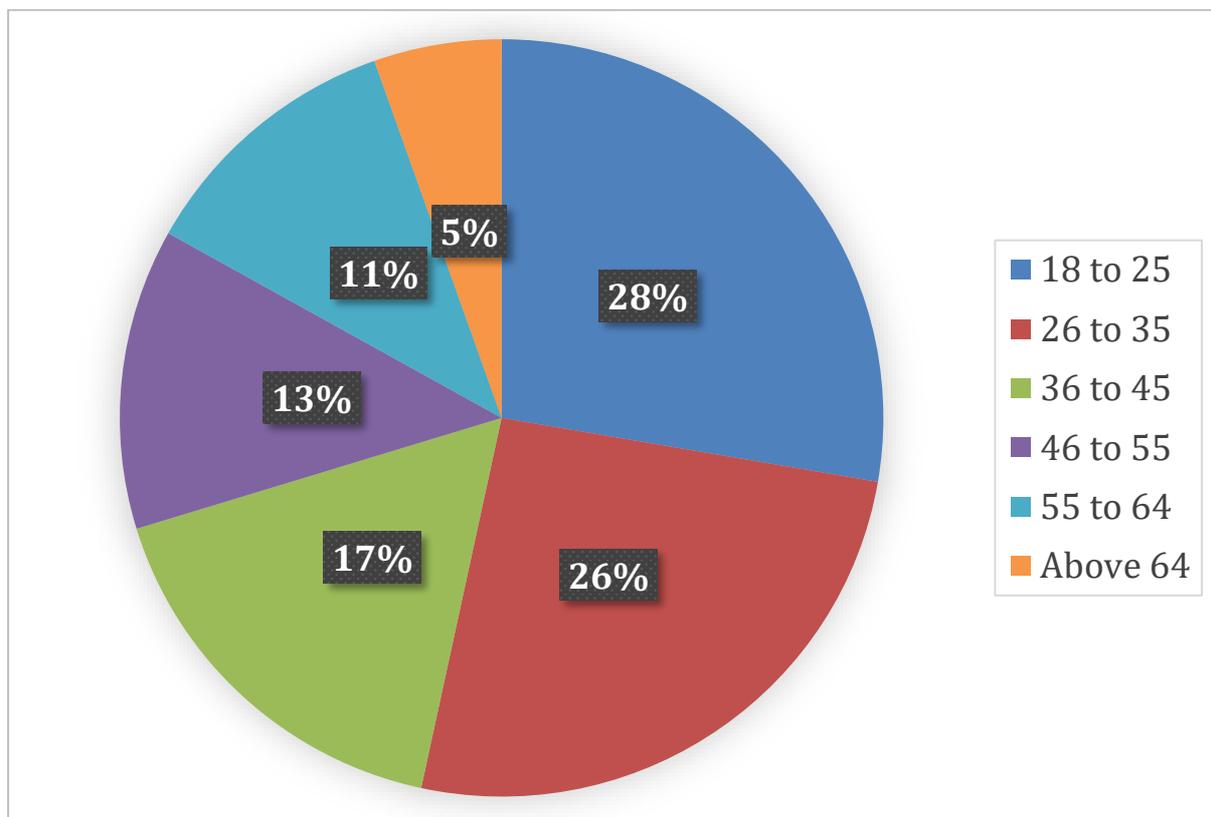
Finally, the survey listed two open-ended questions, the first concerning why users performed certain practices and the second concerning why they had changed or not changed these practices. These questions were formatted with a large text response box encouraging the participant to write more than a few words. The open-ended format also gave the participants some, but not all, of the flexibility that the interviewees had. To assess the full range of features offered by SurveyMonkey, the researcher purchased a short-term subscription, which was not a limitation (albeit a disadvantage of the tool) as it was within the researcher's budget. The survey was kept relatively short as long surveys tend to receive a lower response rate (Creswell & Creswell, 2018, p.245).

There is debate on whether online surveys compare to surveys conducted in person and other forms of research. Although not conclusive, studies have shown that there will not be significant mode effects (when the mode of collection leads to different responses from the same participants) (Bryman, 2012, p.673). Nevertheless, mode effects are possible, so triangulation via another data source was used to the account for this.

Online surveys have inherent limitations compared to face-to-face interviews. Online surveys tend to have a lower response rate (Bryman, 2012, p.674). The anonymity allowed in online surveys may allow people to complete the survey more than once (Bryman 2012, p.677). In this case, SurveyMonkey blocks the participant's IP address upon completing the survey, which would be a limitation for households that have one computer to multiple users. Therefore, mobile device versions were made available, broadening the range of potential participants. Lastly, unavoidable disadvantages of online surveys compared to interviews is that the responses will not be as rich and detailed and the researcher can never be sure that the participant who filled in the survey is whom the researcher believes them to be (Bryman, 2012, p.674). Nevertheless, online surveys are still an insightful source of information, and with greater efficiency, their use resulted in a greater sample size than would have been achievable with interviews.

Of the 148 who participated in the online survey, 52% were female, 46% were male, and the remaining 2% preferred not to answer. Of the participants, 49% lived in urban areas, 35%

lived in suburban areas, and 16% lived rurally, which compares favourably with the UK national distribution of citizens (Coates, 2019). Figure 4 shows the participants' age groups, with over half falling between the ages of 18 and 35, as anticipated in the limitations of online surveys. Figure 5 shows the distribution of participants per region of the UK. Figure 6 shows how many of the participants each drank dairy or PBM (they were permitted to tick all relevant boxes). The prominence of London is in line with national statistics (Coates, 2019), however the North West and South East of England were somewhat under-represented, and Scotland and the South West were slightly overrepresented.



*Figure 4: Age distribution of the user practices survey participants.*

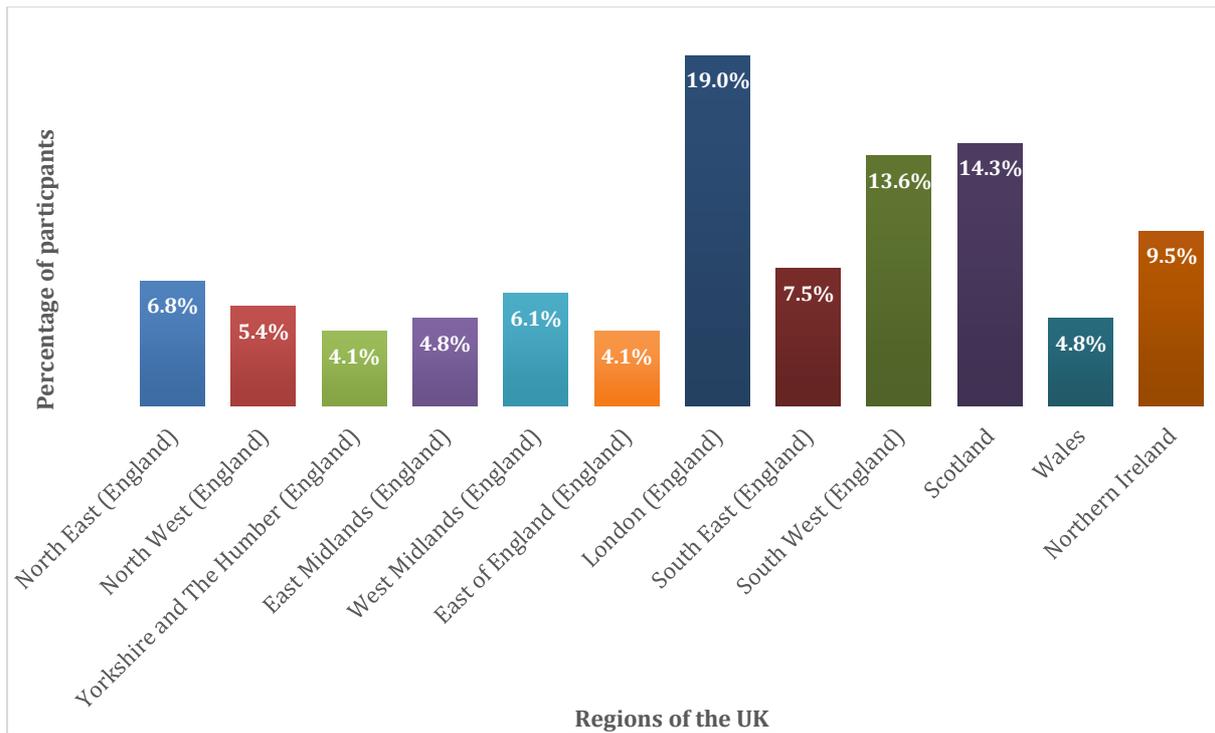


Figure 5: Regional distribution of the user practices survey participants.

