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ACTORS IN SUSTAINABILITY TRANSITIONS

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Abstract

The world is experiencing serious sustainability challenges, such as climate change and the loss of biodiversity. To respond to these sustainability challenges, there is a need for societies throughout the world to make urgent and radical changes. However, the conflict of interests that can be observed on the world stage makes the transition to sustainability extremely difficult.

In recent years, scholars have increasingly turned their attention to understanding the relationship between actors and sustainable change. However, there remains a lack of understanding of why and the ways in which actors contribute to sustainability. In a bid to bridge this gap in our understanding, this doctoral thesis explores the actors involved in sustainability transitions. It takes a critical view of the framework of the multi-level perspective on sustainability transitions. This approach was chosen as the prevailing literature on sustainability transitions tends to neglect human behaviour. Moreover, how companies contribute to sustainability transitions is still a sparsely investigated area of research. Thus, this thesis defines actors either as individuals who intentionally act for the benefit of sustainability or as companies that contribute to sustainability.

To meet the objective outlined above, this thesis combines literature reviews and qualitative studies. It consists of two conceptual publications and two empirical publications. The relevant literature is reviewed in the conceptual publications, and the empirical publications present the empirical data obtained from two qualitative studies involving 42 interviews with individuals active in the field of sustainability in Finland.

Theoretically, this thesis contributes to the existing literature by examining human behaviour and motivations to provide new insights into the multi-level perspective on socio-technical transitions. Second, the thesis contributes by presenting an exploration of human behaviour through sociological accounts. Third, this thesis contributes to extant knowledge by incorporating the life courses approach into the multi-level perspective framework. This doctoral thesis suggests that the findings related to the motivations and sustainable behaviour of individuals may have relevance for other fields.

The results of this thesis imply that companies have a role to play in contributing to sustainability. The outcomes also support the existing understanding that there is a disconnect between company-level and system-level sustainability. This thesis contributes by arguing that poor integration may be a barrier to achieving sustainable development. Second, this thesis suggests that developing an understanding of the overlapping terminology employed in

different disciplines could help to bridge the gap between system-level and company-level sustainability.

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Katariina Koistinen
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List of publications

This thesis is based on the following papers. The rights to include these papers in this thesis have been granted by the relevant publishers.

I.   Koistinen, K., Teerikangas, S., Mikkilä, M., and Linnanen, L. (2018). Agent-Based Change in Facilitating Sustainability Transitions – A Literature Review and a Call for Action. In: Handbook of Engaged Sustainability. Dhiman, S., and Marques, J., ed., pp. 1135-1156. Springer International Publishing. ISBN 978-3-319-71311-3

II. Koistinen, K., Teerikangas, S., Mikkilä, M., and Linnanen, L. (2017). Change Agents Engaged in Sustainable Transformation in the Finnish Food System. In: Boosting Resource Productivity. Ludwig, C., and Matasci, C., ed., pp. 310-322. A World Resources Forum Production, Switzerland. ISBN 978-3-9521409-7-0

III. Koistinen, K., Teerikangas, S., Mikkilä, M., and Linnanen, L. (2018). Active agents of sustainability transitions – A life course approach. *Proceedings of the 13th Corporate Responsibility Research Conference, 11-12 September, 2018, Leeds, United Kingdom.*

IV. Koistinen, K., Laukkanen, M., Mikkilä, M., Huiskonen, J., and Linnanen, L. (2018). Sustainable system value creation: Development of preliminary frameworks for a business model change within a systemic transition process. In: Sustainable business models: Principles, Promise, and Practice. Moratis, L., Melissen, F., and Idowu, S., ed., pp. 105-127. Springer International Publishing. ISBN 978-3-319-73502-3

Author's contribution

Katariina Koistinen is the first author of all papers. More detailed descriptions of the author's contributions are listed below.

Publication I: The author developed the research plan and organised the literature review with the co-authors. The author wrote most of the manuscript and drew conclusions with the co-authors.

Publication II: The author developed the research plan with the co-authors. The author organised the data collection and analysed the data. The author wrote most of the manuscript and drew conclusions with the co-authors.

Publication III: The author developed the research plan together with the co-authors. The author organised the data collection. The author was responsible for analysing the data. The author wrote most of the manuscript and drew conclusions with the co-authors.

Publication IV: The author developed the research plan and collected the literature together with the co-authors. The author drew half of the conclusions and wrote half of the manuscript.

1 Introduction

1.1 Ontological background of the thesis

The world is overflowing with severe sustainability challenges, such as climate change, the loss of biodiversity, and energy and resource shortages, and the global system is now littered with lock-in mechanisms that have resulted in grand challenges of sustainability (Geels, 2011; Klitkou *et al.*, 2015). Human activities have resulted in major challenges that have transgressed the planetary boundaries of the Earth system (Rockström *et al.*, 2009b). Addressing the grand challenges that exist thus calls for urgent and radical change in societies throughout the world and spanning the sectors of energy, water, food, and transport (Geels, 2012; Brown, Farrelly and Loorbach, 2013; Kahiluoto *et al.*, 2014; Shaw *et al.*, 2014). For example, humanity must achieve rapid and significant reductions in the production of greenhouse gases to address climate change (Geels *et al.*, 2017). Moreover, to meet the global warming target limit of two degrees Celsius (IPCC, 2014), substantial action is needed. Sustainable development and sustainability science have emerged to address the increasing environmental challenges of the global system (Kates *et al.*, 2001; Clark and Dickson, 2003). The objective of sustainability science is to unite the natural and social sciences to develop an inter- and multi-disciplinary understanding of sustainability problems (Jerneck *et al.*, 2011).

The ontological background of this thesis is to contribute to sustainability science and the process of tackling the grand challenges. To respond to the grand challenges, several scholars have already made important inroads into the existing understanding of how technological innovation may foster sustainable development (e.g. Bergek *et al.*, 2015; Hekkert *et al.*, 2007; Markard and Truffer, 2008). Moreover, to achieve ever-greater sustainability, the role of politics and sustainability governance has also attracted a large amount of interest (e.g. Geels, 2014b; Kivimaa and Kern, 2016; Loorbach and Rotmans, 2010). Nonetheless, despite the development of additional sustainable technologies and the launch of innovations that offer more sustainable alternatives, many societies continue to experience difficulties overcoming the path dependency and lock-ins of the existing system (Seyfang and Haxeltine, 2012). For example, many political and public debates are predominantly focussed on standard, relatively short-term economic issues, such as monetary losses, start-stop economic growth, increasing unemployment, falling real estate prices, failing banks, the threat of nation-level bankruptcy, and the methods by which economic growth can be assured (Loorbach *et al.*, 2016). In addition, many countries continue to increase their fossil fuel consumption and, in many places, the achievements made in renewable-energy production have not been fundamental enough to offset the growth of aggregate emissions (York, 2011). One explanation for this is that the current global system is dominated by vested interests that make achieving sustainability difficult (Haukkala, 2015).

Recently, a body of knowledge has emerged that seeks to better understand the relationship between actors and sustainable change[1] (e.g. de Haan and Rotmans, 2018; Mossberg *et al.*, 2018; Wittmayer *et al.*, 2017). However, the holistic effect of actors, i.e. why and how actors contribute to sustainability, is not yet fully understood (e.g. Antadze and McGowan, 2017).

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[1] Please see Chapter 1.5. for the definitions of the key terms used in the thesis. The term "change" is used as a general concept for all terms that describe something becoming different.

Thus, to move towards stronger sustainability, stronger emphasis must be placed on the role actors play in implementing sustainability. The questions surrounding how actors implement sustainability are interesting from both a theoretical and practical perspective. For instance, what are the dynamics of actors involved in sustainability transitions? This thesis specifically focuses on individuals and companies as actors.

Having clarified the ontological background of this research, it is now appropriate to discuss the grand challenges, sustainability science, and the different schools of thought on sustainability change. After describing the larger setting in which this thesis is situated, the theoretical context and research gaps in the literature are discussed. Then, the more detailed purpose of the thesis, including the research questions, is presented. Subsequently, key elements of previous research into actors and sustainability is described as background for the focus of this work. The introduction section will conclude by presenting the key concepts used in the thesis and the overall structure of the paper.

1.1.1 Grand challenges

Challenges, such as, water scarcity, epidemics, climate change, natural and manmade disasters, violent conflicts, rapid urbanisation—typically including others problems such as air pollution or social segregation—and other persistent and complex threats bear a severe risk for the viability and integrity of global societies (Kates and Parris, 2003; Rockström *et al.*, 2009b). Human activities have been proven to be the drivers of the global environmental changes that have contributed to these major challenges (Rockström *et al.*, 2009a; Steffen *et al.*, 2008; IPCC, 2014).

In addition, despite the 1997 Kyoto protocol and several other climate change policies that have been implemented during the last decades, the growth of global carbon-dioxide emissions does not show distinct signs of slowing (Geels, 2014b). It appears that modern societies have engaged in increasingly disruptive modes of interaction with the Earth's system. This is widely regarded as being much more than a simple side effect; it is an ingrained characteristic of modern societies (Jackson, 2009). Taking the urgency and magnitude of global environmental change into consideration, a fundamental, radical, and rapid change toward sustainability is crucial (Nelson 2009; Shove *et al.*, 2012). The sustainability challenges described above are typically referred to as *grand challenges*.

The Europe 2020 Strategy proposes that the current grand challenges cover climate change, energy security, transport and resource efficiency, food safety, obesity, and environmentally friendly production (Geels, 2014a). However, the Sustainable Development Goals of the United Nations may be the most well-known and applied grand challenges of today (George *et al.*, 2016). In September 2015, 193 member states of the United Nations agreed 17 common targets to end poverty, protect the planet, and ensure prosperity for all as part of a sustainable development agenda (George *et al.*, 2016).

While the grand challenges are complex and resistant by their very nature, overcoming them requires various actors through the global system. Tackling the grand challenges often involves changing individual and societal behaviours and how actions are organised and implemented, and fostering technological development. Thus, natural and physical scientists and engineers

have unhesitatingly applied such a lens and language in their definition of global problems, with social scientists recently joining this collaborative effort (George *et al.*, 2016).

1.1.2   Sustainability science

The threat of grand challenges has led to the ongoing emergence of *sustainability science*. In the light of waning resources and increased pollution due to a myriad of emissions, governments since '*Limits to growth*' (Meadows *et al.*, 1972) and the oil shocks of the 70s have been trying to achieve more sustainable societies (Chappin and Ligtvoet, 2014). Perhaps the most broadly applied definition of sustainable development was introduced in the 1987 United Nations World Commission on Environment and Development (WCED) report '*Our Common Future'*, as follows:

"*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987).

Kates *et al*. (2001) argued that this attempt to meet the demands of the current generation without compromising the ability of future generations to meet their needs is the very essence of sustainable development. During the last decades, these challenges have brought about a broad variety of societal responses from industries, universities, and civil society companies (Lang *et al.*, 2012). Within the last two decades, increasing numbers of movements have emerged that adopt the view that overcoming the challenges to achieving sustainable development involves reconciling society's development goals with the planet's environmental limits over the long term and harnessing science and technology in the quest for a change toward sustainability (Clark and Dickinson, 2003). Since the late 1990s, academia has vigorously responded to sustainability challenges through the emergence of a new field of research, sustainability science (Kates *et al.*, 2001; Clark and Dickson, 2003; Swart, Raskin and Robinson, 2004; Wiek *et al.*, 2012). Despite the emergence of sustainability science, following the WCED's definition, attempts to meet the demands of the current generation without compromising the future generations' ability to meet their needs, has remained, at best, a distant goal (Brandt *et al.*, 2013). Therefore, the need for fundamental and rapid sustainability changes remains.

1.1.3   Sustainability transformation and transition

To explore the path to more sustainable societies, two distinct schools of thought have emerged (see Figure 1). Ultimately, both research disciplines aim to respond to the grand challenges and drive the changes required to overcome threats to sustainability.
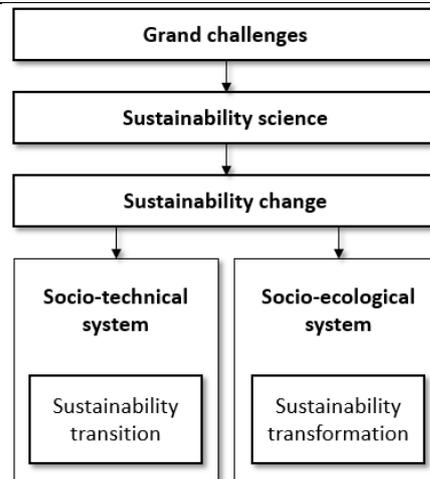
Figure 1. Different system-change disciplines that aim to respond to the grand challenges.

Thus, depending on the scientific discourse within sustainability science, there are calls for either *system transformation* or *system transition*. In a variety of research approaches, transformation and transition are often employed in seemingly interchangeable ways to refer to radical, non-linear, and structural change in complex adaptive systems (Feola, 2015; Kuokkanen, 2016; Patterson *et al.*, 2016). Although both terms refer to the need for large-scale changes to achieve a sustainable society (Hölscher, Wittmayer and Loorbach, 2018), they still have somewhat different focuses and foundations.

Perhaps the most significant difference between these two concepts is the setting in which the different forms of sustainability change are typically applied. Research approaches concerned with global environmental change, such as resilience (Olsson, Galaz, and Boonstra, 2014) and transformative adaptation (O'Brien, 2012), address transformation as a means of exploring fundamental shifts in human and environmental interactions and feedback. Transitions are especially used in the sustainability transitions research community to address fundamental social, technological, institutional, and economic change from one societal regime to another (Rotmans, Kemp, and van Asselt, 2001).

Transformation studies originate from socio-ecological research, which itself emerged from the natural sciences abandoning the view that ecosystem changes are linear, predictable, and controllable, providing a new view of tightly coupled social and environmental systems (Folke *et al.*, 2005). For example, O'Brien (2012) defines "*transformation*" as follows:

 "*Transformation can be defined as physical and/or qualitative changes in form, structure or meaning-making. It can also be understood as a psycho-social process involving the unleashing of human potential to commit, care, and effect change for a better life.*"

Typical socio-ecological studies revolve around developing resilience and transformation in human-environmental interactions and feedback to reverse current unsustainable trends, for example, loss of biodiversity (Folke *et al.*, 2011; Steffen *et al.*, 2011; Westley *et al.*, 2011). The

transformation studies that interface with technological systems, that is, industrial transformation approaches, originate from innovation studies and their focus is the large-scale technological, institutional, and environmental changes in social-ecological industrial systems, such as agriculture and fisheries, that are required to implement a shift towards sustainable economies (De Bruijn and Norberg-Bohm, 2005).

In this thesis, the change to sustainability and the actors of desirable sustainability change are explored mostly through the lens of sustainability transitions and the multi-level perspective. Sustainability transition studies mainly analyse changes in societal subsystems, such as energy or transport, the focus being on social, technological, and institutional interactions (Loorbach *et al*., 2017). The setting of sustainability transitions research is the socio-technical system. Grin and Schot (2010) define societal "*transitions*" as follows:

 "*Transitions are co-evolution processes that require multiple changes in sociotechnical systems and configurations.* […] [They are] *multi-actor processes,* […] *radical shifts from one system or configuration to another. The term 'radical' refers to the scope of change.* […] *Transitions are 'long-term processes' and 'macroscopic'.*"

The literature on sustainability transitions has been developed to address the sustainability challenges that the global system is now encountering. Literature on sustainability transitions is concerned with understanding environmental problems as inherent in existing socio-technical systems (STS) and the stable configurations of institutions, techniques and artefacts, as well as the rules, practices and networks that determine the typical development (Rip and Kemp, 1998). Socio-technical systems form from sectors, such as energy supply or transportation. Socio-technical systems are seen as consisting of multiple actors, such as individuals, firms, and other companies; collective actors; and institutions, such as societal and technical norms, regulations, standards of good practice, and material artefacts and knowledge (Weber, 2003; Geels, 2004; Markard, 2011). The different components of the system provide specific services to society through their various interactions (Markard, Raven and Truffer, 2012; Köhler *et al*., 2019). Perhaps the most commonly applied framework for societal transitions is the multi-level perspective, which is frequently employed to illustrate societal system changes spanning various regimes, such as energy or transport (Geels, 2002; Geels 2004).

A socio-technical transition is a set of processes that result in a major change in socio-technical systems (Kemp, 1994; Geels and Schot, 2010). A transition involves far-reaching changes and covers various dimensions: technological, material, organisational, institutional, political, economic, and socio-cultural. Transitions also involve a wide range of actors and typically develop over considerable timespans of 50 years and more (Markard, Raven and Truffer, 2012). During development of a transition, new products, services, business models, and companies emerge; some complement each other while others substitute existing ones (Markard, Raven and Truffer, 2012).

Sustainability transitions are long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems evolve into more sustainable versions of production and consumption (Markard, Raven and Truffer, 2012). One key characteristic of sustainability transitions is that they are goal-oriented in the sense that they address environmental problems, whereas many historical transitions were described as emergent (Smith, Stirling and Berkhout, 2005; Geels, 2011).

The central elements of transitions research include the concepts of socio-technical regimes and niches. The idea of a socio-technical regime was developed from the concept of a technological regime that was presented by Nelson and Winter (1982). For example, Rip and Kemp (1998) studied regime shifts, or transitions, and the factors that resulted in the destabilization of existing regimes and emergence of new regimes. The vested notion of a regime is that it is inherently directed for incremental socio-technical change along established trajectories of development (Rip and Kemp, 1998; Geels and Schot, 2007). The existing regime embodies power that causes incumbents to develop strong positions against pioneers, who are often the first to develop environmental innovations (Geels, 2011). Socio-technical niches have been described as protected spaces, for example, specific markets in which radical innovations can develop without being exposed to the selection pressure of the prevailing regime during an early phase of a transition (Kemp, Schot and Hoogma, 1998). Through processes of social learning across multiple experiments, articulating promising expectations and heterogeneous networking, niche innovations gain momentum and can eventually challenge and compete with the existing regime (Geels and Raven, 2006).

The current research pertaining to sustainability transitions draws from four dominating theories that have been developed simultaneously: (1) Transition Management, (2) Strategic Niche Management, (3) Technological Innovation System and (4) the Multi-level Perspective on Socio-technical Transitions. The first three of these theories are discussed in brief in Chapter 2.2.1. The multi-level perspective on sociotechnical transitions (MLP) is presented separately because of its importance for this thesis and its focus on actors and agency through the lens of the multi-level perspective.

1.2 Context of the thesis and the research gaps in the literature

1.2.1 Multi-level perspective and actors

Theoretically, this thesis adopts the framework of the multi-level perspective (MLP) on socio-technical transitions. The multi-level perspective has gained well-deserved prominence in the transition literature. This prominence may be explained by the fact that the framework incorporates both technological and social elements in an effort to explain the transition to sustainability. The multi-level perspective conceptualises transition dynamics, with a focus on socio-technical systems and pays attention to co-evolution and the role of actors (Verbong and Geels, 2010). In addition, the multi-level perspective complements the conceptualisation of the interactions between the system and its environment (Markard and Truffer, 2008). Currently, the multi-level perspective is employed as a productive framework to describe and analyse various historical transitions (Markard, Raven, and Truffer, 2012).

The multi-level perspective is not a theory of everything; rather, it represents a middle-range theory that integrates certain elements from other theories (Geels and Schot, 2010). The theoretical background of the multi-level perspective consists of a combination of evolutionary theory, science and technology studies, and sociology (Geels and Schot, 2010). The multi-level perspective places a particular emphasis on agency in the form of bounded rationality and interpretive activities (Geels and Schot, 2010; Geels, 2011; Geels, 2002). In this thesis, the sociology behind the multi-level perspective is of interest, and thus, actors are examined through the lens of sociology. In sociology, actors can be considered both as individuals and

companies (e.g. Giddens, 1984; Law, 1992). Actors in sociology and in sustainability transitions are described in greater detail in Chapter 2.1.

The multi-level perspective is used to analyse sustainability transitions on three distinct levels: niche, socio-technical regime, and exogenous socio-technical landscape (Rip and Kemp, 1998; Geels, 2002). The prevailing idea of the multi-level perspective is that transitions emerge through the alignment of trajectories and ongoing processes within and between these three levels (Geels 2002; Geels and Schot 2007). The dynamics between the three levels of the multi-level perspective can be summarised as follows. First, niche innovations gradually increase internal momentum (Geels, 2002; Geels, 2010). Second, changes at the landscape level put pressure on the regime (Geels 2002; Geels and Schot, 2007). Third, the destabilisation of the regime creates windows of opportunity for the diffusion of niche innovations, which align with ongoing regime processes resulting in substantial transformation and disruption (Rip and Kemp, 1998; Geels, 2002). Ultimately, emerging sustainability innovations are targeted at challenging, and even replacing, the existing, often unsustainable, system (Geels and Schot, 2007; Geels 2011).

Given this, the focus of this thesis is on the question of how actors influence transitions. Figure 2 presents the focus of this thesis (marked in red).
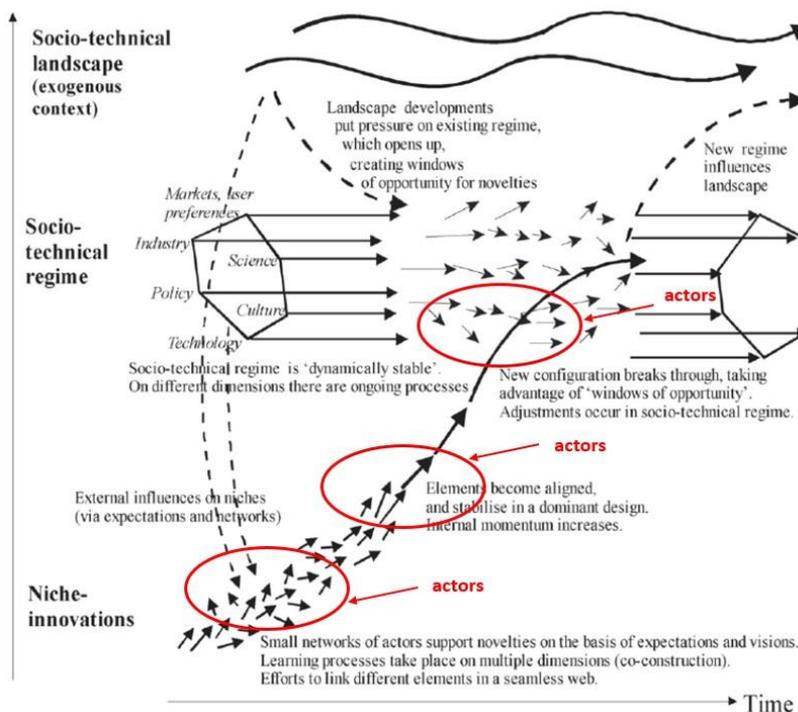

Figure 2. The focus of this thesis in relation to the MLP framework (adapted from Geels, 2002).

While in the multi-level perspective, actors have often been studied at the niche level (Geels, 2011; Upham *et al.*, 2015), in this thesis, actors are studied both in terms of niches and the

existing regime. The discursive actions that are performed at the niche and regime levels are perceived to result in cultural repertoires on the landscape level (Geels and Verhees, 2011). For this reason, actors are explored beyond the niche level, i.e. as companies that operate on the regime level or individual actors who represent the regime.

The individual and company actors of sustainability transitions can be referred to as agents of sustainability transitions. Agency can be perceived as the actors' ability to exert a wide variety of powers in causal terms (Frohlich, Corin, and Potvin, 2001). To obtain a deeper understanding of the phenomenon of actors in sustainability transition, it is necessary to examine the essence of agency in sociology. This is crucial to understanding the ways in which actors influence their surroundings, for example, how actors influence the socio-technical system and its landscape. To explain this connection, structuration theory must also be discussed. Structuration theory addresses the relation of agents and their effect on prevalent structures (Giddens, 1984). One of the theories underpinning the multi-level perspective is structuration theory (Geels and Schot, 2010), and thus, the multi-level perspective can be perceived as a manifestation of structuration theory in the field of sustainability science.

1.2.2 Research gaps

This thesis explores two distinct research gaps in the existing literature. Together these gaps represent two research streams for the thesis. The first research gap addresses the relation of individual actors and the framework of multi-level perspective.

In recent years, several authors have identified a research gap in transition literature and in the multi-level perspective, when considering individual actors (e.g. Bögel and Upham, 2018; Upham *et al*., 2018; Gazheli, Antal, and van den Bergh, 2015; Hynes, 2016; Pesch, 2015; Pesch *et al.,* 2017; Sarrica, 2016). Actors in transition literature, including the multi-level perspective, have gained increasing interest (e.g. Fischer and Newig, 2016; de Haan and Rotmans, 2018), yet despite this emerging research, the psychosocial processes of individuals remain largely under-researched (Whitmarsh, 2012; Gazheli, Antal, and van den Bergh, 2015; Bögel and Upham, 2018). For example, Pesch (2015) argues that the multi-level perspective imposes an overly static view on actors since it tends to focus on the reproduction rules rather than on the emergence of new regimes. According to Pesch (2015), this has led to an overly static view of human behaviour and its associated complexities in general in this field. In addition, Bögel and Upham (2018) state that the psychosocial processes of individuals are rarely examined in transition literature. Additionally, transition literature is further perceived to be disconnected from the disciplines that have accumulated knowledge about agents' behaviour and behavioural change (Gazheli, Antal, and van den Bergh, 2015). These statements are supported by Whitmarsh's (2012) argument that perception, behavioural, attitudinal, or practice changes relating to a broader range of system actors have largely been missing from the socio-technical transition literature.

Moreover, while the study of actors in transition literature has recently increased (Fischer and Newig, 2016; de Haan and Rotmans, 2018), sustainability transitions have not been moving forward on a global, systemic scale. In this thesis it is argued that the psychosocial processes of individuals may help to enable sustainability transitions. Thus, the thesis addresses a research gap well-noted by others (e.g. Gazheli, Antal, and van den Bergh, 2015; Bögel and Upham,

2018; Upham *et al*., 2018) and explores the motivations of individual actors to engage in sustainability transitions, the ways that individuals influence sustainability transitions, and how agency forms through the life courses of individual actors. The thesis argues that sustainability transitions are ultimately dependent on the intentional behaviour of agents, i.e. on structuration. Publication I and Publication III of this thesis address this research gap.

Publication II of the thesis is also considered to pertain to the first research gap. Publication II can be perceived as a test study of the research process applied in this thesis. Publication II marked an important phase in the dissertation process as it revealed a substantial need to study the psychosocial processes of actors in sustainability transitions in greater detail. This led to a more developed paper (Publication III) that explored the motivations and life courses of actors more deeply and using a more theoretically justified approach. Publication III of this thesis can be considered as a precedent to Publication II, and thus, the limited contribution of Publication II is justified. The contribution of Publication II is best considered in concert with the contribution provided by Publication III.

The second research gap involves companies as a form of agency. Transition literature and research into companies' influence on sustainability in other fields have remained separate for a long time (Dyllick and Muff, 2015). To understand how companies enable sustainability transitions, the literature on company sustainability and transition research need to be brought together. Previous literature suggests that sustainable business models might act as bridges to connect company-level sustainability and system-level sustainability (Boons *et al*., 2013; Bolton and Hannon, 2016). Thus, this thesis argues that it is critical to change existing business models and implement sustainable business models to achieve successful sustainability transitions. Companies and their relation to sustainable development and transition literature is discussed in greater detail in Chapter 2.2.4.

While the thesis explores two gaps in the existing literature, the emphasis is on the first research gap. The second gap offers, however, a means of explicating the multidimensionality and complexity of agency in sustainability transitions. Moreover, the second research avenue illustrates that companies have a crucial role to play in sustainable development. As a peer-reviewed publication, Publication IV brings together the literature on transition and company sustainability.

Figure 3 presents the publications of this thesis, the two research gaps addressed, and their connection to the niche and regime levels of the multi-level perspective. Figure 3 also indicates whether actors are explored as individuals or as companies. However, in reality the distinction between individual and company actors might not be this distinct since it may be difficult or even impossible to differentiate certain actor types. For example, an "*entrepreneur*" may represent an individual or a company, or even both. Moreover, Figure 3 presents a possible subsystem or context for the sustainability transition if one is applied in a publication. In Publication II and Publication IV, actors are examined in a certain context, while Publication II explores actors in the Finnish food system and Publication IV in a business environment. However, it should be noted that the publications do not focus on actual systemic transition but rather the actors in these contexts. Publications I and III explore actors' motivations and the ways in which they influence sustainability transitions at the general, societal level. Thus, there are no contexts listed for Publication I and III in Figure 3. In all publications the actors are the main focus.
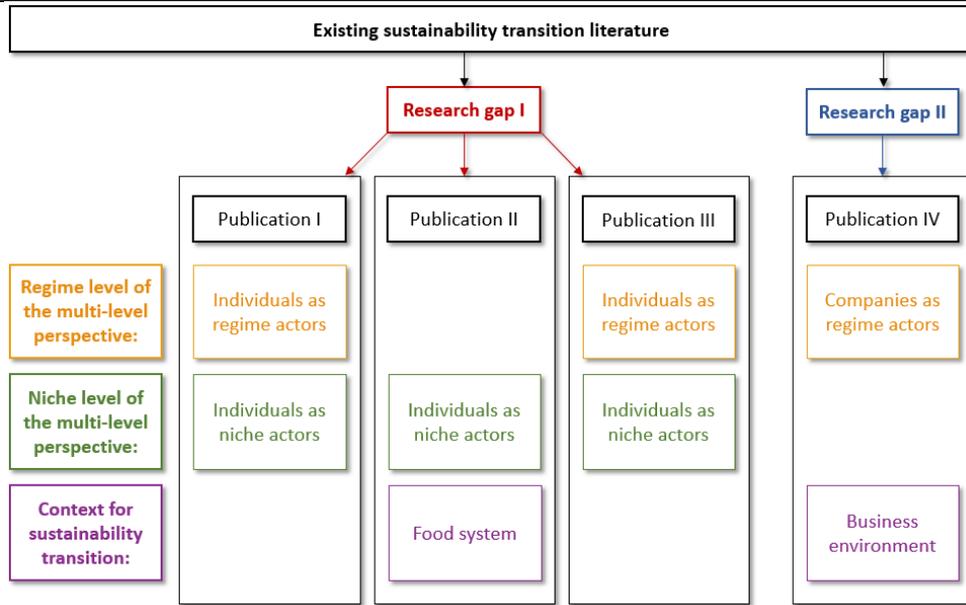
Figure 3. The research gaps addressed in this thesis and the publications of this thesis.

Figure 4 presents an overview of the positioning of this study in relation to the background literature. The key literature that underpins this thesis features in the middle, while the bottom rows outline the research gaps in the literature and thus the focus of this thesis. The broken line indicates that the research area listed is not considered in this thesis. The grey line indicates that the research area listed has had a strong effect on the phenomenon under observation but is not the focus of the present thesis.
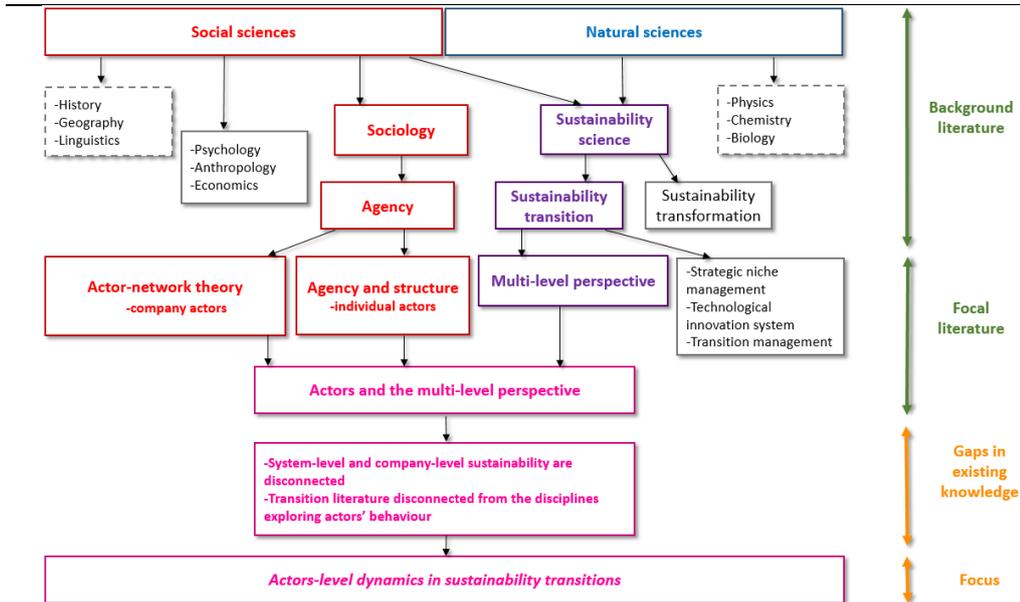
Figure 4. The focus of this thesis within the context of the background literature.

1.3 The purpose of the thesis and the research questions

Given the setting and the background of this work, the main objective of this thesis is to explore how actors make a difference to sustainability. The thesis focuses on two different actor types: (1) individuals who perform intentional actions towards the achievement of sustainability and (2) companies that contribute to sustainability. In reality, there exist various other actor types (see e.g. Fischer and Newig, 2016; Köhler *et al*., 2019) that bear potential to influence sustainability. In this thesis, purposeful actions are embedded in the context of sustainability. Hence, they are referred to as intentional sustainability actions. The multi-level perspective incorporates both structuration theory and actor-network theory (ANT) (Geels and Schot, 2010). Thus, actors, or agents, are studied mainly through the lens of structuration theory, while some components of the actor-network theory are also taken into consideration (Giddens, 1984; Law, 1992).

In this thesis, actors are explored both in a specific setting and more generally. A comparison between individual and company actors and specific and general settings is presented in Table 1.

Table 1. The way in which different actors are explored in this thesis.

	Individual Actor	*Company Actor*
Actors in a general setting	• Agents facilitating sustainability transitions	

	• The life courses of agents of sustainability transitions	
Actors in a specific setting	• Change agents of the Finnish food system	• Companies as actors creating sustainability through business model change

Based on the above, the main research question directing this thesis is:

How do individual and company actors contribute to sustainability transitions?

This main research question is divided into four sub-questions. This thesis thus draws from four publications that, in combination, respond to the main research question by examining more specific sub-questions. While the diverse nature of individual agency remains less studied in the transition literature (Pesch *et al.,* 2017; Pesch, 2015), to understand the phenomenon of individual actors in sustainability transitions, it is essential to review current understanding regarding the agents of sustainability transitions. Hence, the first conceptual publication that supports this thesis (Publication I) explores the existing literature that deals with individual actors of sustainability transitions. Thus, the first sub-question concerns the role of individuals in the transition literature:

SQ1: What is missing regarding the role of individual actors in sustainability transitions?

Since the psychosocial processes of agency tend to be under-researched in the literature on sustainability transitions (Gazheli, Antal and van den Bergh, 2015; Hynes, 2016; Bögel and Upham, 2018), sub-questions 2 and 3 aim to generate more knowledge on the actor-level dynamics at play in the process of sustainability transitions. Publication III observes the development paths of individual-level agency. Thus, the empirical papers of this thesis (Publication II and Publication III) explore the behaviour of individual actors of sustainability transitions:

SQ2: What motivations underlie the actions of individuals actively involved in sustainability transitions?

SQ3: How do individuals embark on, and sustain, a path of intentional sustainability actions?

Since the concepts of company sustainability and larger system transition towards sustainable development have remained rather disconnected (Dyllick and Muff, 2015), the fourth sub-question aims to acquire greater insight into the methods that can successfully unite system transition and business model literature. In transition literature, it is acknowledged that companies contribute to sustainability (Geels, 2002; Geels and Schot, 2007; Geels 2014a). Transition trajectories derive from the multi-level interaction between actors through the entire

multi-level perspective, in which companies are often linked to the existing regime (Geels and Schot, 2007). Geels (2014a) argues that companies might overcome lock-in mechanisms and reorient towards radical innovations and, hence, achieve faster sustainable development when placed under increasing pressure. Therefore, the acknowledged disconnection between company-level sustainability and system-level sustainability is explored in the second conceptual publication (Publication IV) of this thesis.

SQ4: How do companies act in sustainability transition?

1.4 Types of actors examined in this thesis

1.4.1 Individual actors

Before the emergence of sustainability science, the academic discourse in this domain typically focused on human-environment interactions (Clark and Dickson, 2003). Thus, previous research on the relationship between individual actors and sustainability was often seen as the interface between individuals and the natural environment both in the social and natural sciences. For this reason, how individuals influence sustainability has previously been explored in a way that is conceptually different to that employed in the field of sustainability science. It is worth noting that in this thesis the word "*environment*" is used to describe both the natural environment, including the climate and natural resources, and the surrounding societal or institutional environment of an actor.

The interactions between the natural environment and actors have been studied broadly in the context of the social sciences, for example, in anthropology, psychology, sociology, and economics. Each of these disciplines study, at least to some extent, society, human behaviour, and social relationships. In addition, each discipline involves both the macro study of society and the micro study of individual cases. The emphasis of research varies depending on the discipline and sub-discipline. For example, psychology focusses on exploring individuals' minds, cognition, and individual differences, while sociology emphasises individuals' interpretations, situational factors, and the effect of their surroundings (Oishi, Kesebir, and Snyder, 2009). In anthropology, problem-focused participatory research through which individuals and their behaviour are studied in a social context has become the increasingly dominant approach (Johnston, 2010). Typically, economics focusses on the complex dynamics of interactions between human and natural systems, which addresses the place of individuals in their environment, the role of ethics and monetary values, and the limits associated with regulating the behaviour of individuals and companies (Boulding, 1978; Norgaard, 1984; van den Bergh, 2007).

In anthropology, studies in this area have largely fallen into two major categories: ecological anthropology and anthropology of environmentalism (Little, 1999). The former employs ecological methodologies to study the interrelations between human groups and their environment, while the latter employs ethnographic methodologies to study environmentalism as a type of human action (Little, 1999). In the mid-1970s, the study of environmental problems begun to alert some sociologists to the reality of environmental problems and ecological constraints (Dunlap and Catton, 1979). This led to a reappraisal of widely held sociological assumptions, such as the supposed irrelevance of physical environments for understanding

social behaviour, which resulted in the emergence of environmental sociology (Dunlap and Catton, 1979). Since the 1970s, environmental sociology can roughly be divided into two categories: the conservation and preservation of nature for nature's sake, i.e. the eco-centric view; the maintenance of the environment as a necessary habitat for humankind, which is referred to as the anthropogenic view (Gross and Heinrichs, 2010). The aim of environmental psychology is to understand human behaviours in relation to the ecological environment (Barker, 1968). In economics, the study of individuals and the natural environment is also divided into two major streams of study, environmental economics and ecological economics, both of which are concerned with the economic analysis of the causes and the nature of environmental problems and their solutions (van den Bergh, 2007). Table 2 presents a simplified overview of the existing studies on actors and their effect on the natural environment that have been conducted in anthropology, economics, sociology, and psychology together with example references.

Table 2. The relationship between the natural environment and actors in key branches of the social sciences.

Branch of Social Sciences	Relation to Environment and Actors	Example Research Streams
Anthropology	Ecological Anthropology	Political and human ecology (Roseberry, 1988) Historical ecology (Balée, 1998)
	Anthropology of Environmentalism	Environmental movements (Guha, 1989) Environmental rights (ChirifTirado *et al.*, 1991) Environmental discourses (Bird-David, 1993)
Economics	Environmental Economics	Monetary valuation (Johansson, 1987) Environmental policy (Baumol and Oaters, 1988)
	Ecological Economics	Evolutionary economics (Nelson and Winter, 1982)
Sociology	Environmental Sociology	Eco-centric view (Schnaiberg, 1980)

		Anthropogenic view (Higgs, 2003)
Psychology	Environmental Psychology	Pro-environmental behaviour (Bamberg and Möser, 2007) Theory of planned behaviour (Ajzen, 1991) Environmentally significant consumption (Stern, 1997)

In particular, this thesis highlights the effect individual actors have on their surroundings and the interpretations of individual actors. Hence, in Chapters 2.1. and 2.3. of this thesis, the relation between the natural environment and individuals will be discussed in depth with a particular emphasis on agency, sociology, and the multi-level perspective. In addition, Publications I-III focus on individual actors.

1.4.2 Company actors

Traditionally, the primary objective of companies' business operations has not been to ensure sustainable development; however, it has been widely acknowledged that companies are able to contribute to sustainability (Banerjee, 2001; Bansal, 2005; Boons *et al.*, 2013; Bocken *et al.*, 2014; Geels, 2014a). Before and after the turn of the millennium, the relationship between companies and sustainability has gradually evolved to more deeply amalgamate sustainability issues and business operations. Currently, companies are perceived to be drivers of sustainability, for example, through developing and implementing sustainable business models (Lüdeke-Freund, 2010; Boons and Lüdeke-Freund, 2013). Hence, companies may be considered actors of sustainability transitions. Table 3 presents an overview of some of the disciplines in which company sustainability has been addressed. However, companies are also able to obstruct sustainability transitions (see e.g. Berggren, Magnusson, and Sushandoyo, 2015; Johnstone, Stirling, and Sovacool, 2017), and thus, act as opposing actors.

Table 3. Branches of company literature in relation to sustainability.

Literature	*Focus*	*Example Reference*
Ecological Modernisation	Economic growth can be disconnected from environmental degradation.	Christoff (1996)
Corporate Sustainability	The connection between sustainable development and a company, the target being to	Baumgartner and Ebner (2010)

	have positive effects on societies in the long term.	
Corporate Social Responsibility	Actions that appear to further some social good beyond the interests of the firm and that are required by law.	McWilliams and Siegel (2001)
Transition Studies	Incumbent companies possess the power and resources to influence sustainability. Companies should pursue radical innovations.	Geels (2014a)
Environmental Strategies	Integration of environmental issues can occur at different levels of strategy depending on managerial perceptions of the importance of environmental issues.	Banerjee (2001)
Sustainable Business Models	A business model that creates competitive advantage through superior customer value and contributes to the sustainable development of the company and society.	Boons and Lüdeke-Freund (2013)

Despite the growing body of knowledge in this area, there is a lack of analyses that consider both company sustainability and the wider transition towards sustainability within a system (Dyllick and Muff, 2015). As such, there is an inherent need for an in-depth examination of companies as actors of sustainability transition to achieve system-level changes. The way in which companies enable sustainability is discussed in more depth in Chapter 2.2.3. of this thesis and in Publication IV.

1.5 The definitions of key concepts

Due to the interdisciplinary nature of this thesis, it is necessary to define the key terms applied in the research. Table 4 presents the key concepts of the thesis and their corresponding definitions.

Before elaborating the key terms, it needs to be noted that the words "*actor*" and "*agent*" are used interchangeably in this thesis. Arguably, a theoretically more justified term for actor would probably be that of *agent*. Agency is often interpreted as the human capability to make free choices and have an impact on one's environment (Giddens, 1984; Archer, 1995). Hence, agents are actors who have the ability to engage in purposeful action and the capacity to perform

this action (Stones, 2005; Sherwin, 2009; Tourish, 2014). However, agency may also be something other than "*human*" (Latour, 1996). While this thesis explores in particular the intentional actions of actors, or agents, the word "*actor*" places a particular emphasis on the act of "*doing*" and, hence, the word is often used as an alternative to *agent*.

Moreover, depending on the scientific discipline, different terms are used. For example, transition literature typically discusses both actors and agents, while the literature on company sustainability tends to favour the term actor. In addition, the terms actor and agent are used interchangeably in the different publications of this thesis. This is explained by the interdisciplinary nature of this thesis, that is, the incorporation of sustainability studies, management studies, and transition literature. For these reasons, both terms are used interchangeably throughout this thesis.

Table 4. The key concepts of this thesis and their definitions.

Key Concept	Definition
Structure	This thesis adopts structuration theory and thus applies the idea that the social and the individual are mutually constituted in practice (Giddens, 1979). According to Giddens (1979), the concept of the "*duality of structure*" refers to the inseparable double nature of structure as both medium and outcome of recursively organised social practices. In structuration theory, structure represents a set of rules and resources marked by the absence of the subject (Giddens, 1984). Social systems comprise the situated activities of human agents (Giddens, 1984). Structure and agency are fundamentally inseparable, and hence structure is not possible without action, which always reproduces structure (Giddens, 1984). Ultimately, in structuration theory, structure is constituted in the individual, subjective minds of agents (Giddens, 1984). Thus, structures are seen to exist, but are "*temporally 'present' only in their instantiation*" in practice (Giddens, 1979).
Structuration	In structuration theory, the term "*structuration*" refers to the active process by which individuals, informed by structure, act in the world to reproduce/change the social structures that confront them (King, 2010). Thus, the structuration of social systems refers to the modes in which such systems are produced and reproduced by agents by drawing upon rules and resources (Frohlich *et al.*, 2001). The duality of structure appears when individuals implement structure into practice, simultaneously affirming not only the structure of rules but also the system itself (Giddens, 1984).
Agency	A broadly adopted view of "*agency*" is that it represents the capability of an individual agent to act. Agency can be interpreted as the potential of individuals to exert a wide variety of powers

	in a causal exchange, ergo, as actors' power to independently pursue a goal (Frohlich *et al.,* 2001). In this thesis, agency is perceived similarly as in structuration theory. Giddens (1979) defines agency as "*a continuous flow of conduct*". In general, agency is perceived to involve the possession of power, the "*ability to engage in purposeful action*" and as "*having the capacity to take an action*" (Stones, 2005; Sherwin, 2009; Tourish, 2014). These definitions underline human agency. While this thesis examines actors through the thesis also acknowledges that agency may also be interpreted as constituting something beyond human agency to include, for example, material artefacts (Latour, 1996).
Agent	In this thesis, agents are largely conceptualised according to the definition of "agent" applied in structuration theory. Through this lens, agents are considered active individuals who construct social behaviour, which is embedded in the structure and contributes to that structure's continuation or change (Cockerham *et al*., 1997). Thus, Giddens (1979) proposes that action is generated as a result of the purposive, reasoning behaviour of agents. As he states: "*To be a human being is to be a purposive agent, who both has reasons for his or her activities and is able, if asked, to elaborate discursively upon those reasons (including lying about them).*" (Giddens, 1984). In addition, agents can be understood as something other than human (Latour, 1996). According to actor network theory (ANT), which is also applied in this thesis, non-human, non-individual entities can be agents (Latour, 1996).
Actor	See the definition of "*agent*" above.
Grand challenges	The sustainability challenges that require urgent action and threat the Earth's system are referred to in this thesis as "*grand challenges*". The Sustainable Development Goals of the United Nations may be the most well-known and commonly applied grand challenges of today (George *et al.*, 2016). In 2015, 193 Member States of the United Nations agreed 17 common targets to end poverty, protect the planet, and ensure prosperity for all as part of a sustainable development agenda (George *et al.*, 2016).
Sustainable development	This thesis applies the WCED definition of "*sustainable development*" and understands sustainable development to constitute "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987).