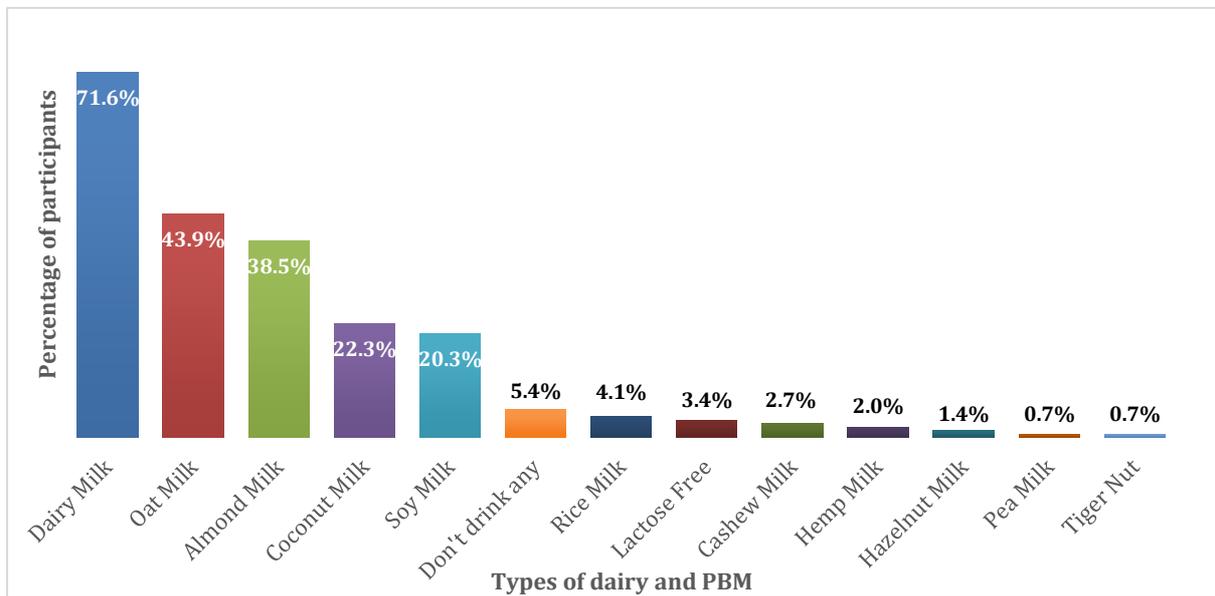


Figure 6: Types of milk by the percentage of user practices survey participants who consumed them.

## 4.4 Data analysis

Once most of the interviews were done, and all responses to qualitative surveys were submitted, the data was organised and prepared for analysis by transcribing the interviews and interview notes and entering the data analysis phase on SurveyMonkey. Then followed a complete read-through of all the data allowing the researcher to gain a general sense of the information and an opportunity to reflect. During the collection phase, ideas for themes began to form for the researcher as this step is the first opportunity to start recording rough ideas for themes that will inform the coding.

The coding phase was originally going to include the use of NVIVO qualitative software for assistance, however, the volume of data from the interviews was achievable by hand. For the survey, SurveyMonkey contains its own data management software with similar functionality to NVIVO. This functionality allows the researcher to add tags to words or phrases while viewing the responses. These tags can then be categorised and easily handled during the coding process.

For the interviews, the data was bracketed in chunks and labelled with a code, either a word or a term, to describe each chunk. These codes were often *in vivo* (e.g. based on the exact wording used by the interviewee) (Creswell & Creswell, 2018, p.313). The interpretation of the data varies depending on the approach (Creswell & Creswell, 2018, p.318), therefore the data was analysed abductively, allowing the iterative interplays discussed in 4.1.

As Barbour (2001) suggests for coding within grounded theory, the process occurred in three waves. First, the researcher set out open codes, including anything that could be relevant, resulting in twenty-four open codes. This was then **winnowed** down to a series of twelve axial codes. Finally, after additional reviews, adding in the final interviews to the data set, and reevaluating each central code numerous times, they were categorised (selective coding) and constructed to five interconnected theoretical codes or themes. As this was an abductive process, there was regular reference back and forth between the data and theory until the themes were comprehensive.

A similar process was followed for the survey response, although they were more straightforward as they included more direct answers to questions. The open coding step was completed within the SurveyMonkey presentation function.

## 4.5 Validity, reflexivity and reliability

Certain strategies were utilised to ensure the **validity** of the findings, as suggested by Creswell & Creswell (2018, pp.319-320). The primary strategy used was triangulation, which is a process of examining evidence from different data sources (Bryman, 2012, p.392; Flick, 2018, p.444). Dairy farmers were interviewed to validate the business interviews. A compressive report of UK consumer dairy and PBM preferences by Mintel (2019) was reviewed to validate the user responses. In addition, insights from data for each system can inform and validate the other as they are discussing similar subjects. Therefore, the themes found are based on converging perspectives from different sources, adding to the validity of the thesis. This is a strength of abductive research.

Steps were taken during the research process to ensure the **reliability** of data and results, as suggested by Bryman (2012, p.393). The transcripts were checked for obvious mistakes, and regular cross-checks during the coding process ensured the meaning of the codes was kept consistent. As shown in the interview guide (see Appendix A), the data was collected, acknowledging that competitive firms are unwilling to share sensitive information. Creswell & Creswell (2018, pp.321-322) also suggest *external reliability* as the degree to which a study can be replicated, but this not that essential for any explanations found as they are not generalisable. However, suitable findings indicate that the CF is a useful complement to the MLP and therefore, the method can be replicated, which is part of this thesis's **contribution** to research.

# 5 Empirical Chapter

Geels (2019) argued that technological innovations are the best entry point for non-technically focused transitions research. Thus, this analysis begins with PBM as a sustainable solution to the dairy industry's contribution to land system change and climate change.

## 5.1 The dairy and PBM industries

This section seeks to provide more details of how dairy and PBM fit into the problem framed by this thesis. In doing so, this section provides the reader with more detail of the two industries to more clearly contextualise and understand the themes raised by the interviewees and survey participants. Also presented in this section are the findings of the review of the consumer market research report by Mintel (2019), which contextualises the alternative milk industry but also serves as triangulation for the user practices section.

### 5.1.1 The UK dairy milk industry

The UK is the eleventh-largest milk producing country in the world (Shortall, 2019). Milk comprises 16.9% of the UK's 2018 total agricultural output, worth £4.5bn in market prices. Although the number of UK dairy cows fell by 27% from 2.6 million in 1996 to 1.9 million in 2018, the yield per cow has increased by 94% from 1975 to 2018 (Uberoi, 2020). The scale of production is shown in Table 4.

*Table 4: Size of UK dairy production. (Adapted from Shortall, 2019 and Uberoi, 2020)*

Land used for Dairy	242 495 km <sup>2</sup>
Number of Dairy farms	12584
Average Herd Size	142 Cows
Average Milk Yield per Cow	7495 litres per cow per year

There have been further significant changes in the UK dairy industry since the mid-1990s, as showed in Table 5, notably in farm-gate price (price per litre received by the milk producers) and the price of milk at retailers. Moreover, a negative indication for the industry is that, although there have been fluctuations across most types of milk products, liquid milk consumption has stayed fairly consistent despite an increasing population.

*Table 5: Table showing size of the UK dairy production. (Adapted from AHDB, 2020a, 2020b and Uberoi, 2020)*

<b>UK milk usage (million litres)</b>	<b>1998</b>	<b>2018</b>	<b>% Change</b>
Liquid consumption	6 768	6 676	-1.4%
Butter	281	315	+12.3%
Cheese	3 270	4 438	+35.7%
Cream	235	281	+19.6%
Yoghurt		385	
Condensed milk	643	323	-49.7%
Milk powder	1 910	871	-54.4%
Other manufacture	469	488	+4.0%
	<b>1995</b>	<b>2020</b>	
% of population with front door milk delivery	45%	3%	-93%
Average Front Door delivery price per pint of milk	37.9p	81p	+113.7%
Average Retailers price per pint of milk	23.9p	28.3p	+22.6%
Farm-gate Price per litre	22.1p	32.9p	+48.9%

### 5.1.2 The UK PBM

In contrast to dairy, a report from Mintel (2019) noted some positive trends in the PBM market. These findings also serve as triangulation for the results in 4.3. According to the report, 23% of UK residents use PBM as of 2019, up from 19% in 2018. Oat Milk sales, in particular, increase 71% from 2017 to 2018, with the total 2018 oat milk market value rising

to £36 million. Half of this market value was due to the sale of the Swedish brand Oatly. Coconut and almond milk also rose by 16% and 10% respectively.