Sustainability science	In this thesis, "*sustainability science*" is understood as a research stream that incorporates both the natural and social sciences and aims to respond to sustainability challenges. Sustainability science focuses on the dynamic interactions between nature and society, paying equal attention to how social change shapes the environment and how environmental change shapes society (Clark and Dickinson, 2003). The three main objectives of sustainability science are: (1) to understand the fundamental interactions between nature and society; (2) to guide these interactions along sustainable trajectories; and (3) to promote the social learning necessary to navigate the transition to sustainability (Kates *et al.*, 2001).
Change	According to the Cambridge Dictionary (2018) "*change*" means "*to make or become different*". In this thesis, the Cambridge Dictionary of change is applied. Moreover, the term "*change*" is used as an overarching concept for all terms that describe something that becomes different, such as transition, transformation, or development.
Socio-ecological system	When considering the definition of "*socio-ecological system*", this thesis follows the socio-ecological approach to sustainability change. In socio-ecological research, the socio-ecological system entails the idea that society and nature are fundamentally interconnected (Dawson et al., 2010). In the socio-ecological system, human (including cultural, management, economic, and socio-political) and physical biological sub-systems or agents interact on multiple temporal and spatial scales (Berkes and Folke, 1998). Socio-ecological systems are a form of Complex Adaptive System, in which a dynamic network of many agents (which may represent species, people, companies, nations, etc.) act independently and in parallel, constantly responding to their environment and to what other agents are doing (Waldrop, 1994). The socio-ecological approach is concerned with global environmental change, such as resilience transformative adaptation (O'Brien, 2012; Olsson, Galaz, and Boonstra, 2014). The research regarding the socio-ecological system focuses mainly on resilience and transformation in human-environmental interactions and feedback to reverse current unsustainable trends, such as the loss of biodiversity or climate change (Westley *et al.*, 2011; Folke *et al.*, 2011; Olsson and Galaz, 2012; Steffen *et al.*, 2011).
Socio-technical system	In defining "*socio-technical system*", this thesis follows the socio-technical approach to sustainability change. According to this approach, socio-technical system reflects the idea that society is consisted of sectors such as energy supply, water

	supply, or transportation, which can be conceptualised as socio-technical systems (Markard, Raven, and Truffer, 2012). Socio-technical systems include (networks of) actors (individuals, firms, and other organisations, collective actors) and institutions (societal and technical norms, regulations, standards of good practice) as well as material artefacts and knowledge (Geels, 2004; Markard, 2011; Weber, 2003). The different elements of the socio-system interact, and together provide specific services for society (Markard, Raven, and Truffer, 2012).
Transformation	Within socio-ecological systems research, the term "*transformation*" is applied to refer to large-scale changes in whole societies, which can be global, national, or local. Characteristic of transformation is the involvement and interaction of human and biophysical system components (Brandt 2014; Folke *et al.*, 2010).
Transition	In socio-technical discourse, "*transition*" refers to a set of processes that lead to a fundamental shift in socio-technical systems (Kemp, 1994; Geels and Schot, 2010). A transition involves far-reaching changes along different dimensions: technological, material, organisational, institutional, political, economic, and socio-cultural (Markard, Raven, and Truffer, 2012). Transitions include a wide variety of actors and transitions typically occur over considerable timespans (Geels, 2002; Markard, Raven and Truffer, 2012). The socio-technical approach considers sustainability transitions as long-term, multi-dimensional, and fundamental change processes through which established socio-technical systems shift to more sustainable versions (Markard, Raven, and Truffer, 2012).
Multi-level perspective	This thesis explores actors through the lens of the multi-level perspective (MLP), which is conceptualised as a framework for understanding sustainability transitions in socio-technical systems research (Rip and Kemp, 1998; Geels, 2002). The framework provides an overview of the multidimensional complexity of changes in socio-technical systems (Geels and Schot, 2007, Geels, 2010). The multi-level perspective aims to explain transitions through the interplay of dynamics at three different levels: niche, regime, and landscape (Geels, 2002). Landscape factors might put pressure on existing regimes and open windows of opportunities for niches to break through and enable fundamental changes, or shifts, in socio-technical regimes (Geels, 2002; Markard, Raven, and Truffer, 2012).

1.6 **Structure of the thesis**

This thesis consists of two main sections: the summary section of the thesis and an overview of the four publications of the thesis.

The thesis summary begins by presenting the research background and an overview of the study. The second chapter then presents the theoretical context of the study. The theoretical framework of the thesis is developed from the theory of agency, the literature on sustainability transitions including the multi-level perspective, a short overview of the background on the relationship between companies and sustainability, and, finally, the relation between the multi-level perspective and individual agents. Third, the summary describes the research design and methods applied in this thesis. Fourth, the publications and their findings and implications are presented. Finally, the fifth chapter discusses the contributions the results of this research make to the existing literature, provides possible research trajectories for future studies and presents the limitations of this work.

The publications section presents the main objectives and contributions of the four publications that form this thesis. Table 5 presents an overview of how the different subsections of the thesis relate to the main research question and sub-questions of the study.

Table 5. The outline of the thesis

Subsection of the Thesis	*Contribution*	*Type of Paper*
SECTION I: Summary of the thesis 1. Introduction 2. Theoretical framework 3. Research design 4. Summary of the publications and main contributions 5. Discussion and conclusions	The main research question	
SECTION II: Publications	Sub-questions	
Publication I: Agent-Based Change in Facilitating Sustainability Transitions	SQ1	Conceptual paper
Publication II: Change Agents Engaged in Sustainable Transformation in the Finnish Food System	SQ2 and SQ3	Empirical paper

Publication III: Active Agents of Sustainability Transitions – A Life Course Approach	SQ2 and SQ3	Empirical paper
Publication IV: Sustainable System Value Creation: Development of Preliminary Frameworks for a Business Model Change within a Systematic Transition Process	SQ4	Conceptual paper

2   Theoretical Framework

The concept of agency is crucial for this thesis. The essence of agency is deeply rooted in the social sciences; hence, in Chapter 2.1, the relation between sociology and agency is presented. To understand the relationship between actors and sustainability transitions, Chapters 2.2. and 2.3. address the sustainability transition literature and how actors have been explored in this literature. In Chapter 2.2.4, the connection between companies and sustainability is examined to understand companies as actors of sustainability transitions. In Chapters 2.3.2 and 2.3.3, the concept of agency and its relation to the multi-level perspective is discussed in greater detail. Chapter 2.3.3 focuses on individuals as actors of sustainability transitions.

2.1   Agency

Although the concept of agency is understood in a variety of way and the multi-level perspective has its own unique view of agency, this thesis adopts the views of the sociologists Giddens, Archer, and Stones on agency. In other words, the interplay of agents and their environment is discussed here. In this section, the environment refers to the surroundings, or the structure, of the actors, not explicitly to the natural environment. In addition, the actor-network theory (ANT) is briefly discussed to highlight that agency is not always understood as being purely human. This is a necessary observation to make since this thesis takes companies as actors into account. Second, the actor-network theory is presented because this theory has influenced the development of the multi-level perspective. To summarise, in this thesis the multi-level perspective is perceived as a manifestation of structuration theory as, ultimately, sustainability transitions rely on the deliberate behaviour of agents, i.e. on structuration theory and the interplay between agents and their environment.

2.1.1   Agency and structure

Perhaps the most widely adopted view of agency is that it represents the capability of an individual agent to act. In general, agency can be interpreted as the potential of individuals to exert a wide variety of powers in a causal exchange, ergo, as actors' power to independently pursue a goal (Frohlich *et al*., 2001). Giddens (1979) defines agency as "a continuous flow of conduct". In general, agency is perceived to involve the possession of power, the "*ability to engage in purposeful action*" and as "*having the capacity to take an action*" (Stones, 2005; Sherwin, 2009; Tourish, 2014). In other words, an agent is an actor who performs intentional actions. Hence, in this thesis, agents are perceived to be actors who perform intentional actions towards the achievement of sustainability.

While this thesis highlights individual agency, it should be noted that the current sociological discussion pays special attention to collective agency and how collectivities pursue a goal. For example, Giddens' definition of agency has been criticised for its lack of conceptual tools to differentiate between the individual and the social, which makes it impossible to make an analytical distinction between individual and collective agency (Eteläpelto *et al*., 2013). Many scholars define agency as a collective and social phenomenon established in a socio-cultural framework (e.g. Lasky, 2005; Billet, 2006; Eteläpelto *et al*., 2013). For example, Billet (2006) argues that the relations between the individual and the social are mutual or reciprocal and thus that they should be viewed as relational, entwined, and interwoven. While collective agency

has similar potential to individual agency in terms of its capacity to create a wide variety of powers, this thesis focuses on the question of how individuals use their agency and effect the broader environment.

The nature of individual agency and its relationship with the larger environment, i.e. the structure, is a widely discussed topic in sociology. From the sociological perspective, agency is often interpreted as the human capability to make free choices and have an impact on one's environment (Giddens, 1984; Archer, 1995). While other definitions of agency have also been proposed (e.g. actor-network theory, elaborated upon later), in this thesis, agency is mainly explored and conceptualised using the explanation provided by Anthony Giddens and Margaret Archer.

Structuration theory is frequently employed to explain the interplay between agents and structure. However, it has been criticised for neglecting situated details, especially the psychosocial processes of actors, such as motivation, perceptions, and agents' contexts (Stones, 2005). The "*strong structuration*" framework was developed to address this criticism and consider agents' internal worlds as a neglected element of organisational and wider structural change (Stones, 2005). For this reason, there is a need to present a strong structuration framework in addition to discussing structuration theory. Therefore, after describing structuration theory, a strong structuration framework is presented as an addition to this theory.

The interplay between individuals and their environments is a crucial part of structuration theory. In structuration theory, agency is perceived as the bidirectional movement between individuals and their environments (Dean *et al*., 2016). Giddens (1984) emphasises that agency and structures are ultimately inseparable. In other words, agency determines structure, which consequently determines opportunities for the expression of agency (Giddens, 1984). This means that, from a structuration perspective, social structures exist and function through agents' actions, which assign specific roles and meanings to those structures (Grin, Rotmans, and Schot, 2010). Following Giddens, Archer (1995) broadens the debate on structure and agency arguing that structure is not possible without action because action reproduces structure. She elaborates upon the view that structure and agency do not exist as a dichotomy but as two separate functions in constant movement: agency constantly affects structure, yet agency is also constantly affected by structure (Archer, 1995). According to Archer, an agent is not the abstract or dependent subject of action but an individual who constructs social behaviour (Cockerham et al., 1997). Social behaviour, however, is embedded in a structure and contributes to that structure's continuation or change (Cockerham et al., 1997). Thus, structures are not predetermined but evolve through social interaction (Archer, 1995). Since structure is both the means and outcome of action, it entails the idea of duality: structure is both objective and subjective at the same time (Cockerham et al., 1997).

Giddens' (1984) structuration theory emphasises the assumed knowledgeability of human actors by examining "*what agents know about what they do, and why they do it*". This knowledgeability suggests that human actors have "*reflexive capacities*" as they continuously monitor their activities, those of others, and the contexts in which they act in the "*ongoing flow of social life*" (Giddens, 1984). The "*reflexive monitoring of action*" derives from another concept of Giddens', namely, the "*rationalization of action*", which asserts that human agents routinely "*maintain a continuing 'theoretical understanding' of the grounds of their activity*"

(Giddens, 1984). These concepts refer to the intentional character of human action, as Giddens (1984) states:

"*To be a human being is to be a purposive agent, who both has reasons for his or her activities and is able, if asked, to elaborate discursively upon those reasons (including lying about them).*"

He distinguishes the "*motivation for action*" from its reflexive monitoring and rationalisation, stating: "*if reasons refer to the grounds of action, motives refer to the wants which prompt it*" (Giddens, 1984). Giddens' (1984) argument is that while actors can usually explain the reasons for their actions, they may not be able to explain their motives, which may be unconscious. He also states that actors tend to provide encompassing plans rather than directly motivating action, except "*in relatively unusual circumstances, situations which in some way break with the routine*" (Giddens, 1984). The motivation, conscious or unconscious, of human agency has always been an integral part of structuration theory, but Giddens does not place a specific emphasis on the internal worlds or psychosocial processes of human actors in a more rigorous sense.

Partly because of the criticism of structuration theory regarding the neglected internal worlds of actors, Stones (2005) developed Giddens' work into what is now widely termed "*strong structuration theory*". Whereas Giddens was especially interested in relatively abstract ontology, Stones went further and encouraged researchers to explore empirical case studies involving specific actors and structures where individual agents are situated in a web of position-practice relations (Coad, Jack, and Kholeif, 2016). While the duality of structure, i.e. the inseparability and thus duality of agency and structure, remains a defining construct in strong structuration theory, Stones states that duality is best understood through the analysis of a quadripartite framework of interrelated components that spans external structures, internal structures, active agency, and outcomes (Coad, Jack, and Kholeif, 2016) in which external structures obligate the actions of agents; internal psychological structures are found within agents; active, intentional agency is assumed; and outcomes occur that are internal and/or external to the agent (Stones 2005; Aldous, 2014; Schwandt and Szabla, 2013; Fjellstedt *et al*., 2015; Upham *et al*., 2018). Within this thesis, agents are studied in the context of sustainability transitions and, more precisely, within the framework of the multi-level perspective. The multi-level perspective, which refers to a wider structure that consists of three different levels of socio-technical structuration, illustrates the external structures of the strong structuration framework. Thus, this thesis explores the "*hows*" of actors in implementing sustainability and influencing structure. To sum up, this thesis aims to generate more knowledge of the motivations of individual actors during sustainability transitions using the lenses of structuration theory and a strong structuration framework.

Stones (2005) describes the four elements of strong structuration as follows: external structures are separate from the actor and they set boundary conditions. In the socio-technical framework of the multi-level perspective, these boundaries include, for example, laws, policies, and companies. Internal structures include two categories: First, those that are general-dispositional, such as norms, values, and attitudes in relation to one's analytic frame; and second, those that are conjuncturally specific, regarding actors' knowledge and understanding of their immediate and wider context. Whereas these two categories are fundamentally distinct, in practice there might be some overlap (Upham *et al*., 2018).

Within this framework, active agency relates to processes of deliberate, sometimes strategic action (Garud and Karnøe, 2001). In this thesis, sustainability agency includes the proactive steps that are taken towards sustainability and the motivations that underpin these actions. Moreover, in this thesis, it is recognised that sustainability agency might appear, for example, among sustainability professionals or entrepreneurs or as resistance to the existing system. Finally, an outcome is any possible consequence of the previous actions for the agents and their structural context (Upham *et al.*, 2018). Typically, the aim of strong structuration is to understand the connections between individual actions and organisational processes and outcomes (Schwandt and Szabla, 2013; Upham *et al*., 2018). In addition, strong structuration is generally understood as a conceptual methodology that aims to develop a bridge between theory and empirical research (Stones and Jack, 2016; Coad, Jack, and Kholeif, 2016). In this thesis, strong structuration within the multi-level perspective is applied within the empirical context of this study.

2.1.2   Actor-network theory

The multi-level perspective of socio-technical transitions incorporates the actor-network theory (ANT) in the development of its framework by adopting insights from science and technology studies (STS). The actor-network theory originated from sociology and the science and technology studies (Law, 1992). The actor-network theory emphasises the construction from a range of things, heterogeneity, and messiness of technological development in local practices, in which social and technical elements interrelate and constitute each other from the beginning (Geels and Schot, 2010). The core idea behind actor-network theory is that knowledge, which covers aspects such as knowledge of agents, social institutions, machines, and companies, may be perceived as a product or outcome of a *network of heterogeneous materials* (Law, 1992). Hence, the actor-network theory is an explicitly socio-technical approach that analyses the building of *actor-networks* (Latour, 1987). This idea assumes that there are no actors without networks.

What distinguishes the actor-network theory from other theories is its perception of agency. While typical studies regarding sociology and social networks focus on the social relations of individual human actors and their frequency, distribution, homogeneity, and proximity, *actor-network theory does not limit itself to human individual actors but extends the word actor to include non-human, non-individual entities* (Latour, 1996). The non-human or non-individual entities may have a similar influence on their environment as that of human actors. This implies that non-human and non-individual entities affect human actors. Thus, the influence of a non-human environment should not be overlooked in a study of agency.

The aim of actor-network theory is to explore the essence of societies and nature by employing social networks to rebuild social theory (Latour, 1996; Latour, 2005). Moreover, the actor-network theory is based on an integral assumption that social and technical developments are embedded in each other, which means that it is simply not possible to explore the social without simultaneously studying relational materiality (Law, 2008). However, it is important to emphasise that this theory does not exclude human agency. In actor-network webs, the distinction between human and non-human is of little initial analytical importance: people are relational effects that include both the human and the non-human, while object-webs conversely

include people (Law, 2008). This leads to certain networks being labelled either as "*human*" or "*non-human*", but this is a secondary matter (Law, 2008).

The actor-network theory can be applied to analyse companies. According to this theory, the sociology of companies should be distinguished from, on the one hand, the *materials* of a company, and on the other, those involved with the *strategy* of a company (Law, 1992). When the character of a company is explored using the actor-network theory, this is considered an effect or a consequence, i.e. the effect of the interaction between the materials and strategies of a company (Law, 1992). From this perspective, a company is an achievement and the components of a company—the hierarchies, company arrangements, power relations, and flows of information—are the uncertain consequences of the ordering of heterogeneous materials, which the actor-network theory analyses and demystifies (Law, 1992). The actor-network theory provides insights that facilitate the exploration of companies as actors, or non-human actors, of sustainability transitions. Moreover, companies may include both non-human and human agency in their operating environment.

2.2 Sustainability transitions

2.2.1 Schools of thought

Transition Management (TM)

Transition management (TM) can be understood as a new governance approach to sustainable development. The transition management framework is based on complex systems theory and new forms of governance that are combined into a new governance approach (Kauffman, 1995; Loorbach, 2010; Rotmans et al., 2001). The ultimate aim of transition management is to transform socio-technical systems (Rotmans, Kemp and van Asselt, 2001). According to transition management, aspects of both the sociotechnical system and sectoral policy regimes need to change structurally to become more sustainable, and policy developments are required to help engender these changes (Kern and Howlett, 2009).

Transition management merges an orientation toward a long-term vision of sustainable development with short-term experimental learning to explore options and find pathways to implement the vision (Voß, Smith and Grin, 2009). One of the leading ideas of transition management is to advance transitions through gathering together different types of actors to create new visions and pathways for change (Hyysalo *et al*., 2019; Köhler *et al*., 2019). The transition management literature emphasizes the multiple and important roles government play in enabling the alternative pathways to a more sustainable future (Kemp and Rotmans, 2004).

Strategic Niche Management (SNM)

Strategic niche management (SNM) theory, which was elaborated by Kemp, Schot and Hoogma (1998), was developed to manage innovations—which are seen as socially desirable and serve long-term goals, such as sustainability—and path-breaking novelties that are not compatible with the existing infrastructures, user practices or regulations. Strategic niche management prevails the idea that niches are spaces that provide temporary protection for the configuration and development of path-breaking innovations (Schot, Hoogma and Elzen, 1994; Kemp, Schot

and Hoogma, 1998). Strategic niche management can be understood as the deliberate creation and support of niches that may eventually enable regime shifts (Kemp, Schot and Hoogma, 1998; Hoogma *et al.*, 2002).

Protection and nurturing in the early stages of a transition are crucial since path-breaking innovations cannot compete within selection environments in the existing socio-technical regime. Examples of such protection include, for example, subsidies and tax incentives. With such protection, the innovations are expected to develop and enter broader and more diverse markets, and the need for protection gradually diminishes as the innovations become competitive and start to contribute to regime shifts towards a new state (Smith and Raven, 2012). The aim of the strategic niche management approach is to bring the knowledge and expertise of users and other actors into the technology development process and foster interactive learning processes and institutional adaptation (Kemp, Schot and Hoogma, 1998). This interplay of actors and institutions in a specific technological field is at the core of the literature on strategic niche management (Kemp, Schot and Hoogma, 1998; Konrad *et al.*, 2012).

Technological innovation system (TIS)

The research on the technological innovation system (TIS) is often utilised in and beyond the context of sustainability transitions (Markard, Suter and Ingold, 2016). Technological innovation system approach addresses the emergence of novel technologies and the institutional and company changes that go simultaneously with technology development (Markard, Raven and Truffer, 2012). The aim of the technological innovation system approach is to understand the dynamics of an innovation system that is centred around a specific technology (Markard, Suter and Ingold, 2016). The perspective of technological innovation systems was developed by Carlsson and Stankiewicz (1991), who argue that the systemic interplay of firms and other actors within a certain institutional infrastructure represents the crucial driver behind the generation, diffusion, and utilization of a technological innovation.

The technological innovation system approach emphasises systemic interdependencies, which bring about different forms of collaboration, such as collective assets on which different actors can draw but would be unable to produce if they worked in isolation (Bergek *et al.*, 2015). The perspective is often utilised to assess the performance of a technological innovation system, identify shortcomings, and gather recommendations for the design of policies in support of a specific technology and, hence, a transition (Alkemade *et al.*, 2011; Weber and Rohracher, 2012; Wieczorek and Hekkert, 2012; Jacobsson and Karltorp, 2013).

2.2.2   Actors of sustainability transitions

The transition literature recognises actors as components of sustainability transitions. All frameworks for sustainability transitions include a rationale of how actors, in one way or the other, underlie a systemic change (de Haan and Rotmans, 2018). The multi-level perspective, for example, is founded on the assumption that transitions occur through the social interactions of actors (Gees, 2011). In general, sustainability transitions are considered to involve a wide variety of actors (Markard, Raven, and Truffer, 2012; Köhler *et al.*, 2019). This pool of actors is often narrowed down to consider only those actors who support a transition and those who hinder it (Markard and Truffer, 2008; Geels, 2014b; Johnstone, Stirling, and Sovacool, 2017;

de Haan and Rotmans, 2018). These actor types, those who support and those who hinder, are often referred to as *regime* (or incumbent) and *niche* actors (Bakker, 2014; Berggren, Magnusson, and Sushandoyo, 2015). However, recently, several scholars have argued that this distinction is overly simplistic and does not consider the possible variation within these two actor categories (Markard and Truffer, 2008; Bakker 2014; Fischer and Newig, 2016). In reality, one actor can potentially be both a supporter and opponent of change (Fischer and Newig, 2016). In addition, Pesch (2015) notes that the multi-level perspective tends to define regime actors according to their institutional affiliation, which can be seen as a rather static approach to defining these actors.

A recent review of the transition literature by Fischer and Newig (2016) has identified a number of actor typologies. The authors note that these different actor categories overlap in real-world context. The actor categories identified included regime, niche, and landscape actors as well as intermediaries, market actors, civil society, and different governmental actors (i.e. local, regional and global). The authors argue that one actor can fall into more than one actor category and that the different actor categories entail strong dependencies since, for example, niche emergence may be largely dependent on policy support (Fischer and Newig, 2016). Thus, the categorisation of different actors and actor groups is not highly distinct but rather a directional typology. Table 6 presents a simplified actor category list adapted from Fischer and Newig's (2016) study of actor categories and describes some of the key actor types found in the transition literature. However, it should be noted that the landscape actors included in Table 6 are not, in fact, actors per se but are included in the category list due to the importance of the landscape level in providing room for agency. In addition, the levels of the multi-level perspective do not have agency (Fischer and Newig, 2016). However, actors and their actions can often be associated with particular levels, such as niche, which explains why the transition literature has begun to explicitly relate actors to the levels of the multi-level perspective, referring specifically to niche and regime actors (Haxeltine *et al*., 2008; Bakker, 2014; Nykvist and Nilsson, 2015).

Table 6. Different agent categories in the transition literature (adapted from Fischer and Newig, 2016).

Actor Type	*Transition Framework*	*Potential Influence on Transition*	*Example*
Niche actor	-Transition Management -Strategic Niche Management -Technological Innovation System -Multi-level Perspective	Niche actors possess agency that enables them to act as the initiator of systemic transition or regime shifts.	A solar panel entrepreneur.
Regime actor	-Transition Management -Strategic Niche Management -Technological Innovation System	Regime itself represents the structure that is influenced by agency. Regime actors possess	A strong company in the established system, such as a market leader in

	-Multi-level Perspective	agency that can be targeted towards supporting or hindering a transition. Regime entails power and resources.	energy production.
Landscape (actor)	-Multi-level Perspective	Landscape provides room for agency.	-
Intermediaries	-Transition Management -Strategic Niche Management -Technological Innovation System -Multi-level Perspective	Intermediary actors are active agents that provide and distribute necessary information and connect niche-level activities with regime-level institutions.	Local politicians who increase public acceptance of renewable energy solutions, e.g. wind energy.
Supporting actor	-Transition Management -Strategic Niche Management -Technological Innovation System -Multi-level Perspective	Supporting actors actively or passively promote a transition and possess the agency to influence transition. Typically, supporting actors are seen to represent the niche level.	NGO representatives that actively support emerging technologies, such as solar energy or vegan products.
Opposing actor	-Transition Management -Strategic Niche Management -Technological Innovation System -Multi-level Perspective	Opposing actors actively or passively hinder a transition and possess the agency to influence transition. Typically, opposing actors are seen to represent the regime level.	Traditional energy companies that base their business models solely on fossil fuels.
New entrants	-Transition Management -Strategic Niche Management -Technological Innovation System	New entrants are actors that enter an already established system with the aim of shaping or replacing the	Emerging firms that enter regime markets, such as a manufacturer of electric vehicles.

	-Multi-level Perspective	existing system. New entrants are typically seen as niche actors. They have agency that can result in a system transition.	
Incumbent actor	-Transition Management -Strategic Niche Management -Technological Innovation System -Multi-level Perspective	Incumbent actors represent the established system and are typically seen to hinder transitions. Incumbent actors are often referred to as regime actors. They have the agency to either hinder or support a transition.	Established company that has a strong position in the current regime, e.g. a traditional car manufacturer.

In addition to Fischer and Newig's (2016) work, other scientific avenues exist to explore actors and sustainability transitions. The research on sustainability transition has gradually grown over the last decade. If a general search of "*sustainability transitions*" is submitted on the Scopus database, it will yield over 5,900[2] results based on the term appearing in the abstract, title, or keywords of publications. The increase of sustainability transition research is portrayed in Figure 5 where the vertical axis describes the amount of publications and the horizontal axis describes the year.

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[2] The search for the keywords "*sustainability transitions*" was conducted on 30th November 2018 and returned 5,920 publications.
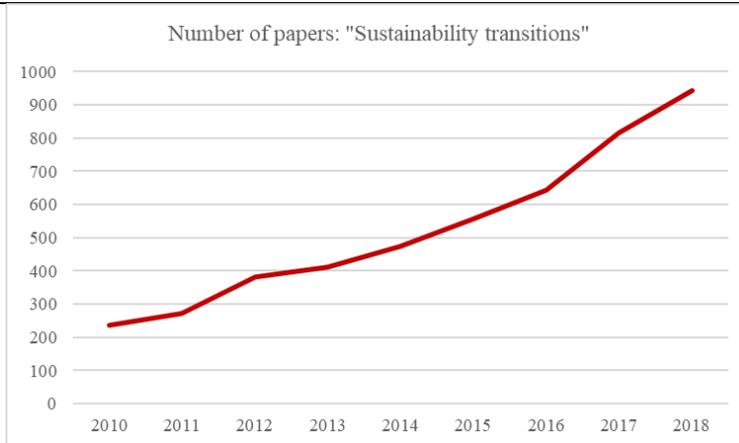
Figure 5. Publications on the Scopus database that include the term "*sustainability transitions*".

However, when the search for the terms "*'Agency' AND sustainability transitions*" is conducted instead of only "*sustainability transitions*", the amount of publications returned, in particular those dated from 2014 onwards, increases substantially (portrayed in Figure 6).
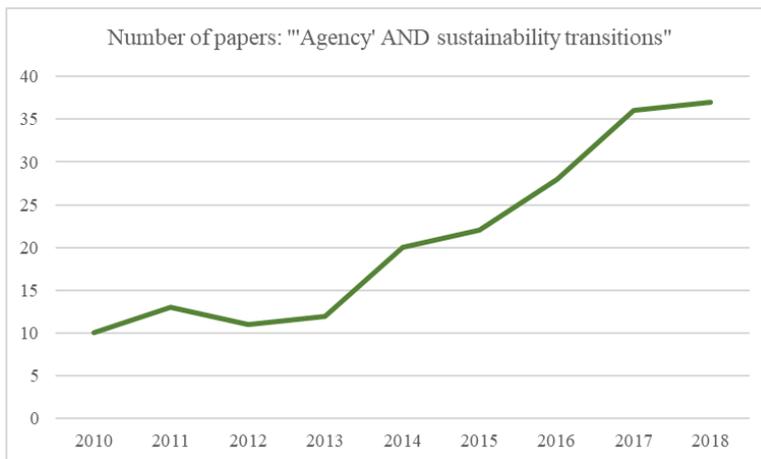
Figure 6. Publications on the Scopus database that include the terms "*'Agency' AND sustainability transitions*".

Given the substantial increase in literature from 2014, this thesis explores how the transition literature has taken stock of the agency and sustainability transitions under examination between the year 2014 and (early) 2019. The search was conducted on the Scopus database to find literature on agency and sustainability transitions. The selected terms for the search were "*'Agency' AND sustainability transitions*" and "*'Agent' AND sustainability transitions*". The

terms "*agency*" and "*agent*" were chosen instead of "*actor*" since the searches were targeted to cover the conceptual basis of agency – at least to some extent.

The results included papers that included the search terms in the abstract, title, or keywords. The search "*'Agency' AND sustainability transitions*" returned 227 results, whereas the search "*'Agent' AND sustainability transitions*" yielded 186 papers.[3] However, the search "*'Agent' AND sustainability transitions*" included many of the same papers as the "*'Agency' AND sustainability transitions*" search. Thus, the search "*'Agency' AND sustainability transitions*" was examined first and after a review of the papers returned, the "*'Agent' AND sustainability transitions*" search was conducted and reviewed to determine the final sample.

The final sample for analysis included only journal papers. The original results included several papers from other fields of study, such as medicine and mathematics, which were excluded from the final sample. In addition, the search results included some publications that focused solely on sustainability transformations and these were also excluded from the final sample. Moreover, some of the papers returned addressed sustainability transitions but not agency or vice versa. After excluding all papers that did not focus on agency and sustainability transitions, a total of 77 journal articles were reviewed in greater detailed. Sixty-four papers out of 77 were from the "*'Agency' AND sustainability transitions*" search and 13 papers were added to the sample from the "*'Agent' AND sustainability transitions*" search.

The review implies that while actors have always been embedded in the transition literature, the study of actors, or agents, and agency entails various streams of research and appears to be somewhat scattered. From the Scopus searches, 12 different themes emerged varying from political discourses to attempts to unite socio-technical and socio-ecological schools of thought. Based on the review, transition literature strongly emphasises agency and politics and individual agency. Recently, studies that draw attention to the different forms and roles of agents have also emerged. It should be noted that the theme "*collective agency*" includes actor-networks, actor interactions, and distributed agency. In addition, the theme "*forms of agency*" can be considered an actor typology and entails themes such as the conceptualisation of agency. The themes identified are illustrated in Table 7.

However, one of the themes that emerges implies that psychosocial considerations of agency are still little examined in transition literature. For example, Antadze and McGowan (2017) notice that morality is an under-researched theme in the transition literature, and Stephenson (2018) argues that questions of how culture influences the behaviour and behaviour change of an individual actor are not explored in-depth in the literature. Moreover, Koehrsen (2018) states that exploring religious agency and how it influences the behaviour of agents could help us to understand sustainability transitions more comprehensively, and thus, to enable sustainability transitions. In addition, Bögel and Upham (2018) argue that in general, psychological theories are rarely applied in the transition literature. Similarly, Upham *et al.* (2018) note that behavioural aspects are often missing from the transition research. Van der Vleuten (2018) also argues that this literature tends to neglect concrete actors and their behaviour. These observations reveal that the absence of psychosocial factors from the transition literature

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[3] Searches covering actors and sustainability transitions were conducted on 13th November 2018.

constitutes a critical gap in this field of research. The theme of psychosocial elements and its relation to the multi-level perspective is discussed in Chapter 2.3.3.

Table 7. Themes emerging from journal articles published between 2014 and 2019.

Theme	*Authors*
Agency and politics	Arapostathis *et al*., 2014; Avelino, 2017; Barnes *et al*., 2018; Bettini *et al*., 2015; Bolton *et al*., 2015; de Gooyert *et al*., 2016; Durrant *et al*., 2018; Frantzeskaki *et al*., 2014; Gaede and Meadowcroft 2016; Gazheli, Antal, and van den Bergh, 2015; Goyal and Howlett, 2018; Haley, 2017; Hausknost, 2014; Hildén *et al*., 2017; Kern, 2015; Kivimaa and Martiskainen, 2018; Klinke, 2017; Loorbach *et al*., 2017; Mercure *et al*., 2016; Partzsch, 2017; Pesch *et al*., 2017; Pitt and Jones, 2016; Rosin *et al*., 2017; Stirling, 2014a; Sørensen *et al*., 2018; Udovyk, 2017
Power of agency	Avelino, 2017; Avelino and Wittmayer, 2016; Barnes *et al*., 2018; Järnberg *et al.,* 2018; Lockwood *et al*., 2017; Loorbach *et al*., 2017; Partzsch, 2017; Pigford *et al*., 2018; Randelli and Rocchi, 2017; Stirling, 2014a
Change agency	Affolderbach and Krueger, 2017; Boodoo *et al*., 2018; Brundiers and Eakin, 2018; Chelleri *et al*., 2016; Frantzeskaki *et al*., 2014; Klinke, 2017; Pflitsch and Radinger-Peer, 2018; Pigford *et al*., 2018; Ramos-Mejía and Balanzo, 2018; Stahlbrand, 2016; Temper *et al*., 2018; Wanner *et al*., 2018; Van Poeck *et al.,* 2017; Wittmayer and Schäpke, 2018
Forms of agency	Avelino and Wittmayer, 2016; Bakker 2014; Bettini *et al*., 2015; de Haan and Rotmans, 2018; Fischer and Newig, 2016; Gorissen *et al*., 2016; Goyal and Howlett, 2018; Kivimaa and Martiskainen, 2018; Koehrsen, 2018; Kuokkanen *et al*., 2018; Matschoss and Heiskanen, 2018; Merrie and Olsson, 2014; Mossberg *et al*., 2018; Rosin *et al*., 2017; Stahlbrand, 2016; Wittmayer and Schäpke, 2018; Sørensen *et al*., 2018; Van Poeck *et al.,* 2017; Wolfram and Frantzeskaki, 2016
Niche formation	Gazheli, Antal, and van den Bergh, 2015; Hildén *et al*., 2017; Kivimaa and Martiskainen, 2018; Pesch, 2015; Pesch *et al*., 2017
Individual agency	Antadze and McGowan, 2017; Bakker 2014; Bögel and Upham, 2018; de Haan and Rotmans, 2018; Fischer and Newig, 2016; Gazheli, Antal, and van den Bergh, 2015;

	Koehrsen, 2018; Kuhmonen, 2017; Kuokkanen *et al.*, 2018; Lockwood *et al.*, 2017; Mercure, 2015; Mossberg *et al.*, 2018; Partzsch, 2017; Pesch, 2015; Pesch *et al.*, 2017; Pflitsch and Radinger-Peer, 2018; Rauschmeyer *et al.*, 2015; Sarrica *et al.*, 2016; Stahlbrand, 2016; Van Poeck *et al.*, 2017; Wittmayer and Schäpke, 2018; Upham *et al.*, 2018
Collective agency	Bergek *et al.*, 2015; de Haan and Rotmans, 2018; Durrant *et al.*, 2018; Fischer and Newig, 2016; Frantzeskaki *et al.*, 2014; Hermans *et al.*, 2016; Kuokkanen *et al.*, 2018; Lockwood *et al.*, 2017; Merrie and Olsson, 2014; Mossberg *et al.*, 2018; Sarrica *et al.*, 2016
Uniting socio-technical transitions and socioecological transformations	Brundiers and Eakin, 2018; Davidson *et al.*, 2016; Ferguson and Lovell, 2015; Hausknost, 2014; Johannessen and Wamsler, 2017; Järnberg *et al.*, 2018; Ollivier *et al.*, 2018; Pigford *et al.*, 2018; Temper *et al.*, 2018
Incumbents	Bakker 2014; Bergek *et al.*, 2015; Bolton *et al.*, 2015; Fischer and Newig, 2016; Lockwood *et al.*, 2017; Matschoss and Heiskanen, 2018
Strategic agency	Bergek *et al.*, 2015; de Haan *et al.*, 2016; Gorissen *et al.*, 2016; Järnberg *et al.*, 2018; Kuokkanen *et al.*, 2018; Novalia *et al.*, 2018; Pesch *et al.*, 2017; Sørensen *et al.*, 2018; Werbeloff *et al.*, 2016
Institutions and agency	Antadze and McGowan, 2017; Arapostathis *et al.*, 2014; Barnes *et al.*, 2018; Bettini *et al.*, 2015; Fuenfschilling and Truffer, 2016; Koehrsen, 2018; Lockwood *et al.*, 2017; Novalia *et al.*, 2018; Rogers *et al.*, 2015; Strambach, 2017
Psychosocial considerations of agency	Antadze and McGowan, 2017; Bakker 2014; Bögel and Upham, 2018; Bögel *et al.*, 2018; Gazheli, Antal, and van den Bergh, 2015; Koehrsen, 2018; Pesch, 2015; Sarrica *et al.*, 2016; Sorrell, 2015; Stephenson, 2018; Upham *et al.*, 2015; Upham *et al.*, 2018; van der Vleuten, 2018

A further search was conducted to explore how agency is studied in the field of strategic niche management (SNM). This search was conducted because the strategic niche management framework was developed simultaneously with that of the multi-level perspective and addresses actors as a necessary part of the transition process (Rip and Kemp, 1998). As the multi-level perspective is explored in greater detail in Chapter 2.3., only strategic niche management is addressed here.

A search of the terms "*'Agency' AND strategic niche management*" and "*'Agent' AND strategic niche management*" returned only four relevant papers about agency and strategic niche management published between 2014 and 2019.[4] Bugge *et al.* (2017) explore companies as agents of sustainability transitions and call for more research on the theme of "*embedded agency*". In contrast, Bush *et al.* (2017) highlight the role of intermediaries as crucial components of niche development. They also question the sufficiency of actor's agency to influence the landscape. Pesch *et al.* (2017) explore niche formation and niche entrepreneurs through the lens of strategic niche management and argue that the role of individual agency is understudied in transition literature. Finally, ElBilali (2018) reviews the transition literature, including that on strategic niche management, in agriculture. He concludes that transition management and the multi-level perspective should pay more attention to agency, while the strategic niche management inherently takes agents into account. According to these results, the terms "*agency*" and "*agent*" appear rather sparsely in the literature on strategic niche management, while in reality strategic niche management introduces the knowledge and expertise of various actors into the niche development process.

To contextualise the research on agency in a wider setting, additional searches were also conducted. When the search "*'Agency' AND sustainability transitions*" is compared with other searches, such as that for "*sustainability transitions*", "*'Policy' AND sustainability transition*", and "*'Technology' AND sustainability transitions*", it appears that the study of agency is still relatively limited in comparison with other topics within transition research. The general search "*sustainability transitions*" (conducted on 30th November 2018) yielded a total of 5,920 papers. As mentioned above, the search "*'Agency' AND sustainability transitions*" returned 227 papers. If these numbers are compared (227/5920 *100%), we see that the study of agency accounts for approximately 3.8% of the sustainability transition research. The search "*'Policy' AND sustainability transitions*" returned 1,910 papers, whereas the search "*'Technology' AND sustainability transitions*" yielded a total of 1,193 papers. Each search individually constitutes roughly 32% of the general "*sustainability transition*" search. Given these numbers, it might be justified to say that the study of agency and actors is not emphasised in the transition literature.

2.2.3   Companies enabling sustainability

This chapter focuses on the second research gap presented in Chapter 1.2.2.: companies as actors of sustainability transitions. To understand how transition research addresses companies as actors of sustainability, the connection between companies and sustainability first needs to be discussed. Second, how the transition literature addresses companies' role in sustainability transitions is reviewed.

Traditionally, sustainability has not been a core strategy of companies. Typically, sustainable development is defined at the system level,[5] or macro level, of societies (Baumgartner and Ebner, 2010), while companies tend to focus on their internal business strategies on the meso level (Dyllick and Muff, 2015), in other words, the regime level of the societal system. The existing, dominant company model, or "*business as usual*", draws on neoclassical economic theory (Brenner and Cochrane, 1991; Stormer, 2003), which argues that the primary concern of companies is to maximise the profits of shareholders. In the business-as-usual world, typical

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[4] These searches were conducted on 5th December 2018.
[5] "*System-level*" and "*system*" refer to the global system, i.e. the macro-level of the socio-technical system.

economic concerns, such as seeking access to cheap resources and efficient processes and striving for a strong market position, are pursued to produce economic value in the form of profit, market value, or, more generally, shareholder value (Dyllick and Muff, 2015). In this traditional economic paradigm, social and environmental goals are subordinate to the primary goal of creating economic value (Freeman and Gilbert Jr., 1992). The risk of the business-as-usual approach is that it can lead to significant externalised costs that are not understood, measured, or declared (Dyllick and Muff, 2015). Many of the grand challenges are negative externalities for incumbent companies in industries such as oil, coal, and agro-food (Geels, 2014a).

Nonetheless, in light of the limits to growth and following the WCED's definition of sustainability, companies have begun to incorporate sustainability into their operations. One of the first disciplines to address the relationship between the environment and companies was ecological modernisation (EM). Ecological modernisation can be considered an alternative worldview to the neoclassical economic perspective (Stubbs and Cocklin, 2008). The underlying idea of ecological modernisation is that economic growth can be disconnected from environmental degradation, and environmental management is pursued through environmental policies, innovation, and new technologies (Baker, 2007). The ecological modernisation approach indicates that companies may influence sustainable development and, hence, play a role in sustainability transitions.

Despite ecological modernisation's pursuit of stronger synergies between the environment and companies, it has been criticised for legitimising and sustaining the very structures and systems that contribute to environmental destruction (Christoff, 1996; Gouldson and Murphy, 1997). Specifically, it is argued that ecological modernisation may sometimes encourage growth as a solution to the planet's ecological crisis rather than enable sustainable development (Baker, 2007).

In addition to ecological modernisation, and partly in response to this criticism, other streams of research have addressed the relationship between companies and sustainability. This includes, for example, research on corporate sustainability (CS) and corporate social responsibility (CSR). This is a further step towards introducing sustainability into companies and it highlights that sustainability is more than just acknowledging the relevance of sustainability and, consequently, is an assertion that companies need to respond to social and environmental concerns as well as economic concerns (Dyllick and Muff, 2015). These three pillars of sustainability—social, economic, and environmental—are typically referred to as the triple bottom line. These three dimensions should constantly interact with each other (Ebner and Baumgartner, 2006). Both corporate sustainability and corporate social responsibility aim to achieve a balance between economic prosperity, social integrity, and environmental responsibility, regardless of whether they conceptualise environmental issues as a part of social issues or as the third element of sustainability (Montiel, 2008).

Arguably, the essence of corporate sustainability is slightly broader than that of corporate social responsibility. Corporate sustainability, refers to the connection between sustainable development and a company, the target of corporate sustainability being to have a positive effect on societies in the long term (Baumgartner and Ebner, 2010). For companies to achieve a comprehensive corporate sustainability strategy, they need to consider all the dimensions of the triple bottom line and their effects and interrelations (Baumgartner and Ebner, 2010). Hence,

corporate sustainability researchers tend to argue that the economic, social, and environmental dimensions are interconnected (Montiel, 2008). In addition, corporate sustainability scholars acknowledge that external influences also have an effect on the corporate orientation of sustainability (Baumgartner and Ebner, 2010).

Corporate social responsibility, (CSR) is defined in the responsibility literature as an umbrella term that overlaps with some and is synonymous with other conceptions of business-society relations (Matten and Moon, 2008). In addition, at the turn of the millennium, McWilliams and Siegel (2001) defined corporate social responsibility millennium as follows:

"*We define CSR as actions that appear to further some social good, beyond the interests of the firm and that which is required by law. This definition underscores that, to us, CSR means going beyond obeying the law. Thus, a company that avoids discriminating against women and minorities is not engaging in a socially responsible act; it is merely abiding by the law*."

In other words, corporate social responsibility scholars have traditionally emphasised the social elements of responsibility such as equality or human rights in developing countries. However, the corporate social responsibility research community has recently started to place greater emphasis on companies' social and environmental practices (Bansal et al., 2014). For example, Flammer (2013) calls for stronger inclusion of environmental responsibility in business's corporate social responsibility operations, such as reducing CO_2 emissions.

The underlying aim of companies that focus on both corporate sustainability and corporate social responsibility is to invent, produce, and report measurable results within well-defined sustainable development areas while remaining economically sound and profitable (Dyllick and Muff, 2015). However, companies typically apply both corporate sustainability and corporate social responsibility inside-out, that is, from companies to stakeholders, and omit any strategic approach that would incorporate the system level (Dyllick and Muff, 2015). While the link between sustainability and companies is becoming progressively clearer, the disconnection between sustainable development at the system level and business-level operations remains.

In more recent times, the transition research community has also acknowledged that companies are powerful actors of sustainability transitions. Companies can be large, politically powerful, and scale-intensive with many sunk investments (Geels, 2014a). In addition, these powerful incumbent companies possess many "*complementary assets*", such as specialised manufacturing capability, experience with large-scale test trials, access to distribution channels, service networks, and complementary technologies, which allows them to establish a strong position in the socio-technical regime (Rothaermel, 2001). However, large incumbent companies may have a significant influence on the process through which grand challenges are addressed by developing and marketing radical innovations (Geels and Schot, 2007; Geels, 2014a). The transition literature suggests that pressure from other actors, such as consumers, policymakers, civil society, and social movements, may prompt incumbent companies to overcome lock-in mechanisms and reorient towards more radical innovations (Geels, 2014a). This reorientation would enable companies to better address the grand challenges.

To illustrate the connection between the transition literature and research on company sustainability, Table 8 presents a collection of the journal articles published between 2014 and (early) 2019 based on Scopus searches. The year 2014 is chosen as the reference year due to

the fact that it was used as a reference year in the Scopus searches previously discussed (in Chapter 2.2.2.). Two searches were conducted to examine the connection between companies and the transition literature. The first search terms were "*'Company' AND sustainability transitions*" and the second search terms were "*'Firm' AND sustainability transitions*".[6] These search terms were selected because they describe the business organisations, i.e. companies, that are the second actor group examined in this thesis. The results included papers that include the search terms in the abstract, title, or keywords. The search "*'Company' AND sustainability transitions*" returned 313 results, whereas the search "*'Firm' AND sustainability transitions*" yielded 144 papers.

While the original searches yielded over 400 results, the number of papers that addressed both companies and sustainability transitions was significantly lower. Conference papers and book chapters were excluded from the more detailed analysis. Thus, the final sample included only 55 journal articles. Based on these 55 publications, eight themes emerged in relation to transition literature and companies, which are presented in Table 8. It appears that the role of governance is highlighted in texts exploring companies and sustainability transitions. Another theme that appeared frequently was the interplay between incumbent firms and niches. Moreover, several papers considered different strategies for how companies could achieve sustainability transitions. One key theme was the growing research on business model change and transitions since 2014.

Table 8. Themes emerging from journal articles published between 2014 and 2019.