Mintel (2019) surveyed 2,000 UK residents and indicated that these positive trends were driven by younger consumers. During January of 2019, 92% of people 45 and older said they had drunk cow's milk, whereas only 73% of people between 16 to 24 said they had done the same. Also of note, 26% of the women surveyed said they prefer PBM, compared to 19% of men. When asked what motivated those surveyed to start drinking PBM, health (37%), ethics (33%), environment (36%), and variety in their diets, were the most common responses.

There is debate as to whether health should be valid reasons to change to PBM. Research has found a large number of PBM products to compare unfavourably to dairy milk in terms of nutrition (Chalupa-Krebzdak, Long & Bohrer, 2018). However, most of these PBM are the cheaper brands usually made from mixing water with a concentrated plant-based syrup, whereas higher quality products, particularly oat milks with added nutritional compounds compare favourably to the nutrition of dairy milk (Bocken, Smeke Morales & Lehner, 2020; Morris, Mylan & Beech, 2019).

Ethics focused responses related to animal welfare but also to plastic waste reduction, sustainable farming, and recycling (Mintel, 2019). Animal welfare concerns are valid, as although dairy farming is associated with imagery of cows grazing on grass, pasture grazing is a declining practice in the UK (Shortall, 2019). It is being replaced by more industrialised systems with cows raised mostly indoors and given concentrated feed, leading to mastitis and lameness (Jackson, Green, Millar & Kaler, 2020). Furthermore, as cows need to be continually impregnated to produce milk, their numerous offspring are often slaughtered, and they can become infertile (Jackson et al. 2020).

The evidence for the reduced environmental impact of PBM compared to dairy is very clear (see Figure 7). But, as Figure 7 shows, not all PBM have the same benefits. In the context of the UK, not all plant bases can be grown domestically, and the extensive distanced needed for shipping drives up transport emissions compared to domestic dairy (Haas, Schnepps, Pichler & Meixner, 2019). Of the PBM, only hazelnuts, hemp and oats grow in the UK (Mintel, 2019). The rest must be imported, often from tropical areas as in the case of coconuts. In fact, all the Oatly products sold come from their sole production plant in Skåne, Sweden and are imported ready-made to maintain the quality (Bocken, Smeke Morales & Lehner, 2020). This

is effective but is expensive and drives up emissions. Oats and hemp both grow with little water and are high in fibre and omega-3 respectively (Poore & Nemecek, 2018). Rice requires more water in its production but has calcium, vitamin B, and magnesium. Soy, high in protein, requires a lot of land and is a major contributor to deforestation. Almonds use by far the most water. Therefore, it is fair to say that sustainable transitions to oat and hemp-based milks are the most beneficial for the environment (Poore & Nemecek, 2018).

## Which milk should I choose?

Environmental impact of one glass (200ml) of different milks

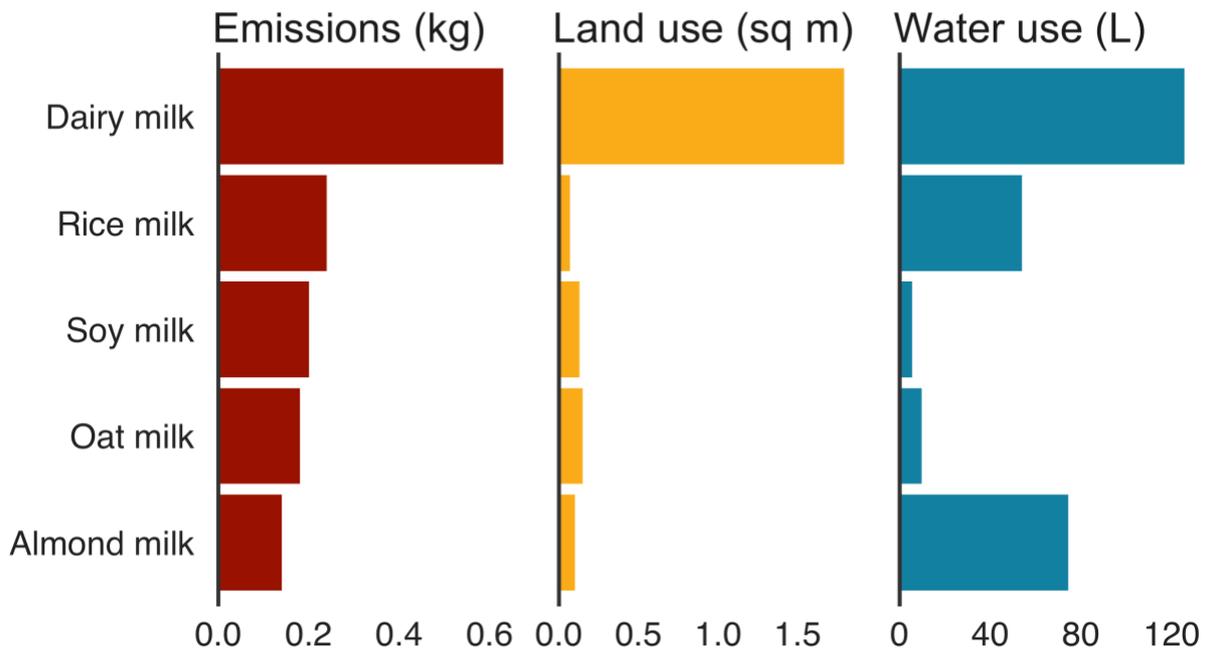


Figure 7: Environmental impact of a 200ml glass of milk and plant-based milks (Adapted from Poore & Nemecek, 2018, p.988).

Despite these encouraging signs in PBM sales, as mentioned focally in the problem statement, PBM only make up 4% of volume sales and 8% of value sales of the combined industries as of 2018 (Mintel, 2019). Areas of particularly low acceptance of PBM are use in hot drinks (42% use PBM but 82% use dairy milk) and cooking (25% use PBM but 42% use dairy milk) (Mintel, 2019). These statistics do not account for the varied environmental benefits of PBM.

## 5.2 Business Strategies

In this section, the results of the data analysis for business strategies are presented and discussed. Each theme is divided into four paragraphs: first to present the results of the interviews with brands; second to triangulate with other data sources; third to see if the MLP can be applied and lead to a theoretical explanation of what is happening; and four to repeat this with the CF.

### 5.2.1 Plant-based milk acceptance

An ongoing problem for PBM companies is the lack of acceptance of PBM. Indeed, as Company 5 notes, “there is an ongoing suspicion of consumers about PBM - will they taste nice, aren't they just for allergy sufferers? Many people are more open-minded than some years ago but not everyone”. This issue was raised by all eight companies, however, some emphasised it more than others. Companies 6, 7 and 8 have found a suitable demographic who are more open to PMB products, specifically wealthier people between the age of 18 and 40 who live in urban areas. Company 4 expressed their focus on expanding their product reach beyond this demographic. Company 1, 2, 3 and 5 are small and so are still trying to find a comfortable customer base.

This theme was triangulated by evidence from the interviews with farmers. Farmer 1 said people are emotionally connected to the idea of local dairy farmers, and they wish to support them. Farmers 4 and 5 said consumers enjoyed milk for so many reasons that most of the market is unlikely to give it up entirely. The construction of this theme was further triangulated by the user practices survey, with some citing their suspicion of the taste, consistency, health benefits and price of PBM.

This kind of strategy can be well accounted for within the MLP. The MLP's understanding of the regime anticipates resistance from exiting regime (Unruh, 2000) due to lock-in mechanisms and path-dependency (Klitkou et al. 2015), which is the case for the dairy milk regime (Mylan et al. 2019). This includes social and cognitive mechanisms (Pierson, 2000), as the brands are seeking social fitness (Powell, 1991, p.184) for PBM within the institutional rules of the regime. Users within the regime are set in their ways and will not change without disruption from niche or landscape pressure (Geels, 2019). Thus PBM brands in the niche try

to apply such pressure. According to Mylan et al. (2019), there is currently insufficient pressure on the UK dairy regime for disruption, but it has been growing.

The CF can also provide a theoretical explanation. PBM businesses trying to persuade consumers to buy their product is a form of causal interaction from businesses to user practices. If this is successful, the users begin to demand more PBM, and so businesses will seek to provide. Therefore the two systems are changing due to each other, which is coevolution (Foxon, 2011). However, the PBM coevolution can be undermined by strong contrasting interactions (e.g. institutional maintenance mechanisms for dairy) or insufficient supporting interactions (e.g. inadequate awareness of dairy's damage to ecosystems).

### 5.2.2 Brand awareness

Related to PBM acceptance, all eight PBM producers have had to struggle for brand awareness. As the PBM market becomes somewhat more established, a key goal is to distinguish one's brand from the rest. Indeed companies 3, 4 and 8 all anticipate the number of competitors in the market to keep growing. Companies 4, 6 and 7 are older, more established brands, whereas the others can still be classified as start-ups, so brand awareness is a natural objective. Although they all pursue similar strategies, during the interviews they each emphasised different ones. Companies 1 and 2 market themselves on being locally sourced producers. Companies 1, 3 and 4 emphasise the quality of their product. Companies 6, 7 and 8 market the variety of milk types and products.

Farmer 1, who sells his oats to two PBM producers, emphasised the importance of PBM brand awareness. Consumers considering changing were often trying different brands for the first time. If they did not like the taste or “cannot keep together in a hot cup of tea”, the consumer may be put off the PBM but certainly will be put off the brand. This focus on the quality of each brand was raised by numerous consumers in the survey, with regards to taste and use in hot drinks.

The MLP can again offer a clear explanation. As Figure 2 shows, numerous niche business will use trial-and-error and fail in the attempt. A plausible example is almond milk producers who were main players in the early disruption of dairy but have begun to suffer from their water usage issues being raised (Haas et al. 2019). However, the presence of this number of PBM bands is a sign of the niche becoming well-developed (Mylan et al. 2019).

For the CF, business strategies are causally interacting with user practices, attempting to convince them to buy their brand over others. In return, if the users' demand additional value from the product (e.g. extra nutrition, lower price), the business will seek to provide it, so again, the systems are coevolving (Foxon, 2011).

### 5.2.3 Technical strategies

Regardless of the extent that the companies' focus on innovation, there is no guarantee of technical progress. As company 3 said, "New product development is a challenge. We're often creating something new and genuinely innovative. It's not easy to develop a product that tastes good, is technically sound, meets consumers' needs and does all of this at the right price". Companies 2, 5 and 8 highlighted making the production process more technically efficient and lowering costs. Companies 1, 4, 6 and 7 prioritised developing milk-based products such as cheese and yoghurt, from their respective plant bases. Company 1, 2, 3, 4 and 5 expressed the importance of creating milk products that closely matched the dairy milk that they were trying to replace, both in taste and consistency. Company 4, in particular, reflected that their achievement of creating a product that maintained its consistency in hot drinks and while being foamed had been vital to their success so far. Companies 2, 5, 6, 7 and 8 also noted the importance of Company 4's achievement in hot drink milk consistency and have sought to emulate it. Companies 1, 4, 5 and 8 all said they added nutrients and minerals to their products to attract health-focused customers, which are a big part of their target market.

Farmers 1 and 2 both discussed how they were wary of the PBM market because a lot of PBM brands seem happier to cheaply import the concentrated plant-based syrup, rather than investing in the technology to make a better PBM product.

Conceptualising how technical progress and innovation systems impact transitions, despite their complexity, is a strength of the MLP (Smith, Voß & Grin, 2010). Mylan et al. (2019) showed the MLP's capability in this regard for PBM in the UK. Indeed, the coevolution between social and technical systems is the lynchpin of the MLP framework (Geels, 2002). As discussed in Chapter 3, the MLP is grounded in innovation studies (Smith, Voß & Grin, 2010), STS literature (Geels, 2002) and evolutionary technology literature (Dosi, 1982; Nelson & Winter, 1982) and so is widely regarded as a vital tool.

The CF is not as successful. Although the CF places technological systems as a fundamental system in its own right, bring in complementary insights from innovation system theory (Lundvall, 1993) and accepts similar understandings as the MLP, it lacks the same depth. Indeed, if the CF was more effective at conceptualising socio-technical content, it would become a rival rather than a complement of the MLP.

#### 5.2.4 The role of supermarkets

All of the companies discussed the powerful role that supermarkets have in the distribution of dairy and PMBs, often not framing them as an ally. Company 3 re-raised the issue of brand awareness in the context of limited space on supermarket shelves, making it difficult to stand out. Companies 2 and 5, by choice, are not available in supermarkets. Company 2 delivers directly to customers in London, and company 5 manages a chain of coffee shops for which they supply their own PBM. Companies 1 and 4 are more premium brands and have secured exclusive deals with premium supermarkets such as Waitrose. Conversely, companies 6 and 8 are cheaper and have secured placement in midrange supermarkets such as Sainsbury's. Companies 1, 3, 4 and 7 also discussed the supermarkets bringing in their own brand PBM, which for the most part are very price competitive yet low quality.

The significant role played by the supermarket is verified by the online survey in which 95.2% of participants said they mostly purchase their PBM and dairy milk at supermarkets.

The significant role of supermarkets as incumbent institutions (Mylan et al. 2019) is well explained by the MLP. An agro-food industry being dominated by such corporations is common (Grin et al. 2010. p.250). As discussed in 3.2, the role of institutions is not static. They can both restrict and encourage behaviour (Nelson, 2005), as the gatekeepers of change (Gliedt, Hoicka & Jackson, 2018) Based on the interview results, the UK supermarkets are stabilising the regime currently by not encouraging PBM, as they could by using their complementary assets (Geels et al. 2016, Rothaermel, 2001). The supermarkets bringing in their own PBM milks shows that they want to maintain their place in the regime during transformation or reconfigure transitional pathways. Yet, as their PBM are lower quality, they damage PBM acceptance and reducing niche and landscape pressure.

The CF conceptualises supermarkets slightly differently, with their powerful role as incumbents being part of the institutions system and their strategies of not supporting PBM

brands and offering mediocre PBM products being part of business strategies. These business strategies still have causal interactions on users but hinder rather than stimulate coevolution toward PBM.

### 5.2.5 Pricing strategies

Most companies acknowledged difficulties in becoming price-competitive with dairy milk and discussed a range of methods to address this. Companies 1 and 4 price their products to generate a good return even though this means making it more expensive than milk, arguing that it is simply impossible to manufacture quality products (particularly with the consistency elements) and be price competitive with dairy. Companies 6 and 8 offer a cheaper product and argue in favour of its quality, although companies 1, 2, 3, 4, 5 and 7 all referenced companies 6 and 8's products as inadequate for activities like baking or mixing with hot drinks. Companies 1, 3, 4 and 7 also discussed the supermarkets bringing in their own brand of PBM that are normally cheap and low-quality syrup-based PBM.

Farmers 4, 5 and 6 discussed with some animation the supermarkets' long-lasting strategy of using milk as a 'loss leader', i.e. selling a popular product under market value to attract customers to stores (Dhar & Cox, 2003), which has reduced their profits and crippled the functionality of the milk industry. It is a common and effective strategy used by supermarkets, especially with milk as a staple product, placing it as far inside the store as possible (Green & Park, 1998). Cheaper supermarkets such as Morrisons, Asda, Aldi and Lidl are all in a "race to the bottom," as farmer 6 said, thus more premium supermarkets such as Waitrose also have to lower milk prices to stay somewhat competitive. As farmer 5 said, "Milk is a commodity and has a standard price that fluctuates beyond our control. If it drops, we lose, and the supermarkets have been forcing it down for years." This would not be such a problem, Farmer 5 explained, if supermarkets took the loss on themselves. Instead, they demand cheaper milk from farmers or dairy processors, such as Daily Crest, Arla and First Milk, or threaten to import milk from abroad. The processors also do not want to absorb the loss, and benefit from economies of scale, demanding cheaper milk or threatening to take their business to other farmers. According to Farmers 4, 5 and 6, many farmers often take whatever price they can get to cover costs as they only have one income stream, and this is a contributing factor to many dairy farmers going out of business in recent years. The survivors try to grow to benefit from economies of scale and have more sway with the processors and

supermarkets, as Farmers 4, 5 and 6 have. Although many farmers are subsidies to make up for this loss, this does not stop the consumer having an expectation for cheap milk (Moore, 2015) This loss-leader strategy and its consequences have been documented by the media (Glaister, 2012; Price, 2019; Webster, 2015) and government institutions (House of Commons, 2016). There is a valid argument that not only domestic supermarkets are to blame, as milk commodity prices are based on global supply and demand (Lingard, 2015). The significant price differential between the types of milk is shown in Table 6 and was also noted by Mylan et al. (2019).