Theme	*Authors*
Incumbents	Berggren *et al*., 2015; de Almeida and de Melo, 2017; Ghassim and Foss, 2018; Geels, 2014a; Guerra-Mota *et al*., 2018; Magnusson, 2016; Marletto, 2018; Matschoss and Heiskanen, 2018; Mazur *et al*., 2015; Mäkitie *et al*., 2018; Skellern et al., 2017; Smink *et al*., 2015; Steen and Weaver, 2017; van Mossel *et al.,* 2018
Interplay of incumbents and niches	Amaral *et al*., 2017; Berggren *et al*., 2015; Fallde and Eklund, 2016; Imbert *et al*., 2019; Matschoss and Heiskanen, 2018; Mäkitie *et al*., 2018; Smink *et al*., 2015; Steen and Weaver, 2017
Niche development	Bohnsack, 2018; Cohen and Naor, 2017; Fallde and Eklund, 2016; Imbert *et al*., 2019; Kishna *et al*., 2017; Kern et al., 2015; Normann, 2017; Walvyn *et al*., 2018; van Geenhuizen and Ye, 2014; Wentlandt, 2016
Business model change	Bocken *et al*., 2018; Bolton and Hannon, 2016; Franceschini and Pansera, 2015; Gorissen *et al.,* 2016; Iñigo and Albareda, 2016; Laukkanen and Patala, 2014; Long *et al*., 2018; Nasiri

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[6] These searches were conducted on 3rd December 2018.

	et al., 2018; Newton and Newman, 2015; Sarasini and Linder, 2018
Interplay of governance and firms	Bolton and Hannon, 2016; Cohen and Naor, 2017; Fallde and Eklund, 2016; Gibbs and O'Neill, 2015; Isaksson and Heikkinen, 2018; Kirchherr *et al.*, 2018; Magnusson, 2016; Mazur *et al.*, 2015; Mejía-Dugand *et al.,* 2017; Normann, 2017; Polzin *et al.,* 2017; Rogge and Schleich, 2018; Saintier, 2017;
Local firms	Amaral *et al.*, 2017; Bohnsack, 2018; Cohen and Naor, 2017; Long *et al.*, 2018; Matschoss and Heiskanen, 2018; Mejía-Dugand *et al.*, 2017; Normann, 2017; Saintier, 2017; Walvyn *et al.*, 2018; Wentland, 2016
Company behaviour	Brones *et al.*, 2017; Dumitru *et al.,* 2016; Freire, 2018; Franceschini and Pansera, 2015; Iñigo and Albareda, 2016; van Mossel *et al.,* 2018
Strategies for sustainability	Baas and Hjelm, 2016; Berggren *et al.*, 2015; Chang *et al.*, 2017; de Almeida and de Melo, 2017; Díaz López and Montalvo, 2015; Gaziulusoy and Brezet, 2015; Geels, 2014a; Geels, 2015; Iñigo and Albareda, 2016; Kiefer *et al.,* 2018; Kishna *et al.*, 2017; Polzin *et al.,* 2017; Schulte and Hallstedt, 2018; Smink *et al.*, 2015; Steen and Weaver, 2017; Sunny, 2017; Vezzoli *et al.*, 2015; Yap and Truffer, 2018

The relatively small number of papers that consider companies and sustainability transitions imply that, in general, companies' relation to sustainability has gradually evolved towards stronger sustainability. Despite the gradual increase in interest and research regarding the interplay of sustainability transitions and companies, the specific effect of companies on sustainable development remains unclear. The "*sustainability transitions*" search returned 5,920 publications, meaning that the company sustainability and transition research results (457 papers) accounts for only around 7.7% of the transition literature. These figures alone reveal that company sustainability and sustainability transitions research remain disconnected. The argument becomes stronger when we consider that only 55 papers out of the 457 papers actually considered both transition literature and companies.

Dyllick and Muff (2015) note that while the goals of sustainable development have recently become more embedded in companies, the impact of company actions has been scarce at the system level. One reason for the poor integration of sustainability into companies' operations may be that companies have limited knowledge of how to incorporate sustainability issues into their business routines and strategies (Baumgartner and Ebner, 2010). Consequently, integration between the system level and business level has remained largely absent (Dyllick and Muff, 2015). Recently, however, sustainable business models have been suggested as mechanisms that can bridge the divide between the company and system levels (Boons and

Lüdeke-Freund, 2013; Boons *et al.*, 2013; Bocken *et al.*, 2018). A sustainable business model is typically understood as "*a business model that creates competitive advantage through superior customer value and contributes to a sustainable development of the company and society*" (Lüdeke-Freund, 2010). Hence, sustainable business models may generate technological and social innovations that eventually result in system-level sustainability (Bocken *et al.*, 2014). These innovations may often be oriented towards radical innovations and, thus, sustainable business models may play a key role in addressing the grand challenges. Since companies typically possess power and resources, this thesis argues that the emerging study of business model change and sustainability transitions should be nurtured to achieve change to system-level sustainability, and thus, to create sustainable development.

To summarise, while companies can contribute to sustainability in various ways, sustainable business models may enable companies to reach their full potential in this regard by encouraging them to act as agents of sustainability transitions. In this thesis, companies represent the regime level of the multi-level perspective. Small entrepreneurial firms may represent the niche level, but the focus of this thesis in relation to companies and the setting of sustainability transitions is on the regime level.

2.3   Multi-level perspective on socio-technical transitions

In this section, the multi-level perspective (MLP) is addressed to present the setting in which the actors of sustainability transitions are situated in this thesis. In addition, the relation between agents, or actors, and the framework of the multi-level perspective is discussed to understand the relationship between the multi-level perspective and actors involved in sustainability transitions.

2.3.1   Development of the multi-level perspective

The multi-level perspective (MLP), which was described by Geels (2002), can be conceptualized as a middle-range theory that conceptualises general dynamic patterns in socio-technical transitions. The key question in the multi-level perspective is solving on how environmental innovations emerge and how these can challenge, replace, transform and reconfigure existing, typically unsustainable, technologies and systems (Geels, 2002; Geels, 2011). In the multi-level perspective, transitions are described as complex, long-term processes involving multiple actors (Geels, 2011). The multi-level perspective goes beyond studies of single technologies, such as wind turbines or biofuels, that have previously dominated the literature on environmental innovation (Geels, 2011). In general, the multi-level perspective can be understood as a global model of transitions that captures the overall process (Geels and Schot, 2010).

The multi-level perspective is built on the assumption that structure exists at three different levels: The niche level, the regime level, and the landscape level. Technological trajectories are situated in a socio-technical landscape that consists of a set of deep structural trends, such as economic growth or oil prices (Geels, 2002). Whereas regimes refer to rules that enable and constrain activities within communities, the socio-technical landscape refers to wider factors beyond technology or single innovation. The landscape is more difficult to change than the

socio-technological regimes. Landscapes eventually change, but at a slower pace than regimes. It is typical for regimes to generate incremental innovations (Rip and Kemp, 1998). In contrast, radical innovations are generated in niches (Geels 2002). The status quo and the existing landscape and regimes are premised as actors that continue to reinforce the current structure on the basis that they are either seen as legitimate, or their legitimacy is taken for granted (Cashmore and Wejs, 2014). In this setting, the agents, or actors, are also inherently set (Geels, 2011). If the perspective to agency is an active shaping role, there is a space and potential for individual actors to impact sustainability transitions.

The framework of the multi-level perspective originates from the crossovers of *evolutionary economics, science and technology studies* (STS) and *sociology*. The framework includes several concepts from *evolutionary economics*, such as trajectories, regimes, niches, speciation, path dependence, and routines (Geels and Schot, 2010). The multi-level perspective adopts from *science and technology studies* is concerned with sense-making, social networks and innovation as a social process shaped by broader societal contexts (Geels, 2011). In a more sociological sense, the multi-level perspective incorporates the *structuration theory* and *neo-institutional theory* through the concepts of rules and institutions as deep structures on which knowledgeable actors decide their actions, and through the duality of structure (Geels, 2004; Geels and Schot, 2007).

While the transitions are described to include multiple actors, the multi-level perspective does not seem to place a special emphasis on agency. However, actors and agency are an integral part of the multi-level perspective (Geels, 2011; Upham *et al.*, 2015). The different theories behind the multi-level perspective provide diverse, yet complementary, views on agency and actors. The science and technology studies focus on the relations between actors and socio-technical systems and configurations, while structuration theory and neo-institutional theory discuss relationships between actors and structures or regimes (Geels and Schot, 2010) and evolutionary economics focus on a specific cross-section of socio-technical configurations and the interactions between variation and selection environments that can be observed within (Geels and Schot, 2010). The arguments regarding agency and actors indicate that the assumptions that are applied in science and technology studies, structuration theory and evolutionary economics are similar enough to create the combined view of agency from a multi-level perspective.

Geels and Schot (2010) concluded that the multi-level perspective is strong in combining the sensitivities of science and technology studies about micro-processes with long patterns and processes. Especially in relation to niche-innovations, the multi-level perspective adopts science and technology studies insights that emphasise alternatives, uncertainties, interpretive flexibility, visions, learning, network building and enrolment. However, since longer-term patterns and macro-dynamics are also included in the multi-level perspective, the crossover made between science and technology studies, sociology and evolutionary economics is essential.

2.3.2 Actors in the multi-level perspective

It is generally acknowledged that agency plays a crucial role in the sustainability transition process. Geels (2011) argues that actors always enact the trajectories and multi-level alignments

in the framework and that the different structural levels of the multi-level perspective—niche, regime and landscape—are continuously reproduced and enacted by actors through concrete activities. Hence, all social orders, institutional orders, and artefacts are both the media and outcome of human aspirations (Geels, 2011). In other words, the pathways towards sustainability transition are ultimately dependent on the social interactions between different actors.

Since the framework of multi-level perspective is based on crossovers between sociology, evolutionary economics, and science and technology studies, the multi-level perspective places a particular emphasis on agency in the form of bounded rationality and interpretive activities (Geels and Schot, 2010; Geels, 2011; Geels, 2002). In this sense, agents are often perceived as individual, human actors. However, the multi-level perspective acknowledges that companies are also actors. Companies are perceived as one type of actor in the socio-technical system. In addition, sustainability transitions are seen to emerge often as a result of small organisations challenging the existing regime (Geels and Schot, 2007). Large incumbent companies may address the grand challenges by developing and marketing radical technical innovations (Geels, 2014a). Hence, the agents of sustainability transitions in the multi-level perspective are both individual and company actors.

The importance of agency for sustainability transitions is explained by the actors' capability to bring forth change and create sustainable change. Agency has been described as being necessary during particular phases of a sustainability transition (King, 2008; Grin, Rotmans and Schot, 2011; Wiek *et al.*, 2012). Moreover, agency is critical, as actors have the abilities, means, and power for deliberate action and can thus contribute to the development of more sustainable societies (Wiek *et al*. 2012). In contributing to sustainability, in practice, multiple agents, not a single actor, seek to influence the progress of a transition (Grin, Rotmans and Schot, 2011). In the existing literature, agency is embedded at all levels of the multi-level perspective (Åm, 2015).

Recent studies suggest that by empowering ordinary people and communities, agency might be the most effective resource for creating a sustainable future (Walker *et al.*, 2010; Fudge, Peters, and Woodman, 2016). The multi-level perspective acknowledges that agents can introduce transitions outside of the prevailing regime. In particular, it has been observed that discursive activities at the regime and niche levels lead to the development of cultural repertoires and, eventually, changes at the landscape level (Geels and Schot, 2007; Geels, 2011; Geels and Verhees, 2011). Actors have further been found to be capable of influencing the speed at which transitions occur. According to the socio-technical approach, agency is considered to affect both how and how fast a particular transition develops. The complex systems approach considers actors as capable of utilising and creating windows of opportunity to enable sustainability transitions (Grin, Rotmans and Schot, 2011). Flourishing sustainability transitions depend on agency to drive niche-level innovations, implement regime-level changes, and connect the niche and regime levels (Grin, Rotmans and Schot, 2011). In the framework of the multi-level perspective, niche agency in particular is considered to be essential for sustainability transitions given that it has the potential to stimulate systemic change and radical innovations (Geels 2011).

The ultimate aim of the actions of agents is to replace the existing regime. To challenge the prevailing regime, new innovations need to achieve legitimacy (Haxeltine and Seyfang, 2009; Bork *et al.*, 2015), which is achieved by overcoming resistance to change. This is important

since challenging the status quo leads to resistance from the current regime, i.e. the incumbent agents (Geels and Schot, 2007; Markard, Raven and Truffer, 2012; Geels, 2014b). In addition to proactive sustainability-driving agency, the multi-level perspective addresses incumbent— or regime—agents. Incumbents typically refer to actors who represent the vested interests of the prevailing regime. The distinction between supporters and opponents of transitions, however, is rather crude and in reality actors may have overlapping roles and interests (Bakker 2014; Fischer and Newig, 2016; de Haan and Rotmans, 2018). In sum, an actor can potentially be both a supporter and opponent of change (Fischer and Newig, 2016; Kuokkanen et al., 2018; Mossberg *et al.*, 2018). Understanding both incumbent agents' and niche agents' behaviour, actions, and strategies is crucial to achieving large-scale transitions and overcoming resistance (Gazheli, Antal, and van den Bergh, 2012). It is essential that regime-shaping actors understand the possibilities and limitations of the prevailing context and have the ability to expand their span of agency by positioning themselves in a broader spatial and temporal context (Grin, Rotmans, and Schot, 2011).

While it is acknowledged that actors play a role in sustainability transitions, the research on agency in the multi-level perspective has attracted a significant amount of criticism. In particular, the multi-level perspective has been accused of not taking agency as the focal point (de Haan and Rotmans, 2018; van der Vleuten, 2018). For example, Kivimaa (2014) calls for the more comprehensive incorporation of intermediaries as potentially strong actors in niche building and regime destabilisation. Recently, Pesch (2015) stated that the framework has a skewed focus on the reproduction of rules, neglecting the production of rules, which results in an overly static image of agency. Van der Vleuten (2018) notes that the question of whether actors are sufficiently included in sustainability transition theories has recently triggered heated debate in the transition research including the multi-level perspective. Fischer and Newig (2016) argue that in reality, the transition literature provides a comprehensive examination of actors and agency but findings are disconnected because of the differing research approaches applied. The authors continue that the discussion of the different roles of actors tends to be erratic in the literature since actor roles may change over time and one single actor may have various roles (Fischer and Newig, 2016). Arguably, while the appreciation of the significance of agency has grown in the literature on sustainability transitions, certain elements of agency have been given less attention.

2.3.3   **The multi-level perspective and static view of individual actors**

The gap in the literature principally concerns the psychosocial processes associated with the individual actors of sustainability transitions. For example, social psychological insights have been little used in the socio-technical transitions literature (Bögel and Upham, 2018). In addition, the multi-level perspective embodies a static image of human behaviour, since the transition literature predominantly links the motivations of people to their institutional roles. Thus, they are seen, for instance, as representatives of industry, regulative bodies, or specific political interests (Pesch, 2015).

Sarrica *et al.* (2016) call for a stronger integration of the human perspective as a crucial component in our understanding of transitions. Stephenson (2018) notes that how culture influences the behaviour and behaviour change of an individual actor is under-exploited in the multi-level perspective. In general, the integration of psychological and sociological theories

within the transition literature is scarce (Upham *et al.*, 2018). For example, theories of perception, behavioural, attitudinal, or practice change in relation to a broader range of system actors is largely absent in the socio-technical transitions literature, including the multi-level perspective (Whitmarsh, 2012). The transition literature appears to be disconnected from those disciplines that have strong knowledge about individual behaviour and behavioural change based on empirical evidence (Gazheli, Antal, and van den Bergh, 2015). Scholars have called for the full range of human needs, values, and potentials to be considered within the context of socio-technical transitions and hence the multi-level perspective (Rauschmayer *et al.*, 2011; Whitmarsh, 2012).

While psychological explanations of individual agency arguably have their own intrinsic value, in the transition literature, psychological concepts are often referred to indirectly, and only a limited number of studies directly mention psychological theories (Bögel and Upham, 2018). In general, the appreciation of psychological theories seems to be functional, for example, in terms of outcomes, and ignores the potential for these theories to present a deep analysis of the actual psychological processes of actors (Nye, Whitmarsh, and Foxon, 2010; Whitmarsh, 2012; Gazheli, Antal, and van den Bergh, 2015; Stephenson, Hopkins, and Doering, 2015; Bögel and Upham, 2018). It appears that the incorporation of psychological theories within the transition literature is only just emerging.

The literature on transitions has acknowledged that actors with different behavioural characteristics have a role to play in the distinct stages of transitions, notably, predevelopment, take-off, acceleration, and stabilisation (Rotmans, Kemp, and van Asselt, 2001). However, in the sustainability transitions literature, agency, as actor behaviour, has mostly been addressed in collective settings and at collective levels with the psychosocial processes of both individuals per se and individuals in their social context being largely neglected (Bögel and Upham, 2018). Pesch *et al.* (2017) also argue that, in general, individual agency and the role of individuals is understudied. Clearly, the behavioural elements of actors have gained little attention in the transition literature.

Notably, a key feature of psychological approaches to research is that they have been found to neglect: (1) the influence of the environment; and (2) the influence of individuals on their environment, or bidirectionality (Sorrell, 2015). As Sorrell (2015) argues: "*Finally and most importantly, the focus on autonomous decision-making by individuals neglects how preferences, attitudes, expectations and behaviours are embedded in and shaped by broader physical and social systems that both enable and constrain individual choice*". This same tendency appears in the use of other theoretical approaches that focus on the individual level, for example, those employed in behavioural economics (Gazheli, Antal, and van den Bergh, 2015). Bögel and Upham (2018) argue that this tendency is one of the main reasons why individual agency has been given minimal theoretical attention in the transitions literature.

While psychological approaches may leave room for the stronger analysis of contextual elements in the study of individual behaviour, in reality, the behaviour of individuals and contextual factors complement each other and help to provide a complete explanation of the behavioural regularities underlying transitions or their absence (Gazheli, Antal, and van den Bergh, 2015). Since actors' behavioural aspects may play a crucial role in transition processes, analyses of transitions must pay more explicit attention to behaviour (Gazheli, Antal, and van den Bergh, 2015). Moreover, different barriers to sustainability transitions, such as lock-in

mechanisms or resistance to change, may result, to some extent, from the features of individual and group behaviours (Gazheli, Antal, and van den Bergh, 2015). Hence, the behaviour of actors should be explored in greater detail.

Moreover, the existing literature on transitions addresses the types of policies that manage, govern, and facilitate transitions (Kemp, Schot, and Hoogma, 1998; Kemp and Loorbach, 2003; van den Bergh, 2013). The emphasis on larger institutions in the transition literature may partly explain why the psychosocial dimensions of actors has attracted less attention from researchers. Previous research suggests that the socio-technical transition literature highlights various forms of collective agency, such as institutions and companies, which has ultimately resulted in a reduced emphasis on the psychosocial processes of individuals (Smith, Stirling, and Berkhout, 2005; Hynes, 2016; Bögel and Upham, 2018). However, the emphasis on actor-level processes plays a crucial role in understanding the behaviour of individuals (Bögel and Upham, 2018). This is an especially important consideration given that, in general, the processes of actors tend to be neglected in the sustainability transition literature (Meadowcroft, 2009). Gazheli, Antal, and van den Bergh (2015) argue that transition studies tend to adopt a rather abstract and high-level view of actors, and either no or indirect attention is paid to their behaviour. This has led to discontinuity between the transition literature and those disciplines that have accumulated significant knowledge about individual behaviour and behavioural change on the basis of empirical evidence (Gazheli, Antal, and van den Bergh, 2015).

Taking a critical stance, the current literature on sustainability transitions tends to focus on the roles of agents from an outcome perspective rather than from behavioural perspectives, such as those focusing on motivation or power (Koistinen *et al.*, 2018a). Actors of sustainability transitions are seen as components that have the potential to shape the existing regime to enable sustainability transitions. This, however, results in a relatively narrow and functionalist representation of actors, whereas the motivational factors of actors might exert a significant influence on sustainability transitions (Koistinen *et al.*, 2018a). In addition, the individual circumstances and factors that emerge from agents' personal interpretations are known to influence the transition process (Rothenberg and Levy, 2012). For example, Bakker (2014) suggests that more effort should be invested in understanding agents' rationales for influencing emerging socio-technical systems since actors of sustainability transitions arguably have individual preferences and adopt differing pathways to achieve their desires. Thus, the motivations and power dynamics of the actors involved in sustainability transitions should be explored in greater detail. Overall, the empirical evidence of individual behaviour and its application in the literature on sustainability transitions should be more fully explored.

The relative absence of the psychosocial dimensions of agency in the literature may also be explained by the existing view of agency in the multi-level perspective and, more precisely, structuration theory. While the multi-level perspective emphasises the importance of structuration theory, structuration focuses primarily on the role of agents, or actors, and their practices in these processes (Giddens, 1984). Referring to the concept of agency, Giddens (1984) states that in structuration theory the essence of agency is the bidirectional movement between individuals and their environments. In structuration theory, the knowledgeable human agents *know what they do and why they do it*" (Giddens, 1984). This implies that human motivations are included in structuration theory.

Giddens' (1984) key argument concerns the assumed knowledgeability of human agents, which underpins the view that human agents have "*reflexive capacities*" as they repeatedly monitor their activities, those of others, and the contexts in which they act in the "*ongoing flow of social life*". The idea of the "*reflexive monitoring of action*" is connected to the "*rationalization of action*", which is another concept that Giddens (1984) explored in some detail. The rationalisation of action means that human agents routinely "*maintain a continuing 'theoretical understanding' of the grounds of their activity*" (Giddens, 1984). Both concepts highlight the power of intentional human action: "*To be a human being is to be a purposive agent, who both has reasons for his or her activities and is able, if asked, to elaborate discursively upon those reasons (including lying about them)*" (Giddens, 1984).

Giddens (1984) distinguishes between actual motivation, "*motivation for action*", and "*reflexive monitoring and rationalization*", stating: "*If reasons refer to the grounds of action, motives refer to the wants which prompt it*". Giddens' (1984) main argument is that even though actors are typically capable of rationalising their reasons for performing an action, they may not be aware of their unconscious motivations and, hence they often generate large-scale plans rather than directly motivated action. However, Giddens' work has encountered criticism. Upham *et al.* (2018) argue that while Giddens gave a leading role to agents, his focus was not on the processes of individuals, such as the attitudes or beliefs of agents; as such, his approach pays insufficient theoretical and empirical attention. In addition, some authors have criticised Giddens for his simplistic description of agents' situated motivations, reflexive monitoring, and knowledgeability (Stones, 2005; Frie, 2011; Coad *et al.*, 2015). As the discussion above highlights, the reasons or motivations for action are an integral part of structuration theory. However, it is reasonable to assert that Giddens was focusing more on "*how*" individuals influence and are influenced by the structure rather than "*why*" individuals influence the structure.

This thesis investigates the actors of sustainability transitions through an examination of their activities and the reasons they act. While, at best, sociology and psychology complement each other in terms of our exploration of human behaviour, the two disciplines also have some fundamental differences, as Thoits (1995) states: "*Sociologists generally devote their efforts to identifying which social phenomena have effects on individuals while psychologists generally specialize in identifying the mechanisms or processes through which social phenomena have their effect on individuals*". Hence, sociology places a distinct focus on understanding how the processes that are external to the individual influence the individual, while psychology emphasises the characteristics and processes of individuals (micro level) or a group of individuals (meso level) (Bögel and Upham, 2018). Thus, sociology emphasises how individuals are influenced by their surroundings, for example, through nurture, human interaction, or learning experiences. This, again, relates to the bidirectional movement of agents and the structure and the idea that agency and structure are inseparable.

In the transition literature, sociological studies have emerged that emphasise the role of subjective human experience (Stedman, 2016). This thesis continues along this path and explores the actors of sustainability transitions through their individual experiences in a bid to answer the main research question presented in Chapter 1.2: *How do individual and company actors contribute to sustainability transitions?*

2.4   **Operationalisation of the theoretical framework**

To sum up, Figure 7 presents an overview of the theoretical framework that underpins this thesis. In Figure 7, the grand challenges are applied as the framework for the thesis. While the grand challenges and increasing sustainability challenges impact the global system, they also influence the operational environments of companies. However, knowledge and practice of how companies respond to the grand challenges is just beginning to emerge. Thus, the arrow from companies to the grand challenges is less distinct than the other arrows in the framework. Moreover, the grand challenges have resulted in the emergence of sustainability science and literature on sustainability transitions and thus clearly have a strong impact on these fields. Sustainability science and transition literature aim to present solutions to the grand challenges. Therefore, the arrows connecting these elements move bi-directionally in the theoretical framework. The focus of this thesis is to understand how actors–individual or company– contribute to sustainability and, hence, to the grand challenges. The theory of agency explains the actors' influence on surrounding structures. The theoretical framework summarises how actors have been studied in inter- and multidimensional research within sustainability science and the study of the grand challenges that the global system is now facing. The stronger emphasis of this thesis is on the individual actors of sustainability transitions.
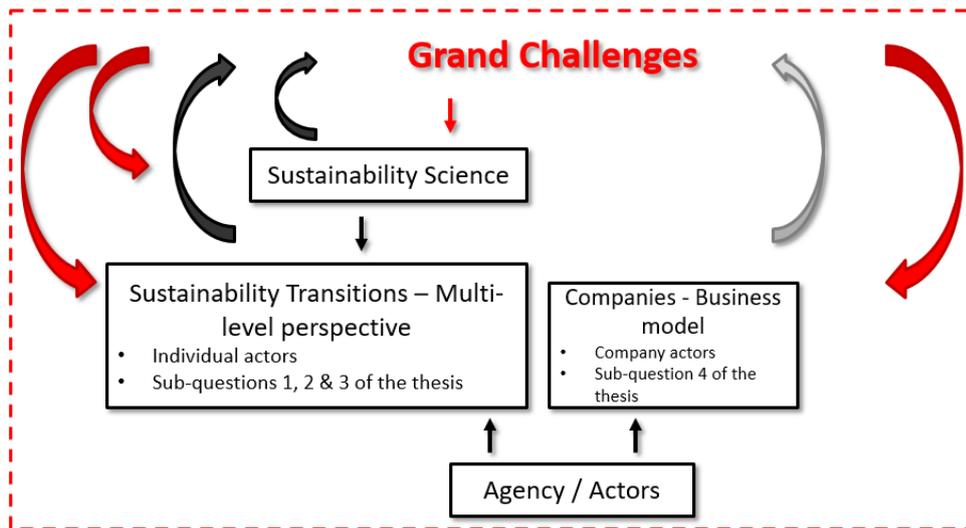
Figure 7. The theoretical framework of this thesis.

3 Research design

This section presents the research design and methods applied in this study. The quality of the research approach is also discussed. Before presenting the more detailed research approach to the phenomenon under observation, it is important to acknowledge the philosophical considerations that the research is based on. Philosophical assumptions often underpin research, but it is important to explicitly acknowledge them as they play a major role in shaping the methodological choices of a study (Creswell, 2009).

To understand the philosophical considerations of a research project, two key concepts, "*ontology*" and "*epistemology*", need to be considered. Ontology concerns the nature of reality and being and addresses questions such as what the form and nature of reality is, and what can be known about that reality (Ponterotto, 2005). Epistemology is focussed on the relationship between the "knower"–the research participant–and the "would-be knower"–the researcher (Ponterotto, 2005). The philosophy of science is often divided into two main paradigms: positivism and constructivism. In the positivistic paradigm it is believed that there is only one true reality and this reality is apprehensible, identifiable, and measurable (Guba and Lincoln, 1994; Ponterotto, 2005). In contrast, in the constructivist paradigm it is believed that there exist multiple, constructed realities rather than a single, true reality (Guba and Lincoln, 1994; Ponterotto, 2005). In terms of epistemology, positivists emphasise dualism and objectivism. In other words, the researcher and the research participant and topic are assumed to be independent of one another (dualism), and by following rigorous, standard procedures, the participant and topic can be studied by the researcher without bias (objectivism) (Ponterotto, 2005). In terms of the epistemological considerations of constructivism, a transactional and subjectivist stance is adopted, which maintains that reality is socially-constructed and thus the dynamic interaction between researcher and participant is central to capturing and describing the "lived experience" of the participant (Ponterotto, 2005). Table 9 presents the basic beliefs of these two opposing paradigms in the philosophy of science.

Table 9. Metaphysics of positivism and constructivism (adapted from Guba and Lincoln, 1994.)

	Positivism	*Constructivism*
Ontology	naïve realism–"real" but apprehensible	relativism–local and specific constructed realities
Epistemology	dualist/objectivist; findings true	transactional/subjectivist; created findings
Methodology	experimental/manipulative; verification of hypotheses; chiefly quantitative methods	hermeneutical/dialectical; chiefly qualitative methods
Inquiry aim	explanation; prediction and control	understanding; reconstruction

Values	excluded–influence denied	included–formative
Accommodation	commensurable	incommensurable

In this thesis, the underlying philosophical paradigm is constructivism. Constructivism views knowledge as socially-constructed and thus subject to change depending on the circumstances (Berger and Luckmann, 1966). The constructivist position emphasises a hermeneutical approach, which entails the idea that meaning is hidden and must be brought to the surface through deep reflection (e.g. Schwandt, 2000; Sciarra, 1999). This reflection is considered to be stimulated by the interactive researcher-participant dialogue (Ponterotto, 2005). Thus, a distinguishing characteristic of constructivism is the centrality of the interaction between the investigator and the object of investigation; only through this interaction can deeper meaning be uncovered (Guba and Lincoln, 1994; Ponterotto, 2005). The researcher and their participants jointly create–co-construct–findings from their interactive dialogue and interpretation (Guba and Lincoln, 1994).

The incorporation of qualitative research and constructivism can be traced back to Kant's (1881/1966) *Critique of Pure Reason* (Ponterotto, 2005). Kant's work asserts a central belief of constructivist thinking: that one cannot partition out an objective reality from the person–research participant–who is experiencing, processing, and labeling the reality (Sciarra, 1999). Consequently, according to constructivism, reality is constructed by the actor, for example, by the research participant (Guba and Lincoln, 1994; Ponterotto, 2005), and multiple and possibly diverse constructions of reality may emerge (Guba and Lincoln, 1994; Hipps, 1993; Golafshani, 2003). Constructivism values the multiple realities that individuals have in their minds (Golafshani, 2003). In the late nineties, Crotty (1998) defined constructivism from the social perspectives as follows:

"*The view that all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context.*"

Given these philosophical considerations, this thesis adopts a qualitative research methodology based on constructivism. The thesis is based on a literature review and qualitative empirical methods. Table 10 presents an overview of the methodological basis of this dissertation in relation to the different publications that support the thesis. It is worth repeating that the publications of this thesis do not focus on systemic transition but the actors involved in the transitions. Publications I and III explore actors' motivations and the ways in which they influence sustainability transitions at the general, societal level. In Publication II and in Publication IV actors are examined in a certain context: Publication II explores actors in the Finnish food system and Publication IV in the business environment. The actors are the main focus of all publications. Figure 8 describes the research process used in this study in relation to the publications of this thesis.

Table 10. Methodological basis of the thesis.

| Publication of the Thesis	Type of Paper	Type of Actor
Publication I: Agent-Based Change in Facilitating Sustainability Transitions	Conceptual – literature review I	Individual
Publication II: Change Agents Engaged in Sustainable Transformation in the Finnish Food System	Empirical – data collection I	Individual
Publication III: Active Agents of Sustainability Transitions – A Life Course Approach	Empirical – data collection II	Individual
Publication IV: Sustainable System Value Creation: Development of Preliminary Frameworks for a Business Model Change within a Systematic Transition Process	Conceptual – literature review II	Company
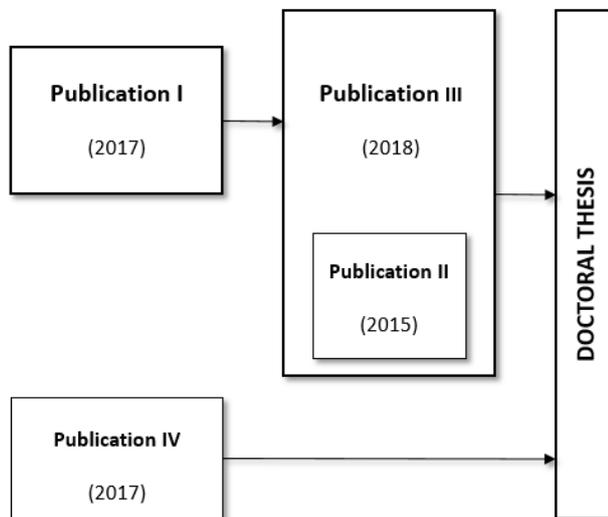
Figure 8. Research process in relation to the different publications of the thesis.

Figure 8 illustrates the four publications that together constitute the thesis. In the brackets are the years in which the different publications were written. The writing process for Publication II began in 2015. Publication I, Publication II and Publication III address the first research gap described in Chapter 1.2. The review processes followed for Publications I-III are presented next. Publication I was submitted for peer review in June 2017. The blind review for Publication I led to after the introduction of minor revisions in July 2017. After the revisions were completed, Publication I was accepted for publication in November 2017. Publication II was initially a conference paper that was expanded into a book chapter in 2015. The conference paper was accepted for presentation by two reviewers. After the conference, the paper was reviewed by the conference's scientific committee to be included in a book. The expanded version was accepted for publication following its evaluation by the scientific committee in April 2016. The book was published in November 2017. The abstract of Publication III was sent to a conference in April 2018. Based on the abstract it was accepted for the conference in May 2018. Publication II makes a limited contribution to this thesis was a necessary phase of the dissertation process as it served as an example study that revealed the need to study the psychosocial processes of actors in sustainability transitions. The focus of this thesis is the first research gap identified and the individual actors of sustainability transitions.

In Figure 8, Publication IV is distinct from Publications I-III. This is because Publication IV addresses a different research gap. Specifically, Publication IV addresses the second research gap introduced in Chapter 1.2. Publication IV was initially submitted for peer review in April 2017. The peer review of Publication IV was conducted as a double-blind review. The revision suggestions for Publication IV were received in May 2017. The reviewer accepted the original manuscript with minor revisions. After addressing the suggestions of the reviewer, e.g. to refine the introduction and expand the discussion section, the publication was accepted for publication in September 2017. It is important to discuss the second research gap to adequately describe the multidimensionality and complex nature of the phenomenon of actors in transitions. Moreover, the second research gap and Publication IV are a means of illustrating that actors of sustainability transitions are not always human.

Figure 9 presents the empirical procedure by which the research that underpins this thesis was performed, beginning with planning. Following the planning phase, the relevant literature presented in Papers I and IV are reviewed. Third, the data presented in Publications II-III is examined. Finally, the data analysis for Publications II-III is conducted. The research procedure is elaborated in Chapter 3.1., 3.2., and 3.3.
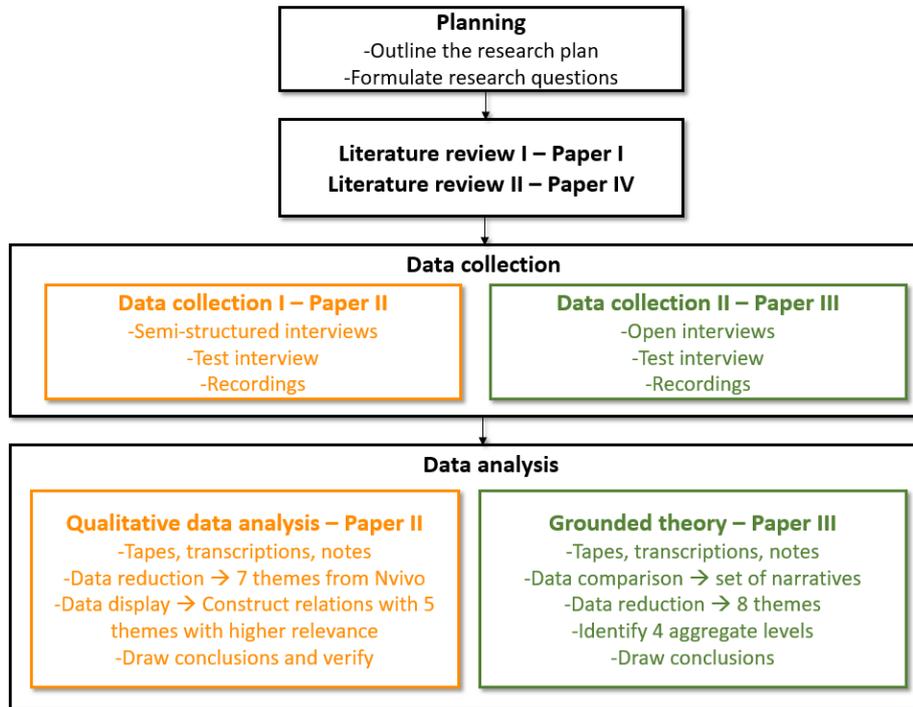
Figure 9. Research procedures for the publications of the thesis.

3.1 Literature review

Since one of the objectives of this dissertation is to bridge the gap in our current understanding of the role of actors in sustainability transitions, literature reviews were carried out. These literature reviews were conducted to identify our existing understanding of the role individuals and companies play in facilitating sustainability transitions. The relevant literature is presented in Publication I and Publication IV of this thesis.

3.1.1 Reviewing the literature on individual actors

The aim of this thesis is to ascertain how individual agency and actors have been studied in the sustainability literature. This aim was explored in the first conceptual paper (Publication I) of this thesis, the objective of which was to answer the second sub-question of this research: *what is missing regarding the role of individual actors in sustainability transitions?*

The first literature review began by selecting journals from the fields of sustainability and environmental management, the target being to achieve a representative sample of journals from these two disciplines. The original sample included the following academic journals: *Journal of Environmental Economics and Management*, *Environmental Values*, *Business and Society*, *Sustainability Science*, *Global Environmental Change*, *Journal of environmental management*, *Journal of Environmental Planning and Management*, *Journal of Environment*

and Development, *Sustainable Development*, *Social Research*, and *Environmental Innovation and Societal Transitions*. Pertinent articles were identified in the selected journals by performing a search of the keyword "*agency*". Since this keyword search yielded only a small set of papers, the search was broadened to include other keywords. Thus, the aim of the journal search process shifted from finding agency-termed papers to finding papers that examined agency and actors within the context of sustainability. This led to the inclusion of the following set of terms in the review: *agent*, *agency*, *actor*, *micro*, *change agent*, *social entrepreneurship*, *social movement*, *civil society*, *consumer*, *stakeholder*, *tempered radical*, *niche*, *enlightened user*, *early adopter*, *private actor*, *collective action*, *individual engagement*, *household engagement*, *grassroots initiative*, *activism*, *movement*, *bottom-up*, *pro-active*, *pro-active motivation*, *distributive leadership*, *sustainable innovation*, *positive social movement*, and *social inclusion*. In the search for relevant articles, more journals, specifically *Energy Policy*, *Research Policy* and *Business, Strategy and the Environment,*[7] were added to the original sample. To gain a comprehensive appreciation of the field, reference and seminal papers were included in the literature review. The search identified a total of over 60 journal articles that were published between 2002 and 2016. During the reading process, some articles were eliminated as they were irrelevant to the research objectives. This led to a final sample of 25 journal articles being selected for review.

3.1.2 Reviewing the literature on company actors

Publication IV of this thesis takes the form of a conceptual paper built on relevant literature. The fourth paper of this thesis collected relevant literature from the fields of sustainability, business models, and system transition. The qualitative literature analysis was conducted in two iterative stages (Miles and Huberman, 1994). First, the main concepts were identified and a literature review was conducted. Second, a constructive research process was implemented to synthesise the findings of the previous literature. To identify relevant articles for inclusion in the literature review, the Scopus database was searched for articles that contained the following keywords or a combination thereof: *business model*, *sustainability*, *transition management*, *system transition*, and *systemic change*. The aim of Publication IV was to gather knowledge related to system transition and business model change to understand companies as actors of sustainability transition. Hence, the objective of this literature analysis was to answer the first sub-question: *how do companies act in sustainability transition?*

3.2 Empirical methodology

The empirical component of this thesis takes the form of qualitative research. A qualitative research approach aims to develop an understanding of phenomena in context-specific settings, such as real-world settings, in which the researcher does not attempt to manipulate the phenomenon of interest (Patton, 2001). In qualitative research, the researcher has an important role to play in interpreting qualitative data. Specifically, the researcher's role is to create a deep,

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[7] However, it was later observed that the sample did not include certain keywords, publications or journals. For example, *Journal of Cleaner Production* and *Technological Forecasting and Social Change* were missing from the selected journals.

systemic, or encompassing overview of the phenomenon of interest (Miles and Huberman, 1994). Strauss and Corbin (1990) define qualitative research broadly as follows:

"*Any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification.*"

Qualitative data takes the form of words rather than numbers and is typically a source of well-argued, rich descriptions and explanations of a certain phenomenon (Miles and Huberman, 1994). By using a qualitative research approach, the researcher can find a flow of causal connections to create fruitful explanations about the phenomenon under observation (Miles and Huberman, 1994). As a holistic knowledge of actors in sustainability transitions is currently just emerging (Pesch, 2015; de Haan and Rotmans, 2018; Koistinen *et al.*, 2018a), a qualitative research approach was chosen to explore this phenomenon. Qualitative research aims to generate rich descriptions that are vivid, situated in a real-world context, and that ring true and thus have a strong influence on the reader (Miles and Huberman, 1994). Hence, the objective of this thesis is to develop a deeper understanding of the actor-level dynamics in sustainability transitions. In terms of the research methodology, the research is based on a qualitative data analysis approach combined with key components of grounded theory.

In this thesis, qualitative data analysis was conducted according to the principles suggested by Miles and Huberman (1994). They divided qualitative data analysis into three major phases: data reduction, data display, and conclusion drawing and verification. In addition to qualitative data analysis, this thesis adopts key components from grounded theory. Grounded theory is a widely acknowledged method that is frequently used to generate new theories by conceptually modelling empirical data (Glaser and Strauss, 1967). While the ultimate objective of grounded theory is to develop a theory, in this thesis, it is applied more narrowly, that is, to identify suitable components from which to start to build a theory regarding the actors of sustainability transitions. Another rationale for applying grounded theory is that it allows the researcher to employ interpretation and process in a way that does not bind them too closely to long-standing assumptions (Suddaby, 2006).

3.3   Data collection and analysis

Interviews with actors in sustainability transitions were conducted to generate the data necessary to address the research questions posed in this thesis. In total, 42 interviews were conducted in Finland. The interviews were implemented in two phases. First, an empirical set of data was collected to explore the role of actors in the context-specific setting of the Finnish food system. The first data collection phase included 26 interviews. The second empirical set of data was collected to explore the dynamics of Finnish actors in sustainability transitions more generally. In this second round of data collection, a total of 16 interviews were conducted.

Data analysis was also conducted in two phases. The first data analysis was carried out while Publication II of this thesis was in the process of being written. The second data analysis was performed while Publication III was being written. Due to the study's qualitative nature, the main focus was on data analysis and interpreting the data collected. Although both of the data analysis exercises employed qualitative methods, the two data analyses are discussed separately as the stream of the qualitative research was different in these two analysis phases.

3.3.1 Finland as the research setting

To understand the context and situational factors of relevance to this thesis, the research setting must first be introduced. The research was conducted in Finland, first considering actors of one specific systemic change, i.e. the actors of the Finnish food system, and second, considering more generally the actors of sustainability transitions in Finland. Finland is a highly industrialised European country with a small population. It has committed to several sustainable development targets. Finland is part of the Nordic model, along with Norway, Sweden, Denmark, Iceland and the Faroe Islands, which includes a welfare state comprising government-provided services financed by general taxation (Pontusson, 2011).

Recently, Finland has announced an ambitious plan to be carbon neutral by 2050 (Salonen *et al.*, 2018). In addition, as mandated by the National Commission on Sustainable Development, chaired by the Prime Minister of Finland, the government aims to ensure that international sustainable development goals are included in national policy.[8] In other words, the Finnish government intends to promote the implementation of the 2030 Agenda for Sustainable Development within the nation.

Sustainable development impacts the everyday lives of the Finnish people. For example, the majority (78%) of 15 to 29-year-old Finns express the opinion that they would act pro-environmentally even when others did not (Salonen and Konkka, 2017). In addition, the market share of organic agricultural products in Finland grew to around 24% in 2012.[9] Moreover, public interest in socially fairer production and consumption habits is exemplified by the fact that, in 2012, the fair-trade market in Finland grew by 48%, a figure that is significantly higher than the worldwide average of 21% (Salonen *et al.*, 2018). Sustainable development also plays a fundamental role in Finnish housing; for example, the energy used to power household lighting in Finland decreased by almost a third (30%) between the years 2010 and 2015 (Salonen *et al.*, 2018.)

The ambition to more thoroughly integrate sustainable development within Finnish society has won Finland recognition for its pursuit of sustainability. According to the Environmental Performance Index 2016, which is carried out by Yale and Columbia Universities in collaboration with the World Economic Forum, Finland is one of the greenest countries in the world.[10] However, much remains to be done in Finland to respond to the grand challenges. While Finns' awareness of climate change has improved, carbon reduction is not a feature of peoples' everyday lives, and it appears that pro-environmental opinions do not always translate into pro-environmental actions (Salonen *et al.,* 2018). In addition, Finland has one of the highest carbon footprints in global comparisons (Hertwich and Peters, 2009; Ivanova *et al.*, 2016).

Sustainable development targets are becoming increasingly prominent in Finnish society. Several green movements have also emerged. However, sustainable development is not yet embedded throughout Finnish society and the everyday lives of Finns. In addition, the small population, industrialised society, and strong role of the state may have an effect on actor-level

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[8] See: https://vnk.fi/en/sustainable-development
[9] See: http://luomu.fi/kirjoitus/luomumarkkinat-kasvoivat-aiempaa-hitaammin/
[10] See: http://www.goodnewsfinland.com/finland-is-the-greenest-country-in-the-world/

dynamics in the processes of sustainability transitions. Hence, this thesis is focussed on Finnish actors of sustainability transitions.

3.3.2 The first phase of data collection and qualitative data analysis

Data collection I

The first round of empirical data collection was conducted to better understand the phenomenon of actors within sustainability transitions without prior expectations. Thus, the first phase was inspired by the grounded theory research design (Glaser and Strauss, 1967). The interviews of this first round of empirical data collection were gathered for use in Publication II of this thesis. The first interviews were performed to answer the second sub-question: *what motivations underlie the actions of individuals actively involved in sustainability transitions?*; and the third sub-question*: how do individuals embark on, and sustain, a path of intentional sustainability actions?*

The empirical data was collected via semi-structured interviews. The first interviews were performed with individuals who have engaged in sustainability change in the specific context of the Finnish food system. The aim was to explore what motivates the sustainable behaviour of actors in the food system and what forms agency takes in the Finnish food system. The data was collected by interviewing individuals who are related to the food system in Finland and who act differently to others who engage in "*mainstream*" behaviours. Actors of sustainability transitions were studied throughout the Finnish agricultural value chain. All interviewees were chosen from the agricultural production, distribution and retailing, and consumption phases of food production. Interviewees' age, gender, and education level varied; their only shared features were that they had all changed their behaviour towards sustainability in Finland's food system. Thus, the defining factor was that they had all changed their behaviour towards sustainability. They were, for example, vegans, organic farmers, or retailers of locally-grown food. The interviewees were identified and enlisted in this research in two phases. First, an internet-based search was carried out, from which the first change agents were identified and contacted via email. During the first interviews, the interviewees were asked to suggest further change agents for interview. This had a snowball effect that led to the discovery of new interviewees thanks to the input of the first interviewees. In total, 26 agents participated in the interviews, which were conducted between September 2014 and May 2015.