*Table 6: Price comparison of dairy milk, oat milk and oat milk with consistency. (Adapted from ASDA, 2020 and Waitrose & Partners, 2020).*

	<b>Litre of Dairy Milk</b>	<b>Litre of cheapest oat milk band</b>	<b>Litre of oat milk for use in hot drinks</b>
<b>Asda</b>	£0.49	£1.00	£1.80
<b>Waitrose</b>	£0.78	£1.45	£1.85

The MLP struggles to understand this problem clearly. Firstly, it does not clearly distinguish between supermarkets as institutions trying to stabilise the regime, or as businesses with agency who are competing for profitability from the niche (e.g. Meadowcroft, 2011; Stenzel & Frenzel, 2008). This is also an example of the greater complexity of niche-landscape-regime identification in agro-food, as described by Lutz and Schachinger (2013) in 2.4.5. Secondly, in this same vein, loss-leader strategies embody the diversity and breadth within agro-food (e.g. El Bilali, 2019, Hargreaves, Longhurst & Seyfang, 2013) compared to energy and transport (e.g. Fourat & Lepiller, 2017), where the MLP has been tested. These industries providing a single service, such as electricity, have no incentive to use a loss-leader. Thirdly, the MLP conceptualises user preferences in price as part of the regime and relies on the niche to provide technological or performance innovations to make PBM more price competitive. This over-reliance on technology, as discussed in 2.4.1, is not always an issue, but in this scenario where reducing emissions is critical, technical solutions cannot always be relied upon (Berkhout, Smith & Stirling, 2004; Geels & Schot, 2007). Landscape pressure on users can sometimes be relied on, but it is impossible to direct, as it is the outcome of so many things (Geels, 2002). Indeed, Mylan et al. (2019) only suggested product diversification as a strategy to overcome this price differential. Concerning time-sensitivity, the MLP does not

conceptualise the direct interactions from the socio-technical system to the ecological system (Boons & McMeekin, 2019, p.14). Ecological systems, as fundamental to the biosphere (Folke et al. 2016), cannot wait for niche-regime-landscape alignment, as is required for sustainable transitions within the MLP.

The CF framework does draw attention to the urgency of overcoming these challenges and can account for the interactions that have led to this because it considers each system to evolve under their own dynamics while influencing and being influenced by the dynamics of other systems (Foxon, 2011). Supermarkets, as businesses, have causal interactions over the years, using dairy in a loss-leader strategy which has drastically undervalued dairy milk for users. The return interaction is that users demand cheap milk, and so businesses provide. This loss-leader strategy was produced within business strategies' system's own dynamics, made possible by supermarkets immense scale which is an internal factor (del Río et al. 2011), which are not often considered by transitions research (Verbong & Geels, 2010). The users did not demand cheaper milk, but they were willing to go to whichever supermarket offered it. So the two systems have coevolved to normalise overly cheap dairy milk.

### 5.3 User Practices

This section seeks to present and discuss empirical evidence of user practices of the UK dairy and PBM consumers (based on the survey in Appendix B). Question 7 aimed to explore the reasons participants had for drinking dairy and PBM, whereas Question 8 looked at how participants rationalise. In response to Question 7 from 148 participants, 98% raised a concern, 43% raised a second concern, 15% raised a third concern, and 2% participants raised a fourth concern. This is due to one of the limitations of online surveys, in that participants often provide only the minimum information required. Through the coding and abductive analysis process, the responses from Question 7 yielded seven themes. Question 8 yielded six of those seven themes but with different emphasis.

Similar to 5.2, each theme is divided into five paragraphs: the results of Question 7, then from Question 8, to then validate with other data sources, to apply the MLP, and finally to apply the CF.

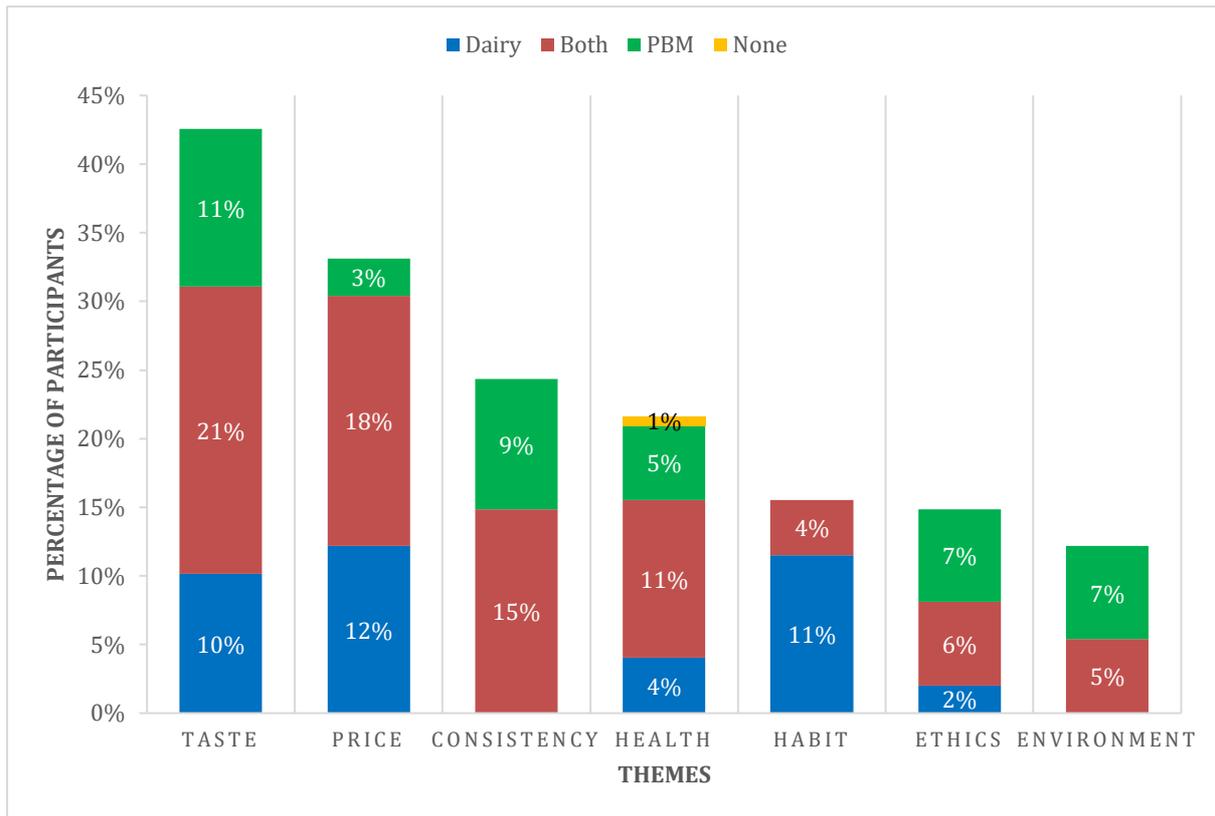


Figure 8: Themes based on the number of participants who raised each concern for Question 7 subdivided by which milks those participants drink.

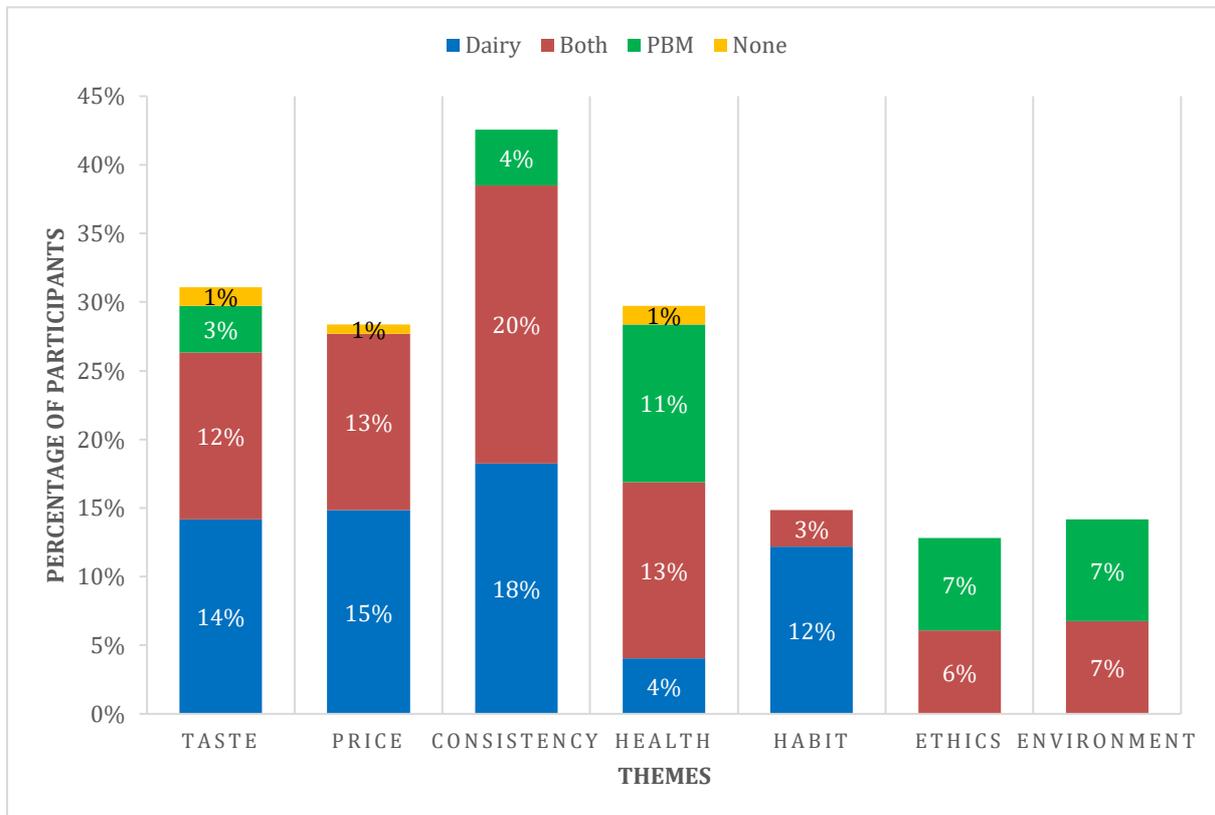


Figure 9: Themes based on the number of participants who raised each concern for Question 8 subdivided by which milks those participants drink.

### 5.3.1 Taste

Figure 8 shows 43% of participants raised **taste** as a concern. Participant 124 said, “Nothing beats the taste of cow milk and hard to replace in recipes” and as Figure 8 shows, taste was raised by a similar number of dairy drinkers as PBM drinkers. Interestingly, twice as many drinkers of both raised taste, which indicates they fluctuate between whichever suits a specific use. As Participant 39 said, “I’m happy to have almond milk in my cereal, but I need dairy milk for baking”.

In Figure 9, taste was less prevalent, raised by 31% of participants. Moreover, it was raised by far more dairy drinkers and far fewer PBM/both drinkers, indicating that people change to PBM for other reasons.

The importance of taste was triangulated by both the dairy farmers, who emphasised the value the consumers held in the taste of dairy milk, and by the PBM businesses who acknowledged how difficult it was to modify people’s taste for dairy. Furthermore, motivation other than taste for PBM drinkers is validated by the findings of Mintel (2019).

The applications of both frameworks here are similar to their application in 5.2.1. In the MPL, user preferences for taste are part of the regime, as shown in Figure 3, but can be disrupted by sufficient landscape or niche pressures (Geels, 2020) which are currently insufficient (Mylan et al. 2019).

For the CF, users demand businesses to provide, and businesses seek to convince users to buy what their supply; thus, causal interactions are bidirectional, and the systems coevolve.

### 5.3.2 Price

Figure 8 shows 33% of participants suggested **price** was of significant concern. It was raised by a similar number of dairy and both drinkers as taste, but significantly less PBM drinkers, which may indicate that PBM drinkers tend to be more affluent. Notably, in Figure 9, 28% of participants named price as their concern about changing, none of which drank only PBM.

These findings are supported by Mintel (2019) in that PBM drinkers have other concerns and are also supported by Table 6, which shows how expensive PBM is compared to dairy.

The MLP also offers a clear explanation as users within the regime are expected to maintain the regime the point at which the niche offers a cheaper or higher-performing product, worth the higher price, as described in Figure 2. In this instance, the MLP indicates that PBM have not found that quality-price balance yet.

In CF, price results from the causal interactions between business strategies and user practices. For-profit business can set a price, informed by taxes (institutions) and production costs (technologies), where they see users will pay for what they perceive as good value. This is continually adjusted by market supply and demand (Safarzyńska & van den Bergh, 2010). In this way, user practices have continual causal interactions on business strategies, and coevolve.

### 5.3.3 Consistency

Consistency was raised by 24% of participants, all of which were either PBM only or both drinkers, as shown in Figure 8. This indicates that when choosing PBM, users are looking for a product that can maintain its consistency and creamy texture. Intriguingly, in Figure 9, consistency became the main issue, raised by 43% participants, as to why they had not changed (or changed completely) to PBM, and the inability of PBM to maintain consistency in hot drinks was frequently cited by these participants.

This crucial element of consistency is triangulated by the findings of Mintel (2019), the view of Farmer 4 and 6, and insights from Companies 2, 4, 5, 6, 7 and 8 in section 5.2.3. The syrup-based PBM, in particular, lack consistency.

Similar to the discussion in 5.2.3, as PBM consistency is a technical problem, the MLP requires niche innovations to provide a product that is performance- and price-competitive to create pressure and disrupt the socio-technical regime, showing again the MLP's over-reliance on technological innovations (Berkhout, Smith & Stirling, 2004).

The CF places this demand for PBM consistency as a causal interaction from users to businesses, and in turn to technology. If the technological system is successful, the interactions are mutual and the three coevolve toward greater use of PBM. However, how technological systems do this is better understood within the MLP.

### 5.3.4 Health

As Figure 8 shows, 22% of participants said their perception of **health** benefits influenced their choice. Dairy and PBM drinkers had roughly even shares of the minority, and both drinkers were the majority, as both products have different health benefits for different people. In Figure 9, 30% of participants raised health, with most of the increase coming from a greater number of PBM only drinkers. Common reasoning cited were ‘stomach issues’ or ‘acne breakouts’ after consuming too much dairy.

These findings are in line with Mintel (2019), which showed that 37% chose PBM based on health, and in line with Companies 1, 4, 5 and 8 targeting the health element.

The MLP can conceptualise the interest in health as emerging pressure from the landscape and the PBM brands’ healthy products creating pressure from the niche. If enough pressure is applied, the regime will align (Geels, 2002) and transition to one with more healthy products. Indeed, health emerged as was conceptualised as such in Mylan et al. (2019).

The CF can conceptualise the interest in health as change coming from the internal dynamics of user practices and creating causal interactions with business strategies and with technological systems to provide such products. But again, how the technological systems can do this is better understood within the MLP.

### 5.3.5 Habit

Of all participants, 16% said they go purchase their milk or PBM out of **habit**, almost all of which were dairy only drinkers and none of which PBM only drinkers, as Figure 8 shows. As participant number 90 said, “Have always drunk dairy milk, don’t have a reason to consider alternatives” and as participant 19 said, “it is what my parents bought”. For the case of dairy, a user’s cup of tea and breakfast cereal only taste a certain way with their regular type of milk. Question 8 emphasised these findings as even more dairy milk only drinkers say they had no reason to consider alternatives.

For habit, the MLP is not very effective. It understands user practices in an economic and institutional sense but only broadly in a sociological sense (Bui et al. 2016) and lacks depth terms of how food practices can be culturally embedded (Isgren & Ness, 2017). In this way, the MLP expects that if the niche can provide competitive products (in terms issues such as

price and taste) or the landscape exerts enough pressure, the regime will align and change (Geels, 2002) but offers no focus as to where or how landscape pressure can increase.

The CF is well suited for conceptualising habits due to its acceptance of social practice theory (Shove & Spurling, 2013; Spurling et al. 2013) where drinking milk exemplifies *ordinary consumption* which has been embedded. This is the justification of why user practices have an equal placement in the five systems of the coevolutionary framework. Regardless if new technology provides improvements, ordinary consumption can be slow to change. The CF draws focus to solving this barrier to change.

### 5.3.6 Ethical and environmental issues

Figure 8 shows that 15% of participants raised ethical issues. This included 19 PBM and both drinkers were worried about animal welfare, and the 3 dairy milk drinkers wanted to support local farmers. In Figure 9, the same 19 stated they had changed (or partially changed) to PBM was due to ethical concerns.

These findings are supported by Mintel (2019), who found 33% of those they interviewed changed to PBM due to their ethical concerns. In addition, all 3 dairy farmers discussed how they also were aware of animal welfare and they all follow the New Zealand style pasture grazing system for 11 months of the year, but that other's do not. They noted that one of the reasons that milk can be imported cheaper than produced locally is due to overseas dairy industries not having the same welfare regulations that exist in the UK.