All the interviews revolved around a central theme but were conducted in a conversational tone in an effort to access data that was as representative of reality as possible. The duration of the interviews varied from 30 minutes to up to 2 hours. All the interviews were conducted by the PhD researcher. The interview questions related to a similar theme, but the interviewees were given the opportunity to freely articulate their thoughts and feelings. Specifically, the interview questions concerned individuals' reasons for exhibiting change-promoting behaviour and performing change engagement. Moreover, the questions probed actors' motivations to engage in sustainable change and their willingness to act as a change agent. The interview questions examined also how the agents differ from the mainstream and how they stay engaged in change.

Qualitative data analysis

In the first phase of data collection and data analysis, the semi-structured interviews were recorded. Following completion of the interviews, the content of the recordings was transcribed into Word files. During the first phase of data collection and analysis, the interviews were tested to ensure reliability.

The data analysis was carried out using Word and Nvivo, the main focus being on analysis and generating interpretations from the data collected. The first phase of the data analysis was data reduction. To begin the data reduction process, the opening quotes for Publication II were chosen from the Word files. Nvivo was selected as the data analysis program since it efficiently reduces data and can be readily used in the data display phases of data analysis (Miles and Huberman, 1994). The data was reduced by creating codes in Nvivo. This made it easier to categorise the data to ensure the reliability of the research. The use of coding resulted in the identification of the initial categories drawn from the raw data.

In the data display phase, the Nvivo codes were used to structure the data and identify systematic patterns and interrelationships. During the display phase, additional conceptual categories or themes emerged from the initial codes. This led to the drawing conclusions phase. The data analysis was verified by checking the initial notes of the researcher and reviewing the findings and conclusions with the co-authors. In addition, using Nvivo allowed the researcher to repeat the data analysis several times to test the conclusions and verify the findings, thereby ensuring the validity of the research (Miles and Huberman, 1994).

3.3.3 The second phase of empirical data collection and grounded theory analysis

Data collection II

The second empirical data collection process was conducted subsequent to the literature review and thus with prior knowledge of sustainability transitions. The focus at this stage was on exploring the individual agents of sustainability transitions. The second interviews of this thesis were performed for Publication III. The aim of these interviews was to understand how sustainability agency forms and how sustainability agents sustain their agency. Hence, the second interviews also aimed to answer the second sub-question: *what motivations underlie the actions of individuals actively involved in sustainability transitions?*; and the third sub-question*: how do individuals embark on, and sustain, a path of intentional sustainability actions?*

The data was collected via open interviews with sustainability agents who were active at the niche and regime levels of the existing socio-technical system. During the data collection process, a test interview was carried out to ensure reliability. During the interviews, a narrative methodology was applied to identify the meaningful events in the actors' life courses that had resulted in their intentional sustainability actions. The interviews were carried out in a tone that was as conversational as possible to give the interviewees the chance to articulate their thoughts freely. The interview questions were generally concerned with the actors' life courses from childhood to the time of the interview. The agents' relationship to sustainability was investigated from several points of view, for example, questions were asked regarding the development path of their actions, the obstacles respondents had encountered during their life

courses in relation to sustainability, and how they perceived the current system in relation to sustainability, and the actors elaborated upon the critical events that had led to their deliberative actions. The interviewees were also asked if they had specific values that had influenced their lives. The connection between agents' values and agents' deliberative actions were addressed with specific questions. Since the interviews adopted an open format, some questions varied across the different interviews, but the central themes and question topics remained the same in each interview.

In total, 16 interviews with active agents of sustainability transitions were conducted, all by the PhD researcher. The interviews were held between autumn 2016 and autumn 2017. The duration of the interviews varied from 30 minutes to just over 2 hours; the total recorded material amounted to 16 hours and 17 minutes. The interviewees were found via a process that involved an initial desktop research followed by snowball sampling, the objective being to find active agents of sustainability transitions who represented different roles and locations in the socio-technical system. All the interviewees were contacted via email. The interviewees were also selected based on their activity; however, the actual setting, or environment, of their action could vary. Hence, the agents were selected from different fields, for example, from the energy sector or food system. The interviewees represented the private, public, and third (e.g. voluntary or non-profit) sectors of Finnish society.

Grounded theory data analysis

The second empirical data analysis exercise was conducted following the principles of grounded theory. As with the first data collection and data analysis stage, all the interviews were recorded and transcribed. The opening quotes published in Publication III were selected from the transcripts. The data analysis was carried out using data comparison and data reduction to generate categories from the interviews and move in a more conceptual direction (Glaser and Strauss, 1967; Gioia, Corley and Hamilton, 2013). The objective of grounded theory is to find patterns from data through concepts and to then build theoretical models based on these patterns (Glaser and Strauss, 167; Glaser, 1978). Thus, the objective of the second data analysis stage was to find themes within the data that could provide greater detail and insights than simply categorising the data could achieve. The data analysis was implemented in three main phases, the aim being to indicate aggregate levels from the data (Corley and Gioia, 2004; Gioia, Corley and Hamilton, 2013). At the beginning, a set of narratives was collected that described both agency-formation processes and actors' rationales to remain resilient when engaging in sustainability transitions. Second, integrative themes that connected the first-level narratives were identified. The aim of the third phase was to identify the conditions and triggers for the formation process of agency and the rationales for actors to remain engaged in sustainability transitions. Thus, the main objective of the third analysis phase was to structure the data into more theoretical categories and create aggregate dimensions (Corley and Gioia, 2004; Gioia, Corley and Hamilton, 2013).

3.4   Evaluation of reliability and validity

3.4.1   Evaluating the quality of the thesis

To ensure the value of a research study, it is crucial for the researcher to examine its credibility. While credibility in quantitative research depends on instrument construction, in qualitative research, the researcher is the instrument (Patton, 2001). The concepts of reliability and validity in qualitative research are both controversial. This is in large part explained by the fact that the concepts of "*reliability*" and "*validity*" are typically used to test and evaluate quantitative research (Golafshani, 2003). For example, Stenbacka (2001) argues that the concept of reliability is misleading in qualitative research. However, qualitative researchers recognise that there is a need to perform certain qualifying checks or measures in their research (Golafshani, 2003). For example, Patton (2001) argues that validity and reliability are two aspects that qualitative researchers should address when designing a research study, analysing results, and evaluating the quality of the research.

In qualitative research, the power of the researcher is emphasised. As constructivism highlights the co-creation conducted by the research participant and the researcher (Guba and Lincoln, 1994), in terms of scientific research, this indicates that the researcher constructs scientific knowledge, which directly influences the quality of the research. The reliability and validity of qualitative research are thus perceived to be influenced by the researcher's perception of reliability and validity and paradigm assumption (Cresswell and Miller, 2000). Moreover, it is suggested that the quality of a study in each paradigm should be evaluated by its own paradigm's terms (Healy and Perry, 2000). This has led many researchers to develop their own concepts of validity and to generate or adopt more appropriate terms, such as "*quality*", "*rigor*", and "*trustworthiness*" to evaluate reliability and validity (Davies and Dodd, 2002; Lincoln and Guba, 1985; Seale, 1999; Stenbacka, 2001). Hence, while the terms "*reliability*" and "*validity*" are crucial for evaluating the quality of quantitative paradigms, in qualitative paradigms the terms "*credibility*", "*neutrality* or *confirmability*", "*consistency* or *dependability*", and "*applicability* or *transferability*" are believed to be essential when considering the quality of the research (Lincoln and Guba, 1985).

In qualitative research, data consistency is perceived to be achieved when the steps of the research are verified through an examination of different phases, such as raw data collection, generation of data reduction results, and creation of process notes (Campbell, 1996). Lincoln and Guba (1985) highlight the use of inquiry audits to enhance the dependability of qualitative research.

Gioia, Corley, and Hamilton (2013) suggest that to ensure the quality of research, the researcher should aim to access more aggregate levels in the data analysis as a means of describing and explaining the phenomenon of interest. In addition, the objective of qualitative methodologies is to engage in research that seeks a deeper understanding of a phenomenon rather than simply examining its superficial features (Johnson, 1995). It appears, again, that the credibility of the qualitative research is largely dependent on the researcher.

In addition, to achieve valid and reliable qualitative research with multiple and diverse realities, various methods of searching for and gathering data play important roles in the research process

(Golafshani, 2003). Within the paradigm of constructivism, the use of investigators, multiple methods, and data triangulation to record the construction of reality may help to validate the reliability and validity of the research (Johnson, 1997). Data triangulation in constructivism allows other research participants to assist the researcher to respond to the research question and collect valid data (Golafhsani, 2003). Moreover, combining multiple methods, such as observation, interviews, and recordings, can result in a more valid, reliable, and diverse construction of realities (Golafshani 2003). To sum up, the researcher can involve peer researchers in the design of the study and interpretation of the data as a means of ensuring the credibility of the qualitative research.

The aim of this thesis is to achieve a deeper understanding of the actors involved in sustainability transitions through both qualitative data analysis and analysing data using the principles of grounded theory. The first data collection process was conducted without any prior knowledge of the actor dynamics at play in transition processes. This approach was chosen on the basis that examining the literature too early on may result in prior hypothesis bias or confirmation bias (Gioia, Corley, and Hamilton, 2013). In other words, this approach was chosen to minimise the potential for individual bias.

The second data collection proves was conducted following a literature review and thus with more extensive knowledge of sustainability transitions. The two separate phases of data collection were suitable for qualitative research as collecting data in two different phases can strengthen the credibility of the research, particularly as the first data collection process in this study involved semi-structured interviews and the second data collection process took the form of open interviews. All 42 interviews conducted as part of the current study were recorded and transcribed to ensure the credibility of the research. The interviews in both phases ended when theoretical saturation was reached as opposed to terminating at a set point. This approach was based primarily on the researcher's subjective perception that there was little to be gained from additional interviews. In addition, during both data collection phases, a test interview was carried out to ensure the reliability and validity of the studies. Moreover, both Publication II and Publication III cited quotations from the interviewees to reduce the subjectivity of the research and ensure its reliability.

Throughout both empirical data collection processes, the aim was to give a voice to the interviewees in the early stages of data gathering and analysis and ensure that these voices were represented fairly in the way in which the research findings were reported. This creates rich opportunities for the discovery of new concepts rather than simply affirming existing concepts (Gioia, Corley and Hamilton, 2013). This is vital since it decreases the possibility of the researcher limiting themselves to prior hypotheses or assumptions.

The aim of both data collection phases was to find conceptual, or aggregate, levels from the data. The data analysis of the information collected from the first set of interviews followed the principles of qualitative data analysis (Miles and Huberman, 1994). In the qualitative data analysis phase, data reduction was used to abstract the phenomenon under investigation. The data analysis conducted following the second data collection process followed the principles of grounded theory (Gioia, Corley, and Hamilton, 2013). The target of this second data analysis was to structure the data into more theoretical categories and to ultimately conceptualise aggregate dimensions. The conceptualisation of both data analyses aimed to ensure the credibility of the research and minimise the risk of the researcher manipulating the data.

In addition, data triangulation was applied throughout the research process. The supervisors of the thesis and co-authors assisted the PhD researcher with the research questions, data collection, and data analysis to ensure the reliability and validity of the thesis.

3.4.2   **Researcher's pre-understanding**

Researcher biases can potentially influence the research process and outcomes. As such, there is a requirement to examine the researcher's pre-understanding. Every researcher is unique, and a myriad of situational factors have shaped who they are. For instance, a researcher's background has an effect on how they will performs research, conduct interviews, interpret data, and compose papers. Furthermore, the quality of qualitative research depends largely on the researcher. These two factors, however, introduce the risk that the researcher is biased in terms of prior hypotheses and subjectivity, and this can influence the credibility of the research.

Arguably, social sciences and qualitative research, in particular, are largely dependent on the researcher (Cresswell and Miller, 2000; Patton 2001). Thus, qualitative research may be characterised as an ultimately subjective matter. In the case of the current study, the researcher's prior education in environmental engineering may result in biases. These biases may impact, for example, the research questions, data collection, and data analysis.

In terms of the research questions, there is a risk that existing presumptions and perceptions may influence the questions asked, with the unconscious objective present in the asking of these questions influencing how they are answered. During the data collection process, and especially interviews, there is the possibility that the researcher's background may influence the research. For example, in this instance, the interviewees may not speak in as much detail if they assume that the researcher has abundant prior knowledge of sustainability. On the other hand, the researcher's prior knowledge of environmental technology and sustainability may be an advantage in the interview sessions; for example, it could help the researcher to understand technical issues, such as the technological solutions for renewable energy, related to energy transitions. In addition, if the interviewee also holds a degree related to environment or sustainability, it may help the interviewee to open up and provide more details and personal accounts.

Another risk is that the researcher asks questions designed to confirm their presumptions. Thus, during the interviews, it is crucial to allow the interviewees to speak freely and continue to explain their response for as long as is needed. In this research, the technological background of the researcher may have helped them, at least in the beginning, to view the largely sociological phenomenon of actors in sustainability transitions as an outsider and may have prevented the researcher from bringing existing presumptions with them into the research had they had a background in sociology.

In addition, the nationality of the researcher is Finnish, and she was born and raised in Finland. This may create a bias towards Finnish society, which may lead to difficulties in understanding the relevance of the research findings in other contexts. While this thesis examines only Finnish actors in sustainability transitions, this risk should be taken into consideration when the researcher seeks to generalise the findings.

As discussed earlier, carefully chosen research methods may help to prevent the biases described above. For this reason, in both studies, the interviews were tested before being conducted with the research participants to minimise the influence that the researcher's prior knowledge may have on the process and outcomes of the research. In addition, the research questions, data collection process, and data analysis were reviewed by other researchers to reduce the risk of biases, subjectivity, and presumptions.

4 Summary of the publications and main contributions

This section of the thesis summarises the results and outlines the publications included in the dissertation. Each of the publications has a distinct focus that aims to answer the research question presented in the first chapter: *How do individual and company actors contribute to sustainability transitions?*

4.1 Publication I

Agent-Based Change in Facilitating Sustainability Transitions

4.1.1 Objectives

The aim of the first publication was to acquire stronger knowledge of how sustainability transitions can be enabled. Hence, the first publication of this thesis took the form of a conceptual paper. The objective of the first publication was to understand what is presently known on the role individuals play in facilitating sustainability transitions through a literature review.

The first publication evaluated the role of actor-led change in enabling sustainability transitions. The focus in the practice and research on sustainability transitions has traditionally been on large-scale institutional actors (Smith, Stirling and Berkhout, 2005; Markard, Raven and Truffer, 2012). However, to make a difference, micro-led change, i.e., engaged individuals driving sustainability transitions, is also needed. Publication I explored the role engaged individuals play in facilitating sustainability transitions in the existing research from the fields of sustainability and environmental management. Despite the potential engaged individuals have to enable sustainability transitions, a closer look at the sustainability transitions literature leads to the observation that the role of agency tends to be underplayed at the expense of a focus on technological solutions and policy orientation (Cashmore and Wejs 2014; Bakker 2014; Mercure *et al*. 2016). In other words, it appears that a macro-orientation has prevailed at the expense of a micro-level perspective. The aim of Publication I was to explore the current knowledge to ascertain how agency has been studied in sustainability studies, with a particular focus on the sustainability transitions literature.

4.1.2 Main findings and contributions

The literature review of the first publication and the analysis of the relevant articles led to the identification of two broad categories of findings: first, challenges in the study of agency in this literature; second, an overview of the means through which agents influence sustainability transitions. Via these findings, the contributions of the paper are twofold.

Publication I contributes firstly by bringing together the scattered knowledge related to sustainability agency. The most invigorating finding from the review of literature is that agency, or engaged individuals, truly matters. Sustainability agents are acknowledged to introduce and

drive sustainability transitions, and they have a crucial role to play in the pathway towards sustainability.

Secondly, the publication contributes by identifying several gaps in the existing research literature. The review revealed that, overall, agency remains neglected in the sustainability literature. Whereas agency is acknowledged, the representation of agency is narrow. Sustainability agents are perceived to be tools for sustainability transitions rather than individuals who possess distinct rationales and aspirations. The life paths, motivations, and other psychological processes of agents remain currently underrepresented. The knowledge on how agency is formed and how it evolves toward collective action is missing. Going forward, even though all levels of the multi-level perspective have agency, the research is still biased on niche agency.

4.2 Publication II

Change agents engaged in sustainable transformation in the Finnish Food System

4.2.1 Objectives

The aim of the second publication was to understand why some individuals change their behaviour towards sustainability and why they remain engaged in sustainable change. Publication II of this thesis took the form of an empirical paper. The objective of the second publication was studied within the designated context of the Finnish food system. Recent studies have implied that about one-third of the environmental impact in the EU is caused by the current food system (Tukker *et al.*, 2006; Tukker *et al.*, 2009). To achieve a more sustainable food system, the need for large-scale changes is evident (Simons, 2015). How individuals make a difference in the framework of a food system was selected for the setting since achieving a more sustainable food system and feeding future generations are noted as crucial goals for the upcoming years.

The problem guiding the inquiry was the dominating macro-perspective in the literature of sustainable transformation (Abell *et al.*, 2008; Markman and Waldron, 2014). Whilst macro-led change is necessary for system transformation, there is also a certain place for change that is initiated at the micro level. The two fundamental arguments are that individual agents are part of the system and are capable of changing the system. The argument us that understanding individuals is a critical element of sustainability transitions that is still underplayed in the research on system transformation. Therefore, the unit of analysis is change agency and how agents enable sustainable transformation.

Publication II attempted to bridge this gap in understanding by the dynamics of agency through two research questions: (1) What motivations underlie the pro-ecological behaviour of change agents in the food system? and (2) What forms does change agency take in the Finnish food system? The publication seeks understanding from social sciences and management research. Within the paper, the concepts of change agency and micro-level change from company research are embedded within the issue of sustainable systemic transformation in response to calls to create synergy between the technical and social sciences. At the heart of the concept of micro-level change is the assumption that change starts with individuals and the decision to

accept and adopt something new depends on individuals and their reactions to the new style of practice. Furthermore, internal change agents are believed to play an important role in implementing change (Van der Heijden *et al*., 2012). The term 'change agents' refers to individuals who act as catalysts, embracing the responsibility for managing change activities (Robbins *et al*., 2010). Researchers have acknowledged that micro-level change can create society-level outcomes, and even causally produce strategic phenomena, but it is still unclear as to how these phenomena emerge from individual actions (Abell *et al*., 2008).

4.2.2   Main findings and contributions

The second publication makes three contributions to extant research. First, the current system literature and sustainability change literature are primarily focussed on the macro level, and the systematic utilisation of the micro perspective is somewhat lacking. In addition, the literature in the field of agricultural innovation has been largely based on the systems approach, meaning that the effect of the parts of the system is still scant (Lamprinopoulou *et al*., 2014). Hence, the primary contribution of the publication is to provide early, explorative findings on the role of individual-level factors in enabling sustainable system transformation, through the study of change agents in the Finnish food system. The findings of the second publication had two main focuses: The motivations of change agents and the nature of change agency.

The findings of the publication revealed that individuals change their behaviour and stay engaged in change based on their intrinsic motivation and ethical standpoints. The results underline how individuals appear to be very environmentally and ethically consciousness. These change agents often have very deep knowledge about their chosen sustainable actions and possess valuable knowledge about sustainable practices. Many of the agents can be described as specialists in their chosen sustainable movement. The results showed that agency can be either active or passive, and change agents can possess different kinds of capabilities. These could be identified as 'specialist' capabilities and 'marketer' capabilities.

The second contribution this publication makes was to argue that current systems are governed by the macro perspective and that sustainable transformation is often structured by exploiting sustainable consumption policies. However, leaning on policies and macro-level forces is not enough. The underlying argument of the second publication is that systemic change needs a micro perspective too. In an attempt to bring more recognition to the individual level, this paper explored systemic transformation through the lens of change agency.

Third, this publication responded to calls to bring the social sciences more explicitly into the fields of sustainable change and system transformation, where the current discussion is mainly dominated by hard technical sciences. The attempt was to merge the ecological view with change agency theories from social and management sciences.

4.3   **Publication III**

Active agents of sustainability transitions – A life course approach

4.3.1   Objectives

The focus of the third publication was on agency and, to put it more precisely, on the active sustainability agents of sustainability transitions within the framework of the multi-level perspective (MLP). While agents are widely acknowledged as being crucial components of sustainability transitions, their role in the literature on sustainability transitions tends to be undermined by the researchers' focus on technological solutions and policy instruments (Cashmore and Wejs, 2014; Bakker, 2014; Grin, Rotmans and Schot, 2011; Mercure et al., 2016). For example, previous studies have stated that the multi-level perspective is dominated by rational action, which leaves room for a stronger analysis of agency (Genus and Coles, 2008; Smith, Stirling and Berkhout, 2005). In addition, a recent review of the extant knowledge on agency has shown that understanding is scattered and scarce throughout the discipline (Koistinen *et al*., 2018a). Even if agency is acknowledged within the transition process, agents are often treated as tools of transition rather than as social beings (Koistinen *et al*., 2018a). The current understanding of agency remains limited since the psychosocial processes of agents are largely absent in the existing research. Bakker (2014) suggests that more focus is needed to understand agents' rationales for influencing socio-technical systems since agents likely have individual preferences and pathways toward achieving their desires. To conclude, several crucial questions, such as who the agents actually are (as social beings) and how agency forms, remain unresolved.

Hence, the third publication aimed to address some of these gaps through an empirical paper. The underlying objective of the publication was to explore the agents who are active in sustainability transitions via a life courses approach. This problem was addressed using three research questions: (1) How does agency form? (2) How do agents sustain their agency? and (3) Is sustainability agency a niche-driven phenomenon?

4.3.2   Main findings and contributions

The main contribution of the third publication was to offer a more explicit portrayal of the agents of sustainability transitions. While previous research has portrayed agents in sustainability transitions as tools of transformation, the objective of the publication was to explore the social dimensions of agency through the lens of a life courses approach. The chosen approach helped to create a more nuanced portrayal of the agents of sustainability transitions and their respective lives. Arguably, this is one of the first publications to undertake a life courses approach to the study of active agents in sustainability transitions.

The second contribution the third publication made was to provide early insights into the formation process of sustainability agency. Two main paths for agency formation were identified. Based on the analysis, agency typically forms either through upbringing and education or certain awakening moments.

Debatably, an understanding of individuals' internal worlds and the effect these have on the sustainability agency-formation process have been lacking to date. Hence, the findings provide early implications that the same development path (which has already been acknowledged in other social sciences) is also evident within the formation process of sustainability agents in the context of sustainability transitions, especially when considering their internal worlds.

As the third contribution of the third publication, the analysis led to the identification of two main rationales for agents to sustain their agency. Firstly, the dichotomy between individual and collective expectations appeared as an incentive for the agents to sustain their agency; secondly, holism also appeared as an incentive for the agents to sustain their agency. Both rationales for sustaining agency could be associated with the agents' personalities. The findings imply that the features related to a sustainability agent's personality, or a cognitive entity, can explain why a sustainability agent might remain engaged in sustainability transitions. Given the analysis, sustainability actions appear to be integral parts of sustainability agents' lives but also act as a meaningful component of their self-image. In addition, it appeared that sustainability agents' critical, yet hopeful, mindsets both formed and sustained the agency.

Overall, the findings portray a sample picture of a sustainability agent as someone who is (1) more resilient than the mainstream, (2) possesses a personality that supports both sustainability agency formation activities but also helps to sustain the agency, and (3) has a high level of self-knowledge and clear reasoning for engaging and remaining engaged in sustainability actions.

The fourth contribution the publication made concerned the identification of the tentative implication that sustainability agency is not purely a niche-driven phenomenon. Based on the analysis, the agents of sustainability transition cannot be categorised only as niche agents or as regime agents. While some of the agents in the sample represented the current regime (at least according to their affiliations), they also indicated their willingness to shape the existing system.

4.4   Publication IV

Sustainable system value creation: Development of preliminary frameworks for a business model change within a systemic transition process

4.4.1   Objectives

The fourth publication of this thesis took the form of a conceptual paper. The objective of the fourth publication was to deepen understanding of the ways in which companies create and capture sustainable value through business models that form part of a larger operating system. The theories pertaining to how businesses work towards achieving this target include transition theory, the concepts of weak and strong sustainability, and the research literature of business model change to sustainability. The focus in Publication IV was on the dualistic role companies play in pursuing sustainable development targets—both contributing to sustainability within the business dimensions and assisting the broader systemic change through the new sustainable business models. Companies are perceived as actors that have the capability to influence sustainability transition and contribute to sustainability.

Although the sustainability challenges are mounting, the actual progress that is made towards sustainability is often in stagnation. Dyllick and Muff (2015) identified a significant disconnection between the company, micro-level concepts of corporate sustainability and sustainable business and the global, macro-level concept of sustainable development. The fourth publication argues that company-level actions make a marginal contribution to global sustainability if corporate sustainability and sustainable development are disconnected and, consequently, the performance measures remain disconnected. Three conceptual challenges

disconnecting the concepts of corporate sustainability and sustainable development were addressed: (1) The poor integration of all three dimensions (economic, ecological and social) in the business sustainability discourse, (2) the insufficient integration of the societal macro level with the company micro level, and (3) the focus on economic success as the dominating performance measure. Hence, to enable sustainable development, there is a requirement to understand better the role companies play as actors of sustainability transitions.

The concept of the business model was adopted for the fourth publication since the business model is presented as a bridge between changes at the company level, micro level, and the system level, macro level (Boons and Lüdeke-Freund, 2013; Boons *et al.*, 2013). The sustainable business model represents one approach by which firms can reconceptualise their purpose and value creation logic to improve their economic, environmental and social sustainability (Bocken *et al.*, 2014). Since companies are capable of contributing to sustainability through multiple transition pathways (Geels and Schot, 2007; Geels, 2014a), the companies can also be interpreted as agents of sustainability transitions. In sum, the fourth publication aims to generate more knowledge on the sustainable value capture and creation at the company level, but also within a larger operating system.

4.4.2   Main findings and contributions

The fourth publication contributes to the extant literature by applying transition literature to explain both the business model change at the company level and wider socio-technical transition towards sustainability. The publication contributes conceptually to existing sustainable business model literature in three ways.

First, the publication presents how sustainable business models can be used to create sustainable value. Sustainable value is captured through business model change from business-as-usual to a truly sustainable business. Sustainable value steers companies towards strong sustainability, hence creating possibilities for a stable economic position while adapting human activities—in this case, business operations—to meet the boundaries of natural resources. Consequently, value creation can be interpreted as a bridge to sustainable business and, later, as a component of a larger system-level transition. This is a process through which companies act as agents of sustainability transitions and have an influence on the transition process.

Secondly, the publication presents pathways towards sustainability in relation to companies in different research disciplines. Based on a review of the different disciplines, the research found that disciplines use scattered and often overlapping terminology to describe the evolution from weak sustainability to strong sustainability. Developing a stronger understanding of the overlapping typology, while the phenomena remain much the same, can ultimately advance the integration of different disciplines. This being said, the fourth publication began the process of bridging the disciplines of system transition and business model.

Thirdly, the findings of the publication imply that the lack of integration between the system level (system transition) and company level (business model change) continues to exist. To adopt sustainable business models and, hence, sustainable value, companies need to consider system-level influences on the change process. Since the current regime puts strong pressure on companies' operations; for example, via legislation, a sustainable regime would assist

companies to adopt sustainable business models. To achieve strong sustainability, more synergies between the system-level and business-level environments is required.

4.5 Summary of the findings

The main research question of *how do individual and company actors contribute to sustainability transitions?* was divided into four sub-questions. The sub-questions addressed, key objectives, findings, and contributions of each publication are summarised in Table 11.

Table 11. Publications and their main objectives, key findings, and contributions.

Publication and Sub-question	Key Objectives	Key Findings	Key Contributions
Publication I SQ1: What is missing regarding the role of individual actors in sustainability transitions?	The objective was to understand what is presently known about the role individual actors play in facilitating sustainability transitions through a literature review.	Knowledge regarding actors in sustainability transitions is often scattered. There are several gaps in the existing literature regarding actors in sustainability transitions.	Individual actors are necessary to ensure sustainability transitions succeed. Transition literature needs to pay more attention to the psychosocial processes of actors.
Publication II SQ2: What motivations underlie the actions of individuals actively involved in sustainability transitions? SQ3: How do individuals embark on, and sustain, a path of intentional	The objective was to understand why some individual actors change their behaviour towards sustainability and why they remain engaged in sustainable change.	Intrinsic motivation engages individual actors in sustainability transitions. Current systems are governed by the macro perspective.	Individual actors use different means to influence sustainability transitions. Strengthening the link between social sciences and sustainability change.

sustainability actions?			
Publication III *SQ3: How do individuals embark on, and sustain, a path of intentional sustainability actions?* *SQ2: What motivations underlie the actions of individuals actively involved in sustainability transitions?*	The objective was to explore the agents who are active in sustainability transitions via a life courses approach.	Active sustainability agency forms through upbringing and education or via altering moments. Intrinsic motivation helps actors to sustain their sustainability agency.	A life course approach to the study of active sustainability actors. There is a need to generate a more explicit portrayal of agents in sustainability transitions. Actors can sometimes exhibit role ambivalence.
Publication IV *SQ4: How do companies act in sustainability transition?*	The objective was to deepen our understanding of the ways in which companies create and capture sustainable value through business models that form part of a larger operating system.	Verifying the disconnection between system-level and company-level sustainability. Different disciplines use overlapping terminology to describe sustainable development.	The disconnection between the system level and company level appears to be a barrier to sustainable development. Understanding overlapping terminology may help the integration of different disciplines.

This thesis highlights the capability of actors to influence sustainability transitions. Moreover, the findings of this thesis underline how, in general, the individual actors in sustainability transitions embed intentional sustainability actions in their lives. This thesis argues that individual actors of sustainability transitions actively influence their surroundings through their intentional sustainability actions. The motivations that lead to intentional sustainability actions can be perceived as a manifestation of agency and structuration (Giddens, 1984). In addition, the findings imply that a single person can influence and contribute to a sustainability transition.

This in turn implies that individuals are capable of addressing the grand challenges and contributing to sustainable development through structuration. Moreover, companies as actors possess resources to contribute to sustainability (Geels, 2014a); however, based on the findings of this thesis, companies are not exploiting their full potential to advance sustainability transitions.

5 Discussion and conclusions

5.1 Contributions to the extant literature

Through its focus on actors in sustainability transitions, this thesis makes four contributions to the existing literature. These contributions are conceptually summarised in Figure 10 and then discussed in detail.
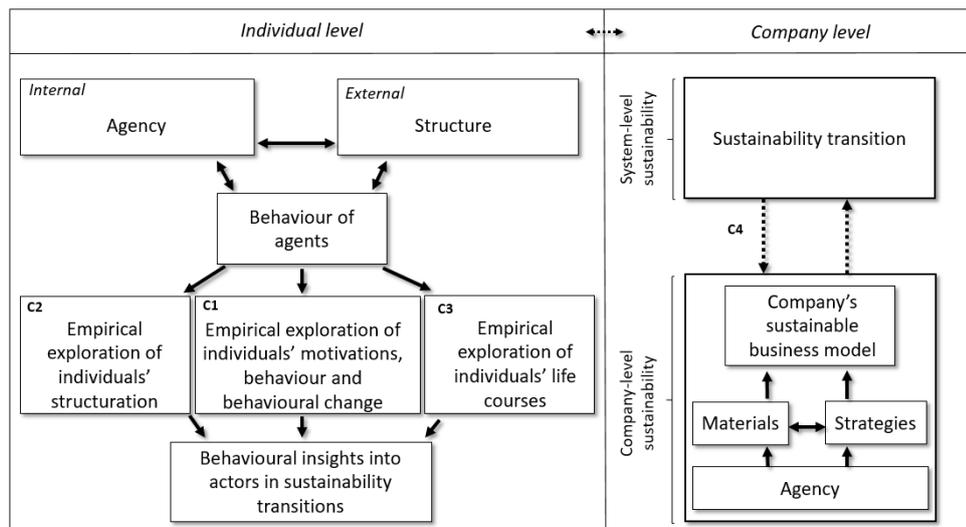
Figure 10. Conceptual model of the contributions of the thesis, in which C1, C2, C3, and C4 refer to the contributions of the thesis.

First, the multi-level perspective can be criticised in terms of how it treats individual actors. Recently, several prominent authors in this field (see e.g. Antadze and McGowan, 2017; Bakker 2014; Bögel and Upham, 2018; Bögel *et al.,* 2018; Gazheli, Antal, and van den Bergh, 2015; Koehrsen, 2018; Pesch, 2015; Sarrica *et al*., 2016; Sorrell, 2015; Stephenson, 2018; Upham *et al*., 2015; Upham *et al*., 2018; van der Vleuten, 2018) have noted the sparse study of psychosocial considerations in the transition literature and the multi-level perspective. The multi-level perspective largely embodies a static take on human behaviour; actors thus tend to be perceived through their institutional roles (Pesch, 2015). Such a static take on agency has resulted in a disconnect between the transition literature and the disciplines that focus on human behaviour (Gazheli, Antal, and van den Bergh, 2015; Sarrica *et al*., 2016; Bögel *et al*., 2018). Thus, the multi-level perspective tends to fade away the effect of human behaviour (van der Vleuten, 2018). Bögel and Upham (2018) note that making use of both psychological and sociological accounts in understanding human behaviour would add to this literature. This thesis participates in these recent discussions through the study of active sustainability agents as follows.

This thesis actively focuses on individual sustainability actors, exploring their behaviour and motivations to act. This thesis thus contributes to the multi-level perspective by offering insights into the behaviours and motivations of actors actively involved in sustainability transitions. The thesis finds that active individuals' ambivalent life roles affect their behaviours. Individuals assume various roles and thus face diverse pressures from the existing regime. The findings highlight how active individuals make decisions to act towards sustainability based on their intrinsic motivation, which may be contrary to their institutional role or the expectations of the existing regime. Moreover, the findings highlight that individual actors actively involved in sustainability transitions are willing to change their institutional role so that it is better aligned with their intrinsic motivation. For example, active individuals may change their education or career paths so that they are better placed to pursue sustainability. This thesis thus suggests that the ambivalent roles of individual actors influence their intentional sustainability actions, and in so doing, their engagement in sustainability transitions. It is likely that these findings offer insights beyond the multi-level perspective. Factors relating to individuals' motivations and sustainable behaviour are likely to be relevant to other fields of research, such as psychology or anthropology.

The second contribution this thesis makes to the extant literature is in considering the sociology of agency within the multi-level perspective framework. The multi-level perspective is a middle-range theory (Geels and Schot, 2010). A sociological perspective on agency is considered critical to understanding the actors involved in sustainability transitions given that the roots of the study of agency are in sociology. Recently, Upham *et al*. (2018) note that structuration per se has been given scant attention in the transition literature and the multi-level perspective. This thesis examines the sociology underlying transition studies and offers novel insights into actors in sustainability transitions. The thesis empirically explores how individuals' motivations lead to intentional sustainability actions. The sustainability actions that emerge from individual actors' motivations affect structuration. In other words, individuals influence their surroundings. Thus, the actions of individuals contribute to systemic change and help in addressing the grand challenges. This consequently contributes to sustainable development. In other words, understanding the motivations of individual actors enables us to understand the dynamics of structuration in the context of sustainability transitions – i.e. how actors' agency enables regime shaping niche developments. Theoretically, the contribution of this thesis is to incorporate structuration theory more thoroughly into the transition literature through literature reviews and empirical analyses. While transition thoughts provide fruitful tools to study sustainability, understanding the actors who participate in sustainable development calls for the incorporation of background theories, such as sociology.

The study of life courses and their effect on individuals' behavioural change and continuity is commonly employed in a range of disciplines, for example, in educational sciences (e.g. Elder 1994; Elder, 1998). The prevailing idea of life course research is that the consequences of life events are likely influenced by their timing, perceived relevance, and subjective experience (de Vries *et al*., 2001; Jang and Haley, 2002). To the best of the researcher's knowledge, a life courses approach has not been previously employed to study the actors involved in sustainability transitions or within the multi-level perspective framework. The life course approach enables an in-depth exploration of individual actors' behaviour and behaviour change. Hence, this approach offers a fresh perspective from which to appreciate individuals actively involved in sustainability transitions. The findings of the thesis argue that the life path and

intrinsic motivation of an individual actor bring forth agency, which leads to deliberate sustainability actions that enable regime destabilisation. In addition, the choice to apply a method from a seemingly distant branch of social sciences may enable the further incorporation of social studies that integrate knowledge regarding human behaviour into transition studies.

Fourthly, this thesis observes that a lack of integration between system- and company-level sustainability remains an issue. Despite the fact that companies tend to focus on their internal processes, such as, marketing or research and development, the transition literature rarely pays attention to these company processes (Abdelkafi and Täuscher, 2016; Gorissen *et al*., 2016; Geels, 2014a). This finding strengthens our existing understanding of business sustainability. The findings of this thesis verify that companies are actors of sustainability transitions and serves to highlight the fact that their potential in this role is under-exploited. Thus, this thesis suggests that companies should pay more attention to the larger environment within which they operate, including mounting sustainability challenges.

5.2 Future research directions

The objective of this thesis is to explore the actor-level dynamics involved in sustainability transition processes. In addition, this thesis aims to bring more nuance to the existing portrayal of individual actors of sustainability transitions in the framework of multi-level perspective. While this thesis provides some insights into actors' rationales for pursuing intentional sustainability actions and ways to contribute to sustainability, the findings of this thesis are nonetheless merely a starting point. The psychosocial processes of actors are still under-researched in the transition literature and thus also in the (e.g. Gazheli, Antal, and van den Bergh, 2015; Pesch, 2015; Bögel and Upham, 2018; van der Vleuten, 2018). This thesis suggests that the tentative insights drawn here regarding actors' rationales for intentional sustainability actions and ways to influence sustainability transitions could serve as a foundation for further work and be enhanced by the deeper integration of the various psychosocial processes of agents into the multi-level perspective. Hence, future research should focus on bringing the transition literature and the framework of multi-level perspective closer to those disciplines, such as sociology and psychology, that have accumulated knowledge on individual behaviour. There are various possible directions through which the actors of sustainability transitions can be studied. For example, how do the values, self-esteem or wellbeing of an individual influence intentional sustainability actions? Moreover, future research could build on the research avenues introduced by Bögel *et al*., (2018), Koehrsen (2018), and Stephenson (2018). In other words, the purposeful application of culture and religion theories in transition literature would further this discipline. In addition, many psychological theories are not applied in specific contexts in transition literature. To develop a profound understanding of the meaning of individual actors in influencing sustainability transitions and, thus, sustainable development, actor dynamics should be fully considered in forthcoming studies.

As discussed earlier, the framework of multi-level perspective has always included actors. Typically, the appreciation of actors has been on the niche level (Whitmarsh, 2012; Pesch, 2015, Koistinen *et al.*, 2018a) and the regime and landscape levels have attracted less attention. In addition, the regime level is often determined by the institutions of the regime, not by the individual actors of the regime (Pesch, 2015). This thesis aims to identify both the niche and

regime actors involved in the socio-technical system; however, the encompassing focus on regime actors is not addressed here. Moreover, Antadze and McGowan (2017) argue that landscape-level agency is an under-researched phenomenon in the multi-level perspective. Hence, future research should pay more attention to the actors involved at the regime and landscape levels and how they engage in sustainability actions and influence transition processes at a systemic level.

The third recommendation for future research avenues concerns the ambivalent roles of actors. Bakker (2014) argues that individual actors constantly encounter various, ambivalent rationales that have an effect on them. Similarly, Pesch (2015) notes that the multi-level perspective adopts a view of agency that is overly static and the framework determines regime actors through their institutions and thus does not take their ambivalent roles into account. Based on the findings of this thesis, individual actors confront pressure from the existing regime, which leads to ambivalence. However, there is a lack of knowledge pertaining to the extent to which this ambivalence influences behaviour. Thus, the various roles in the lives of individual actors and their effect on their intentional sustainability actions and thus sustainability transitions should be explored further.

As the final recommendation for future research, this thesis suggests the stronger incorporation of system-level and company-level sustainability in upcoming studies. This is important since the gap between system-level and company-level sustainability is still evident (Dyllick and Muff, 2015; Koistinen *et al.*, 2018b). This thesis emphasises that this lack of integration acts as a barrier to sustainable development. Hence, this field of study requires greater attention in the future. In addition, Heikkurinen (2013) states that companies typically introduce a single strategy regarding sustainability while, in reality, companies are formed of a multitude of individuals who adopt various interpretations of sustainability. This indicates that consensus on sustainability does not necessarily exist within a company and while some views on sustainability prevail, others may be suppressed (Heikkurinen, 2013). This once again highlights the ambivalence and various pressures that different actors encounter. This thesis perceives companies as actors and does not examine the research question through the lens of the individuals that form the company. Hence, there is a need to understand companies as both collective entities and as groups of distinct individuals before the role companies play in sustainability transitions can be fully understood.

In addition, to bridge the continuing gap between the system and company levels, transition scholars and practitioners should consider the opportunities that companies have access to, for example, power, resources, and a stable position in the regime. Hence, treating companies as agents of sustainability transitions may help transition scholars and practitioners to identify additional possibilities that companies have to influence sustainable development. Consequently, this could provide an avenue for fruitful business opportunities, which could be supported by policy work or research and development, as per the theories that underpin the strategic niche management approach (Schot, Hoogma and Elzen, 1994; Kemp, Schot, and Hoogma, 1998; Hoogma *et al.*, 2002). Thus, stronger incorporation of company- and system-level factors could lead to the development of more substantially sustainability-oriented companies that enable regime shifts.

5.3 Limitations

This thesis aims to provide insights into the actors involved in sustainability transitions. However, the empirical sample of the actors was from Finland. Thus, the findings of this thesis are derived from a highly industrialised European country that one could describe as privileged. The findings of this thesis do not address the actors, or agency, of developing countries. The question of how individual and company actors contribute to sustainability transitions in developing countries remains unanswered. Arguably, the findings of this thesis cannot be generalised globally. However, the implications of the thesis may be relevant to other, similar countries, such as other Nordic or European countries. Moreover, it is possible that Finland may serve as a benchmark for countries outside of Europe. In addition, Finland's small population may play a role in the total effect of actors' intentional sustainability actions in contributing to sustainability. The size of the population raises a question regarding the limits of agency: to what extent can actors within a small country have a global influence?

Another limitation of this thesis is the concept of companies as actors. In this thesis, companies are treated as unified wholes where one company equals one actor. However, Heikkurinen (2013), for example, argues that, fundamentally, a company consists of individuals in different roles and one company thus includes various views on sustainability. This implies that the essence of companies as actors of sustainability transitions may be as multidimensional as it is with the individual actors who have different rationales and practices for intentional sustainability actions. To fully understand companies as actors of sustainability transitions, the different roles within an organisation should be considered. However, in this thesis, companies' conceptions of sustainability are considered to be derived from the firms' strategies and business models and not from the individuals who form the companies.

In addition, companies and their operating environments are typically highly dynamic, with change continually emerging (Teece, 2007). The multi-level perspective may be characterised as static, and the framework is often focussed on transitions that have already occurred. While there is a need to bridge the system and company level, the question of how the multi-level perspective adapts to address the company level remains unanswered. This consideration underpins the inter- and multidisciplinary nature of agency and highlights the complexity of exploring the agents involved in sustainability transitions. This thesis does not empirically explore companies as actors. Without a doubt, empirical data would have added to the findings of this thesis.

The empirical findings of this thesis are drawn from two different qualitative data collection processes, which both took the form of interviews. Hence, while the credibility of the data is acceptable, this thesis would have been strengthened by the use of additional data, such as diaries or news articles. In addition, while qualitative research has its advantages and is a well-justified method for exploring phenomena, the empirical findings of this thesis cannot be generalised. Indeed, the objective of qualitative research is not to create generalisable findings. For that reason, additional research that is supported by quantitative methods would add to this thesis. However, this thesis has started to explore a phenomenon that has several complexities. Hence, it provides an ideal starting point from which further research involving qualitative and quantitative methods can be performed. Another limitation of the thesis concerns the literature review in Publication I. The sample was excluding journals, such as, Technological Forecasting & Social Change, Journal of Cleaner Production, and Technology Analysis and Strategic

Management that address transition literature. Despite this limitation, the journal sample led to finding several gaps in the transition literature and noting that the knowledge on actors in sustainability transitions is often scattered.

A further limitation of this work that should be noted is the focus of the research. The focus of this thesis is broad since the aim is to explore the actors, both individual and company, involved in sustainability transitions. Arguably, this is an ambitious objective as the phenomenon of actors and agency in sustainability transitions is inter- and multidisciplinary. However, the nature of sustainability science is inter- and multidisciplinary and responding to the grand challenges correspondingly requires a multidisciplinary approach. This thesis adopts several components to establish a general view of the actors involved in sustainability transitions. In addition, while knowledge of the psychosocial processes of individual actors is currently largely absent from the transition literature (Gazheli, Antal, and van den Bergh, 2015; Pesch, 2015; Bögel and Upham, 2018; Bögel *et al*., 2018), this thesis has highlighted this absence and provides tentative empirical evidence regarding the actor-level dynamics involved in sustainability transitions. This may inform future research in this exciting, yet broad field of study. Moreover, while companies as actors of sustainability is a broad phenomenon, it can justifiably be argued that examining the potential of companies in implementing sustainability across a range of research directions can further our comprehension of this topic.

References

Abdelkafi, N. and Täuscher, K. (2016) 'Business models for sustainability from a system dynamics perspective', *Organization and Environment*, 29(1), pp. 74-96.

Abell, P., Felin, T. and Foss N. (2008) 'Building micro-foundations for the routines, capabilities and performance links', *Managerial and Decision Economics*, 29, pp. 489–502.

Affolderbach, J. and Rob Krueger, R. (2017) '"Just" ecopreneurs: reconceptualising green transitions and entrepreneurship', *Local Environment*, 22(4), pp. 410–423. doi: 10.1080/13549839.2016.1210591

Ajzen, I. (1991) 'The theory of planned behavior', *Company Behavior and Human Decision Processes*, 50, pp. 179–211. doi: 10.1016/0749-5978(91)90020-T

Aldous, D. (2014) 'Understanding the complexity of the lived experiences of Foundation Degree sport lecturers within the context of Further Education', *Sport, Education and Society*, 19(4), pp. 472–88. doi: 10.1080/13573322.2012.674506

Alkemade, F., Hekkert, M.P. and Negro, S.O. (2011) 'Transition policy and innovation policy: Friends or foes?', *Environmental Innovation and Societal Transitions* 1, pp. 125–129.

Amaral, G., Marx, R. and Salerno, M. (2017) 'Investigating work organization for innovation and technological transition in the Brazilian power sector', *Gestão & Produção*, 24(2), pp. 236–247. doi: http://dx.doi.org/10.1590/0104-530X2260-15

Antadze, N. and McGowan, K. (2017) 'Moral entrepreneurship: Thinking and acting at the landscape level to foster sustainability transitions', *Environmental Innovation and Societal Transitions,* 25, pp. 1–13.

Arapostathis, S., Pearson, P. and Foxon, T. (2014) 'UK natural gas system integration in the making, 1960–2010: Complexity, transitional uncertainties and uncertain transitions', *Environmental Innovation and Societal Transitions,* 11, pp. 87–102.

Archer, M. (1995) *Realist Social Theory: The Morphogenetic Approach*. Cambridge University Press., 368 p., ISBN 0521484421

Aronson, J. (2011) 'Sustainability science demands that we define our terms across diverse disciplines', *Landscape Ecology*, 26(4), pp. 457–460. doi: 10.1007/s10980-011-9586-2.

Avelino, F. and Wittmayer, J.M. (2016) 'Shifting Power Relations in Sustainability Transitions: A Multi-actor Perspective', *Journal of Environmental Policy & Planning*, 18(5), pp. 628–649. doi: 10.1080/1523908X.2015.1112259

Avelino, F. (2017) 'Power in Sustainability Transitions: Analysing power and (dis)empowerment in transformative change towards sustainability', *Environmental Policy and Governance,* 27, pp. 505–520. doi: 10.1002/eet.1777

Baas, L. and Hjelm, O. (2015) 'Support your future today: enhancing sustainable transitions by experimenting at academic conferences', *Journal of Cleaner Production*, 98, pp. 1–7. doi: http://dx.doi.org/10.1016/j.jclepro.2015.02.059

Baker, S. (2007) 'Sustainable development as symbolic commitment: Declaratory politics and the seductive appeal of ecological modernisation in the European Union', *Environmental Politics*, 16, pp. 297-317.

Bakker, S. (2014) 'Actor rationales in sustainability transitions – Interests and expectations regarding electric vehicle recharging', *Environmental Innovation and Societal Transitions*, 13, pp. 60–74. doi: 10.1016/j.eist.2014.08.002.

Bamberg, S. and Möser, G. (2007) 'Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour', *Journal of Environmental Psycholog*y, 27, pp. 14–25. doi:10.1016/j.jenvp.2006.12.002

Banerjee, S. B. (2001) 'Corporate environmental strategies and actions', *Management Decision*, 39(1), pp. 36–44.

Bansal, P. (2005) 'Evolving sustainably: A longitudinal study of corporate sustainable development', *Strategic Management Journal*, 26(3), pp. 197–218. doi: 10.1002/smj.441.

Bansal, P., Gao, J. and Qureshi, I. (2014) 'The extensiveness of corporate social and environmental commitment across firms over time', *Company Studies*, 35, pp. 949–966.

Barker, R. (1968) *Ecological psychology: Concepts and methods for studying the environment of human behavio*r. Stanford: Stanford University Press (1st ed. in 1953).

Barnes, J., Durrant, R., Kern, F. and MacKerron, G. (2018) 'The institutionalisation of sustainable practices in cities: how initiatives shape local selection environments', *Environmental Innovation and Societal Transitions*, 29, pp 68–80. doi: https://doi.org/10.1016/j.eist.2018.04.003

Baumgartner, R. J. and Ebner, D. (2010) 'Corporate Sustainability Strategies: Sustainability Profiles and Maturity Levels', *Sustainable Development*, 18, pp. 76–89. doi: 10.1002/sd.447.

Baumol, W.J. and Oates, W.E. (1988) *The theory of environmental policy*, 2nd ed. Cambridge University Press, Cambridge, UK.

Bergek, A., Hekkert, M., Jacobsson, S., Markard, J., Sandén, B. and Truffer, B. (2015) 'Technological innovation systems in contexts: Conceptualizing contextual structures and interaction dynamics', *Environmental Innovation and Societal Transitions*, 16, pp. 51–64. doi: 10.1016/j.eist.2015.07.003.

Berger, P. L. and Luckmann, T. (1966) *The social construction of reality: A treatise in the sociology og knowledge.*, *Garden City, NY: Doubleday*. doi: 10.2307/323448.

Berggren, C., Magnusson, T. and Sushandoyo, D. (2015) 'Transition pathways revisited: Established firms as multi-level actorsin the heavy vehicle industry', *Research Policy*, 44, pp.

1017–1028.

Berkes, F. and Folke, C. (eds) (1998) *Linking social ecological systems: management practices and social mechanisms for building resilience*. Cambridge University press, Cambridge.

van den Bergh, J. C. J. M. (2007) 'Evolutionary thinking in environmental economics', *Journal of Evolutionary Economics*, 17, pp. 521–549. doi: 10.1007/s00191-006-0054-0

van den Bergh, J. C. J. M. (2013) 'Policies to enhance economic feasibility of a sustainable energy transition', *Proceedings of the National Academy of Sciences*, 110(7), pp. 2436–2437. doi: 10.1073/pnas.1221894110.

Berggren, C., Magnusson, T. and Sushandoyo, D. (2015) 'Transition pathways revisited: Established firms as multi-level actorsin the heavy vehicle industry', *Research Policy*, 44, pp. 1017–1028. doi: http://dx.doi.org/10.1016/j.respol.2014.11.009

Bettencourt, L. M. A. and Kaur, J. (2011) 'Evolution and structure of sustainability science', *Proceedings of the National Academy of Sciences of the United States of America*, 108(6), pp. 19540–19545. doi: https://doi.org/10.1073/pnas.1102712108.

Bettini, Y., Brown, R., de Haan, F. and Farrelly, M. (2015). 'Understanding institutional capacity for urbanwater transitions', *Technological Forecasting & Social Change*, 94, pp. 65–79. doi: http://dx.doi.org/10.1016/j.techfore.2014.06.002

Billett, S. (2006) 'Relational Interdependence Between Social and Individual Agency in Work and Working Life', *Mind, Culture, and Activity*, 13(1), pp. 53-69, doi: 10.1207/s15327884mca1301_5

Bird-David, N. (1993). Tribal metaphorization of human-nature relatedness: a comparative analysis. See Milton 1993, pp. 112-25.

Bocken, N., Short, S., Rana, P. and Evans, S. (2014) 'A literature and practice review to develop sustainable business model archetypes', *Journal of Cleaner Production*, 65, pp. 42–56. doi: 10.1016/j.jclepro.2013.11.039.

Bocken, N., Schuit, C. and Kraaijenhagen, C. (2018) 'Experimenting with a circular business model: Lessons from eight cases', *Environmental Innovation and Societal Transitions*, 28, pp. 79–95

Bohnsack, R. (2018) 'Local niches and firm responses in sustainability transitions: The case of low-emission vehicles in China', *Technovation*, 70–71 pp. 20–32.

Bolton, R., Foxon, T. and Hall, S. (2016) 'Energy transitions and uncertainty: Creating low carbon investment opportunities in the UK electricity sector', *Environment and Planning C: Government and Policy*, 34(8) pp. 1387–1403. doi; 10.1177/0263774X15619628

Bolton, R. and Hannon, M. (2016) 'Governing sustainability transitions through business modelinnovation: Towards a systems understanding', *Research Policy*, 45, pp. 1731–1742.

Boodoo, Z., Mersmann, F. and Holm Olsen, K. (2018) 'The implications of how climate funds conceptualize transformational change in developing countries', *Climate and Development,* 10(8), pp. 673–686. doi: 10.1080/17565529.2018.1442788

Boons, F. *et al.* (2013) 'Sustainable innovation, business models and economic performance: An overview', *Journal of Cleaner Production*, 45, pp. 1–8. doi: 10.1016/j.jclepro.2012.08.013.

Boons, F. and Lüdeke-Freund, F. (2013) 'Business models for sustainable innovation: State-of-the-art and steps towards a research agenda', *Journal of Cleaner Production*, 45, pp. 9–19. doi: 10.1016/j.jclepro.2012.07.007.

Bork, S. *et al.* (2015) 'How actors can influence the legitimation of new consumer product categories: A theoretical framework', *Environmental Innovation and Societal Transitions*, 16, pp. 38–50. doi: 10.1016/j.eist.2015.07.002.

Boulding, K.E. (1978) *Ecodynamics: a new theory of societal evolution*. Sage, Beverly Hills.

Brandt, P. *et al.* (2013) 'A review of transdisciplinary research in sustainability science', *Ecological Economics*, 92, pp. 1–15. doi: 10.1016/j.ecolecon.2013.04.008.

Brand, U. (2014) *Transition und transformation: sozialökologische perspektiven*. In: Brie, M. (Ed.), Futuring. Perspektiven Der Transformation Im Kapitalismus über Ihn Hinaus. Westfälisches Dampfboot, Münster, pp. 242–280.

Brenner, S. and Cochrane, P. (1991) The stakeholder theory of the firm: Implications for business and society theory and research. *IABS Proceedings 1991*, pp. 449-467.

Brown, R. R., Farrelly, M. A. and Loorbach, D. A. (2013) 'Actors working the institutions in sustainability transitions: The case of Melbourne's stormwater management', *Global Environmental Change*, 23, pp. 701–718. doi: 10.1016/j.gloenvcha.2013.02.013.

Brones, F.A., de Carvalho, M.M. and de Senzi Zancul, E. (2017) 'Reviews, action and learning on change management for ecodesign transition', *Journal of Cleaner Production*, 142, pp. 8–22.

Brundiers, K. and Eakin, H.C. (2018) 'Leveraging Post-Disaster Windows of Opportunities for Change towards Sustainability: A Framework', *Sustainability*, 10(1390), pp. 1–20. doi:10.3390/su10051390

Brundtland, G.H. (1987) 'Our Common Future: Report of the World Commission on Environment and Development', *United Nations Commission*, 4(1), p. 300. doi: 10.1080/07488008808408783.

Bugge, M., Coenen, L., Marques, P. and Morgan, K. (2017) Governing system innovation: assisted living experiments in the UK and Norway, *European Planning Studies*, 25(12), pp. 2138–2156. doi: 10.1080/09654313.2017.1349078

Bush, R.E., Bale, C.S.E., Powell, M., Gouldson A., Taylor, P.G. and Gale, W.F. (2017) 'The role of intermediaries in low carbon transitions – Empowering innovations to unlock district

heating in the UK', *Journal of Cleaner Production*, 148, pp. 137–147.

Bögel, P.M. and Upham, P. (2018) 'The role of psychology in sociotechnical transitions literature: A review and discussion in relation to consumption and technology acceptance', *Environmental Innovation and Societal Transitions,* 28, pp. 122–136. doi: 10.1016/j.eist.2018.01.002.

Bögel, P.M., Oltra, C., Sala, R., Lores, M., Upham, P., Dütschke, E., Schneider, U. and Wiemann, P. (2018) 'The role of attitudes in technology acceptance management: Reflections on the case of hydrogen fuel cells in Europe', *Journal of Cleaner Production*, 188, pp. 125–135. doi: https://doi.org/10.1016/j.jclepro.2018.03.266

Cambridge Dictionary. (2018) Available at: https://dictionary.cambridge.org/ [accessed 17. December 2018]

Campbell, T. (1996) 'Technology, multimedia, and qualitative research in education', *Journal of Research on Computing in Education*, 30(9), pp. 122-133.

Cashmore, M. and Wejs, A. (2014). 'Constructing legitimacy for climate change planning: A study of local government in Denmark', *Global Environmental Change*, 24, pp. 203–212.

Chang, R-D., Zuo, J., Soebarto, V., Zhao, Z-Y. and Zillante, G. (2017) 'Dynamic interactions between sustainability and competitiveness in construction firms: A transition perspective', *Engineering, Construction and Architectural Management*, 24(5), pp. 842–859. doi: https://doi.org/10.1108/ECAM-01-2016-0025

Chappin, E. J. L. and Ligtvoet, A. (2014) 'Transition and transformation: A bibliometric analysis of two scientific networks researching socio-technical change', *Renewable and Sustainable Energy Reviews*. Pergamon, 30, pp. 715–723. doi: 10.1016/J.RSER.2013.11.013.

Chelleri, L., Wei Kua, H., Sánchez, J.P.R., Nahiduzzaman, K.M. and Thondhlana, G. (2016) Are People Responsive to a More Sustainable, Decentralized, and User-Driven Management of Urban Metabolism? *Sustainability*, 8(275), pp. 1–12. doi:10.3390/su8030275

ChirifTirado, A., García Hierro, P. and Chase Smith, R. (1991). El Indigena y su Territorio Son uno Solo: Estrategias para la Defensa de los Pueblos y Territorios Indigenas en la Cuenca Amaz6nica. Lima: OXFAM Clay JW. 1994. Resource wars: nation and

Christoff, P. (1996) 'Ecological modernisation, ecological Modernities', *Environmental Politics*, 5, pp. 476-500.

Clark, W. C. (2007) 'Sustainability Science: A room of its own', *Proceedings of the National Academy of Sciences*, 104(6), pp. 1737–1738. doi: 10.1073/pnas.0611291104.

Clark, W. C. and Dickson, N. M. (2003) 'Sustainability science: the emerging research program.', *Proceedings of the National Academy of Sciences of the United States of America*, 100(14), pp. 8086–91. doi: 10.1073/pnas.1231333100.

Coad, A., Jack, L., and Kholeif, A.O.R. (2015) 'Structuration theory: reflections on its further potential for management accounting research', *Qualitative Research in Accounting & Management*, 12(2), pp. 153–171.

Coad, A., Jack, L. and Kholeif, A. (2016) 'Strong structuration theory in accounting research', *Accounting, Auditing and Accountability Journal*, 29(7), pp. 1138–1144. doi: 10.1108/AAAJ-07-2016-2625.

Cockerham, W., Rütten A. and Abel, T. (1997) 'Conceptualizing Contemporary Health Lifestyles: Moving Beyond Weber', *The Sociological Quarterly*, 38(2), pp. 321-342.

Cohen, N. and Naor, M. (2017) 'Entrepreneurial failure in the transition to electric vehicles: a case study of support for sustainability policy in Israel', *Policy and Society*, 36(4), pp. 595–610. doi: 10.1080/14494035.2017.1369678

Corley, K. and Gioia, D. (2004) 'Identity ambiguity and change in the wake of a corporate spin-off', *Administrative Science Quarterly*, 49, pp. 173–208.

Cresswell, J. W. and Miller, D. L. (2000) 'Determining validity in qualitative inquiry', *Theory into Practice*, 39(3), pp. 124–131.

Creswell, J., 2009. *Research Design: Qualitative, Quantitative and Mixed Methods Approache*s, 3rd edition. ed. SAGE Publications Ltd, Thousand Oaks, California.

Crotty, M. (1998). *The Foundations of Social Research: Meaning and Perspective in the Research Process*. Thousand Oaks, Calif.: Sage Publications

Davidson, D., Jones, K. and Parkins, J. (2016) 'Food safety risks, disruptive events and alternative beef production: a case study of agricultural transition in Alberta', *Agriculture and Human Values*, 33, pp. 359–371. doi: 10.1007/s10460-015-9609-8

Davies, D. and Dodd, J. (2002). 'Qualitative research and the question of rigor. *Qualitative Health research*', 12(2), pp. 279-289.

Dawson, T., Rounsevell, M.D.A., Kluvánková-Oravská, T., Chobotová, V. and Stirling A. (2010) 'Dynamic properties of complex adaptive ecosystems: implications for the sustainability of service provision', *Biodiversity and Conservation*, 19, pp. 2843–2853. doi: 10.1007/s10531-010-9892-z

de Almeida, M. and de Melo, M. (2017) 'Sociotechnical regimes, technological innovation and corporate sustainability: from principles to action', *Technology Analysis & Strategic Management*, 29(4), pp. 395–413, doi: 10.1080/09537325.2016.1215419

Dean, W., Sharkey, J. and Johnson, C. (2016). 'The Possibilities and Limits of Personal Agency. Food, Culture & Society', *An International Journal of Multidisciplinary Research,* 19(1), pp. 129–149.

De Bruijn, T.J.N.M. and Norberg-Bohm, V. (Eds.), (2005). *Industrial Transformation; Voluntary Collaborative and Information-based Approaches in Environmental Policies in the US and Europe*. MIT Press, Cambridge, MA.

de Gooyert, V., Rouwette, E., van Kranenburg, H., Freeman, E. and van Breen, H. (2016) 'Sustainability transition dynamics: Towards overcoming policy resistance', *Technological Forecasting & Social Change*, 111, pp. 135–145. doi: http://dx.doi.org/10.1016/j.techfore.2016.06.019

de Haan, F., Rogers, B., Brown, R. and Deletic, A. (2016) 'Many roads to Rome: The emergence of pathways from patterns of change through exploratory modelling of sustainability transitions', *Environmental Modelling & Software*, 85, pp. 279–292. doi: http://dx.doi.org/10.1016/j.envsoft.2016.05.019

de Haan, F. and Rotmans, J. (2018) 'A proposed theoretical framework for actors in transformative change', *Technological Forecasting & Social Change*, 128, pp. 275–286.

de Vries, B., Blando, J., Southard, P. and Bubeck, C. (2001). *The times of our lives*. In: G. Kenyon, P. Clark, and B. De Vries (Eds.), Narrative gerontology: Theory, research, and practice (p. 137–158). New York: Springer.

Dunlap, R. E. and Catton, W. R. Jr (1979) Environmental sociology: a framework for analysis. In: O'Riordan T, D'Arge RC (eds) *Progress in resource management and environmental planning vol 1*. Wiley, Chichester, pp. 57–85.

Dumitru, A., De Gregorio, E., Bonne, M., Bonaiuto, M., Carrus, G., Garcia-Mira, R. and Maricchiolo, F. (2016) 'Low carbon energy behaviors in the workplace: A qualitative study in Italy and Spain', *Energy Research & Social Science*, 13, pp. 49–59.

Durrant, R., Barnes, J., Kern, F. and Mackerron, G. (2018) 'The acceleration of transitions to urban sustainability: a case study of Brighton and Hove', *European Planning Studies*, 26(8), pp. 1537–1558. doi: 10.1080/09654313.2018.1489783

Dyllick, T. and Muff, K. (2015) 'Clarifying the Meaning of Sustainable Business: Introducing a Typology From Business-as-Usual to True Business Sustainability', *Organization and Environment*, 29(2), pp. 156–174. doi: 10.1177/1086026615575176.

Ebner D. and Baumgartner R.J. (2006). The Relationship Between Sustainable Development and Corporate Social Responsibility. www.crrconference.org [17 September 2007].

El Bilali, H. (2018) Transition heuristic frameworks in research on agro-food sustainability transitions, *Environment, Development and Sustainability*, pp. 1–36. doi: https://doi.org/10.1007/s10668-018-0290-0

Elder, G. (1994) 'Time, Human Agency, and Social Change: Perspectives on the Life Course', *Social Psychology Quarterly,* 57(1), pp. 4–15.

Elder, G. (1998). The life course as developmental theory. *Child Development*, 69, pp. 1–12.

Elzen, B., Geels, F. W. and Green, K. (2004) *System innovation and the transition to sustainability : theory, evidence and policy*. Edward Elgar.

Eteläpelto, A., Vähäsantanen, K., Hökkä, P. and Paloniemi, S. (2013) 'What is agency? Conceptualizing professional agency at work', *Educational Research Review*, 10, pp. 45–65.

Fallde, M. and Eklund, M. (2015) 'Towards a sustainable socio-technical system of biogas for transport: the case of the city of Linköping in Sweden', *Journal of Cleaner Production*, 98, pp. 17–28. doi: http://dx.doi.org/10.1016/j.jclepro.2014.05.089

Feola, G. (2015) 'Societal transformation in response to global environmental change: A review of emerging concepts', *Ambio*. Springer Netherlands, 44(5), pp. 376–390. doi: 10.1007/s13280-014-0582-z.

Ferguson, R. S., and S. T. Lovell. (2015). 'Grassroots engagement with transition to sustainability: diversity and modes of participation in the international permaculture movement', *Ecology and Society*, 20(4), pp. 39. doi: http://dx.doi.org/10.5751/ES-08048-200439

Fischer, L-B. and Newig, J. (2016). 'Importance of actors and agency in sustainability transitions: A systematic exploration of the literature', *Sustainability,* 8(476), pp. 2–21.

Fjellstedt, L. (2015). *Examining Multidimensional Resistance to Company Change: A Strong Structuration Approach*. The George Washington University, ProQuest LLC, Anne Arbour.

Flammer, C. (2013) 'Corporate social responsibility and shareholder reaction: The environmental awareness of investors', *Academy of Management Journal*, 56, pp. 758–781.

Folke, C., Hahn, T., Olsson, P. and Norberg, J. (2005) 'Adaptive governance of social ecological systems', *Annual Review of Environment and Resource*s, 30, pp. 441–473.

Folke, C., Carpenter, S.R., Walker, B., Scheffer, M., Chapin, T. and Rockström, J. (2010) 'Resilience thinking: integrating resilience, adaptability and transformability', *Ecology and Society*, 15(4), pp. 20.

Folke, C. et al., (2011) 'Reconnecting to the biosphere', *Ambio*, 31(5), pp. 437–40.

Franceschini. S. and Pansera, M. (2015) 'Beyond unsustainable eco-innovation: The role of narratives in the evolution of the lighting sector', *Technological Forecasting & Social Change*, 92, pp. 69–83.

Frantzeskaki, N., Wittmayer, J. and Loorbach, D. (2014) 'The role of partnerships in 'realising' urban sustainability in Rotterdam's City Ports Area, The Netherlands', *Journal of Cleaner Production*, 65, pp. 406–417.

Freeman, R. E. and Gilbert, D.R., Jr. (1992). 'Business, ethics and society: A critical agenda', *Business & Society*, 31, pp. 9.

Freire, P.A. (2018) 'Enhancing innovation through behavioral stimulation: The use of behavioral determinants of innovation in the implementation of ecoinnovation processes in industrial sectors and companies', *Journal of Cleaner Production*, 170, pp. 1677–1687.

Frie, R. (2011). 'Situated experience: psychological agency, meaning, and morality in worldly contexts', *International Journal of Psychoanalytic Self Psychology*, 6(3), pp. 340–351. doi: http:// dx.doi.org/10.1080/15551024.2011.582935

Frohlich, K. L., Corin, E. and Potvin, L. (2001) 'A theoretical proposal for the relationship between context and disease', *Sociology of Health & Illness*, 23(6), pp. 776–797.

Fudge, S., Peters, M. and Woodman, B. (2016) 'Local authorities as niche actors: The case of energy governance in the UK', *Environmental Innovation and Societal Transitions*, 18, pp. 1–17. doi: 10.1016/j.eist.2015.06.004.

Fuenfschilling, L. and Truffer, B. (2016) 'The interplay of institutions, actors and technologies in socio-technical systems — An analysis of transformations in the Australian urban water sector', *Technological Forecasting & Social Change*, 103, pp. 298–312. doi: http://dx.doi.org/10.1016/j.techfore.2015.11.023

Gaede, J. and Meadowcroft, J. (2016) 'A Question of Authenticity: Status Quo Bias and the International Energy Agency's World Energy Outlook', *Journal of Environmental Policy & Planning*, 18(5), pp. 608–627. doi: 10.1080/1523908X.2015.1116380

Gazheli, A., Antal, M. and van den Bergh, J. (2012) 'Behavioral Foundations of Sustainability Transitions', *Futures*, 69, pp. 14–30. doi: https://doi.org/10.1016/j.futures.2015.03.008

Gazheli, A., Antal, M. and van den Bergh, J. (2015) 'The behavioral basis of policies fostering long-run transitions: Stakeholders, limited rationality and social context', *Futures*, 69, pp. 14–30. doi: 10.1016/j.futures.2015.03.008.

Gaziulusoy, A. and Brezet, H. (2015) 'Design for system innovations and transitions: a conceptual framework integrating insights from sustainablity science and theories of system innovations and transitions', *Journal of Cleaner Production*, 108, pp. 558–568.

Garud, R. and Karnøe, P. (2001). Path Dependence as a Process of Mindful Deviation. *Path dependence and creation*, pp. 1–40. doi: 10.1561/100.00000006

Geels, F.W. (2002) 'Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study', *Research Policy*, 31(8–9), pp. 1257–1274. doi: 10.1016/S0048-7333(02)00062-8

Geels, F.W. (2004) 'From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory', *Research Policy*, 33(6–7), pp. 897–920. doi: 10.1016/j.respol.2004.01.015

Geels, F.W. (2005) 'Processes and patterns in transitions and system innovations: Refining the co-evolutionary multi-level perspective', *Technological Forecasting and Social Change*, 72(6), pp. 681–696. doi: 10.1016/j.techfore.2004.08.014.

Geels, F.W. (2010) 'Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective', *Research Policy*. Elsevier B.V., 39(4), pp. 495–510. doi: 10.1016/j.respol.2010.01.022

Geels, F.W. (2011) 'The multi-level perspective on sustainability transitions: Responses to seven criticisms', *Environmental Innovation and Societal Transitions*, 1(1), pp. 24–40. doi: 10.1016/j.eist.2011.02.002

Geels, F.W. (2012) *Automobility in transition? : a socio-technical analysis of sustainable transport*. Routledge. Available at: https://www.routledge.com/Automobility-in-Transition-A-Socio-Technical-Analysis-of-Sustainable/Geels-Kemp-Dudley-Lyons/p/book/9780415885058 (Accessed: 22 May 2018).

Geels, F.W. (2014a) 'Reconceptualising the co-evolution of firms-in-industries and their environments: Developing an inter-disciplinary Triple Embeddedness Framework', *Research Policy*, 43(2), pp. 261–277. doi: 10.1016/j.respol.2013.10.006.

Geels, F.W. (2014b) 'Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective', *Theory, Culture & Society*, 31(5), pp. 21–40. doi: 10.1177/0263276414531627.

Geels, F.W. and Raven, R. (2006) 'Non-linearity and expectations in niche-development trajectories: Ups and downs in Dutch biogas development (1973-2003)', *Technology Analysis and Strategic Management*, 18(3–4), pp. 375–392. doi: 10.1080/09537320600777143

Geels, F.W. and Schot, J. (2007) 'Typology of sociotechnical transition pathways', *Research Policy*, 36(3), pp. 399–417. doi: 10.1016/j.respol.2007.01.003

Geels, F.W. and Schot, J. (2010) *The Dynamics of Transitions: A Socio-Technical Perspective*, *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*. Routledge London.

Geels, F.W. and Verhees, B. (2011) 'Cultural legitimacy and framing struggles in innovation journeys: A cultural-performative perspective and a case study of Dutch nuclear energy (1945-1986)', *Technological Forecasting and Social Change*. Elsevier Inc., 78(6), pp. 910–930. doi: 10.1016/j.techfore.2010.12.004

Geels, F.W., McMeekin, A., Mylan, J. and Southerton, D. (2015) 'A critical appraisal of Sustainable Consumption and Production research: The reformist, revolutionary and reconfiguration positions', *Global Environmental Change*, 34, pp. 1–12.

Geels, F.W. *et al.* (2017) 'Sociotechnical transitions for deep decarbonization', *Science*, 357(6357), pp. 1242–1244. doi: 10.1126/science.aao3760

Genus, A. and Coles, A. M. (2008) 'Rethinking the multi-level perspective of technological transitions', *Research Policy*, 37(9), pp. 1436–1445. doi: 10.1016/j.respol.2008.05.006

George, G. *et al.* (2016) 'Understanding and Tackling Societal Grand Challenges Through Management Research', *Academy of Management Journal*, 59(6), pp. 1880–1895. doi:

10.5465/amj.2016.4007

Ghassim, B. and Foss, L. (2018) 'Understanding the micro-foundations of internal capabilities for open innovation in the minerals industry: a holistic sustainability perspective', *Resources Policy*. doi: https://doi.org/10.1016/j.resourpol.2018.09.011

Gibbs, D. and O'Neill, K. (2015) 'Building a green economy? Sustainability transitions in the UK building sector', *Geoforum*, 59, pp. 133–141.

Giddens, A. (1979). *Central Problems in Social Theory*, London: Macmillan/Berkeley: University of California Press. 294 p. ISBN: 9780520039759

Giddens, A. (1984). *The Constitution of Society*, University of California Press, Berkeley. 402 p. ISBN: 9780520052925

Gioia, D. A., Corley, K. G. and Hamilton, A. L. (2013) 'Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology', *Company Research Methods*, 16(1), pp. 15–31. doi: 10.1177/1094428112452151

Glaser, B. and Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago, IL: Aldine, 282 p. ISBN 978-0202302607.

Golafshani, N. (2003) 'Understanding Reliability and Validity in Qualitative Research', *The Qualitative Report*, 8(4), 597-606.

Gorissen, L., Vrancken, K. and Manshoven, S., 2016, 'Transition thinking and business model innovation-towards a transformative business model and new role for the reuse centers of Limburg, Belgium', *Sustainability*, 8(2), 1-23.

Gouldson, A. and Murphy, J. (1997). *Ecological modernisation: Restructuring industrial economie*s. In: M. Jacobs (Ed.), Greening the Millennium? The new politics of the environment (pp. 74-86). Oxford, UK: Blackwell.

Goyal, N. and Howlett, M. (2018) 'Technology and Instrument Constituencies as Agents of Innovation: Sustainability Transitions and the Governance of Urban Transport', *Energies*, 11, pp. 1–14. doi: 10.3390/en11051198

Grin, J., Rotmans, J. and Schot, J. (2010). *Transitions to Sustainable Development*. London: Routledge. 398 p. ISBN: 9780415876759

Grin, J., Rotmans, J. and Schot, J. (2011) 'On patterns and agency in transition dynamics: Some key insights from the KSI programme', *Environmental Innovation and Societal Transitions*. Elsevier B.V., 1(1), pp. 76–81. doi: 10.1016/j.eist.2011.04.008.

Gross, M. and Heinrichs, H. (2010). *Environmental Sociology: European Perspectives and Interdisciplinary Challenges*. Springer. 361 p. ISBN 978-90-481-8729-4

Guba, E. G. and Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research*. (pp. 105–117). Thousand Oaks, CA: Sage.

Guha, R. (1989). *Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya*. Berkeley: Univ. Calif. Press. 214 p.

Guerra-Mota, M., Aquino, Y. and Soares, I. (2018) 'European electricity utilities managing energy transition challenges', *Environment, Development and Sustainability*, 20, pp. 213–230. doi: https://doi.org/10.1007/s10668-018-0170-7

de Haan, F. J. and Rotmans, J. (2018) 'A proposed theoretical framework for actors in transformative change', *Technological Forecasting and Social Change*, 128, pp. 275–286. doi: 10.1016/j.techfore.2017.12.017.

Haley, B. (2017) 'Designing the public sector to promote sustainabilitytransitions: Institutional principles and a case study of ARPA-E', *Environmental Innovation and Societal Transitions*, 25, pp. 107–121.

Haukkala, T. (2015) 'Does the sun shine in the High North? Vested interests as a barrier to solar energy deployment in Finland', *Energy Research and Social Science*, 6, pp. 50–58. doi: 10.1016/j.erss.2014.11.005.

Hausknost, D. (2014) 'Decision, choice, solution: 'agentic deadlock' in environmental politics, *Environmental Politics*, 23(3), pp. 357–375. doi: 10.1080/09644016.2013.874138

Haxeltine, A., Whitmarsh, L., Bergman, N., Rotmans, J., Schilperoord, M. and Köhler, J. (2008) 'A conceptual framework for transition modelling', *International Journal of Innovation and Sustainable Development*, 3, pp. 93–114.

Haxeltine, A. and Seyfang, G. (2009) 'Transitions for the People : Theory and Practice of " Transition " and " Resilience " in the UK ' s Transition Movement', Presented at the 1st *European Conference on Sustainability Transitions*, (July), p. 35. Available at: http://library.uniteddiversity.coop/Transition_Relocalisation_Resilience/Transition_Network/ Transitions%20for%20the%20People.pdf.

van der Heijden, A., Cramer, J. M. and Driessen, P. P. J. (2012) 'Change agent sensemaking for sustainability in a multinational subsidiary', *Journal of Company Change Management*, 25(4), pp. 535–559. doi: 10.1108/09534811211239218.

Healy, M. and Perry, C. (2000) 'Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm', *Qualitative Market Research*, 3(3), pp. 118-126.

Heikkurinen, P. (2013). *Reframing strategic corporate responsibility: from economic instrumentalism and stakeholder thinking to awareness and sustainable development*. Helsinki: Aalto University publication series Doctoral dissertations.

Hekkert, M. P. *et al.* (2007) 'Functions of innovation systems: A new approach for analysing

technological change', *Technological Forecasting and Social Change*, 74(4), pp. 413–432. doi: 10.1016/j.techfore.2006.03.002.

Hermans, F., Roep, D. and Klerkx, L. (2016) 'Scale dynamics of grassroots innovations through parallel pathways of transformative change', *Ecological Economics*, 130, pp. 285–295. doi: http://dx.doi.org/10.1016/j.ecolecon.2016.07.011

Hertwich, E. and Peters, G. (2009) 'Carbon footprint of nations: a global, trade-linked analysis', *Environmental Science & Technology*, 43(16), pp. 6414-6420.

Higgs, E. S. (2003). *Nature by design: people, natural process, and ecological restoration*. MIT Press, Cambridge, MA

Hildén M., Jordan, A. and Huitema, D. (2017) 'Special issue on experimentation for climate change solutions editorial: The search for climate change and sustainability solutions - The promise and the pitfalls of experimentation', *Journal of Cleaner Production*, 169, pp. 1–7.

Hipps, J. A. (1993). *Trustworthiness and authenticity: Alternate ways to judge authentic assessments*. Paper presented at the annual meeting of the American Educational Research Association. Atlanta, GA.

Hirsch Hadorn, G. *et al.* (2006) 'Implications of transdisciplinarity for sustainability research', *Ecological Economics*, 60(1), pp. 119–128 doi: 10.1016/j.ecolecon.2005.12.002.

Hoogma, R. *et al.* (2002) *Experimenting for Sustainable Transport. The Approach of Strategic Niche Management*. 212 p. Taylor & Francis. ISBN 9780415271172

Hynes, M. (2016) 'Developing (tele)work? A multi-level sociotechnical perspective of telework in Ireland', *Research in Transportation Economics*, 57, pp. 21–31. doi: 10.1016/j.retrec.2016.06.008.

Hyysalo, S., Lukkarinen, J., Kivimaa, P., Lovio, R., Temmes, A., Hildén, M., Tatu Marttila, T., Auvinen, K., Perikangas, S., Pyhälammi, A., Peljo, J., Kaisa Savolainen, K., Hakkarainen, L., Rask, M., Matschoss, K., Huomo, T., Annukka Berg, A. and Pantsar, M. (2019) 'Developing Policy Pathways: Redesigning Transition Arenas for Mid-Range Planning', *Sustainability*, 11, 603, pp. 1–22. doi:10.3390/su11030603

Hölscher, K., Wittmayer, J.M. and Loorbach, D. (2018) 'Transition versus transformation: what's the difference?', *Environmental Innovation and Societal Transitions*, 27, pp. 1–3. doi: 10.1016/j.eist.2017.10.007.

Imbert, E., Luana Ladu, L., Tani, A. and Moronea, P. (2019) 'The transition towards a bio-based economy: A comparative study based on social network analysis', *Journal of Environmental Management*, 230, pp. 255–265. doi: https://doi.org/10.1016/j.jenvman.2018.09.068

Iñigo, E.A. and Albareda, L. (2016) 'Understanding sustainable innovation as a complex adaptive system: a systemic approach to the firm', *Journal of Cleaner Production*, 126, pp. 1–20. doi: http://dx.doi.org/10.1016/j.jclepro.2016.03.036

Isaksson, K. and Satu Heikkinen, S. (2018) 'Sustainability Transitions at the Frontline. Lock-in and Potential for Change in the Local Planning Arena', *Sustainability*, 10, 840, pp. 1–17. doi:10.3390/su10030840

Ivanova, D., Stadler, K., Steen-Olsen, K., Wood, R., Vita, G., Tukker, A. and Hertwich, E. (2016) 'Environmental impact assessment of household consumption', *Journal of Industrial Ecology*, 20(3), pp. 526–536.

Jackson, T. (2009) *Prosperity without growth : economics for a finite planet*. 264 p. Earthscan. ISBN 9781844078943

Jacobsson, S. and Karltorp, K. (2013) 'Mechanisms blocking the dynamics of the European offshore wind energy innovation system—challenges for policy intervention', *Energy Policy*, 63, pp. 1182–1195.

Jang, Y., Haley, W. E., et al. (2002). Life events and stres*s*. In: D. Ekerdt, R. Applebaum, K. Holden, S. Post, K. Rockwood, R. Schulz, et al. (Eds.), *Encyclopedia of aging* (pp. 784-789). New York: Macmillan Reference USA.

Jerneck, A. *et al.* (2011) 'Structuring sustainability science', *Sustainability Science*, 6(1), pp. 69–82. doi: 10.1007/s11625-010-0117-x.

Johannessen, Å., and Wamsler, C. (2017) 'What does resilience mean for urban water services?', *Ecology and Society*, 22(1) pp. 1. doi: https://doi.org/10.5751/ES-08870-220101

Johansson, P.O. (1987). *The economic theory and measurement of environmental benefits*. Cambridge University Press, Cambridge, UK.

Johnson, S. D. (1995) 'Will our research hold up under scrutiny?', *Journal of Industrial Teacher Education,* 32(3), pp. 3–6.

Johnson, B. R. (1997) 'Examining the validity structure of qualitative research', *Education*, 118(3), pp. 282–292.

Johnston, B. (2010) 'Social Responsibility and the Anthropological Citizen', *Current Anthropology*, 51(2), pp. 235–247.

Johnstone, P., Stirling, A. and Sovacool, B. (2017) 'Policy mixes for incumbency: Exploring the destructive recreation of renewable energy, shale gas 'fracking,' and nuclear power in the United Kingdom', *Energy Research & Social Science*, 33, pp. 147–162. doi: http://dx.doi.org/10.1016/j.erss.2017.09.005

Järnberg, L., Kautsky, E.E., Dagerskog, L. and Olsson, P. (2018) 'Green niche actors navigating an opaque opportunity context: Prospects for a sustainable transformation of Ethiopian agriculture', *Land Use Policy*, 71, pp. 409–421. doi: https://doi.org/10.1016/j.landusepol.2017.11.053

Kahiluoto, H., Kuisma M., Kuokkanen A., Mikkilä, M., and Linnanen, L. (2014) 'Taking planetary nutrient boundaries seriously: Can we feed the people?', *Global Food Security*.

Elsevier, 3(1), pp. 16–21. doi: 10.1016/j.gfs.2013.11.002.

Kates, R. W. *et al.* (2001) 'Environment and development. Sustainability science.', *Science (New York, N.Y.)*. American Association for the Advancement of Science, 292(5517), pp. 641–2. doi: 10.1126/SCIENCE.1059386.

Kates, R. W. and Parris, T. M. (2003) 'Long-term trends and a sustainability transition', *Proceedings of the National Academy of Sciences*, 100(14), pp. 8062–8067. doi: 10.1073/pnas.1231331100.

Kauffman, S. (1995). *At Home in the Universe: The Search for the Laws of Self- Company and Complexity*. Oxford University Press, New York.

Kemp, R. (1994). Technology and the transition to environmental sustainability. *Futures* 26, pp. 1023–1046.

Kemp, R. and Loorbach, D. (2003) 'Governance for Sustainability through Transition Management', *Open Meeting of the Human Dimensions of Global Environmental Change Research Community*, pp. 1–14. Available at: http://sedac.ciesin.columbia.edu/openmtg/docs/kemp.pdf.

Kemp, R. and Rotmans, J. (2004). Managing the transition to sustainable mobility. In: B. Elzen, F. W. Geels, & K. Green (Eds.), *System innovation and the transition to sustainability. Theory, evidence and policy*. Cheltenham: Edward Elgar.

Kemp, R., Schot, J. and Hoogma, R. (1998) 'Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management', *Technology Analysis & Strategic Management*, 10(2), pp. 175–198. doi: 10.1080/09537329808524310.

Kern, F. and Howlett, M. (2009) 'Implementing transition management as policy reforms: A case study of the Dutch energy sector', *Policy Sciences*, 42(4), pp. 391–408. doi: 10.1007/s11077-009-9099-x

Kern, F. (2015). 'Engaging with the politics, agency and structures in the technological innovation systems approach', *Environmental Innovation and Societal Transitions*, 16, pp. 67–69. doi: http://dx.doi.org/10.1016/j.eist.2015.07.001

Kern, F., Verhees, B., Raven, R. and Smith, A. (2015) 'Empowering sustainable niches: Comparing UK and Dutch offshore wind developments', *Technological Forecasting & Social Change*, 100, pp. 344–355.

Kiefer, C., Del Río González, P. and Carrillo-Hermosilla, J. (2018) 'Drivers and barriers of eco-innovation types for sustainable transitions: A quantitative perspective', *Business Strategy and the Environment*, pp. 1–18. doi: 10.1002/bse.2246

King, B. (2008) 'Perspective of Stakeholder Collective Action and Influence', *Business and Society*, 47(1), pp. 21–49. doi: 10.1177/0007650307306636.

Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A.

and Hekkert, M.P. (2018) 'Barriers to the Circular Economy: Evidence From the European Union (EU)', *Ecological Economics*, 150, pp. 264–272.

Kishna, M., Niesten, E., Negro, S. and, Hekkert, M.P. (2017) 'The role of alliances in creating legitimacy of sustainable technologies: A study on the field of bio-plastics', *Journal of Cleaner Production*, 155, pp. 7–16. doi: http://dx.doi.org/10.1016/j.jclepro.2016.06.089

Kivimaa, P. (2014) 'Government-affiliated intermediary companies as actors in system-level transitions', *Research Policy*, 43(8), pp. 1370–1380. doi: https://doi.org/10.1016/j.respol.2014.02.007

Kivimaa, P. and Kern, F. (2016) 'Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions', *Research Policy*, 45(1), pp. 205–217.

Kivimaa, P. and Martiskainen, M. (2018) 'Dynamics of policy change and intermediation: The arduous transition towards low-energy homes in the United Kingdom', *Energy Research & Social Science*, 44, pp. 83–99. doi: https://doi.org/10.1016/j.erss.2018.04.032

Klinke, A. (2017) 'Dynamic multilevel governance for sustainable transformation as postnational configuration', *Innovation: The European Journal of Social Science Research*, 30(3), pp. 323–349. doi: 10.1080/13511610.2016.1205969

Klitkou, A. *et al.* (2015) 'The role of lock-in mechanisms in transition processes: The case of energy for road transport', *Environmental Innovation and Societal Transitions*. Elsevier B.V., 16, pp. 22–37. doi: 10.1016/j.eist.2015.07.005.

Koehrsen, J. (2018) 'Religious agency in sustainability transitions: Between experimentation, upscaling, and regime support', *Environmental Innovation and Societal Transitions*, 27, pp. 4–15.

Koistinen, K., Teerikangas, S., Mikkilä, M. and Linnanen, L. (2018a) 'Agent-Based Change in Facilitating Sustainability Transitions', in *Handbook of Engaged Sustainability*. Cham: Springer International Publishing, pp. 1–23. doi: 10.1007/978-3-319-53121-2_31-1.

Koistinen, K., Laukkanen, M., Mikkilä, M., Huiskonen, J., and Linnanen, L. (2018b) Sustainable system value creation: Development of preliminary frameworks for a business model change within a systemic transition process. In: *Sustainable business models: Principles, Promise, and Practice*. Moratis, L., Melissen, F., and Idowu, S., ed., pp. 105-127. Springer International Publishing. ISBN 978-3-319-73502-3

Konrad, K., Markard, J., Ruef, A. and Truffer, B. (2012) 'Strategic responses to fuel cell hype and disappointment', *Technological Forecasting & Social Change*, 79, pp. 1084–1098. doi: 10.1016/j.techfore.2011.09.008

Kuhmonen, T. (2017) 'Exposing the attractors of evolving complex adaptive systems by utilising futures images: Milestones of the food sustainability journey', *Technological Forecasting & Social Change*, 114, pp. 214–225. doi: http://dx.doi.org/10.1016/j.techfore.2016.08.015

Kuokkanen, A. (2016). *Understanding complex system change for a sustainable food system.* Lappeenranta: Lappeenranta University of technology publication series, Doctoral dissertations.

Kuokkanen, A., Nurmi, A., Mikkilä, M., Kuisma M., Kahiluoto, H. and Linnanen, L. (2018) 'Agency in regime destabilization through the selection environment: The Finnish food system's sustainability transition', *Research Policy*, 47, pp. 1513–1522.

Köhler, J., Geels, F.W., Kern, F., Markard, J., Wieczorek, A., Alkemade, F., Avelino, F., Bergek, A., Boons, F., Fünfschilling, L., Hessk, D., Georg Holtz, G., Hyysalo, S., Jenkins, K., Kivimaa, P., Martiskainen, M., McMeekin, A., Mühlemeier, M.S., Nykvist, B., Onsongo, E., Pel, B., Raven, R., Rohracher, H., Sandén, B., Schot, J., Sovacool, B., Turnheim, B., Welch, D. and Wells, P. (2019) 'An agenda for sustainability transitions research: State of the art and future directions', *Environmental Innovation and Societal Transitions*, in press. doi: https://doi.org/10.1016/j.eist.2019.01.004

Lamprinopoulou, C., Renwick, A., Klerkx, L., Hermans, F. and Roep, D. (2014) 'Application of an integrated systemic framework for analysing agricultural innovation systems and informing innovation policies: comparing the Dutch and Scottish agrifood sectors', *Agricultural Systems*, 129, pp. 40–54.

Lang, D. J. *et al.* (2012) 'Transdisciplinary research in sustainability science: Practice, principles, and challenges', *Sustainability Science*, 7, pp. 25–43. doi: 10.1007/s11625-011-0149-x.

Lasky, S. (2005) 'A sociocultural approach to understanding teacher identity, agency and professional vulnerability in a context of secondary school reform', *Teaching and Teacher Education*, 21(8), pp. 899–916.

Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society.* Milton Keynes: Open University Press.

Latour, B. (1996) 'On actor-network theory: A few clarifications', *Soziale Welt*. Nomos Verlagsgesellschaft mbH, pp. 369–381. doi: 10.2307/40878163.

Latour, B. (2005). *Reassembling the Social: An Introduction to Actor-Network-Theory*, Oxford: Oxford University Press.

Laukkanen, M. and Patala, S. (2014) 'Analysing barriers to sustainable business model innovations: Innovation systems approach', I*nternational Journal of Innovation Management,* 18(6), pp. 21 doi: https://doi.org/10.1142/S1363919614400106

Law, J. (1992). 'Notes on the Theory of the Actor-Network: Ordering, Strategy and Heterogeneity', *Systems Practice*, 5, pp. 379-93.

Law, J. (2008) Actor-network theory and material semiotics. In: Turner, Bryan S. ed. *The New Blackwell Companion to Social Theory*, 3rd Edition. Oxford: Blackwell, pp. 141–158.

Lincoln, Y. S. and Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage.

Little, P. E. (1999) 'Environments and Environmentalisms in Anthropological Research : Facing a New Millennium Author (s): Paul E . Little Published by : Annual Reviews Stable URL : http://www.jstor.org/stable/223395 REFERENCES Linked references are available on JSTOR for th', *Annual Review of Anthropology*, 28(May), pp. 253–284.

Lockwood, M., Kuzemko, C., Mitchell, C., and Hoggett, R. (2017) 'Historical institutionalism and the politics of sustainable energy transitions: A research agenda', *Environment and Planning C: Politics and Space*, 35(2), pp. 312–333. doi: https://doi.org/10.1177/0263774X16660561

Long, T.B., Looijen, A. and Blok, V. (2018) 'Critical success factors for the transition to business models for sustainability in the food and beverage industry in the Netherlands', *Journal of Cleaner Production*, 175, pp. 82–95. doi: https://doi.org/10.1016/j.jclepro.2017.11.067

Loorbach, D. (2010) 'Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework', *Governance*, 23(1), pp. 161–183. doi: 10.1111/j.1468-0491.2009.01471.x.