The environmental was only the primary concern for 12% of participants, none of which were dairy milk only drinkers. Figure 9 shows that 13% participants changed (at least partially) to PBM for environmental reasons. Most of these participants said they drank dairy milk until recently but had tried to reduce their dairy consumption since become aware of the GHG emissions, although only one mentioned land systems change. No participants mentioned a variance in the sustainability benefits of different types of PBM or the increased emissions of importing tropical plant bases.

Mintel (2019) who found 36% of those they interviewed changed to PBM due to their environmental concerns which is a greater number but nevertheless supports the inclusion of

the theme. Oat farmers 2 or 3 acknowledged environmental concerns amongst the public but said they were only motivated to sell their oats for oat milk if it would be profitable.

Mylan et al. (2019), who also found environmental and ethical concerns as contributors in growing UK PBM sales, conceptualised them as part of the landscape pressure. While this is justified, it is incomplete. Sustainable transitions are for collective benefits that may not be monetary (Böcker & Meelen, 2017). The MLP does accept the need for policy or economic support when sustainable products such as PBM struggle to be competitive (Geels, 2011). But the MLP does not fully embrace the need for a change in values from an only profit focus, so ecological systems will be properly regarded, as in ecological economics (e.g. van den Bergh, 2014) and transformations literature (e.g. O'Brien, 2018). As a consequence, MLP lacks a clear link to the ethical and environmental consequences on ecological systems (Smith & Stirling, 2008; Olsson & Galaz, 2012; Røpke 2016). The New Zealand system of ethical dairy farming is a former niche innovation that has been incorporated into the regime (but not disrupting it), and landscape pressure is building to remove unethical farming and slightly reducing pressure (Jackson et al. 2020), but the source of agency for further landscape pressure remains unclear (Olsson, 2017). An avenue for raising awareness to influence user preferences within the regime is social innovations, which are also undervalued in MLP research (Avelino et al. 2019; McGowan, Westley & Tjörnbo, 2017).

The CF, in contrast, does accept understandings from of ecological economics (De Jesus & Mendonça, 2018; Siebenhüner, Rodela & Ecker, 2016; van den Bergh, 2014) and social-ecological systems as complex adaptive systems (Levin et al. 2013). It is not within the scope of this thesis to examine the CF's ecological systems in the same detail as users and business. However, the CFs strength in this regard is that it acknowledges the direct causal interactions from, users dairy milk and business selling dairy, to the unethical impact on cattle as an ecosystem and the detrimental impact on natural ecosystems. This is of vital importance as the biosphere depends on ecosystems systems (Folke et al. 2016).

### 5.3.7 Intolerant

10% participants were lactose intolerant. Nevertheless the interactions from this theme cannot be considered as the user are practising not drinking milk based on physical limitations. Although 6 of them drink lactose-free dairy milk, which has the same emissions

level as dairy, their choice to do so is based on one or more of the other themes. For the remaining 9, their intolerance resulting in them drinking PBM or no type of milk cannot be scaled up so does not need to be conceptualised.

### 5.3.8 Convenience

Finally, the participants were asked where they buy their milk and PBM products and why, of which 95% said they regularly use supermarkets and 93% said that distance to why they chose their supermarket (see Figure 10). Although price was a concern for 18%, the overwhelming issue raised was convenience and distance. This included choosing supermarkets on commuter routes, near homes and who offered home delivery. This does not represent a relevant theme in terms of PBM and dairy milk, but it does serve as further evidence of the powerful role the supermarkets have in the transition, discussed in 5.3.4.

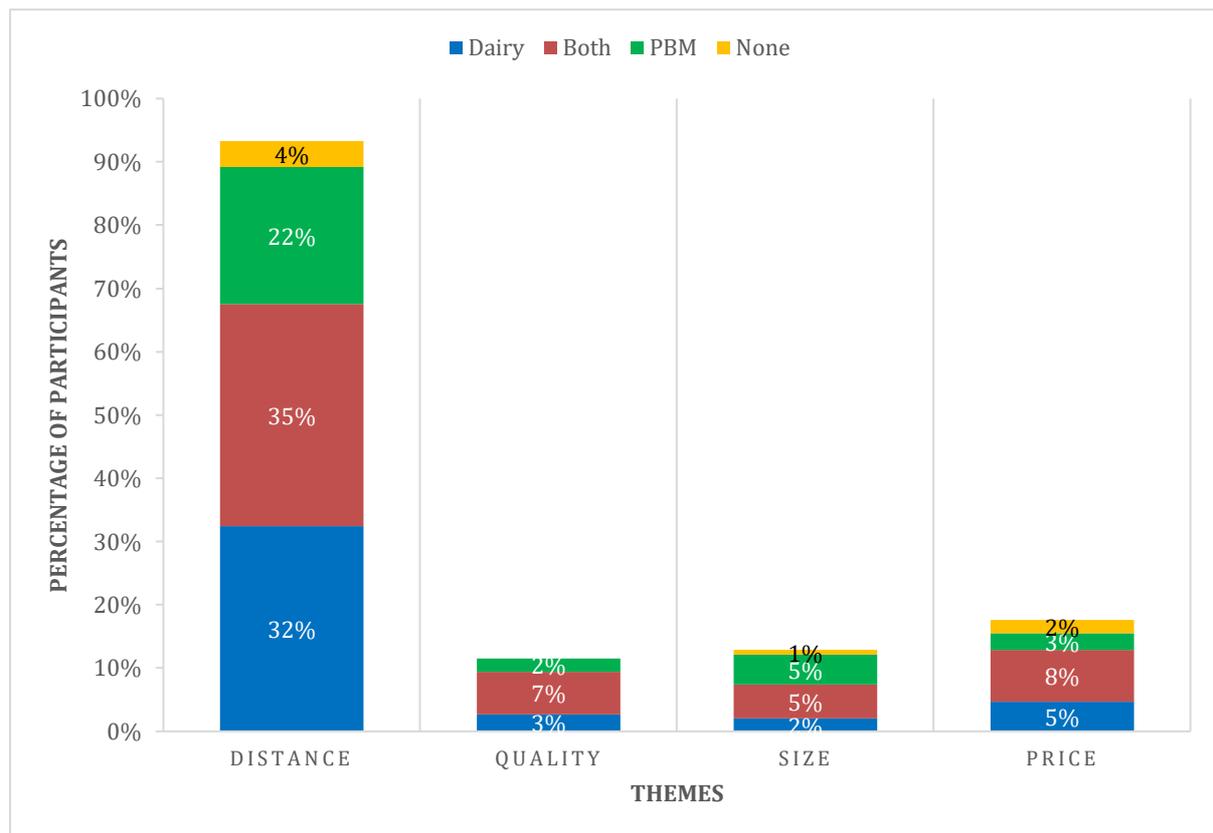


Figure 10: Themes based on the number of participants who raised preferences for Question 9 subdivided by which milks those participants drink.

## 5.4 Explanations outside the MLP

The MLP clearly conceptualised many of the themes raised by both business and users. It was particularly comprehensive in explaining how PBM, as technical innovations, are impacting the regime. However, the MLP struggled to provide explanations for user habits, their ethical and environmental concerns, and supermarkets pricing strategies (see Table 7).

*Table 7: Outcomes of the application of the CF and MLP framework on issues raised by PBM brands and consumers.*

		<b>Sufficient conceptual explanation</b>	
<b>Data Source</b>	<b>Themes</b>	<b>CF</b>	<b>MLP</b>
Businesses	PBM acceptance	✓	✓
	Brand awareness	✓	✓
	Technical strategies		✓
	The role of supermarkets	✓	✓
	Pricing strategies	✓	
Users	Taste	✓	✓
	Price	✓	✓
	Consistency		✓
	Health		✓
	Habits	✓	
	Ethical issues	✓	
	Environmental issues	✓	

When applied in tandem to the data, the CF and MLP can provide explanations for all of the themes found from the data. This was shown three times during the application of both frameworks.