Loorbach, D. and Rotmans, J. (2010) 'The practice of transition management: Examples and lessons from four distinct cases', *Futures*. Elsevier Ltd, 42(3), pp. 237–246. doi: 10.1016/j.futures.2009.11.009.

Loorbach, D. *et al.* (2016) 'The economic crisis as a game changer? Exploring the role of social construction in sustainability transitions', *Ecology and Society*, 21(4). doi: 10.5751/ES-08761-210415.

Loorbach, D., Frantzeskaki, N. and Avelino, F. (2017) 'Sustainability transitions research: transforming science and practice for societal change', *Annual Review of Environmental Resources*, 42(1), pp. 599–626. doi: https://doi.org/10.1146/annurev-environ-102014-021340

López, F.J.D. and Montalvo, C. (2015) 'A comprehensive review of the evolving and cumulative nature of eco-innovation in the chemical industry', *Journal of Cleaner Production*, 102, pp. 30–43.

Lüdeke-Freund, F. (2010) Towards a conceptual framework of business models for sustainability. In: *ERSCP-EMU Conference*, Delft, The Netherlands, pp. 1-28.

Magnusson, D. (2016) 'Who brings the heat? – From municipal to diversified ownership in the Swedish district heating market post-liberalization', *Energy Research & Social Science*, 22, pp. 198–209.

Markard, J. (2011) 'Transformation of infrastructures: sector characteristics and implications for fundamental change', *Journal of Infrastructure Systems (ASCE),* 17, pp. 107–117.

Markard, J., Raven, R. and Truffer, B. (2012) 'Sustainability transitions: An emerging field of research and its prospects', *Research Policy*, 41(6), pp. 955–967. doi: 10.1016/j.respol.2012.02.013

Markard, J., Suter, M. and Ingold, K. (2016) 'Socio-technical transitions and policy change – Advocacy coalitions in Swiss energy policy', *Environmental Innovation and Societal Transitions*. Elsevier, 18, pp. 215–237. doi: 10.1016/J.EIST.2015.05.003

Markard, J. and Truffer, B. (2008) 'Technological innovation systems and the multi-level perspective: Towards an integrated framework', *Research Policy*, 37(4), pp. 596–615. doi: 10.1016/j.respol.2008.01.004

Markman, G.D. and Waldron, T.L. (2014). 'Small entrants and large incumbents: a framework of micro entry', *The Academy of Management Perspectives*, 28(2), pp. 179–197.

Marletto, G. (2018) 'Who will drive the transition to self-driving? A socio-technical analysis of the future impact of automated vehicles', *Technological Forecasting & Social Change*. doi: https://doi.org/10.1016/j.techfore.2018.10.023

Matten, D. and Moon, J. (2008). '"Implicit" and "explicit" CSR: A conceptual framework for a comparative understanding of corporate social responsibility', *Academy of Management Review*, 33, pp. 404–424.

Matschoss, K. and Heiskanen, E. (2018) 'Innovation intermediary challenging the energy incumbent: enactment of local socio-technical transition pathways by destabilisation of regime rules', *Technology Analysis & Strategic Management*, 30(12), pp. 1455–1469. doi: 10.1080/09537325.2018.1473853

Mazur, C., Contestabile, M., Offer, G.J. and Brandon, N.P. (2015) 'Understanding the drivers of fleet emission reduction activities of the German car manufacturers', *Environmental Innovation and Societal Transitions*, 16, pp. 3–21.

McWilliams, A. and Siegel, D.S. (2001) 'Corporate social responsibility: A theory of the firm perspective', *Academy of Management Review*, 26, pp. 117–127.

Meadowcroft, J. (2009) 'What about the politics? Sustainable development, transition management, and long term energy transitions', *Policy Sciences*, 42(4), pp. 323–340. doi: 10.1007/s11077-009-9097-z.

Meadows, D. H., Meadows, D. L., Randers, J. and Behrems, W. (1972). *The Limits to growth*. 1st edn. 205 p. New York: Universe Books.

Mejía-Dugand, S., Hjelm, O. and Baas, L. (2017) 'Public utility companies in liberalized markets – The impact of management models on local and regional sustainability', *Utilities Policy*, 49, pp. 137–144.

Mercure, J-F. (2015) 'An age structured demographic theory of technological change', *Journal of Evolutionary Economics*, 25, pp. 787–820. doi: 10.1007/s00191-015-0413-9

Mercure, J-F., Pollitt, H., Bassi, A., Viñuales, J. and Edwards, N. (2016) 'Modelling complex systems of heterogeneous agents to better design sustainability transitions policy', *Global Environmental Change*, 37, pp. 102–115, https://doi.org/10.1016/j.gloenvcha.2016.02.003.

Merrie, A. and Olsson, P. (2014) 'An innovation and agency perspective on the emergence and spread of Marine Spatial Planning', *Marine Policy*, 44, pp. 366–374.

Miles, M. B. and Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA, US: Sage Publications, Inc.

Montiel, I. (2008) 'Corporate social responsibility and corporate sustainability: Separate pasts, common futures', *Organization and Environment*, 21(3), pp. 245–269. doi: 10.1177/1086026608321329.

Mossberg, J., Söderholm, P., Hellsmark H. and Nordqvist, S. (2018) 'Crossing the biorefinery valley of death? Actor roles and networks in overcoming barriers to a sustainability transition', *Environmental Innovation and Societal Transitions*, pp. 83–101. doi: 10.1016/j.eist.2017.10.008.

Mäkitie, T., Andersen, A.D., Hanson, J., Normann, H.E. and Thune, T.M. (2018) 'Established sectors expediting clean technology industries? The Norwegian oil and gas sector's influence on offshore wind power', *Journal of Cleaner Production*, 177, pp. 813–823.

Nasiri, M., Rantala, T., Saunila, M., Ukko, J. and Rantanen, H. (2018) 'Transition towards Sustainable Solutions: Product, Service, Technology, and Business Model', *Sustainability*, 10(358). pp. 1–18. doi:10.3390/su10020358

Nelson, R.R. and Winter, S. (1982). *An evolutionary theory of economic change*. Harvard University Press, Cambridge, MA.

Newton, P. and Newman, P. (2015) 'Critical Connections: The Role of the Built Environment Sector in Delivering Green Cities and a Green Economy', *Sustainability*, 7, pp. 9417–9443. doi: doi:10.3390/su7079417

Norgaard, R.B. (1984) 'Coevolutionary development potential', *Land Economics*, 60, pp. 160–173.

Normann, H.E. (2017) 'Policy networks in energy transitions: The cases of carbon capture and storage and offshore wind in Norway', *Technological Forecasting & Social Change*, 118, pp. 80–93.

Novalia, W., Brown, R.R., Rogers, B.C. and Bos, J.J. (2018). 'A diagnostic framework of strategic agency: Operationalising complex interrelationships of agency and institutions in the urban infrastructure sector', *Environmental Innovation and Societal Transitions*, 83, pp.11–21.

Nye, M., Whitmarsh, L. and Foxon, T. (2010) 'Sociopsychological perspectives on the active roles of domestic actors in transition to a lower carbon electricity economy', *Environment and Planning A*, 42(3), pp. 697–714. doi: 10.1068/a4245.

Nykvist, B. and Nilsson, M. (2015) 'The ev paradox—A multilevel study of why stockholm is not a leader in electric vehicles', *Environmental Innovation and Societal Transitions*, 14, 26–44.

O'Brien, K. (2012). Global environmental change II: From adaptation to deliberate transformation. *Progress in Human Geography* 36, pp. 667–676.

Oishi, S., Kesebir, S. and Snyder, B. H. (2009) 'Sociology: A lost connection in social psychology', *Personality and Social Psychology Review*, 13(4), pp. 334–353. doi: 10.1177/1088868309347835.

Ollivier, G., Magda, D., Mazé, A., Plumecocq, G. and Lamine, C. (2018) 'Agroecological transitions: What can sustainability transition frameworks teach us? An ontological and empirical analysis', *Ecology and Society*, 23(2), pp. 5. doi: https://doi.org/10.5751/ES-09952-230205

Olsson, P. and Galaz, V. (2012) *Social-Ecological Innovation and Transformation. In Social Innovation*. Palgrave Macmillan. pp. 223–47.

Olsson, P., Galaz, V. and Boonstra, W. J. (2014) 'Sustainability transformations: A resilience perspective', *Ecology and Society*, 19(4). doi: 10.5751/ES-06799-190401.

Partzsch, L. (2017) ''Power with' and 'power to' in environmental politics and the transition to sustainability', *Environmental Politics*, 26(2), pp. 193–211, doi: 10.1080/09644016.2016.1256961

Patterson, J., Schulz, K., Vervoort, J., van der Hel, S., Widerberg, O., Adler, C., Hurlbert, M., Anderton, K., Sethi, M. and Barau, A. (2016). Exploring the governance and politics of transformations towards sustainability. *Environmental Innovation and Societal Transition*, 24, pp. 1–16. http://dx.doi.org/10.1016/j.eist.2016.09.001.

Patton, M. Q. (2001). *Qualitative evaluation and research methods* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Pesch, U. (2015) 'Tracing discursive space: Agency and change in sustainability transitions', *Technological Forecasting and Social Change*. Elsevier Inc., 90(PB), pp. 379–388. doi: 10.1016/j.techfore.2014.05.009.

Pesch. U., Vernay, A-L., van Bueren, E. and Iverot, S.P. (2017) 'Niche entrepreneurs in urban systems integration: On the role of individuals in niche formation', *Environment and Planning A*, 49(8), pp. 1922–1942. doi: 10.1177/0308518X17705383

Pflitsch, G. and Radinger-Peer, V. (2018) 'Developing Boundary-Spanning Capacity for Regional Sustainability Transitions—A Comparative Case Study of the Universities of Augsburg (Germany) and Linz (Austria)', *Sustainability*, 10(918), pp. 1–26. doi: 10.3390/su10040918

Pigford, A-A.E., Hickey, G.M. and Klerkx, L. (2018) 'Beyond agricultural innovation systems? Exploring an agricultural innovation ecosystems approach for niche design and development in sustainability transitions', *Agricultural Systems*, 164, pp. 116–121.

Pitt, H. and Jones, M. (2016) 'Scaling up and out as a Pathway for Food System Transitions', *Sustainability*, 8(1025), pp. 1–16. doi: 10.3390/su8101025

Polzin, F., Sanders, M. and Täube, F. (2017) 'A diverse and resilient financial system for investments in the energy transition', *Current Opinion in Environmental Sustainability*, 28, pp. 24–32. doi: http://dx.doi.org/10.1016/j.cosust.2017.07.004

Ponterotto, J. (2005) 'Qualitative Research in Counseling Psychology: A Primer on Research Paradigms and Philosophy of Science', *Journal of Counseling Psychology*, 52(2), pp. 126–136. doi: 10.1037/0022-0167.52.2.126

Pontusson, J. (2011). Once Again A Model: Nordic Social Democracy in a Globalized World. In: Shoch, James; Ross, George W.; Cronin, James E. (Eds.) *What's Left of the Left: Democrats and Social Democrats in Challenging Times*. Duke University Press. pp. 89–115. ISBN 9780199322510.

Ramos-Mejía, M. and Alejandro Balanzo, A. (2018) 'What It Takes to Lead Sustainability Transitions from the Bottom-Up: Strategic Interactions of Grassroots Ecopreneurs, *Sustainability*', 10(2294), pp. 1–20. doi: 10.3390/su10072294

Randelli, F. and Rocchi, B. (2017) 'Analysing the role of consumers within technologicalinnovation systems: The case of alternative food networks', *Environmental Innovation and Societal Transitions*, 25, pp. 94–106. doi: http://dx.doi.org/10.1016/j.eist.2017.01.001

Rauschmayer, F., Omann, I., and Frühmann, J. (2011). *Sustainable Development: Capabilities, Needs, and Well-Being*. New York: Routledge.

Rauschmayer, F., Bauler, T. and Schäpke, N. (2015). 'Towards a thick understanding of sustainability transitions — Linking transition management, capabilities and social practices', *Ecological Economics*, 109, pp. 211–221. doi: http://dx.doi.org/10.1016/j.ecolecon.2014.11.018

Rip, A. and Kemp, R. (1998) 'Technological Change'. In S. Rayner, & E. L. Malone (Eds.), *Human choice and climate change. Vol. II, Resources and Technology* (pp. 327-399). Columbus, Ohio: Battelle Press.

Robbins, S.P., Judge, T.A. and Campbell T.T. (2010). *Company Behaviour*. Pearson Education Limited, Essex.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., *et al.* (2009) 'A safe operating space for humanity', *Nature*, 461(7263), pp. 472–475. doi: 10.1038/461472a.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E., *et al.* (2009) 'Planetary boundaries: Exploring the safe operating space for humanity', *Ecology and Society*, 14(2). doi: 10.5751/ES-03180-140232

Rogge, K.S. and Schleich, J. (2018) 'Do policy mix characteristics matter for low-carbon innovation? A survey-based exploration of renewable power generation technologies in Germany', *Research Policy*, 47(9), pp.1639–1654. doi: https://doi.org/10.1016/j.respol.2018.05.011

Rogers, B., Brown, R., de Haan, F. and Deletic, A. (2015) 'Analysis of institutional work on innovation trajectories in water infrastructure systems of Melbourne, Australia', *Environmental Innovation and Societal Transitions*, 15, pp. 42–64. doi: http://dx.doi.org/10.1016/j.eist.2013.12.001

Rosin, C., Legun, K., Campbell, H. and Sautier, M. (2017) 'From compliance to co-production: Emergent forms of agency in Sustainable Wine Production in New Zealand', *Environment and Planning A: Economy and Space*, 49(12), pp. 2780–2799. doi: https://doi.org/10.1177/0308518X17733747

Rothenberg, S. and Levy, D. L. (2012) 'Corporate Perceptions of Climate Science', *Business & Society*, 51(1), pp. 31–61. doi: 10.1177/0007650311427424.

Rothaermel, F. (2001). Incumbent's advantage through exploiting complementary assets via inter firm cooperation. *Strategic Management Journal*, 22 (6–7), pp. 687–699.

Rotmans, J., Kemp, R. and van Asselt, M. (2001) 'More evolution than revolution: transition management in public policy', *Foresight*, 3(1), pp. 15–31. doi: 10.1108/03684920610675157

Saintier, S. (2017) 'Community Energy Companies in the UK: A Potential Model for Sustainable Development in "Local" Energy?', *Sustainability*, 9(1325), pp. 1–18. doi:10.3390/su9081325

Salonen, A. and Konkka, J. (2017). Kun tyytyväisyys ratkaisee. Nuorten suhtautuminen globaaleihin haasteisiin, käsitykset ihanneyhteiskunnasta ja toiveet omasta tulevaisuudesta. In: *Katse Tulevaisuudessa, Nuorisobarometri 2016*; Myllyniemi, S., Ed.; Opetus-ja Kulttuuriministeriö, Valtion Nuorisoneuvosto ja Nuorisotutkimusverkosto: Helsinki, Finland, pp. 137–156.

Salonen, A., Siirilä, J. and Valtonen, M. (2018). 'Sustainable Living in Finland: Combating Climate Change in Everyday Life', *Sustainability*, 10(104), pp. 2–16. doi: 10.3390/su10010104

Sarasini, S. and Linder, M. (2018) 'Integrating a business model perspective into transition theory: The example of new mobility services', *Environmental Innovation and Societal Transitions*, 27, pp. 16–31. doi: http://dx.doi.org/10.1016/j.eist.2017.09.004

Sarrica, M., Brondi, S., Cottone, P. and Mazzara, B.M. (2016) 'One, no one, one hundred thousand energy transitions in Europe: The quest for a cultural approach', *Energy Research and Social Science*, 13, pp. 1–14. doi: 10.1016/j.erss.2015.12.019.

Scholz, R. W. (2011) *Environmental literacy in science and society : from knowledge to decisions*. 1st edn. Cambridge University Press.

Schot, J., Hoogma, R. and Elzen, B. (1994) 'Strategies for shifting technological systems: The case of the automobile system', *Futures*. Pergamon, 26(10), pp. 1060–1076. doi: 10.1016/0016-3287(94)90073-6.

Schnaiberg, A. (1980) *The environment: from surplus to scarcity*. Oxford University Press, New York

Schwandt, D.R. and Szabla, D.B. (2013). Structuration Theories And Complex Adaptive Social Systems: Inroads To Describing Human Interaction Dynamics. Emergence: *Complexity and Organization,* 15(4), pp. 1–20.

Schwandt, T. A. (2000). Three epistemological stances for qualitative inquiry: Interpretivism, hermeneutics, and social constructionism. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 189–213). Thousand Oaks, CA: Sage.

Schulte, J. and Hallstedt, S.I. (2018) 'Company Risk Management in Light of the Sustainability Transition', *Sustainability*, 10(4137), pp. 1–25. doi:10.3390/su10114137

Sciarra, D. (1999). The role of the qualitative researcher. In M. Kopala & L. A. Suzuki (Eds.), *Using qualitative methods in psychology* (pp. 37–48). Thousand Oaks, CA: Sage.

Seale, C. (1999). Quality in qualitative research. *Qualitative Inquiry*, 5(4), pp. 465–478.

Seyfang, G. and Haxeltine, A. (2012) 'Growing grassroots innovations: Exploring the role of community-based initiatives in governing sustainable energy transitions', *Environment and Planning C: Government and Policy*, 30(3), pp. 381–400. doi: 10.1068/c10222.

Shaw, A. *et al.* (2014) 'Accelerating the sustainability transition: Exploring synergies between adaptation and mitigation in British Columbian communities', *Global Environmental Change*. Elsevier Ltd, 25(1), pp. 41–51. doi: 10.1016/j.gloenvcha.2014.01.002.

Sherwin, S. (2009). 'Relational Existence and Termination of Lives: When Embodiment Precludes Agency', in: *Embodiment and Agency*, Sue Campbell, Letitia Meynell, and Susan Sherwin (Eds.), pp. 145–152. University Park: Pennsylvania State University Press.

Shove, E., Pantzar, M. and Watson, M. (2012) *The dynamics of social practice : everyday life and how it changes*. 208 p. SAGE. ISBN 9781446258170

Shove, E. and Walker, G. (2007) 'Caution! Transitions Ahead: Politics, Practice, and Sustainable Transition Management', *Environment and Planning A*. SAGE PublicationsSage UK: London, England, 39(4), pp. 763–770. doi: 10.1068/a39310.

Simons, L. (2015). *Changing the food game: market transformation strategies for sustainable agriculture*. Greenleaf Publishing Limited, Sheffield, UK.

Skellern, K., Markey, R. and Thornthwaite, L. (2017) 'Identifying attributes of sustainable transitions for traditional regional manufacturing industry sectors – A conceptual framework', *Journal of Cleaner Production*, 140, pp. 1782–1793.

Smink, M.M., Hekkert, M.P. and Negro, S.O. (2015) 'Keeping sustainable innovation on a leash? Exploring incumbents' institutional strategies', *Business Strategy and the Environment*, 24, pp. 86–101. doi: 10.1002/bse.1808

Smith, A. and Raven, R., (2012) 'What is protective space? Reconsidering niches in transitions to sustainability', *Research Policy*, 41(6), pp. 1025–1036.

Smith, A., Stirling, A. and Berkhout, F. (2005) 'The governance of sustainable socio-technical transitions', *Research Policy*, 34(10), pp. 1491–1510. doi: 10.1016/j.respol.2005.07.005.

Sorrell, S. (2015) 'Reducing energy demand: A review of issues, challenges and approaches', *Renewable and Sustainable Energy Reviews*, 47, pp. 74–82. doi: 10.1016/J.RSER.2015.03.002.

Stahlbrand, L. (2016) 'The Food For Life Catering Mark: Implementing the Sustainability Transition in University Food Procurement', *Agriculture*, 6(46), pp.1–19.

Stedman, R. C. (2016) 'Subjectivity and social-ecological systems: a rigidity trap (and sense of place as a way out)', *Sustainability Science*. Springer Japan, 11(6), pp. 891–901. doi: 10.1007/s11625-016-0388-y.

Steen, M. and Weaver, T. (2017) 'Incumbents' diversification and cross-sectorial energy industry dynamics', *Research Policy*, 46, pp. 1071–1086.

Steffen, W., Crutzen, P. J. and Mcneill, J. (2008) 'Earth System Governance Project View project Systems approach towards sustainable cities View project'. doi: 10.1579/0044-7447(2007)36[614:TAAHNO]2.0.CO.

Steffen, W. et al. (2011) 'The anthropocene: From global change to planetary stewardship', *Ambio,* 40(7), pp. 739–61.

Stenbacka, C. (2001). 'Qualitative research requires quality concepts of its own', *Management Decision*, 39(7), pp. 551–555.

Stephenson, J. (2018) 'Sustainability cultures and energy research: An actor-centred interpretation of cultural theory', *Energy Research & Social Scienc*e, 44, pp. 242–249.

Stephenson, J., Hopkins, D. and Doering, A. (2015) 'Conceptualizing transport transitions: Energy Cultures as an organizing framework', *Wiley Interdisciplinary Reviews: Energy and Environment*, 4(4), pp. 354–364. doi: 10.1002/wene.149.

Stern, P.C. (1997). Toward a working definition of consumption for environmental research and policy. In: National Research Council (P. C. Stern, T. Dietz, V. W. Ruttan, R. H. Socolow, & J. L Sweeney, Eds.), *Environmentally significant consumption: Research directions* (pp. 12–25). Washington, DC: National Academy Press.

Stirling, A. (2014a) Transforming power: Social science and the politics of energy choices, *Energy Research & Social Science*, 1, pp. 83–95.

Stirling, A. (2014b). *Emancipating Transformations: From Controlling 'the Transition' to Culturing Plural Radical Progress*, STEPS Working Paper 64. STEPS Centre, Brighton.

Stones, R. (2005). *Structuration Theory*, Palgrave Macmillan, Basingstoke. 224 p. ISBN: 978-0333793787

Stones, R. and Jack, L. (2016) 'The bridge between ontological concepts and empirical evidence: an interview with rob stones', *Accounting, Auditing and Accountability Journal*, 29(7), pp. 1145–1151.

Stormer, F. (2003) 'Making the shift: Moving from "Ethics Pays" to an inter-systems model of business, *Journal of Business Ethics*, 44, pp. 279-289.

Strambach, S. (2017) 'Combining Knowledge Bases in Transnational Sustainability Innovation: Microdynamics and Institutional Change', *Economic Geography*, 93(5), pp. 500–526. doi: https://doi.org/10.1080/00130095.2017.1366268

Strauss, A. and Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage Publications, Inc.

Stubbs, W. and Cocklin, C. (2008) 'Conceptualizing a "sustainability business model"', *Orgnization and Environment*, 21(2), pp. 103–127. doi: 10.1177/1086026608318042.

Sunny, S.A. (2017) 'Systemic emergence under transitional uncertainty: The dynamic role of energy technology innovation', *Kybernetes*, 46(9), pp. 1527–1541, doi: https://doi.org/10.1108/K-10-2016-0277

Swart, R. J., Raskin, P. and Robinson, J. (2004) 'The problem of the future: Sustainability science and scenario analysis', *Global Environmental Change*, 14(2), pp. 137–146. doi: 10.1016/j.gloenvcha.2003.10.002.

Sørensen, K.H., Lagesen, V.A., and Hojem, T.H.M. (2018) 'Articulations of mundane transition work among consulting engineers', *Environmental Innovation and Societal Transitions,* 28, pp. 70–78.

Teece, D. (2007). Explicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainable) Enterprise Performance, *Strategic Management Journal*, 28, pp. 1319–1350. doi: 10.1002/smj.640

Temper, L., Walter, M., Rodriguez, I., Kothari, A., and Turhan, E. (2018) 'A perspective on radical transformations to sustainability: resistances, movements and alternatives', *Sustainability Science*, 13, pp. 747–764.

Thoits, P. A. (1995) 'Social psychology: the interplay between sociology and psychology', *Social Forces*, 73(4), pp. 1231–1243. doi: 10.1093/sf/73.4.1231

Tourish, D. (2014). 'Leadership, More or Less? A Processual, Communication Perspective on the Role of Agency in Leadership Theory', *Leadership*, 10(1), pp. 79−98.

Tukker, A., Huppes, G., Guine´e, J., Heijungs, R., de Koning, A., van Oers, L., Suh, S., Geerken, T., Van Holderbeke, M., Jansen, B. and Nielsen, P. (2006). Environmental impact of products (EIPRO). Analysis of the life-cycle environmental impacts related to the final consumption of the EU-25. *JRC European Commission*.

Tukker, A., Bausch-Golldbohm, S., Verheijden, M., de Koning, A., Kleijn, R., Wolf, O., et al. (2009). 'Environmental impacts of diets changes in the EU', *JRC Scientific and Technical Reports*.

Udovyk, O. (2017) ''I cannot be passive as I was before': learning from grassroots innovations in Ukraine', *European Journal for Research on the Education and Learning of Adults*, 8(2), pp. 225–243.

Upham, P., Lis, A., Riesch, H. and Stankiewicz, P. (2015) 'Addressing social representations in socio-technical transitions with the case of shale gas', *Environmental Innovation and Societal Transitions*, 16, pp. 120–141. doi: 10.1016/j.eist.2015.01.004.

Upham, P., Dütschke, E., Schneider, U., Oltrad, C., R., Lores, M., Klapper, R. and Bögel, P. (2018) 'Agency and structure in a sociotechnical transition: Hydrogen fuel cells, conjunctural knowledge and structuration in Europe', *Energy Research and Social Science*, pp. 163–174. doi: 10.1016/j.erss.2017.09.040.

van der Vleuten, E. (2018) 'Radical change and deep transitions: Lessons from Europe's infrastructure transition 1815–2015', *Environmental Innovation and Societal Transitions,* doi: https://doi.org/10.1016/j.eist.2017.12.004

van Geenhuizen, M. and Ye, Q. (2014) 'Responsible innovators: open networks on the way to sustainability transitions', *Technological Forecasting & Social Change*, 87, pp. 28–40.

Van Poeck, K., Læssøe, J. and Block, T. (2017) 'An exploration of sustainability change agents as facilitators of nonformal learning: mapping a moving and intertwined landscape', *Ecology and Society*, 22(2), pp. 33. doi: https://doi.org/10.5751/ES-09308-220233

van Mossel, A., van Rijnsoevera, F.J. and Hekkert, M.P. (2018) 'Navigators through the storm: A review of organization theories and the behavior of incumbent firms during transitions', *Environmental Innovation and Societal Transitions*, 26, pp. 44–63. doi: http://dx.doi.org/10.1016/j.eist.2017.07.001

Verbong, G.P.J. and Geels, F.W. (2010) 'Exploring sustainability transitions in the electricity sector with socio-technical pathways', *Technological Forecasting & Social Change*, 77, pp. 1214–1221. doi: 10.1016/j.techfore.2010.04.008

Vezzoli, C., Ceschin, F., Diehl, J.C. and Cindy Kohtala, C. (2015) 'New design challenges to widely implement 'Sustainable Product–Service Systems'', *Journal of Cleaner Production*, 97, pp. 1–12.

Voß, J. P., Smith, A. and Grin, J. (2009) 'Designing long-term policy: Rethinking transition management', *Policy Sciences*, 42(4), pp. 275–302. doi: 10.1007/s11077-009-9103-5.

Wagner, H.R., Glaser, B.G. and Strauss, A.L. (1968) *The Discovery of Grounded Theory: Strategies for Qualitative Research.*, *Social Forces*. doi: 10.2307/2575405

Waldrop, M.M. (1994) *Complexity: the emerging science at the edge of order and chao*s. Penguin, Harmondsworth, UK

Walker, G. *et al.* (2010) 'Trust and community: Exploring the meanings, contexts and dynamics of community renewable energy', *Energy Policy*. Elsevier, 38(6), pp. 2655–2663. doi: 10.1016/j.enpol.2009.05.055.

Walwyn, D., Bertoldi, A. and Gable, C. (2018) 'Building the hydrogen economy through niche experimentation and digitalisation', *Journal of Manufacturing Technology Management*. doi: https://doi.org/10.1108/JMTM-11-2017-0247

Wanner, M., Hilger, A.,Westerkowski, J., Rose, M., Stelzer, F. and Schäpke, N. (2018) Towards a Cyclical Concept of Real-World Laboratories, *disP - The Planning Review*, 54(2), pp. 94–114. doi: 10.1080/02513625.2018.1487651

Weber, K.M. (2003) 'Transforming large socio-technical systems towards sustainability. On the role of users and future visions for the uptake of city logistics and combined heat and power generation', *Innovation*, 16, pp. 155–176.

Weber, K.M. and Rohracher, H. (2012) 'Legitimizing research, technology and innovation policies for transformative change', *Research Policy*, 41, pp. 1037–1047.

Werbeloff, L., Brown, R.R. and Loorbach, D. (2016) 'Pathways of system transformation: Strategic agency to support regime change', *Environmental Science & Policy*, 66, pp. 119–128. doi: http://dx.doi.org/10.1016/j.envsci.2016.08.010

Wentland, A. (2016) 'Imagining and enacting the future of the German energy transition: electric vehicles as grid infrastructure', *Innovation: The European Journal of Social Science Research*, 29(3), pp. 285–302. doi: 10.1080/13511610.2016.1159946

Westley, F. *et al*. (2011) 'Tipping Toward Sustainability: Emerging Pathways of Transformation', *Ambio*, 40, pp. 762–780.

Whitmarsh, L. (2012) 'How useful is the Multi-Level Perspective for transport and sustainability research?', *Journal of Transport Geography*, 24, pp. 483–487. doi: 10.1016/j.jtrangeo.2012.01.022.

Wieczorek, A.J. and Hekkert, M.P. (2012) 'Systemic instruments for systemic innovation problems: A framework for policy makers and innovation scholars', *Science and Public Policy*, 39, pp. 74–87.

Wiek, A. *et al.* (2012) 'From complex systems analysis to transformational change: A comparative appraisal of sustainability science projects', *Sustainability Science*, 7(SUPPL. 1), pp. 5–24. doi: 10.1007/s11625-011-0148-y.

Wittmayer, J.M. and Schäpke, N. (2014) 'Action, research and participation: roles of researchers in sustainability transitions', *Sustainability Science*, 9, pp. 483–496. doi: 10.1007/s11625-014-0258-4

Wittmayer, J.M. *et al.* (2017) 'Actor roles in transition: Insights from sociological perspectives', *Environmental Innovation and Societal Transitions*, 24, pp. 45–56. doi: 10.1016/j.eist.2016.10.003.

Wolfram, M. and Frantzeskaki, N. (2016) 'Cities and Systemic Change for Sustainability: Prevailing Epistemologies and an Emerging Research Agenda', *Sustainability*, 8(144), pp. 1–18. doi:10.3390/su8020144

Yap, X-S. and Bernhard Truffer, B. (2018) 'Shaping selection environments for industrial catch-up and sustainability transitions: A systemic perspective on endogenizing windows of opportunity', *Research Policy*. doi: https://doi.org/10.1016/j.respol.2018.10.002

York, R. (2011) 'Do alternative energy sources displace fossil fuels?', *Nature Climate Change*, 2, pp. 441–443.

Åm, H. (2015) 'The sun also rises in Norway: Solar scientists as transition actors', *Environmental Innovation and Societal Transitions*, 16, pp. 142–153. doi: 10.1016/j.eist.2015.01.002.

Publication I

Koistinen, K., Teerikangas, S., Mikkilä, M., and Linnanen, L.
Agent-Based Change in Facilitating Sustainability Transitions – A Literature Review and a Call for Action.

AGENT BASED CHANGE IN FACILITATING SUSTAINABILITY TRANSITIONS – A LITERATURE REVIEW AND A CALL FOR ACTION

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ABSTRACT

How can sustainability transitions be enabled? The focus in the practice and research on sustainability transitions has traditionally been on large-scale institutional actors. However, in order to make a difference, also micro-led change, i.e. engaged individuals driving sustainable change, is needed. This chapter explores the role of engaged individuals in facilitating sustainability transitions. Who are they and what do they do? Despite much interest, this body of knowledge remains scattered across disciplines. In this chapter, the aim is to take stock of the subject matter by providing a review of the scholarly literature on agent-based change involved in sustainability transitions. The review is based on leading journals in environmental management and sustainability studies. Based on the review, challenges and key dynamics in the study of agent-based sustainability transitions are identified. Moreover, future research directions are provided. The chapter encourages individuals, starting with you and me, to awaken their agency and to start making a difference toward developing a better, more sustainable, tomorrow.

Keywords – agency, actor, micro-led change, sustainability transition, multi-level perspective, niche, incumbent.

**AGENT BASED CHANGE IN FACILITATING SUSTAINABILITY TRANSITIONS –
A LITERATURE REVIEW AND A CALL FOR ACTION**

INTRODUCTION

This chapter explores the role of actor-led change in enabling sustainability transitions. Actor-led change, or agency, refers to individuals or collectives, who take a proactive stance, acting toward a more sustainable planet. With the term sustainability, the focus is on environmental sustainability. Although the connections to social and economic sustainability are acknowledged, they are not actively discussed in this chapter.

Despite the potential of engaged actors in enabling sustainability transitions, a closer look at the sustainability transitions literature leads to observe that the role of agency tends to be underplayed at the expense of a focus on technological solutions and a policy orientation (Cashmore & Wejs 2014; Bakker 2014; Mercure et al. 2016). In other words, it appears that a macro-orientation has prevailed at the expense of a micro-level perspective. In this chapter, the aim is to take stock of the current knowledge in order to find out how agency has been studied in sustainability studies, with a particular focus on the sustainability transitions literature.

To our knowledge, this chapter is the first to undertake a systematic review of the literature on agent-based sustainability transitions. The chapter thus provides an overview of the hitherto scattered literature on agent-based change in the context of sustainability transitions. This is the chapter's main contribution. Within this contribution, the paper's findings are two-fold. First, the chapter compiles together the hitherto scattered terminology on agents involved in sustainability transitions. Second, the chapter summarizes extant understanding on the means through which agents influence sustainability transitions. Given that the field is relatively young, the paper also identifies numerous research directions going forward to guide future research endeavors. Summing up, the review finds that agency, i.e. individual and collective action, bears the potential to accomplish major sustainability transitions. Hence, the role of agency should no longer be underplayed.

The chapter proceeds as follows. The first section presents how the literature review was carried out. The literature review enabled the identification of a number of challenges in the study of agency. These are presented in section three. The fourth section presents the main findings concerning the dynamics of agency in sustainability transitions. The final section concludes by

summarizing the main observations, identifies future research directions and suggests practical implications going forward be it for activists or ordinary citizens and consumers.

METHODOLOGY

As the aim of the chapter is to understand what is presently known on the role of individuals in facilitating sustainability transitions, a literature review was conducted. The review began by selecting journals from the fields of sustainability and environmental management. The aim was to achieve a representative sample of journals from the disciplines of environmental management and sustainability. The original sample included the following leading academic journals: *Journal of Environmental Economics and Management, Environmental values, Business and Society, Sustainability Science, Global Environmental Change, Journal of environmental management, Journal of Environmental Planning and Management, Journal of Environment and Development, Sustainable development, Social Research,* and *Environmental Innovation and Societal Transitions*.

The aim was to find out how agency has been studied in the sustainability literature. The selected journals were searched using the keyword "agency". As this initial keyword yielded only a small set of papers, the search was broadened to include multiple keywords. The aim of the journal search thus shifted from finding agency-termed papers to finding papers studying agency, however defined, in the sustainability literature. In so doing, the actually used keywords included the following set of terms: *agent, agency, actor, micro, change agent, social entrepreneurship, social movement, civil society, consumer, stakeholder, tempered radical, niche, enlightened user, early adopter, private actor, collective action, individual engagement, household engagement, grassroots initiative, activism, movement, bottom-up, pro-active, pro-active motivation, distributive leadership, sustainable innovation, positive social movement, and social inclusion*.

During the search for relevant articles, more journals were added to the original sample. In particular, in order to gain an appreciation of the field, reference and seminal papers were included into the literature review. This led to including journals, such as *Energy Policy, Research Policy and Business,* and *Strategy and the Environment* to the review.

The keyword search yielded a total set of over 60 journal articles published between 2002 and 2016. During the reading process, some articles were eliminated, as they were out of the scope

of the paper. This led to a final sample of 25 journal articles (see Table 2) being selected for review. The analysis of these articles led to identifying two broad categories of findings. First, challenges in the study of agency in this literature. Second, an overview of the means through which agents influence sustainability transitions. Going forward, the chapter proceeds using these headings.

CHALLENGES IN THE STUDY OF AGENCY IN SUSTAINABILITY TRANSITIONS

Challenge #1: Agency is neglected

The first observation arising from the analysis is the relative neglect of agency in the sustainability literature. All the while, the question of how transformation(s) towards more sustainable societal practices occur has gained much attention in recent years. The body of knowledge on sustainability transitions has increased, in particular, in policy research and in the social sciences (Markard, Raven & Truffer 2012). Four theoretical frameworks on sustainability transitions have come to dominate the discipline. These theoretical frameworks include (1) transition management, (2) strategic niche management, (3) the multi-level perspective on socio-technical transitions, and (4) the technological innovation systems perspective (Markard, Raven & Truffer 2012). This chapter takes as its main focus agency in the multi-level perspective (MLP). Notwithstanding, some parts of the literature review, where agency is discussed in relation to sustainability transitions cover sustainability transitions from a more extensive theoretical perspective.

The multi-level perspective (MLP) has been introduced and developed by Frank Geels (2002). This framework has gained prominence in the literature on sustainability transitions. This can largely be explained by the fact that the framework brings together the technical and social dimensions of sustainability transitions. Therefore, the MLP is often regarded as a theory of sustainability transition(s) especially in the frame of socio-technical transitions. The MLP goes beyond studies of single technologies - such as wind turbines, biofuels, fuel cells, and electric vehicles - which previously dominated the literature on environmental innovation (Geels 2011). In MLP, transitions are instead described as complex, long-term processes involving multiple actors (Geels 2011). In sustainability transitions, the key question is solving how environmental

innovations emerge and how these can challenge, replace, transform and reconfigure existing, typically unsustainable, technologies and systems (Geels 2011).

The multi-level perspective is built on the assumption that structure exists at three different levels of analysis: the niche-level, the regime-level, and the landscape-level. Technological trajectories are situated in a socio-technical landscape, consisting in a set of deep structural trends, such as economic growth or oil price (Geels 2002). The landscape is described as an external structure or as a context wherein the interactions of actors occur. Whereas regimes refer to rules that enable and constrain activities within communities, the socio-technical landscape refers to wider factors beyond technology. Notwithstanding, the context of landscape is more difficult to change than the context of regimes. Landscapes eventually change, but slower than regimes. It is typical for regimes to generate incremental innovations. In contrast, radical innovations are generated in niches (Geels 2002). The status quo and hence the existing landscape and regimes are premised on actors continuing to conform to the current structure, as either they are seen as legitimate, or their legitimacy is taken for granted (Cashmore and Wejs 2014). It is into this setting, that hypothetically the role of agency can be set. If the perspective to agency is shifted from a passive conforming role (as above) to an active shaping role, then there is a space for individual actors to impact sustainability transitions. So what is it that extant literature states about active agency?

Several scholars have recognized that agency plays an essential role in sustainable transitions. Agency also forms an integral part of the multi-level perspective (Geels 2011; Upham et al. 2015). In the MLP, agency is considered in the form of bounded rationality, this including individuals' routines and interpretive activities. However, certain types of agency remain less developed, including rational choice, power struggles and cultural discursive activities (Geels 2011).

In this literature, it is suggested that agency is crucial in order to create social change. Moreover, agency is necessary during particular episodes of a sustainability transition (Grin, Rotmans & Schot 2011; King 2008; Wiek et al. 2012). Instead of one, in practice there are multiple agents seeking to influence the progress of a transition (Grin, Rotmans & Schot 2011). Agency is critical, as agents possess the abilities, means, and power for deliberate action, and can thus contribute toward more sustainable societies (Wiek et al. 2012). Agency also bears an influence on the internal conception of sustainability and on individuals interpretations of sustainability;

in so doing, agency helps to further embed sustainability beyond themselves (Lehner 2015; Heijden, van der Cramer & Driessen 2012).

Based on the literature, agency is recognized as an integral part of sustainability transitions. What is more, extant literature has found that agents are capable of contributing to sustainability transitions. Despite this acknowledgement, in practice the role of agency remains neglected in the multi-level perspective (Smith et al. 2005; Shove and Walker 2007; Genus and Coles 2008; Bakker 2014). Taking a critical stance, the MLP has been accused for downplaying the role of agency during transitions (Geels 2011).

Beyond the multi-level perspective, agency has been studied in the general literature exploring the interfaces on science, technology and society. Here, a central debate concerns the recreation of governance and new environmental regimes. In this literature, the role of agency has been suggested to be significant. All the while, also in this literature, the role of agency tends to remain empirically neglected (Clapp 1998; Haufler 1998; Erlich 2006; Rothenberg & Levy 2012). If the focus of research on sustainability transitions relies on technological development and existing regime actors only, there is a risk that agency reinforces existing regimes rather than yields novel or radical innovations and forms a basis for transitions (Audet 2014). This explains the need for more agency-related research. Through an enhanced understanding of the role of agency in sustainability transitions, individuals can be empowered, and their agentic capabilities utilized to create better futures.

To summarize, despite the acknowledgement of agency in the literatures on sustainability transitions, it appears that the role of agency remains underplayed.

Challenge #2: Scattered terminology in the study of agency

The second challenge in the study of agency in sustainability transitions relates to the difficulty of capturing the essence of agency. The analysis conducted for this review suggests that the terminology in the study of agency is scattered, definitions are loose or non-existent, and the underpinning theoretical bases are thin. These issues are reviewed next, starting with a review of seminal theorizing on the concept of agency.

Agency is a central term in the social sciences. The term agency has its roots in sociology, where the nature of agency and its relation to the larger environment (or structure) is discussed.

In sociology, agency tends to be interpreted as the human capability to make free choices and to have an impact on one's environment. In this chapter, agency is explored and defined using the lenses of Anthony Giddens and Margaret Archer, seminal sociologists whose theorizing has come to shape the contemporary debate on agency.

The interplay between individuals and their environment is an essential component in structuration theory, as elaborated initially by Anthony Giddens (1984) and later by e.g. William Sewell (1992, 2001). In structuration theory, agency is considered as the bidirectional movement between individuals and their surroundings (Dean, Sharkey & Johnson 2016). Giddens emphasizes that agency and structures are ultimately inseparable (Giddens 1984). Agency determines structure, which consequently determines the possibilities for the expression of agency (Giddens 1984). This means that structure and agency are co-produced (Cashmore and Wejs 2014). Following Giddens, Margaret Archer (1995) offers another perspective to the debate on structure and agency. Archer sees structure and agency as appearing, instead of a dichotomy, as two separate functions in constant movement (Archer 1995). Agency constantly affects structure, yet agency is also constantly affected by structure (Archer 1995).

In addition to the structure-agency debate, there are numerous other definitions and perspectives to agency. Taking one example, John Law's (1992) Actor Network Theory (ANT) considers how the 'social' can take forms beyond merely human ones. This bears implications for what is considered the remit of agency. Looked at from this perspective, agency can conceptually appear in social systems such as the economy or in ideas, in materials, or in other forms of life including animals (Law 1992). Recently, individualistic conceptions of subjectivity and human agency have come to be critiqued for failing to recognize the historical, political and social conditions, and limitations of everyday life (Autio, Heiskanen & Heinonen 2009). Consequently, such considerations ought to be part of future research endeavors.

In contrast, the review of literature on agency in sustainability transitions reveals little connection to this seminal theorizing on agency. It thus appears that the term agency is used 'lightly' with little consideration of its sociological roots. In addition to the scattered terminology surrounding agency, we observed the definitions of agency to be lacking in numerous papers, see Table 1. When defined, the definitions in use varied. Some authors, such as, Audet (2014), Cashmore and Wejs (2014), and Upham et al. (2015) followed Giddens'

(1984) definition for the agency, in which agency is as co-produced within the larger environment. Other authors, such as, Corry and Jørgensen (2015) or Mercure et al. (2016) defined agency simply as the free will of actors.

INSERT TABLE 1 ABOUT HERE

What is more, the study of agency in sustainability transitions uses numerous terms. Whilst the term agency or actor might be used in the MLP perspective, a closer look at the empirical work on agency shows a more scattered picture. Initially, the review and keyword searches were conducted using the term "*agency*". However, during the article search and literature review processes, it became apparent that this core term did not capture the richness and diversity of academic research on agency involved in sustainability transitions. This led to the observation that the notion of agency is implied using numerous terms. The term "*agency*" is thus not consistently used in the literature on sustainability transitions. A closer look at this terminology leads to observed that the term "agency" appears most often in the journals sampled for this review. The second most frequent word in use is "actor". In addition to the terms "agency" and "actor", agency is referred to using terms such as "strategic agency", "collective action", "niche action", "stakeholder", "niche actor", "new entrant", "change agent", "private actor", "institutional entrepreneur", "niche" "civil society", "social actor", "social agent", "organizational agent" and "micro". This plethora of terms might, in part, explain why the study of agency in sustainability transitions is scattered and seems neglected. An overview of this scholarly literature, as provided in this chapter, has been missing. Table 2 summarizes this understanding of how agency appears in the core articles studied for this literature review.

INSERT TABLE 2 ABOUT HERE

In closing, in order to address the limitations of previous literature, in this chapter, the terms "*agency*" or "*actor*" are consistently used to refer to engaged individuals shaping sustainability transitions. Following Giddens and Archer, agency is considered as the individual's potential to act in one's surroundings and to affect structure(s). Moreover, this chapter acknowledges the ambivalent motivations and strategies for the agency, i.e. agency can act as a positive force encouraging change, or as a negative force resisting change. These dynamics are explored in greater detail in the next section.

WHAT IS KNOWN ON AGENCY IN SUSTAINABILITY TRANSITIONS?

In this part of the literature review, the focus shifts to appreciating and summarizing the main findings on agency in sustainability transitions. The findings are presented with respect to (1) who is an agent, (2) individual vs. collective forms of agency, and (3) how agents affect sustainability transitions. In the latter category, the power struggle between active agents on the one hand, and incumbent agents on the other hand takes center stage.

Who is an agent?

Extant literature considers that agency can be enacted at all systems levels in the multi-level perspective (Åm 2015). Geels (2011) argues that agency is apparent throughout the MLP. This effect is apparent in two ways. For one, trajectories and multi-level alignments are de facto constituted by social groups. This means that the pathways towards sustainability transition are ultimately dependent on social interactions, which occur throughout and across the different levels of the MLP. For another, different structural levels are continuously reproduced and adapted by agents. In other words, agency is implicitly and explicitly embedded into the MLP perspective.

All the while, the focus of agency research in sustainability transitions has largely retained a focus at the niche level (Geels 2011; Upham et al. 2015). Taking a look at exemplars of this research tradition, it can be observed that some have equated sustainability agency with resilience. Such agency is helpful in disaster risk reduction, e.g. when faced with societal sustainability threats (Larsen, Calgaro & Thomalla 2011). Expressions of agency, such as green consumers or civil society, have also been related to the niche level. Thus, the question of sustainable consumption is widely acknowledged. Green consumers are described as goal-oriented agents and influential market actors, who use their purchasing power to bring forth social change by taking into account the environmental consequences of their consumption patterns (Moisander 2001; Autio, Heiskanen & Heinonen 2009).

In addition to proactive sustainability-driving agency, also incumbent agency exists. Incumbents refer to members representing the vested interests of the prevailing regime. Challenging the status-quo results in resistance from the current regime, i.e. the incumbent agents (Markard, Raven & Truffer 2012). At the level of governing systems, the existence and the role of stakeholder agency has also been acknowledged (Larsen, Calgaro & Thomalla 2011).

Furthermore, agency has been recognized as part of policy making. In this literature, the role of agency has been suggested to be significant (Clapp, 1998; Haufler, 1998; Erlich, 2006; Rothenberg & Levy 2012), though in practice neglected in academic research and practice.

In summary, the role of agents in sustainability transitions is acknowledged, but an appreciation of their influence mechanisms remains limited. Moreover, the ways in which agents appear and act at different system levels remains understudied. Since the current knowledge related to agency mainly focuses on the niche level, the interplay between agents at different levels of MLP, and especially the role of regime and landscape agents, needs more attention.

Individual vs. collective forms of agency

In addition to merely representing an individual's capability to act, agency can develop into collective action (Seyfang & Smith 2007). This literature emphasizes the agents' capability to influence one other and thus evolve from individual to collective action. This, by its sheer force, poses a greater threat to the current system than the micro-level action of lone individuals.

As an example, amidst the early green movements, broad-scale social change was seen as deriving from collective action (Gabriel & Lang, 1995; Jamison, 2001; Autio, Heiskanen & Heinonen 2009). Achieving sustainability benefits happens often through small community-based initiatives, since they typically utilize contextualized local knowledge (Seyfang & Smith 2007). The pursuit of sustainability transitions needs to be integrated with the contextual knowledge of consumers and local communities (Grin, Rotmans & Schot 2011).

Change agency can support and empower local communities to shape a process that suits their purposes and allows them to place their own concerns on the sustainability agenda (Wittmayer & Schäpke 2014). The question of why and how some actors are able to facilitate change, and others not, deserves attention. As agents are capable of influencing one another, the overall effect of agency needs to be considered within the remit of complex system dynamics, which themselves are formed by social interaction (Mercure et al. 2016). Such system social dynamics and their link to agency need further attention, in order to advance the understanding of emerging bottom-up sustainability transitions that grow from individual actions toward collective action.

Taking the opposite perspective, agency can also be derived from collective behavior. Thus, certain types of civic environmentalist group operate upon the collectivist assumption that the

group/state is the agent of change/status quo (Corry & Jørgensen 2015). Agency is in this perspective considered as acts that are reflecting agents' values and norms (Hansen, Faran & O'Byrne 2015). Consequently, by finding other actors with similar values and norms, individual agency can develop into collective agency.

Instead of concentrating on one specific agent and the resulting 'natural' limits to agency, the question of whether and how agents are able to connect needs more attention (Grin, Rotmans & Schot 2011). Collective action is considered a promising, but under-researched, area in the realm of sustainability transitions (Seyfang & Smith 2007; Seyfang & Longhurst 2013). To conclude, agents' collective action bears potential in achieving large-scale sustainability transitions. However, the question of what kinds of processes drive collective action remains largely unknown.

Agency enabling sustainability and societal transitions

The potential of agents lies in their capability to shape and challenge the prevailing, currently unsustainable regime. Based on the literature review, it is observed that agents are crucial components of sustainability transitions. This section explores what is known on their role in this regard in extant scholarly literature.

Niche vs. incumbent actors

As noted earlier, the role of agency in socio-technical transitions and its treatment in the literature have been widely debated. Several scholars have argued that the role of agency tends to be underrated in the multi-level perspective (Smith et al. 2005; Shove and Walker 2007; Genus and Coles 2008). During the recent years, researchers have attempted to fill this gap with analyses of actor strategies in transitions (Farla et al. 2012). These analyses attempt to cover both sides of the coin: agents supporting transitions (Markard & Truffer 2008; Musiolik & Markard 2011; Budde, Alkemade & Weber 2012) as well as incumbents hindering transitions (Smink, Hekkert & Negro 2015; Geels 2014).

Niche agency is considered essential for sustainability transitions, given that it bears the potential for systemic change and radical innovations (Geels 2011). Niche agents are often referred as engaged individuals driving societal innovation. The hope of niche agents is that the innovations they introduce will find their place in the existing regime, perhaps even replacing the latter (Geels 2011). However, incumbents bear a remarkable advantage over new agents,

owing to being more widely acknowledged and enjoying legitimacy in the current system (Klitkou et al. 2015).

However, making a clear-cut divide and distinction between supporters and opponents of sustainability transitions is tricky. This distinction relies on the dichotomy between old systems and incumbent actors on the one hand, and newly emerging systems and proactive niche actors on the other (Bakker 2014). Yet, it needs to be remembered that different types of actors can enact many kinds of roles. For instance, incumbent regime actors may display ambivalent strategies (Bakker 2014). In practice, incumbent agents are constrained by parameters from the existing regime. Sustainability transitions enacted by incumbents have been found to follow trajectories set by the current regime, thereby evolving through incremental innovation (Geels & Schot 2007). It thus appears that there is potential for proactive agency also amidst incumbent actors, though this agency is more incremental in nature in contrast with the more radical nature of niche agents. The present literature, however, seems not to have fully tapped into this perspective. The role of incumbent agents in contributing toward sustainability needs to be recognized.

Active agent strategies

A key conundrum in the literature relates to whether agency can influence the prevailing system (Bergek et al. 2015.) Several studies suggest that by empowering ordinary people and communities, agency might be the most effective means of creating sustainable futures (Walker et al. 2010; Fudge, Peters & Woodman 2016).

In the MLP paradigm, it is acknowledged that agents are able to introduce transitions outside of the prevailing regime. In particular, it has been observed that discursive activities at regime and niche levels result in cultural repertoires and changes at the landscape level (Geels & Schot, 2007; Geels & Verhees 2011; Geels 2011). Agents have further been found to be capable of influencing the speed at which transitions occur. According to the sociotechnical approach, agency is considered to affect how and how fast a particular transition develops. In the complex systems approach, agents are able to utilize and create windows of opportunity for enabling transitions (Grin, Rotmans & Schot 2011). Effective sustainable transitions depend on agency driving niche-level innovations, implementing regime-level changes, and connecting niche and regime levels (Grin, Rotmans & Schot 2011). Essential for regime shaping agency is to

understand the opportunities and limitations implied by the prevailing context, and the ability to expand one's span of agency by positioning oneself broader in space and time (Grin, Rotmans & Schot 2011). The encouraging finding from extant research is that agency can make a difference.

The actions of agents are targeted toward replacing the prevailing regime. In order to challenge this regime, new innovations have to achieve legitimacy (Bork et al. 2015; Haxeltine & Seyfang, 2009). Legitimacy is achieved by surpassing resistance to change. Understanding incumbent agents' but also niche agents' behavior, actions, and strategies is crucial to overcome the resistance toward large-scale transitions (Gazheli, Antal & Bergh 2012).

The current regime embodies power: the rules, resources and actor configurations, which are part of the regime, privilege particular practices over others (Grin, Rotmans & Schot 2011). Whereas the incumbent regime uses its power to create resistance towards change, regime changes eventually lead to changes in power relations (Grin, Rotmans & Schot 2011). For regime-shaping agents, the challenge is to create mutually reinforcing transition and political dynamics that start to destabilize the prevailing power dynamics between incumbent and sustainable practices – this, over time, can bear a destabilizing effect on the established regime (Grin Rormans & Schot 2011). Such a destabilization process may emerge through common visions or through the graduate, self-reinforcing structuring of (agentic) practices (Grin, Rotmans & Schot 2011). All the while, the power balance and dynamics between agents and incumbents, and how this leads to shifting power relations and new forms of legitimacy are not yet fully understood (Grin, Rotmans & Schot 2011). One reason for this might be that agents are often considered merely as tools, instead of social beings. The social processes and dynamics of agentic activity might have considerable influence on the effectiveness of a transition. Presently, such processes remain under-researched.

Incumbent strategies

Since agents bear the potential to transform the current regime, the existing regime is likely to react. Notwithstanding, the literature has acknowledged the confrontation between agents and incumbents. The typical question related to the early stages of institutionalization is thus the interplay between those who try to create change, agents, and those who oppose it, incumbents (Delbridge & Edwards 2008). As noted earlier, in transitions that also include broad systemic

changes, there are multiple forms of agents that can act collectively (Farla et al. 2012). However, the involvement of several different kinds of agents may result in conflicts, since they might possess ambivalent interests and motivations (Coenen et al. 2012). Conflict can thus occur both at the level of active actors as well as between agents and incumbents.

As transitions challenge and ultimately aim to replace the existing regime, considerable resistance from incumbent agents can be expected (Geels 2005; Markard, Raven & Truffer 2012). Resistance may be passive, resulting from existing institutions that exclude the new, emerging system, or it may be active resistance from incumbent agents protecting their vested interests granted by the existing regime (Smink, Hekkert & Negro 2013; Geels, 2014; Bakker 2014). The strategies of incumbent agents are thus typically directed at delegitimizing the entering agency category (Geels & Verhees 2011; Bork et al. 2015).

Previous literature has primarily highlighted the incumbents' active resistance to change, but in reality the situation might be more complex (Bergek et al. 2015). Hence, instead of confrontation, the potential for synergies between agents and incumbents need consideration (Haley 2015; Bergek et al. 2015). For example, it has been observed that the opponents and proponents of transitions adjust their discursive framings to increase the salience of expression or discourse along five dimensions; actor credibility, empirical fit, centrality, experiential commensurability, and macro-cultural resonance (Geels & Verhees 2011; Geels 2011).

Many, often unsustainable, systems are rigid and filled with lock-in mechanisms (Geels 2011). A stable incumbent regime is the outcome of various lock-in processes, which become reinforced against novel innovations (Klitkou et al. 2015). Incumbents' institutional commitments, shared beliefs and discourses, power relations, and political lobbying reinforce the existing system (Unruh 2000; Geels 2011). Since lock-in mechanisms reinforce a certain pathway of economic, technological, industrial and institutional development, the opportunity of upscaling a given niche depends on the characteristics of the regime in question (Klitkou et al. 2015).

At the regime level, incumbents use their power and control the status-quo. This leads niche agents to establish alliances with incumbents in order to conserve their innovations (Rothaermel 2001; Geels & Schot 2007; Bergek et al 2015). This disparity between incumbents' and niche agents' power relations and available resources typically leads to transitions that are set by

parameters of the current system. In order to achieve a truly sustainable system, cooperation between innovation-driving agency and incumbent agency is needed.

As in the MLP paradigm generally speaking, also in the agency-incumbent debate, agency is considered mainly at the niche level. However, it has been observed that incumbent actors may withhold strategies and motivations that overlap with those of niche agents. This finding bears potential for synergies between niche-level agents and regime, or landscape-level, agents. What is more, agency appears in multiple forms and in multiple levels - for this reason, a focus on the niche level is insufficient. More attention is needed to better understand the role of agents that are somewhat between active incumbents and active agents (Bakker 2014). In addition, the motivations of agents and how incumbents' situational experiences influence on their agency are not yet fully understood. It is noteworthy that there is an opportunity for incumbent agents to act differently. If they display ambivalent strategies, then they do withhold the potential to support and enable niche agents.

In closing, these findings suggest that the present understanding on agency is limited and especially the interplay between various agents is still underplayed in literature. In addition, the representation of agency is narrow and the forces driving agency are not yet well understood. To conclude, the most promising finding of the literature review related to agency in sustainability transitions is the agents' capability to make a difference toward transforming the world. However, many factors related to agency remain under-researched. There is a need to develop a holistic perspective on how agency influences on sustainability transitions.

FUTURE RESEARCH DIRECTIONS

In addition to the afore-mentioned challenges and key findings, the literature review resulted in to identifying four possible areas for future research. These are explored next.

Agency formation

To begin with, more research is warranted to explore how agency is formed. Whilst agency is known to play an important role in sustainability transitions, the means through which agency is formed remains rather unknown. Further, the processes through which individual agency and collective action emerge and the factors influencing the processes of agency emergence remain unresolved. It is thus critical to appreciate how agency shifts from individual-level action

towards collective behavior (King 2008). Different forms of agency and the environments in which they appear further warrant investigation (Kern, 2015).

In parallel, in order to understand agency that transforms the status quo, the drivers and motivations of agents need to be looked into (Cashmore & Wejs 2014). Individual circumstances and factors emerging from agents' personal interpretations will influence the transition process (Rotherberg & Levy 2012). Bakker (2014) suggests that more attention is warranted toward understanding agents' rationales to influence emerging socio-technical systems, since agents likely have individual preferences and pathways toward achieving their desires. This leads to conclude that the formation processes and the motivations of agents, regardless of their type, are essential research pathways in order to develop a more profound understanding of sustainability transitions.

Psychological dimensions of agency

The second proposed research direction relates to studying the psychological and social dimensions of agency. Whereas the current literature acknowledges that agents play a crucial role in sustainability transitions, detailed knowledge and integration of the psychological processes involved in sustainability-related agency is largely missing (Geels 2013; Upham et al. 2015). Even though agency is part of the multi-level perspective and the processes by which agency is expressed are increasingly specified (Geels 2014), the psychological dimensions of agency in the MLP are largely unknown (Whitmarsh 2012). What is more, processes of agency in general tend to be neglected (Meadowcroft 2009). An appreciation of the life paths of agents is needed. Extant research thus does not acknowledge who agents actually are in a social or psychological sense.

Diversity in forms and dynamics of agency

The third suggestion for future research is to extend the study of agency to the diversity of agent types and to examine the interplay between these agent types, whether at niche, regime and landscape levels.

Even though there have been attempts to develop the MLP further and to pay attention to other types of agency, transition theory has focused on macro-level agency, including corporate, technology and policy actors. Other types of agents, in particular consumers, representing the demand side, are largely neglected (Grin, Rotmans & Schot 2011). By simultaneously

addressing regime and niche agency, the MLP paradigm could benefit from incorporating insights from management studies, including organization theory and strategic management (Geels 2011). In this regard, the literature on strategic alliances offers relevant insights to the synergies between incumbents and agents driving sustainable transitions (Geels 2011).

Beyond the niche-incumbent continuum, variety with respect to forms and expressions of agency tends to be neglected in the socio-technical transitions literature, including the multi-level perspective (Whitmarsh 2012). A diverse agent basis is crucial in the diffusion process of innovations, be it with respect to technological innovations or practice-based innovations (Knobloch & Mercure 2016). Nevertheless, the heterogeneity of agency has largely been neglected to date (Mercure et al. 2016). Whilst the diversity of agency has recently been acknowledged, different forms of agency remain unexplored (Cashmore & Wejs 2014).

The variety of agency includes a diversity of representatives inside the current system, and representatives, for example, in the business environment, which could be interpreted as incumbent agents. Whereas their trajectory towards sustainability might differ from niche agents driving novel innovations, they nevertheless contribute to sustainability whether in passive or active roles. The drivers and motivations of incumbent agents are under-researched in the existing literature. By enabling interaction and cooperation between regime and niche agents, sustainability transitions could possibly emerge in a shorter time span. This further explains why an understanding of agency also at regime and landscape levels is needed.

Representations of agents is narrow

The fourth research direction calls for research on the multiple representations of agency. Taking a critical stance, most of the reviewed literature focuses on the roles of agents from an outcome perspective, rather than from a motivation or power perspective. In the existing literature, agents are seen as components that have the potential to shape the status-quo and to enable sustainability transitions. Therefore current representations of agents are relatively functionalist and narrow. Power dynamics and motivational factors of agents might bear a significant influence on sustainability transitions. Hence, they should no longer remain in the dark.

Even though the use of the term agency can sometimes be inconsistent and the knowledge about agency remains scattered across the discipline, the literature does not question the role of

agency in sustainability transitions. Past literature has emphasized agency at the niche level. However, an appreciation of how agency appears across the different levels of the multi-level perspective remains absent. In addition, an understanding of how agents' motivation and power varies depending on the location within the system is lacking. Therefore, more research is warranted to address the representations, motivations, rationales, locations and processes of agency across different locations of the multi-level perspective. In addition, beyond a focus on the multi-level framework, more research on agency is needed across the discipline of sustainability transitions. To conclude, holistic representations of agency are needed to develop a comprehensive understanding of sustainability transitions.

Summary of the research trajectories

Based on the literature review, it appears that the study of agency in sustainability transitions is a field calling for extensive research endeavors. Further, it seems that such research endeavors can support societal transitions toward better futures.

A number of questions remain unresolved. Table 3 provides a summative overview of the findings of the literature review in terms of what is known vs. what is not yet known. In short, research is warranted to appreciate the processes, motivations, diversity and representations of agency at the different levels of the multi-level perspective. Beyond a focus on the multi-level framework, more research on agency is needed across the discipline of sustainability studies and transitions. The motivations and rationales of agents was observed to be a theme cutting across the four identified research directions. This implies that in order to (1) to achieve a thorough understanding of agency, and (2) sustainability transitions, it is critical to appreciate the motivations and rationales of agents. Are you an agent, and what motivates you?

INSERT TABLE 3 ABOUT HERE

IMPLICATIONS FOR ACTIVISTS

In this section, the focus shifts onto the practical implications emerging from the literature review for environmental and sustainability activists.

The encouraging finding from the literature review is that agents, or individuals, matter. The literature emphasizes agents as the introducers and drivers of sustainability transitions. Active

agents have been found to be able to exert pressure on the current system, thereby shaping the existing regime.

Sustainability activists may play a critical role as agents of sustainable change. Activists are typically deeply engaged to their agenda. Also, their resilience towards challenges is high. Hence the role of activists' in sustainability transitions is non-negligible, and might even emerge as system critical. Whereas sustainability activists are individually engaged toward the sustainability agenda, they are also capable of creating collective action. They inspire likeminded people to join them for the cause of a creating a better future. As stated in the literature, collective action can be a solution for large-scale sustainability transitions. Activists that act as leaders of collective sustainability action can create large-scale leverage on the sustainability agenda. For example, many non-governmental organizations (NGOs) act as sustainability intermediates by exerting pressure on unsustainable business environments and governing systems. Whilst activists and collective action may appear in several forms, every action towards sustainability matters. Such active agency is needed for several reasons. First, owing to the activists' overt role in acting toward a more sustainable future. Second, to inspire like-minded agents. Third, to awaken 'sleeping agents', i.e. individuals that do not yet understand their potential for sustainable agency.

To conclude, different activists and activist groups can act as sustainability agents, in so doing facilitating the processes of sustainability transitions. The findings from this chapter encourage activists to pursue their actions and where possible, to inspire others to join their agenda. No action is too small in contributing to sustainable futures. The role of activists as system catalyzing change agents is non-negligible.

THERE IS ONLY ONE PLANET - A CALL FOR ACTION FOR EVERYONE

One of the underlying aims of this chapter was to make an impact on ordinary people via an appreciation of research-led findings on sustainable change agency. The assumption was that by communicating research findings, individuals can be empowered towards engaged sustainability and sustainable actions regardless of the role that they find themselves in, be it as citizens, consumers, commuters and/or decision-makers. The final section of this chapter is thus

a call for action for individuals, regardless of their location, profession and identity. The time is now. There is only one planet.

Perhaps the singularly most inspiring message of this chapter is that every sustainable act, each sustainability movement, each consumption decision matters. Put bluntly, all forms and representations of agency matter. The characteristic of human nature is to bear agency. It is up to each individual to decide how this agency is enacted - whether by passively conforming to societal standards, including unsustainable or unethical ones, or by acting proactively toward creating a better future.

To begin with, everyone can be the agent of one's life. This encourages individuals to connect with and to cherish the agency within (Wood, Carter & Thistlethwaite 2017; Krogman 2017). This echoes the principles of personal development, as found in philosophical traditions across cultures. Further, individuals can recognize that each of their thoughts, actions and behaviors has an impact on the surrounding systems, whether this action is explicit or implicit. Becoming aware and conscious of one's impact on the surrounding micro-environment is a first step in developing one's agency. Such impacts are visible in one's family environment, but also with one's peers be it at work or in social and societal situations at large (Schiele 2017; Zeiss 2017). The acts of agency may be, for example, moving towards paperless offices or to choosing vegetarian lunch (Dhiman 2017). Or just being nice to random colleagues or passers-by.

Whilst ordinary citizens, you and me, might not change their lifestyles immediately, the continuously growing interest and demand for sustainable living environments and solutions is acting as a snowball effect that can shape the current regime toward greater degrees of sustainability. As an example to this end, vegane and healthy eating habits have increased considerably in the last years, resulting in leading retailers having to broaden their supply in order to cater for this customer base.

Individuals further have the potential to proactively express society-shaping agency, be it in professional or personal life, via voluntary work or peer conversations. In addition to individual agency, collective agency is also needed. Numerous social movements are active locally and internationally. There are a myriad of ways of connecting to like-minded peers be it via social media platforms or in person. Ordinary citizens can create greater leverage by joining together and generating new sustainable collective actions. The leverage offered by social media

platforms is non-negligible in this respect. These implications can also be used in educating future generations. Education might be one of the most potent forms of igniting sustainable agency.

What is your next move? Will you take hummus or steak for lunch today? Ride a bike or car to work tomorrow? Fly to long-haul Costa Rica or enjoy local holidays? Keep enjoying long showers or save water? Smile to your neighbor and an unknown passer-by? Reply to an emotional punch with empathy? The possibilities are unlimited. Such acts of agency can gradually develop into routines that may lead to sustainable practices. To conclude, there is perhaps no need to despair, once the role of everyday action and individuals becomes actively recognized. People do hold the key for a better future. What is your next move? How will you act on the sustainability landscape?

CONCLUSION

The aim of this chapter was to study how agency appears in the current literature of sustainability and environmental management. This chapter provided a multi-disciplinary literature review, which focused on the role of agency in sustainability transitions and especially on the multi-level perspective (MLP). The focus was on agency, since agency is a key component in successful sustainability transitions, and hence also in the pursuit of sustainable societies and environments.

This chapter contributes to the sustainability literature by bringing together the scattered knowledge related to agency. The most invigorating finding from this review of literature is that agency truly matters. Agents are acknowledged to introduce and drive sustainability transitions and they have a crucial role in the trajectory towards sustainability. Agency is also known to evolve from individual to collective agency. In addition, as agency appears throughout the multi-level perspective, sustainability agents are positioned at every level of the society. The question then is, who is active and who is passive, in enacting their agency?

Secondly this chapter contributed to the sustainability transitions literature by identifying several gaps in the current body of knowledge. The review revealed that, overall, agency remains neglected in the sustainability literature. Whereas agency is acknowledged, the representation of agency is narrow. Agents are seen as tools for sustainability transitions rather

than individuals that possess individual rationales and aspirations. The life paths, motivations and other psychological processes of agents remain currently under-researched. The knowledge on how agency is formed and how it evolves toward collective action is missing. Moreover, even though all levels of MLP have agency, the research has concentrated on niche agency. In order to further the understanding of sustainability transitions, the interplay between niche and regime, or landscape, agents needs to be addressed.

Based on the review, the chapter ended with important practical implications for activists on the one hand, and all citizens on the other hand. The message from the chapter is clear - agents, or individuals, matter. What kind of an agent are you, and how is it that you are contributing to the betterment of the planet through your daily actions? The future is here, and the choice to act is yours. As authors, we argue for the need to awaken and energize agency across the planet.

REFERENCES

Archer, M. (1995). *Realist Social Theory: The Morphogenetic Approach*. Cambridge University Press. 368 p. ISBN 0521484421

Audet, R. (2014). The double hermeneutic of sustainability transitions. *Environmental Innovation and Societal Transitions*, 11, 46–49.

Autio, M., Heiskanen, E. & Heinonen, V. (2009). Narratives of 'green' consumers – the antihero, the environmental hero and the anarchist. *Journal of Consumer Behaviour*, 8, 40–53.

Bakker, S., van Lente, H. & Engels, R. (2012). Competition in a technological niche – the cars of the future. *Technology Analysis and Strategic Management*, 24 (5), 421–434.

Bakker, S. (2014). Actor rationales in sustainability transitions – Interests and expectations regarding electric vehicle recharging. *Environmental Innovation and Societal Transitions*, 13, 60–74.

Bergek, A., Hekkert, M., Jacobsson, S., Markard, J., Sandén, B., & Truffer, B. (2015). Technological innovation systems in contexts: Conceptualizing contextual structures and interaction dynamics. *Environmental Innovation and Societal Transitions*, 16, 51–64.

Bork, S., Schoormansb, J., Silvester, S., & Joored, P. (2015). How actors can influence the legitimation of new consumer product categories: A theoretical framework. *Environmental Innovations and Societal Transitions*, 16, 36–50.

Budde, B., Alkemade, F., & Weber, K. (2012). Expectations as a key to understanding actor strategies in the field of fuel cell and hydrogen vehicles. *Technological Forecasting and Social Change*, 79, 1072–1083.

Cashmore, M. & Wejs, A. (2014). Constructing legitimacy for climate change planning: A study of local government in Denmark. *Global Environmental Change*, 24, 203–212.

Clapp, J. (1998). The privatization of global environmental governance: ISO 14000 and the developing world. *Global Governance*, 4, 295–316.

Coenen, L., Benneworth, P. & Truffer, B. (2012). Toward a spatial perspective on sustainability transitions. *Research Policy,* 41(6), 968–979.

Corry, O. & Jørgensen, D. (2015). Beyond 'deniers' and 'believers': Towards a map of the politics of climate change. *Global Environmental Change*, 32, 165–174.

Dean, W., Sharkey, J., & Johnson, C. (2016). The Possibilities and Limits of Personal Agency. *Food, Culture & Society, An International Journal of Multidisciplinary Research*, 19(1), 129–149.

Delbridge, R. & Edwards, T. (2008). Challenging conventions: Roles and processes during non-isomorphic institutional change. *Human Relations*, 61(3), 299–325.

Dhiman, S. (2017). To Eat or Not to Eat Meat: Striking at the Root of Global Warming. *Handbook of Engaged Sustainability*, Springer.

Farla, J., Markard, J., Raven, R., & Coenen, L. (2012). Sustainability transitions in the making: a closer look at actors, strategies and resources. *Technological Forecasting and Social Change*, 79, 991–998.

Fudge, S., Peters, M. & Woodman, B. (2016). Local authorities as niche actors: the case of energy governance in the UK. Environmental Innovation and Societal Transitions, 18, 1–17.

Ehrlich, P. 2006. Environmental science input to public policy. *Social Research*, 73(3), 915–948.

Gabriel, Y. & Lang, T. (1995). *The Unmanageable Consumer*. Contemporary Consumption and its Fragmentation. Sage Publications: London.

Garud, R., Hardy, C. & Maguire, S. (2007). Institutional entrepreneurship as embedded agency: an introduction to the special issue. *Organization Studies*, 28(7), 957–969.

Gazheli A., Antal, M. & Bergh, J. (2012). *Behavioral Foundations of Sustainability Transitions. WWW* for Europe, European Commission.

Geels, F. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy*, 31, 1257–1274.

Geels, F. (2005). Processes and patterns in transitions and system innovations: refining the co-evolutionary multi-level perspective. *Technological Forecasting and Social Change*, 72(6), 681–696.

Geels, F. & Raven, R. (2006). Non-linearity and expectations in niche-development trajectories: ups and downs in Dutch biogas development (1973–2003). *Technology Analysis and Strategic Management*, 18 (3–4), 375–392.

Geels, F. & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, 36(3), 399–417.

Geels, F. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy*, 39, 495–510.

Geels, F. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, 1, 24–40.

Geels, F. & Verhees, B. (2011). Cultural legitimacy and framing struggles in innovation journeys: a cultural-performative perspective and a case study of Dutch nuclear energy (1945-1986). *Technological Forecasting and Social Change*, 78(6), 910–930.

Geels, F. (2013). The impact of the financial–economic crisis on sustainability transitions: financial investment, governance and public discourse. *Environmental Innovation and Societal Transitions, 6*(0), 67–95.

Geels, F. (2014). Regime resistance against low-carbon transitions: introducing politics and power into the multi-level perspective. *Theory Culture & Society*, 31, 21–40.

Genus, A., & Coles, A. (2008). Rethinking the multi-level perspective of technological transitions. *Research Policy*, 37, 1436–1445.

Giddens, A. (1984). *The Constitution of Society:* Outline of the Theory of Structuration, illustrated reprint. Polity Press. 402 p. ISBN 9780745600062

Grin, J., Rotmans, J., & Schot, J. (2011). On patterns and agency in transition dynamics: Some key insights from the KSI programme. *Environmental Innovation and Societal Transitions*, 1, 76–81.

Haley, B. (2015). Low-carbon innovation from a hydroelectric base: the case of electric vehicles in Québec. *Environmental Innovation and Societal Transitions*, 14, 5–25.

Hansen, M., Faran, T. & O'Byrne, D. (2015). The Best Laid Plans: Using the Capability Approach to Assess Neoliberal Conservation in South Africa—The Case of the iSimangaliso Wetland Park. *Journal of Environment & Development*, 24(4), 395–417.

Haufler, V. (1998). *Policy trade-offs and industry choice: Hedging your bets on global climate change.* Boston, MA: American Political Science Association Annual Meeting.

Haxeltine, A. & Seyfang, G. (2009). *Transitions for the People: Theory and practice of 'Transition' and 'Resilience' in UK's Transition Movement.* Tyndall Centre for Climate Change Research, Norwich. Working Paper 134, Available at: http://www.tyndall.ac.uk/sites/default/files/twp134.pdf (accessed 01.03.17).

Heijden, A., van der Cramer, J. & Driessen, P. (2012). Change agent sensemaking for sustainability in a multinational subsidiary. *Journal of Organizational Change Management*, 25(4), 535–559.

Jamison A. (2001). *The Making of Green Knowledge*. Environmental Politics and Cultural Transformation. Cambridge University Press: Cambridge.

Kern, F. (2015). Engaging with the politics, agency and structures in the technological innovation systems approach. *Environmental Innovation and Societal Transitions,* 16, 67–69.

King, B. (2008). A Social Movement Perspective of Stakeholder Collective Action and Influence. *Business & Society*, 47(1), 21–49.

Klitkou, A., Bolwig, S., Hansem, T. & Wessberg, N. (2015). The role of lock-in mechanisms in transition processes: The case of energy for road transport. *Environmental Innovation and Societal Transitions,* 16, 22–37.

Knobloch, F. & Mercure, J.-F. (2016). The behavioural aspect of green technology investments: a general positive model in the context of heterogeneous agents. *Environmental Innovation and Societal Transitions*, 21, 39–55.

Krogman, N. (2017). Moving from the Individual to the Collective approach to Sustainability: Expanding and deepening sustainability curriculum across the disciplines in Higher Education. *Handbook of Engaged Sustainability*, Springer.

Law, J. (1992). Notes on the Theory of the Actor-Network: Ordering, Strategy, and Heterogeneity. *Systems Practice*, 5(4), 379–393.

Larsen, R., Calgaro, E. & Thomalla, F. (2011). Governing resilience building in Thailand's tourism-dependent coastal communities: Conceptualising stakeholder agency in social–ecological systems. *Global Environmental Change*, 21, 481–491.

Lehner, M. (2015). Translating sustainability: the role of the retail store. International *Journal of Retail & Distribution Management*, 43(4), 386–402.

Markard, J. & Truffer, B. (2008). Actor-oriented analysis of innovation systems: exploring micro–meso level linkages in the case of stationary fuel cells. *Technology Analysis and Strategic Management*, 20, 443–464.

Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: an emerging field of research and its prospects. *Research Policy*, 41, 955–967.

Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Science*, 42, 323–340.

Mercure, J-F., Pollitt, H., Bassi, A., Viñuales, J. & Edwards, N. (2016). Modelling complex systems of heterogeneous agents to better design sustainability transitions policy. *Global Environmental Change*, 37, 102–115.

Moisander J. (2001). *Representation of Green Consumerism: A Constructionist Critique*. Helsinki School of Economics and Business Administration: Helsinki.

Musiolik, J., & Markard, J. (2011). Creating and shaping innovation systems: formal networks in the innovation system for stationary fuel cells in Germany. *Energy Policy*, 39, 1909–1922.

Rothaermel, F. (2001). Complementary assets, strategic alliances, and the incumbent's advantage: an empirical study of industry and firm effects in the biopharmaceutical industry. *Research Policy*, 30, 1235–1251.

Rothenberg, S. & Levy, D. (2012). Corporate Perceptions of Climate Science: The Role of Corporate Environmental Scientists. *Business & Society*, 51(1) 31–61.

Sewell Jr., W. (1992). A Theory of Structure: Duality, Agency, and Transformation. *American Journal of Sociology*, 98, 1–29.

Schiele, K. (2017). Utilizing Gamification to Promote Sustainable Practices: Making Sustainability Fun and Rewarding. *Handbook of Engaged Sustainability*, Springer.

Sewell Jr, W. (2001). *Space in Contentious Politics.* In Silence and Voice in the Study of Contentious Politics, edited by R. R. Aminzade, 51–88. Cambridge: Cambridge University Press.

Seyfang, G. & Smith, A. (2007). Grassroots innovations for sustainable development. Towards a new research and policy agenda. *Environmental Politics*, 16(4), 584–603.

Seyfang, G. & Longhurst, N. (2013). Desperately seeking niches: Grassroots innovations and niche development in the community currency field. *Global Environmental Change*, 23, 881–891.

Shove, E., & Walker, G. (2007). CAUTION! Transitions ahead: politics, practice, and sustainable transition management. *Environment and Planning A*, 39, 763–770.

Smink, M., Hekkert, M. & Negro, S. (2013). Keeping sustainable innovation on a leash? Exploring incumbents' institutional strategies. *Business, Strategy and the Environment*.

Smith, A., Stirling, A. & Berkhout, F. (2005). The governance of sustainable socio-technical transitions. *Research Policy*, 34, 1491–1510.

Smink, M., Hekkert, M., & Negro, S. (2015). Keeping sustainable innovation on a leash? Exploring incumbents' institutional strategies. *Business, Strategy and the Environment*, 24, 86–101.

Unruh, G. (2000). Understanding carbon lock-in. *Energy Policy,* 28, 817–830.

Upham, P., Lis, A., Riesch, H., & Stankiewicz, P. (2015). Addressing social representations in socio-technical transitions with the case of shale gas. *Environmental Innovation and Societal Transitions*, 16, 120–141.

Walker, G., Devine-Wright, P., Hunter, S., High, H. & Evans, B. (2010). Trust and community: exploring the meanings, contexts and dynamics of community renewable energy. *Energy Policy*, 38, 2655–2663.

Whitmarsh, L. (2012). How useful is the Multi-Level Perspective for transport and sustainability research? *Journal of Transport Geography*, 24(0), 483–487.

Wiek, A., Ness, B., Schweizer-Ries, P., Brand, F., & Farioli, F. (2012). From complex systems analysis to transformational change: a comparative appraisal of sustainability science projects. *Sustainability Science*, 7(1), 5–24.

Wittmayer, J. & Schäpke, N. (2014). Action, research and participation: roles of researchers in sustainability transitions. *Sustainability Science*, 9, 483–496.

Wood, M., Carter, A., & Thistlethwaite, J. (2017). Sustainable Solutions: Addressing Collective Action Problems Through Multi-Stakeholder Negotiation. *Handbook of Engaged Sustainability*, Springer.

Åm, H. (2015). The sun also rises in Norway: Solar scientists as transition actors. *Environmental Innovation and Societal Transitions*, 16, 142–153.

Zeiss, R. (2017). The importance of routines for sustainable practices: A case of packaging free shopping. *Handbook of Engaged Sustainability*, Springer.

APPENDICES

Tab. 1 Authors of the final sample and if there is or if there is not a definition for agency

Authors who have defined agency in some way	Authors who have not defined agency
Audet 2014; Cashmore & Weijs 2014; Corry & Jørgensen 2015; Geels 2011; Grin, Rotmans & Schot 2011; Larsen, Calgaro & Thomalla 2011; Mercure et al. 2016; Wiek et al. 2012; Upham et al. 2015	Bakker 2014; Bergek et al. 2015; Bork et al. 2015; Fudge et al. 2016; Geels 2002, 2005, 2013, 2014; Kern 2015; King 2008; Klitkou et al. 2015; Rothenberg & Levy 2012; Seyfang & Longhurst 2013; Whetten & Mackey 2002; Wittmayer & Schäpke 2014; Åm 2015

Tab. 2 Agency-related terms in use in sustainability transitions literatures.

Used Terms	Authors
Agency	Bakker 2014; Cashmore & Weijs 2014; Corry & Jørgensen 2015; Geels 2002, 2005, 2011, 2013, 2014; Grin, Rotmans & Schot 2011; Kern 2015; Larsen Calgaro & Thomalla 2011; Mercure et al. 2016; Upham et al. 2015; Åm 2015
Strategic agency	Grin, Rotmans & Schot 2011
Actor	Audet 2014; Bakker 2014; Bergek et al. 2015; Bork et al. 2015; Geels 2002, 2005, 2011, 2013, 2014; Kern 2015; King 2008; Klitkou et al. 2015
Collective action	Fudge et al. 2016; King 2008
Niche action	Fudge et al. 2016
Stakeholder	King 2008; Wiek et al. 2012
Niche actor	Geels 2002, 2005, 2011, 2013, 2014
New entrant	Klitkou et al. 2015
Change agent	Wittmayer & Schäpke 2014
Private actor	Rothenberg & Levy 2012
Institutional entrepreneur	Rothenberg & Levy 2012
Niche	Seyfang & Longhurst 2013
Civil society	Seyfang & Longhurst 2013
Social actor	Whetten & Mackey 2002
Social agent	Wiek et al. 2012
Micro	Åm 2015

Tab. 3 What is known and what is not yet known

What is known: Who is an agent? – A tool for transition	What is not yet known: Who is an agent? – A social being
Agency exists.	What are agents' rationales, life paths psychological processes and motivations?
Agency can grow from individual action to collective action.	What are the processes behind the formation of agency at (1) the individual level, and at (2) the collective level?
All levels of MLP have agency.	Research concentrates on the niche level. Regime- and landscape levels have agency too. What other kinds of agency is there? How could different agent types, particularly across the niche-regime-landscape levels, create synergy?
Agency drives or hinders sustainability transitions.	The representation of agency is narrow, agents may have ambivalent strategies. What are the rationales of agents? What are the intertwined dynamics of proactive vs. hindering agency? What kinds of power dynamics are at play?
Agents are seen as outcomes. They are known to be crucial parts of sustainability transition.	Agents are critical toward sustainability transitions but what are their motivations? How agency is formed?

Publication II

Koistinen, K., Teerikangas, S., Mikkilä, M., and Linnanen, L.
Change Agents Engaged in Sustainable Transformation in the Finnish Food System

Change Agents Engaged in Sustainable Transformation in the Finnish Food System

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Abstract

Food security is a crucial topic in sustainability science. Agricultural land occupies approximately 37–38% of the Earth's land surface, and about one third of the EU's environmental impact is caused by the current food system. Further, feeding the world's rapidly growing population is a mounting challenge. To achieve a sustainable food system, a holistic system transition is required. Whereas past research has primarily focused on macro-level sustainable system transformation, this paper responds to calls to look at change at a micro level, by focusing on sustainable system transformation that is initiated by individuals. Inspired by system intelligence, this paper presents the hypothesis that change agents are needed across the current food system to enable sustainable system transition. This agency is studied throughout the agricultural value chain – from the agricultural production phase, through the distribution and retailing phases to the consumption phase. The paper explores how individuals become involved with, and stay engaged in, sustainable transformation. The findings are based on a qualitative study in which 26 individuals involved in the Finnish agricultural value chain were interviewed. The findings show that individuals' intrinsic motivation and ethical stances explain their engagement with sustainable transformation. Further, the study identifies the fact that change agency can be either active or passive. To our knowledge, this paper is among the first to bring a micro-level perspective to sustainable transformation in the context of food systems. Our findings carry important implications for the emerging study of sustainable transformation that is initiated at the micro level. When our understanding of micro-level change increases, sustainable systemic change is more likely to become institutionalised.

Keywords: Food, agriculture, micro-level change, change agency, sustainable transformation

1 Introduction

Ensuring food security is one of the critical topics in the field of sustainability science (Gregory and George, 2011). Agricultural land takes up about 37–38% of the world's land surface and we are in the phase where the challenge is not solved simply by adding crop fields (Smith et al., 2008; Simons, 2015). Recent studies imply that about one third of the environmental impact in the EU is caused by the current food system (Tukker et al., 2006; Tukker et al., 2009). Creating a more sustainable food system and feeding future generations seem to be crucial goals for the upcoming years.

In order to achieve a more sustainable food system, large-scale changes are needed (Simons, 2015). The current literature and research about sustainable transformation is mainly dominated by a macro-perspective (Abell et al., 2008; Markman and Waldron, 2014). There is a lack of focus and appreciation of the micro-perspective; creating transformation is seen as reliant on macro-level societal forces. Whilst macro-led change is necessary for system transformation, there is a certain place for change initiated at the micro level as well. Our two fundamental arguments are that individual agents are part of the system and that they are capable of changing the system. We argue that understanding individuals is a critical element that is lacking in the present research on system transformation. By ignoring one piece of the puzzle, the dynamics of sustainable transformation cannot be fully understood. Therefore, our

unit of analysis is change agency and how agents enable sustainable transformation. We hypothesize that individuals are the missing link in system transformation.

In this study we start addressing this large gap by exploring the dynamics of agency. This paper seeks understanding from social sciences and from management research. In it, we take the step of embedding change agency and micro-level change from organizational research within the issue of sustainable systemic transformation in response to calls to create synergy between the technical and social sciences. At the heart of the concept of micro-level change is the assumption that change starts with individuals and the decision to accept and adopt something new depends on individuals and their reactions to the new style of practice. Furthermore, internal change agents are argued to play an important role in implementing change (Van der Heijden et al., 2012). The term 'change agents' refers to individuals who act as catalysts, embracing the responsibility for managing change activities (Robbins et al., 2010). It is acknowledged that micro-level change can create society-level outcomes, and even causally produces strategic phenomena, but it is still unclear how these phenomena emerge from individual actions (Abell et al., 2008). To strengthen our argument, we are inspired by a recent research stream called System Intelligence (SI), which seeks to understand human behaviour in complex interactive settings, and in tangible efforts to generate change (Hämäläinen and Saarinen, 2004). Therefore, the role of change agents implementing sustainable systemic change is the focus of our keen interest.

The paper aims to understand why some individuals change their behaviour towards sustainability and why they stay engaged in sustainable change. We are striving for a better understanding of sustainable micro-level change within the framework of the Finnish food system. Individuals' change behaviour and engagement in change is more important than the actual practice of change, as long as the change is related to food and sustainability. The change can be, for instance, an individual's shift to vegetarianism or the decision to start to farm only organic products. The research questions driving our inquiry are: (1) what motivations underlie the pro-ecological behaviour of change agents in the food system? and (2) what forms does change agency take in the Finnish food system? Given the lack of previous research, we selected a qualitative research design with 26 interviews.

The paper contributes to extant research as follows. The first contribution is to offer exploratory findings on pro-ecological change agency in the food context. The focus of the paper was on change agency since the individual level has often been lacking in the current system literature and in the sustainable transformation literature. Our second contribution suggests that in addition to system perspectives, research on sustainable consumption needs to consider the role of individuals as change agents within systems. Our third contribution is to utilise theorising from organizational research in the context of sustainable transformation. In so doing, we respond to recent calls to break the division between technical and social sciences in the study of sustainability.

The paper is structured by presenting first a theoretical overview where we address the system literature and system intelligence to illustrate the connection between systems and individuals. After system literature we discuss the literature from change agency and micro-level change from management research, which we utilize in the sustainability context. Next, we present a more precise methodology and follow this with our empirical study and its results regarding individuals' motivations in sustainable change. We then proceed to the discussion and our concluding remarks.

2 Theoretical Framework and literature review

We bring up a combination from system thinking and managerial thinking since at the present these two different fields of study do not complement one other. The aim of the literature review is to give a general view on how systems are related to the individual level, and furthermore, to provide an impression of where the current literature stands. The main contribution is to strengthen the micro-level perspective within the field of sustainable systemic transformation. After exploring the literature, the research proceeds to a study of the dynamics of agency in the Finnish food system.

2.1 System literature

If human actions are to be brought back within planetary boundaries, it is essential to transform current socio-technological systems (Meadowcroft, 2009). 'Transition management' often refers to the government of sustainable development, and it combines life course, environmental, and political-economic forms of transition (Loorbach and Rotmans, 2010; Brown et al., 2012). Transition management focuses on governing the development of sustainable regimes out of green niches, which includes favouring the selection environment for green niches by putting incumbent regimes under strong sustainability pressure (Smith and Stirling, 2010). Still, we argue that the research that falls under the label 'transition management' has been steered by the top-down approach and that the current literature is too static; it does not pay enough attention to the influence or potential of the individual. This results in the stagnation of system transformation. We aim to bring more dynamism to the debate, and we move the focus from the top-down to the bottom-up approach.

Despite the dominance of the literature on macro-level change in recent years, the phenomenon of System Intelligence, for example, where the main argument is that human agents are able to influence the whole system, has acknowledged the art played by individuals (Hämäläinen and Saarinen, 2004). The reason why system intelligence is so prominent and inspiring for this study, is the great potential for change that it offers; system intelligence refers to the phenomenon whereby an individual successfully combines system thinking and emotional instincts.

It is crucial to realise that the current system in which we are living is defective and the system is not everlasting. We have created the system boundaries ourselves. System intelligence highlights the possibility to redraw these socially constructed system boundaries (Jones and Corner, 2011). The unsustainable system that we are now living in also displays characteristics of a 'system of holding back'; a space in which everyone involved pictures a common desire in his mind, but nobody behaves so as to achieve it (Sasaki et al., 2014). As a consequence, people become entangled in systems that serve nobody's interest and which can make people act in undesirable ways. As people act in such ways, they maintain the system and its influence upon others, partly causing the system of undesirable behaviours to regenerate itself (Hämäläinen and Saarinen, 2004). This carries significant potential for individuals to create change in the system. Even a minor change in the system can result in a radical change (Sasaki et al., 2014). The clear message is that change agents can transform the system and the focus on the macro level is not enough.

2.2 Change agents and micro-level change

In this section, we look at the existing thinking in management studies on general change agency and micro-level change, since the literature lacks research on change agency at the individual level in the field of sustainability. However, being inspired by the above presented emphasis on individuals' capabilities, we highlight change agency as a crucial link in generating sustainable change. Individuals who act and manage change activities are called 'change agents' (Robbins et al., 2010). Change agents often play an important role by articulating and presenting ideas in ways that influence people and result in change (Caldwell, 2003; Lawrence et al., 2006). Many writers also argue that the more complex the change process is, the more difficult it is to achieve, and the greater the need to utilize the skills and

experience of a special change agent (Buchanan and Boddy, 1992; Schuyt and Schuijt, 1998; Lichtenstein, 1997).