Firstly, the MLP particularly struggled to conceptualise the loss leader strategy (see 5.2.5). This is due to its lack of clarity between institutions and agency, the complexity of niche-landscape-regime identification in agro-food, loss-leaders as a unique characteristic of agro-food, and the over-reliance on technology. The significance of this failure is visible in some of the other themes raised by users and business. The MLP requires the niche to pressure the regime to successfully transition by providing green products that are competitive in both price and performance. PBM are green products but simply cannot be produced at a competitive price while providing those crucial features that can disrupt users into change (see 5.2.3 and 5.3.2). Those features include healthy supplements (see 5.3.4) and consistency (see 5.3.3 and 5.2.3), two themes that the MLP explained and the CF did not. The lack of consistency was the primary reason consumers have not changed (Figure 9). Supermarkets and some brands providing the more affordable PBM (see 5.3.1) are actually hindering transitions by dissuading consumers with low-quality products that are also not price competitive. The price of milk is being artificially suppressed, with other industry products in the supermarkets making up the difference. Therefore, at least according to this explanation, raising the price of milk to reflect the price of production better would allow PBM to become more competitive. While the MLP conceptualises this as insufficient niche pressure to warrant change, the CF makes the explanation explicit as a causal interaction from business strategies on user practices. These two systems have thus coevolved with the suppressed dairy price becoming embedded, and the technological system cannot provide the solution.

Secondly, the MLP struggles to account for user habits due to its limited sociological grounding. While it does gain insights from cognitive lock-in mechanisms (Fuenfschilling & Binz, 2018), it lacks the understanding informed by social practice theory (Shove & Spurling, 2013). In contrast, the CF uses social practice theory which can better explain the deep-rooted nature of embedded practices and the difficulty in changing them.

Finally, the MLP conceptualises environmental and ethical concerns as part of the emerging landscape pressure. While this is justified, it lacks an explicit link to the ethical and environmental consequences on ecological systems, on which the biosphere is dependent. The CF makes this link clear, bringing in understandings from ecological economics and social-ecological systems (Folke et al. 2010), to promote ecosystems as one of its five primary systems. Thus, causal interactions from the other systems can be explicitly drawn as influencing ecosystems.

## 6 Conclusion

A significant contributor to land system and climate change is the dairy industry, and the MLP is the dominant framework for conceptualising the complex process of how industries transition to using more sustainable technical innovations. Despite the usefulness of the MLP, it has weaknesses that render it unsuitable in uncovering all the barriers to sustainable transitions, such as PBM as an innovation in the dairy industry, which in turn inhibits the potential of these technologies in reducing climate and land system change. Scholars have called for the MLP to be combined with frameworks and research from other disciplines to aid and address these weaknesses (El Bilali, 2019). One potential framework is the CF (Foxon, 2011), which showed promise in applications to energy and transport systems but had not been applied to agro-food industries. Thus, this thesis sought to explore the potential of the CF in combination with the MLP in a review of PBM in the UK, forming the basis of the research question.

The three main findings were that the MLP struggled to conceptualise a loss-leader pricing strategy, could not comprehend the depth of embedded user habits, and failed to explicitly link the dairy regime to the ecosystems it impacts. However, the CF was able to make these conceptualisations and linkages, uncovering barriers to a PBM transition. These main findings suggest that CF has significant potential to support the MLP in reaching a clearer understanding of what is happening and what the barriers to change are. A clearer understanding improves the likelihood of successful corrective interventions to overcome those barriers. In this regard, this thesis contributes to literature in two ways.

Firstly, for transitions research, this thesis is further evidence that the MLP requires interdisciplinary support to address its weaknesses outlined in section 2.4. This contribution is in line with calls for interdisciplinary approaches to complement the MLP from El Bilali and Probst (2017), McMeekin and Southerton (2012), Meelen and Farla (2013) and Shove (2003) and joins similar and insightful work, summarised in section 2.5, which has answered this call. This could invigorate future MLP research to focus on areas not properly covered by the MLP such as social sustainability (Jenkins, Sovacool & McCauley, 2018; Sareen &

Haarstad, 2018), the global south (El Bilali, 2019) and a spatial perspective (Coenen, Benneworth & Truffer, 2012).

Secondly, this thesis shows the value of CF in agro-food analyses, as historically it has only been applied to energy and transport industries (Foxon, 2014; Foxon & Steinberger, 2013; Pearson & Foxon, 2012). In the future, the MLP CF combination has great potential as a valuable method of barrier identification for agro-food policymakers seeking to facilitate sustainable transitions.

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# Appendix A

## Interview guides

During the data collection process, all participants were treated equally. Some the lines of research had to be withheld to avoid creating biased answers (e.g. the goal of this sustainable transition was for less dairy production). The researcher did not share his personal views on the subject during the interviews. Due to limited resources, no incentives could be provided for participation. As a courtesy, interview participants received a thank-you card for their generosity with their time. Furthermore, all participants' anonymities were maintained throughout, using fake names when necessary. The acknowledgment of these steps being taken is in itself an important step to communicate to readers that all ethical issues have been avoided to the best ability of the researcher. What follows is the guide the researcher used to ensure the quality and consistence of the interviews.

### Basic information checklist

Record the following

- the time
- the date
- where the interview is taking place
- names of the interviewer and interviewee

### Introduction

First let me say thank you for taking the time to talk with me. I really appreciate it. My name is Benjamin Mole and I am a master's student at Lund University in Sweden, studying Innovation and Global Sustainable Development. The intention of this thesis it to gain a greater understanding of the milk and plant-based milk industries in the UK. The interview should not last more than one hour. I have here for you two copies of a consent form. For my use, it acts as proof that you are a willing participant in this research. For your use, it acts as proof that I am committed to storing the recording and notes of this research securely, for only my use, and that they will be presented anonymously.

### For PBM producers

#### Opening Questions

1. What firm do you represent?
2. What is your role at the firm?
3. Which plant-based milk products does your firm produce? (e.g. oat milk, rice milk)

#### Content Questions

1. What are the main reasons consumers buy your product?
2. What are your short-term views on your industry?
3. What are your long-term views on your industry?
4. How do you feel about government involvement in your industry?
5. How do you feel the role of supermarkets in your industry?
6. What are the biggest challenges you have faced?
7. What strategies do you consider effective in overcoming these challenges?
8. How do you take the environmental aspects into account?

**Remainder to probe where necessary!**

## **For farmers**

### **Opening questions**

1. How long have you been farming?
2. Are you from the area?
3. What's your main produce?
4. Is farming your sole source of income?
5. How many cattle do you have on your farm/how many hectares of oats do you farm?

### **Content questions**

9. What are the main reasons consumers buy your product?
10. What are the biggest challenges you have faced?
11. What strategies do you consider effective in overcoming these challenges?
12. What are your short-term views on your industry?
13. What are your long-term views on your industry?
14. How do you feel about government involvement in your industry?
15. What is your perspective on plant-based milks?
16. What is your perspective on the dairy cooperatives/whole sellers?
17. How do you take the environmental aspects into account?

**Remainder to probe where necessary!**

## **Conclusion**

Thank you. I really appreciate you taking time out of your day to help me. Once again, I would like to remind you that the recordings and notes of this research will be stored securely and be presented with complete confidentiality. If you are curious as to the findings, I can send you an abstract of the final paper.



- h) South East (England)
- i) South West (England)
- j) Scotland
- k) Wales
- l) Northern Ireland

5. Do you drink any of the following milks or plant-based milks?

- a) Dairy Milk
- b) Almond Milk
- c) Oat Milk
- d) Coconut Milk
- e) Rice Milk
- f) Soymilk
- g) Hemp Milk
- h) Pea Milk
- i) Cashew Milk
- j) Peanut Milk
- k) Do not drink any milk or PBM
- l) Other (please specify)

6. How do you purchase your milk or plant-based milk? (Please choose all that apply)

- a) At an online retailer site
- b) At a supermarket
- c) At a convenience store
- d) Delivery from the local milkman
- e) Other (please specify)

7. What are your main considerations when choosing which milk or plant-based milk to purchase?

8. What are your rationales for drinking (or not drinking) milk or plant-based milk?

9. Which supermarket do you shop at most often and why?



# Appendix C

## Consent form

### Research of milk and plant-based milk in the UK

#### Consent form for participants in research

Signing this form is proof that you understand that:

- you voluntarily agree to participate in this research thesis
- you may withdraw from the interview at any time or refuse to answer any question
- you can withdraw the data from this interview within three weeks after the interview
- you have had purpose and nature of the thesis explained to you
- participation involves answering some questions about your experiences and views on the industry
- participation does not involve having to reveal any sensitive information
- you agree to the interview being audio-recorded
- all information from this interview will be treated and stored confidentially
- in the results of this research, your identity will remain anonymous by changing names and any details may reveal identities.

#### Signature of research participant

Name:

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Signature of participant

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Date

#### Signature of researcher

**Name:** Benjamin Mole

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Signature of researcher

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Date