The term 'micro-level change' refers to the change that takes place when an individual changes his/her previous behaviour. Micro-level change plays a key role, since the beginning of the change usually lies in the minds of individuals and, given the right conditions, individuals can change the whole presenting system with their actions. Millar et al. (2012) indicated that, at the micro level, individuals need to adopt and internalize new practices profoundly to make them effective. The individuals and their thoughts should not be ignored any longer, if the goal is to reach systemic transformation.

The macro level dominates the presenting literature on sustainable transformation (Abell et al., 2008; Markman and Waldron, 2014). However, the focus needs to change; it is time to turn our attention to the micro level. Individuals cannot be disregarded any more (Abell et al., 2008). Langley et al. (2013) state that individuals play a crucial role as key actors in many recent studies, but still there is a certain lack of analysis focusing on the individual level itself. Felin and Foss (2005) argue that new routines emerge from or are created and changed by individual actions. These arguments strengthen the statement that sustainable changes and developments can emerge from individuals and can also be made to flow into the mainstream by them. This suggests that there is a need for a better understanding of the individual level in order to create sustainable systemic transformation.

The human brain is capable of adapting rapidly to new visions, new circumstances. Because of this flexibility, sustainable transformation, initiated by individuals, can emerge quickly from the micro level in suitable conditions. It is striking that individuals' visions can be collective (Mintzberg and Waters, 1985). This collective behaviour may play a key role in sustainable transformation, since collective visions often take the form of the pursuit of a cause in which individuals are willing to sacrifice short-term personal gain for longer-term, generally beneficial collective aims (Hernandez, 2012; Donaldson and Davis, 1991; Donaldson and Preston, 1995). Still, individuals' intrinsic motivation is often the single most compelling reason why individuals embark on an activity and why they stay engaged in it. By 'intrinsic motivation' we mean the motivation of engaging in an activity purely for the sake of the activity itself (Lepper et al., 1973). When individuals are intrinsically motivated, they pursue activities for the interest and enjoyment those activities provide (Csíkszentmihályi, 1975), and they often perform them at fairly high levels (Amabile, 1996; Grolnick and Ryan, 1987). People, who are intrinsically motivated to sustainable transformation, are likely capable to enable change.

Even though understanding micro-level change is the core of this study, individuals live in the world and they are surrounded by interaction. Individuals are part of a system. In fact, the most straightforward way to move from the micro level to the macro level is built on the assumption that the whole, macro, is the sum of its parts, micros (Alexander et al., 1987). The macro level is a large institutional level including the whole of society, and on this level there are also other ruling factors than just the micros. Still, when the macro level is examined and divided into small enough parts, behind every institution we eventually find individuals. Generalized, it does not matter how large the entity under consideration, the macro level is only the repeated experiences of large numbers of people in time and space (Alexander et al., 1987). In addition, if the members of an organization share a vision, in this case about a sustainable food system, and identify so strongly with it that they pursue it as an ideology, they are bound to exhibit patterns in their behaviour, so that clear realized strategies can be identified (Mintzberg and Waters, 1985). It is crucial to understand that the output of a successful micro-level change can be significant.

2.3 Research design

It is clear that activities at the micro level are able to create system-level outcomes, and even causally produce strategic phenomena, but how these phenomena emerge from individual actions is still beyond

current understanding (Abell et al., 2008; Hämäläinen and Saarinen, 2004). In this paper, we stated earlier that a sustainable food system is needed, and this requires systemic transformation. Systemic transformation has mainly focused on top-down policies, and we have argued that this is not enough, and that we need a stronger focus on the micro level. We are now aiming to make that micro-focus apparent through change agency in an empirical study.

We have discussed the reasons why the micro level is crucial, how individuals possess a significant potential, and how they are capable of creating change. It was necessary to demonstrate how systemic transformation and micro-level change are bundled together in order to create a synergy between technical systems and people-oriented social sciences. Still, the current research lacks knowledge about change agency in the food context, and even in the sustainability context. We argue that without enhancing change agency in systemic change, the potential of individuals is lost, and therefore we aim to understand micro-level change through our qualitative study, which includes 26 change agents.

To our knowledge, this paper is among the first papers to focus on change that is led from the micro level in sustainable transformation. In addition, there is very little to be found on micro-level change in the existing research in sustainable food science. Since it is limited or even absent in the existing literature, we have taken an abductive perspective to our study.

3 Methodology

The empirical part of this paper covers our qualitative research, which was implemented by semi-structured interviews, the aim being to find answers to the research questions. The core of the empirical part was constructed by interviewing individuals who are related to the food system in Finland, and who act differently compared to the mainstream. Change agency was studied throughout the Finnish agricultural value chain. Respondents were chosen from the agricultural production phase, the distribution and retailing phase, and from the consumption phase. Respondents' age, gender and education varied; the only combining factors were that they had all changed their behaviour towards sustainability in Finland's food system. Respondents were, for example vegans, organic farmers, or retailers of locally-grown food. In total, 26 change agents who participated the interviews and the interviews were carried out between September 2014 and May 2015. The interviewees were gathered in two phases. First, we carried out an internet-based search, from which the first change agents were selected. During the first interviews, we asked interviewees to suggest further change agents. This created a snowball-effect, which led to finding new interviewees from our first interviewees. During the later interviews, the responses started to repeat each other. It was clear that, with our sample of 26 change agents, the saturation point had been reached and we had achieved the desired effect. Details about the interviewees are presented in the Table 1.

Interviewee	Food system phase	Field	Duration
1	Distribution and Retailing	Local food	30min–1h
2	Distribution and Retailing	Local food	30min–1h

3	Agricultural production, distribution and retailing	Organic food	1h–2h
4	Agricultural production, distribution and retailing	Organic food	1h–2h
5	Distribution and retailing	Local food	1h–2h
6	Agricultural production	Urban farming	30min–1h
7	Agricultural production	Local food	30min–1h
8	Distribution and retailing	Veganism	30min–1h
9	Consumer	Vegetarian diet	30min–1h
10	Consumer	Reducing food waste	30min–1h
11	Agricultural production, distribution and retailing	Organic food	1h–2h
12	Agricultural production, distribution and retailing	Organic food	1h–2h
13	Agricultural production, distribution and retailing	Organic food	1h–2h
14	Specialist	Whole food system	30min–1h
15	Distribution and retailing	Veganism	30min–1h
16	Consumer	Vegetarian diet	30min–1h
17	Consumer	Veganism	30min–1h
18	Agricultural production, distribution and retailing	Organic food	30min–1h
19	Consumer	Veganism	30min–1h
20	Consumer	Vegetarian diet	30min–1h

21	Distribution and retailing	Whole food system	30min–1h
22	Distribution and retailing	Whole food system	30min–1h
23	Consumer	Veganism	30min–1h
24	Agricultural production	Organic food	1h–2h
25	Consumer	Organic, local and vegetarian food	30min–1h
26	Agricultural production	Organic food	30min–1h

Table 1: Interviewees

Because of the study's qualitative nature, the main focus is on data analysis and creating interpretations from the received data. First, we carried out the interviews and recorded them. After the interview sessions the recordings were transcribed. Later, the data analysis was conducted using Word and Nvivo. The open quotes were chosen from the Word files. The quantifiable data was analysed using Nvivo. It is a characteristic of Nvivo that the data analysis can be conducted repeatedly to ensure the validity of the study. In Nvivo, coding is also easy to categorize in order to ensure reliability. In the study, the interviews were tested beforehand and all the interviews were recorded to achieve good reliability.

The semi-structured interview format was a suitable choice for the empirical part of the study since we were carrying out qualitative research. Interviews moved around the central theme, but they were conducted in a conversational tone, in order to get data that was as representative as possible. The interview questions revolved around a similar core in every interview, but respondents were given the opportunity to freely articulate their thoughts and feelings during the interviews. It is noteworthy that even though there was no strict structure in the interview, the questions needed to remain around the theme (Tuomi and Sarajärvi, 2002). The interview questions centred on individuals' reasons for change-promoting behaviour and change engagement. The core of the interview questions, and the theme to which they are linked is shown in Figure 1. The questions were strictly chosen to ensure validity and support finding the answer to our research question.
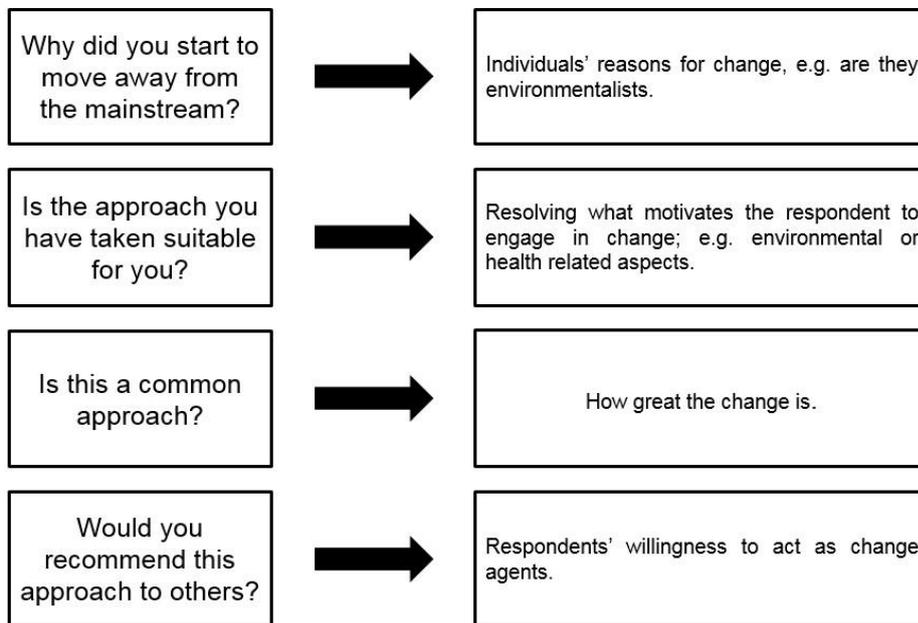
Figure 1: Core of the interview questions and what the questions were aimed at

4 Dynamics of Agency in the Finnish food system

4.1 Why do agents act?

The reasons why individuals change their behaviour and stay engaged in change were the main interests of this paper, since the underlying assumption was that when we have an understanding at the individual level, systemic change can also be understood holistically. The responses of the interviewees varied somewhat, but certain similarities could be identified. Table 2 summarizes the inducements to action most frequently mentioned by the individuals we interviewed in categories of significance.

Reason why individuals changed their behaviour or maintained new behaviour	Category of significance
Environmental concerns	High
Social environment	Medium
Animal rights	Medium

Contact with the countryside	Medium
Health	Medium
Affected by consumer behaviour	Low
General ethical concerns	Low

Table 2: Main reasons why individuals changed their behaviour

Given from the responses, the most significant motivation for change behaviour was environmental reasons. Environmental reasons varied from concerns about carbon emissions and overuse of water to wanting to reduce the distribution phase of the food system. One respondent spoke about environmental concerns as follows: "*I have thought about the environment, and thought about how much fodder production consumes water. When I saw the figures, it was shocking.*" Another respondent described a personal connection to the environment as follows: "*We have always lived very strongly from the earth. An environmentally-friendly lifestyle has always been present.*" Even though 20 out of 26 respondents told us that environmental reasons motivated them to act, only eight of them said that caring for the environment was the dominant reason.

After the environmental reasons four medium motivations were found: individual's social environment, animal rights, individuals' deep connection to the countryside, and health related concerns. During the interviews, animal rights were given as a medium/high motivation for behavioural change as often as health-related concerns, contact with the countryside, or the effect of one's social environment. However respondents named animal rights as the dominant motivation more frequently than the other reasons: "*The most important inducement, for me, is animal rights*"; "*I think the well-being of animals has been the motivation for me*"; and "*The biggest influence on my decision was animal rights.*"

Health was also a strong motivation for change for the respondents. It was seen as a desirable goal either for the respondent or the respondent's family. Organic food, locally produced food or a vegetarian diet were seen as healthier than the mainstream diet. In addition, a food's purity or authenticity was also described as a health-related aspect in the interviews. Respondents said that food purity promotes their health. They expressed concerns about the purity of 'regular' food, and mentioned issues such as, for example, antibiotic residues, or how well nutrients survive during long periods in handling and distribution. Four interviewees said that health concerns were dominant or self-evident reasons for acting differently, and one interviewee told us that her choice was affected by health-related aspects: "*My purpose was to find authentic food, which includes as little as possible food additives and has the shortest distribution as possible.*"

Even though the answers gave an indication of each individual's deep intrinsic motivation, we also saw demonstrated the fact that individuals are not isolated. Their social environment had an effect on their behaviour. Several respondents told us that their interest in food was shaped at home during childhood. For example, one of the respondents described childhood memories: "My mother, for example, made very traditional foods, and sustained food traditions. I have always been very interested in how traditional foods are made. Those were very nice childhood memories." Other interviewees mentioned that the social connections that influenced their decisions were spouses, friends, and in general the surrounding community, for instance: "*My eyes were opened when I met my wife, who was born in the country*." Many of the interviewees also told us that they either grew up or had spent a great deal of time in rural areas during their childhood, for example, with their grandparents. They described positive memories of rural life: "*I grew up in the countryside, so I have respect for nature*"; "*As a child, I watched how my*

grandfather farmed cabbage and I saw how he kept the potatoes in the cellar, so it (interest in food) came from my childhood."

In contrast to these four motivations, which appeared at the significance level of medium/strong, we found that 'consumer behaviour' and 'general ethical concerns' were given a lower significance as motivations for change behaviour and continued engagement in change. For example, one respondent described her consumer behaviour as follows: "*It is just very a reasonable idea that food does not need to come from far away. We could be using local products, and if we did, the need for packaging would decrease, and the money would stay in the local area. Maintaining the local economy and the vitality of rural areas is important to me.*" The general ethical concerns were characterised as a moral obligation for change behaviour. Respondents appealed, for example, to the rightness of the chosen behaviour: "*My decision makes me feel good, because I think it is just the right thing to do*".

The findings suggest that intrinsic motivation is individuals' main driving force in changing to sustainable behaviour, or in maintaining this behaviour. In this paper, intrinsic motivation appears mainly as concern about environmental threats, concern about animal rights and interest in health benefits. As an addition to individuals' intrinsic behaviour, the results showed that people who are affiliated to an individual can have an impact on the individual's behaviour. The findings show that individuals whose actions promote sustainability are typically very environmentally conscious and their change behaviour and engagement in change are mainly affected by ethical standpoints. The findings also endorse the assumption that individuals may have a significant influence on others, since the importance of the social environment was so apparent in the data.

4.2 How do agents act?

In terms of our second research question, we discovered that the form of change agency depends on the agent involved. First, it was apparent that agency can be either active or passive. Most of the individuals we interviewed were very active and passionate in promoting their chosen behaviour and sustainable change. For instance, one respondent described the choice to become a vegan as follows: "*I would definitely recommend veganism for others. But only recommending it just feels so insufficient. Actually we should ask others (who eat meat or dairy products) to justify their actions. I just don't get it why the norm is upside-down.*" However, some of the respondents described the change as a very self-evident part of their life. They acted in a more sustainable way, but they did not feel any need to advocate their choices. Some respondents even indicated that their sustainable actions are very personal, and that they feel it is more or less unnecessary to talk about their sustainable actions to others. Even though they did not actively promote their actions or behaviour, many of them had an effect on others. For example, one of the agents had a farm from which products were distributed mainly to the local area. The agent did not show any interest in promoting local food, but the products were still widely known and were given the quality label for local produce. The agent described his behaviour as follows: "*I grew up with this. I have been doing this since I was a kid,*" and "*I could be doing something more stupid. Food produced here simply tastes better than some foods produced further away*." Based on these findings, we conclude that agency can be active or passive, but regardless of which it is, it can influence others.

We also found that change agents' capabilities can vary; they can be specialists or marketers. Most of the respondents were typically deeply engaged in change and their knowledge about the phenomenon was great. They appeared to be specialists in their chosen behaviour. For these change agents, it was also typical that their original sustainable change often occurred without influence from their social environment or any other social contact. The following quote describes very well the knowledge-level of many of the specialist change agents: "*The main reason why organic food is in a stage of stagnation is the absence of knowledge. Farmers don't know how to farm naturally and productively at the same time.*

There are so many ways to be organic but also have productive crops. The problem is also that counselling is so poor, and counselling is often affected by the agricultural business, and that creates conflicts of interest. Organic farming also suffers from negative images but that is because of ignorance. If we teach the farmers, they will realise their possibilities and understand how organic farming makes sense in agriculture. In addition, organic food costs too much; it should be cheaper to the customer. There should be higher taxes on those agricultural methods that harm the environment."

However, there were also a few respondents who may have lacked up-to-date knowledge about their chosen sustainable phenomenon, but they clearly knew how to inspire others. Typically, their original change behaviour was influenced by their social surroundings or rural affiliation. They had not concretely created anything new in the food system by themselves, but they were able to market pre-existing actions further on. They were looking for ways to improve the current system and their marketing capabilities were visible during the interviews: "*The timing was very important (for the spread of organic food), since people were ready for organic food. But you cannot change individuals' values. It is important to appeal to the green consumers, because they are likely to buy organic food if they know what organic food is and how other types of food work.*" "*I think that examples in the media are too distant. Preaching doesn't work either; we should show that a vegetarian diet is easy. And the change doesn't need to be definitive, even small changes create stimulus for bigger changes. People hunger for a sense of community.*"

We found out that change agents who had more specialist tendencies were often capable of creating change and successful grassroots movements. Their deep knowledge helped them to discover flaws in the existing system and they were able to think beyond existing system boundaries. They also had a sense of how to change the existing system and find more sustainable alternatives to the status quo. Change agents with marketing capabilities were also able to look beyond the current system boundaries, but their thoughts were more human-centred. They sought and discovered ways to influence others in order to disseminate more sustainable approaches in ever-wider circles.

We argue that when systemic change takes place, the form of agency should be taken into consideration. The form of agency can dramatically influence the change for better or for worse. Figure 2 presents an example of how a change agent's capabilities can ease systemic change.
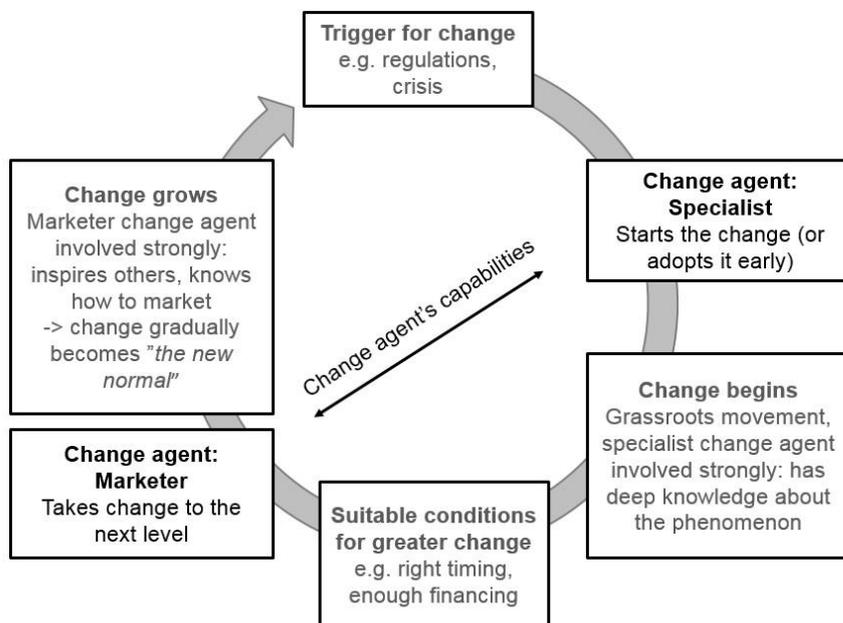
Figure 2: Cycle of change and how change agents can affect change

We maintain that different phases of the system need different forms of agency. When the change agents are in the system phase that is most natural to them, they can exploit their capabilities optimally. 'Marketer change agents' may not discover opportunities to create change, but on the other hand, when the aim is to inspire greater change, the 'specialist change agent' might not give the best possible output. In order to create a holistic systemic change, every individual's greatest positive potential should be exploited.

5 Discussion

The aim of this research was to achieve a better understanding of change agency and micro-level change as a crucial part of systemic sustainable transformation. We studied the dynamics of the agency in the Finnish food system. Our paper makes three contribution to extant theorizing.

First, the current system literature and sustainable transformation literature are primarily focussed on the macro level and the systematic utilization of the micro perspective is lacking. In addition, the literature in the field of agricultural innovation is largely using the systems approach, whereas our understanding of the effect of the parts of the system is scant (Lamprinopoulou et al., 2014). It is into this context that our first contribution needs to be set. We provide early, explorative findings on the role of micro-level factors in enabling sustainable system transformation, through the study of change agents in the Finnish food system. Our findings were two-fold, focused on the motivations of change agents on the one hand, and the nature of change agency on the other hand.

Our theoretical framework identified intrinsic motivation as an engaging factor in individuals' activities. Our research results also revealed that individuals change their behaviour and stay engaged in change based on their intrinsic motivation and ethical standpoints. Intrinsic motivation engages change agents in change even if sustainable change is not always easy. The results make clear that individuals appear

to be very environmentally and ethically consciousness. These change agents often have very deep knowledge about their chosen sustainable actions and they possess valuable knowledge about sustainable practices. Many of the interviewed agents can be described as specialists in their chosen sustainable movement. However, one significant problem seems to be that these agents are able to create or sustain successful sustainable grassroots movements, but these often remain locked into very small niches. Actually, we might not even know the real extent of different sustainable movements. This finding implies that large systemic transformations are stagnant at the micro level. A holistic systemic change needs new ways to move the transformation beyond their niches.

Further, the research results reveal that in the food context change agency activities are visible and therefore change agency can be utilized in the sustainable transformation. The results showed that agency can be either active or passive, and change agents can possess different kinds of capabilities. We identified 'specialist' capabilities and 'marketer' capabilities. This finding raises a question; what other kinds of capabilities can be found? This finding also draws attention to system structures and how to exploit change agents' capabilities in the different phases of the system.

Second, we argue that current systems are governed by the macro perspective, and that sustainable transformation is often structured by exploiting sustainable consumption policies. However, we state that leaning on policies and macro-level forces is not enough. Inspired by system intelligence, we wanted to learn more about the micro level and about individuals' motivations in the sustainability field. We argue that systemic change needs a micro perspective too. As an attempt to bring more recognition to the individual level, we studied systemic transformation through the lens of change agency. We hypothesize that when the agency is holistically understood in system transformation, implementing sustainable consumption policies will become simpler. Consequently, sustainable consumption will increase.

Third, in this paper we are responding to calls to bring the social sciences into the fields of sustainable transformation and system transformation, where the discussion is mainly dominated by hard technical sciences. We wanted to break this monopoly and we utilized findings from organizational theories. We have made an attempt to merge the ecological view into change agency theories from social and management sciences. Our unit of analysis was change agents since our argument is that people do not change their behaviour based on top-down policies, and we conclude that there is a need for a greater emphasis and understanding on the micro level. Our aim was not to solve major philosophical problems according to micro and macro oppositions, but we wanted to study agency, to start the journey of understanding individuals in the systems, and how to strengthen the connection between sustainable systemic change and individuals. We wanted to understand the process by which agents move the change from A to B. We brought up new insights about what triggers individual change in Finland's agricultural value chain. However, we still call for more research with a greater emphasis on the micro. We are calling for new bridges for sustainable systemic transformation and change agency.

This paper is only a beginning of the attempt to understand the whole of sustainable systemic transformation. Our study is just starting to grasp the phenomenon and therefore our view is limited. The research was conducted in Finland with a limited group of respondents and the nature of the study was qualitative. Because of the qualitative nature of the study, the data is always subjective and based on interpretations. Hence, the generalization of the findings is challenging, and our aim was merely to open new paradigms.

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References

Abell, P., Felin, T. & Foss N. (2008). 'Building micro-foundations for the routines, capabilities and performance links.' Managerial and Decision Economics, 29, 489–502.

Alexander, J., Giesen, B., Münch, R. & Smelser, N. (1987). The Micro-Macro Link. University of California Press, Oakland, Ca.

Brown, G., Kraft, P., Pickerill, J. & Upton C. (2012). 'Holding the future together: towards a theorisation of the spaces and times of transition'. Environmental Planning, 44, 1607–1623.

Buchanan, D.A. & Boddy D. (1992). The Expertise of the Change Agent. Prentice Hall, London.

Caldwell, R. (2003). 'Models of change agency: a fourfold classification'. British Journal of Management, 14, 131–42.

Csíkszentmihályi, M. (1975). Beyond Boredom and Anxiety. Jossey-Bass, San Francisco, Ca.

Donaldson, L. & Davis, J.H. (1991). 'Agency theory and stewardship theory: CEO governance and shareholder returns'. Australian Journal of Management, 16(1), 49–64.

Donaldson, T. & Preston, L.E. (1995). 'The stakeholder theory of the corporation: concepts, evidence, and implications. Academy of Management Review, 20(1), 65–91.

Felin, T. & Foss, N. (2005). 'Strategic organization: a field in search of microfoundations'. Strategic Organization, 3(4), 441–455.

Gregory, P.J. & George, T.S. (2011). 'Feeding nine billion: the challenge to sustainable crop production'. Journal of Experimental Botany, 62(15), 5233–5239.

Grolnick, W. & Ryan, R. (1987). 'Autonomy in children's learning: an experimental and individual difference investigation'. Journal of Personality and Social Psychology, 52(5), 890–898.

Hernandez, M. (2012). 'Toward an understanding of the psychology of stewardship'. Academy of Management Review, 37(2), 172–193.

Hämäläinen, R., & Saarinen, E. (2004). System intelligence: discovering a hidden competence in human action and organisational life. Helsinki University of Technology Systems Analysis Laboratory Research Reports.

Jones, R. & Corner, J. (2011). 'Stages and dimensions of system intelligence'. Systems Research and Behavioral Science, 29, 30–45.

Lamprinopoulou, C., Renwick, A., Klerkx, L., Hermans, F. & Roep, D. (2014). 'Application of an integrated systemic framework for analysing agricultural innovation systems and informing innovation policies: comparing the Dutch and Scottish agrifood sectors'. Agricultural Systems, 129, 40–54.

Langley, A., Smallman, C., Tsoukas, H. & Van de Ven, A.H. (2013). 'Process studies of change in organizations: unveiling temporality, activity, and flow'. Academy of Management Journal, 56(1), 1–13.

Lawrence, T.B., Dyck, B., Maitlis, S. & Mauws, M.K. (2006). 'The underlying structure of continuous change.' MIT Sloan Management Review, 47(4), 59–66.

Lepper, M., Greene, D. & Nisbett, R. (1973). 'Undermining children's intrinsic interest with extrinsic rewards: a test of the ''overjustification'' hypothesis'. Journal of Personality and Social Psychology, 28, 129–137.

Lichtenstein, B.M. (1997). 'Grace, magic and miracles: a "chaotic logic" of organizational transformation. Journal of Organizational Change Management, 10(5), 393–411.

Loorbach, D., & Rotmans, J. (2010). 'The practice of transition management: examples and lessons from four distinct cases'. Futures, 42(3), 237–246.

Markman, G.D. & Waldron, T.L. (2014). Small entrants and large incumbents: a framework of micro entry. The Academy of Management Perspectives, 28(2), 179–197.

Meadowcroft, J. (2009). 'What about the politics? Sustainable development, transition management, and long term energy transitions'. Policy Science, 42, 323–340.

Millar, C., Hind, P. & Magala, S. (2012). 'Sustainability and the need for change: organisational change and transformational vision'. Journal of Organizational Change Management, 25(4), 489–500.

Mintzberg, H., & Waters, J.A. (1985). 'Of strategies, deliberate and emergent'. Strategic Management Journal, 6(3), 257–272.

Robbins, S.P., Judge, T.A. & Campbell T.T. (2010). Organizational Behaviour. Pearson Education Limited, Essex.

Sasaki, Y., Hämäläinen, R. & Saarinen, E. (2014). 'Modeling systems of holding back as hypergames and their connections with systems intelligence'. Systems Research and Behavioural Science, published online in Wiley online library. Available: http://onlinelibrary.wiley.com/doi/10.1002/sres.2276/abstract [cited at 16.9.2015.]

Schuyt T. & Schuijt J. (1998). 'Rituals and rules: about magic in consultancy'. Journal of Organizational Change Management, 11(5), 399–406.

Simons, L. (2015). Changing the food game: market transformation strategies for sustainable agriculture. Greenleaf Publishing Limited, Sheffield, UK.

Smith, P., Martino, D., Cai, Z., Gwary, D., Janzen, H., Kumar, P., et al. (2008). 'Greenhouse gas mitigation in agriculture'. Philosophical Transactions B, 363(1492), 789–813.

Smith, A. & Stirling, A. (2010). 'The politics of socio-ecological resilience and sustainable socio-technical transitions'. Ecology and Society, 15(1), 11.

Tukker, A., Huppes, G., Guine´e, J., Heijungs, R., de Koning, A., van Oers, L., Suh, S., Geerken, T., Van Holderbeke, M., Jansen, B. & Nielsen, P. (2006). Environmental impact of products (EIPRO). Analysis of the life-cycle environmental impacts related to the final consumption of the EU-25. JRC European Commission.

Tukker, A., Bausch-Golldbohm, S., Verheijden, M., de Koning, A., Kleijn, R., Wolf, O., et al. (2009). Environmental impacts of diets changes in the EU. JRC Scientific and Technical Reports.

Tuomi, J. & Sarajärvi, A. (2002). Laadullinen tutkimus ja sisällönanalyysi. Kustannusosakeyhtiö Tammi, Helsinki.

Van der Heijden, A., Cramer, J.M., & Driessen, P.P.J. (2012). 'Change agent sense making for sustainability in a multinational subsidiary'. Journal of Organizational Change Management, 25(4), 535–559.

Publication III

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Active agents of sustainability transitions – A life course approach
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Active agents of sustainability transitions—A life course approach

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Abstract: Active individuals, or agents, are often considered crucial components of sustainability transitions, but the current portrayal of agents in the literature remains narrow and relatively functional in nature. In this paper, we offer an exploration of active agents in sustainability transitions via a life courses approach. Our objective is to unveil the formation processes of agency and to understand why agents remain engaged in sustainability transitions. The findings of this paper are based on a qualitative study using 16 interviews in which we interviewed proactive individuals within the existing socio-technical system from the private, public, and third (i.e., non-profit) sector in Finland. The main contribution of the paper is in delving deeply into agency in sustainability transitions via a life courses approach; the paper also contributes to an appreciation of agency formation and sustenance. We identify two main paths for agency formation: (1) upbringing and education, and (2) awakening moments during life courses. We have identified two main rationales for individuals to sustain their agency. First, agents experience dichotomy between individual desires and collective expectations; this dichotomy assists them in sustaining their agency. Second, agents' holistic view of life helps them to stay engaged within sustainability transitions. Agents' critical mind-sets, combined with their strong beliefs in a sustainable future, also appear as an explaining factor for agency formation as well as playing a role in sustaining the agency. A high level of resilience is also a describing factor for the active agency of sustainability transitions. As a fourth contribution, the paper questions the prevailing divide between niche versus regime agents. More research in this exciting area is warranted in the future.

Keywords: *sustainability transition; agency; agents; life course; multi-level perspective*

1. Introduction

The current global system is unsustainable and is filled with multiple lock-in mechanisms that have ultimately resulted in major challenges, including climate change and resource insufficiency [1, 2]. The world has a distinct need for what are known as sustainability transitions to overcome these lock-in mechanisms and to move toward more sustainable societies. General interest in learning how transitions toward sustainability occur has increased, but the ongoing conversation about sustainability transitions has largely focused on governing sustainability, on socio-technical solutions, or on large-scale institutional actors [3]. The focus of this paper is on agency, and more precisely on active agents of sustainability transitions within the framework of the multi-level perspective (MLP). In this paper, "agency" refers to individuals who take proactive steps toward a more sustainable society.

While agents are widely acknowledged as being crucial components of sustainability transitions, their role in the literature of sustainability transitions is somewhat undermined by

the literature's focus on technological solutions and on policy instruments [3, 4, 5, 6]. For example, previous studies have stated that the MLP is dominated by rational action, which leaves room for a stronger analysis of agency [7, 8]. In addition, a recent review of extant knowledge on agency has shown that understanding is scattered and scarce throughout the discipline [9]. Even if agency is acknowledged within the transition process, agents are often seen as tools of transition rather than as social beings [9]. The current understanding of agency is limited, since the psychological dimensions of agency are largely absent in current research. Bakker [5] has suggested that more focus is needed to understand agents' rationales for influencing socio-technical systems, since agents likely have individual preferences and pathways toward achieving their desires. In other words, several crucial questions, such as who the agents actually are (as social beings) and how agency forms, still remain unresolved.

This paper aims to address some of these gaps. The underlying objective of the paper is to explore active agents in sustainability transitions via a life courses approach. We address this problem using three research questions: (1) How does agency form? (2) How do agents sustain their agency? and (3) Is sustainability agency a niche-driven phenomenon? In contrast to previous research, the assumption guiding our inquiry relies on an appreciation of agents as social beings rather than solely being the tools of sustainability transition. In this paper, the life courses of agents are seen to unveil the formation process of agency. In addition, life course research provides an avenue to find explanatory factors for agency maintenance. In order to answer the research questions, we draw from a qualitative study including 16 interviews with active agents of sustainability transitions. The stronger appreciation of agency may result in a stronger understanding of which way a trajectory a transition is directed, and consequently may help to understand the success stories of sustainability transitions. Having an understanding of individual agency-formation processes may also provide insight into learning how agency develops into collective forms.

The current knowledge about agency is still emerging; this paper's main contribution is to add to the existing literature by providing a more explicit portrayal of agency within sustainability transitions. We begin by drawing a more explicit portrayal of sustainability agency that goes beyond seeing agents solely as tools of transition. In relation to our main contribution, this paper provides three additional contributions. First, we add to the understanding of the formation process of sustainability agency. Second, our paper contributes by identifying two main rationales for agents to sustain their agency; these rationales give insights regarding how active agents of sustainability transitions differ from the mainstream. Third, we contribute by providing a tentative implication that sustainability agency is not only a niche-driven phenomenon.

The remainder of this paper is structured as follows. We begin our review of relevant bodies of knowledge with a short description of the sociology of agency and the interplay between agency and structure. The second component of our literature review concerns the relation between agency and sustainability transitions. The final section of the literature review describes of current life courses research. After our review of relevant bodies of knowledge, we present the methodology applied in this study. We then discuss our findings and offer several conclusions.

2. Review of relevant bodies of knowledge

We narrowed down three main branches of the relevant literature into a more precise consideration in order to study the formation process of agency and the maintenance of agency.

Figure 1 shows the main theoretical components of the present study in relation to our research questions. Our first body of knowledge is the connection between agency and sustainability transitions. We have studied the life courses of agents in a specific setting: within sustainability transitions of the socio-technical system. The connection between agency and sustainability transitions was necessary to determine in order to (1) understand the context in which agency formation is explored and (2) find relevant agents for our empirical part of the study.

Second, the essence of agency and its relation to the larger environment are also crucial to determine in order to understand how individuals try to shape their surroundings. Our final theoretical component was life course research, which we selected because such research is widely used to interpret individuals' life paths and to find meaningful events during their life courses.
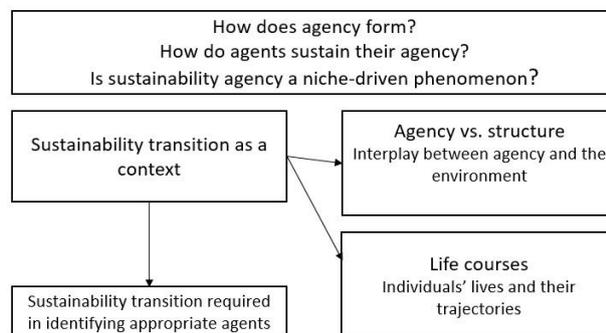

Figure 1. Theoretical components adopted in relation to our research questions

2.1. Sustainability transition in relation to agency

We have studied agents' life courses in the framework of the multi-level perspective (MLP) mentioned earlier, which was initially elaborated on by Geels [10]; the framework is currently prominent within the discipline. The popularity of the framework is largely explained by the fact that the MLP aims to bring together the technical and social aspects of sustainability transitions. Whereas single technologies such as wind turbines or biofuels previously dominated the literature on environmental innovation, the MLP draws a more explicit picture of transition processes, including social and governmental dimensions in transition [1]. In the MLP, transitions are perceived as complex, long-term processes involving multiple actors [1, 10, 11]. The research on sustainability transitions attempts to answer the question of how niche innovations emerge and how those innovations then challenge, replace, transform, and eventually reconfigure existing—typically unsustainable—technologies and systems [1].

How agency is situated in the context of socio-technical transition has been the subject of much debate in recent years. Whereas agency has always been an integral part of the MLP [1, 11, 12], the essence of agency has still been a controversial subject within the discipline. The debate in the literature has typically focused on the question of whether agency can influence the prevailing system [13]. Several scholars have concluded that agency is a crucial component of sustainability transitions [3, 14, 15]. The importance of agency is explained by the fact that agents are capable of shaping the current regime. The MLP also includes the vested idea that agents are able to introduce transitions outside the existing regime. Geels [1] has stated that

agents are an essential factor, since sustainability transitions do not occur without the actions and interactions of a broad range of actors and social groups. In particular, various studies have found that discursive activities at the regime and niche levels eventually lead to cultural "repertoires" and changes at the landscape level [1, 16, 17].

Agency is critical, since agents possess the abilities, means, and power for deliberate action, all of which can result in more sustainable societies [15]. Agency also influences the internal conception of sustainability as well as individuals' interpretations of sustainability; by doing so, agency enables people to further embed sustainability beyond themselves [18, 19]. Recent studies have suggested that by empowering ordinary people and communities, agency may become one of the most effective ways of creating sustainable futures [20, 21]. Grin et al. [3] have argued that a successful sustainability transition ultimately depends on agency driving niche-level innovations that implement regime-level changes and connect the niche and regime levels.

Several scholars, however, have stated that agency generally tends to be underrated in the multi-level perspective [7, 22, 8, 23]. Agency also tends to be a somewhat neglected subject within the transition-management discipline. Rotmans et al. [24] have included agency within transition management through backcasting, although both transition management and backcasting typically only involve certain types of agents, which leaves room for several other representations of agents, especially at the local level [25, 26, 27]. One of the largest theoretical debates within the transition discipline is thus currently concentrated on the question of how to more explicitly conceptualize and integrate actors and agency into the study of socio-technical transitions [28].

In addition to the general downplay of agency within the MLP, the portrayal of agency also remains fairly narrow. Whereas past research has acknowledged agents as components who have the potential to shape the status quo and to enable sustainability transitions, the literature typically sees agents from an outcome perspective, rather than from a motivation or power perspective [9]. The existing knowledge of agency is still relatively narrow and functionalist, since the individual rationales, aspirations, and formation processes remain under-researched [9]. The current research has also not yet acknowledged the life courses of agents [9]. An appreciation of agency within the sustainability-transition literature appears to be in the process of emerging; while the holistic view of agency is now emerging throughout the discipline, the rationales of agents and how agency forms and is sustained still remain under-researched.

2.2. The interplay between agents and their environments

The term "agency" is a central concept in the social sciences. The nature of agency and its relation to the larger environment (or structure) is a widely discussed topic in sociology, in which agency is often interpreted as the human capability of making free choices and of having an impact on one's environment [29, 30]. While other existing definitions for agency have been put forth as well [e.g., 31, 32], in this paper, agency is studied and defined using the explanation from Anthony Giddens and Margaret Archer, influential sociologists whose theorizing has shaped the contemporary debate on agency. Structuration theory is an often-applied theory to explain the interplay between agents and structure, although the theory has been criticized for neglecting situated details, especially the psychological dimensions of agents (such as motivation and perceptions) and agents' contexts [33]. The "strong" structuration framework was developed in particular to consider agents' internal worlds as a neglected element of organizational and wider structural change [33]. Hence, the strong structuration framework is

more relevant in this paper; after briefly describing structuration theory, we will return to the strong structuration framework.

The interplay between individuals and their environments is a crucial part of structuration theory, which Giddens initially formulated [29]. In structuration theory, agency is understood as the bidirectional movement between individuals and their environments [34]. Giddens underlined how agency and structures are ultimately inseparable [29]. Agency determines structure, which consequently determines the opportunities for the expression of agency [29]. This means that, from a structuration perspective, social structures exist and function through agents' actions, which assign specific roles and meanings for those structures [35]. Following Giddens, Archer [30] expanded the debate on structure and agency by elaborating on structure and agency as existing not as a dichotomy but as two separate functions in constant movement [30]: agency constantly affects structure, yet agency is also constantly affected by structure [30].

After Giddens's and Archer's work, others elaborated further on structuration theory. Stones [33] in particular has developed Giddens's work into what is now widely acknowledged as strong structuration theory. Whereas Giddens was especially interested in relatively abstract ontology, Stones moved forward and encouraged researchers to explore empirical case studies of particular agents and structures, where individual agents are situated in a web of position-practice relations [36]. Although the duality of structure—meaning that agency and structure are inseparable and exist only in duality—remains a defining construct in strong structuration theory, Stones states that the duality is best understood through the analysis of a quadripartite framework of interrelated components, including *external structures*, *internal structures*, *active agency*, and *outcomes* [36], in which external structures obligate the actions of agents; internal psychological structures are found within agents; active, intentional agency is assumed; and outcomes occur that are internal and/or external to the agent [33, 37, 38, 39, 40]. Within this paper, we study the life courses of agents in the context of sustainability transitions, and more precisely within the framework of the multi-level perspective. The MLP, which refers to a wider structure with three different levels of socio-technical structuration, provides an illustration for the external structures of the strong structuration framework.

Stones [33] explains the four elements in this way: external structures are separate from the agent, and they set boundary conditions. In the MLP's socio-technical framework, these boundaries include, for example, laws, policies, and organizations. Internal structures include two categories: first, those that are general-dispositional, such as norms, values, and attitudes in relation to one's analytic frame; the second is those that are conjuncturally specific, regarding agents' knowledge and understanding of their immediate and wider context. Whereas these two categories are fundamentally distinct, in practice they may overlap [40].

Within this framework, active agency relates to processes of deliberate, sometimes strategic, action [41]. In this paper, active agency includes proactive steps that are taken toward sustainability, both in agents' personal and professional lives. Active agency might appear, for example, among sustainability professionals or entrepreneurs or as resistance to the existing system. In the end, outcomes are any possible consequence of the previous actions for the agents and their structural context [40]. In this paper, "outcomes" include all forms of socio-technical pathways and the possible tensions that these pathways entail. Strong structuration is often applied to understand the connections between individual action and organizational processes and outcomes [37, 40]. Strong structuration is generally understood as a conceptual methodology that acts as a bridge between theory and empirical research [42, 36]. Hence, we

apply strong structuration in the framework of the MLP to our study of agents' life courses, as discussed in the next section.

2.3. Life courses

Life course research is a widely used method for the study of individual lives and their trajectories. Research on life courses examines individuals' lives in time and place and applies historical and biographical perspectives [43]. A life course perspective is built on the assumption that experiences at every level of life inform our experiences at subsequent stages in our lives as part of an overall trajectory that eventually demonstrates the evolution of life experience over time [44]. In addition to examining individual life paths, life course research also covers the interdependence of people's lives in relational contexts by generating more knowledge about the ways in which individuals share their life experiences through their close ties with one another [45]. Mitchell [46] p. 22, for example, has defined a life course as "a sequence of socially defined events and roles that the individual enacts over time," adding that "these events do not necessarily proceed in a given sequence, but rather constitute the sum total of the person's actual experience." Because it is possible to perceive crucial inside information from individuals through their life courses, such courses hold a significant position in the process of creating maps from individuals' meaningful life events that have an effect on their behavior. Doing so consequently helps to understand agency formation and actors' interests and rationales.

The focus of life course research is on an agent's context in which the person experiences life events. Life course research puts forth the idea that the consequences of life events are likely influenced by the events' timing, perceived relevance, and subjective experience [47, 48]. A fundamental feature of the life course framework is to focus on the relation between life courses and the social environments and experiences of the life course "passengers" [49]. For this reason, it is crucial to acknowledge the narrative descriptions of events in the context of an agent's life in addition to having a scalar assessment of his or her life events [50]. By integrating an event-based perspective with the personal life course narrative, it is possible to achieve an insider's perspective of an agent's life course [44, 51]. Hence, the study of life courses allows for the creation of lifelines or timelines by using qualitative narratives about crucial events or periods of time in individuals' lives [44]. Within this paper, "narratives" refer to a body of events as well as the contextual details surrounding those events' occurrence [52, 53, 54, 55]. It is necessary to point out that narratives always include—in addition to the position, the action, and the outcome of a narrative—individuals' own interpretations, agendas, and influences [56]. It is also necessary to remember that, although the lifelines that are gathered from agents may seem linear, in reality the seemingly linear continuum is likely a set of discontinuous events that have been assembled together.

Regarding the positioning of agency within the larger environment during one's life course, Bühlmann and Levy's [49] argument that life courses result from individuals' personal agency has gained in prominence in recent years. In other words, agents use their free will to steer their life course. But it is important to acknowledge, on the level of actual behavior, the difference between free-willed, agentic influence on one's own life course and the life course that is being shaped by institutional, or environmental, influences [49]. Hence it is crucial to understand the variety of different agents involved and to implement the life course perspective using agents' individual life courses and social constructions [49]. In terms of this paper, the life courses of agents provide the story behind the agency, and therefore the life courses also explain why the

active agency of sustainability transition takes shape. Examining agents' crucial life events and life courses also helps to understand the interests of agents as well as clarifying the rationales for deliberative sustainability action and the rationales for agents to stay engaged in sustainability transitions.

Individuals' interests, however, are currently the subject of controversy. Interests include a vested hypothesis about action; the hypothesis presupposes that agents are truly aware of their interests. Some sociologists have debated the concept of interest [57, 58]. In sociology, interests are frequently seen instead as constructs, so interests are typically treated as an outcome rather than as sources of inspiration for action [59]. Geels [58] has argued that a rational calculation of effects of possible options might be useful in certain specific settings, but such estimates are less predictable in times of radical changes. Several sociologists have also stated, however, that interests are major driving forces for social behavior [59]. For example, Bakker [5] argues how interests matter in transitions and that these interests should not be undermined because, regardless of whether interests are real or mere constructs of the agents themselves, they do matter insofar as agents take these interests into account when making decisions about whether or not to engage in transition. In this paper, we assume that agents have several rationales for engaging in (and remaining engaged in) sustainability transitions. The rationales can be explained as being derived from the agents' interests through their life courses.

In summary, within this paper we examine the agents of sustainability transitions. Our objective is to examine how agency forms and how agents sustain their agency; we also explore if sustainability agency is a niche-driven phenomenon. We aim to address these questions through agents' life courses and the theories of sustainability transition and agency in relation to structure.

3. Methods

Our data is derived from open interviews with active sustainability agents from the niche and regime levels in the existing socio-technical system. We applied a narrative methodology to find the meaningful events during agents' life courses that had resulted in deliberative sustainability actions. In total, we conducted 16 interviews with active agents of sustainability transitions. We selected the respondents based first on initial desktop research and then on snowball sampling.

We aimed to find active agents of sustainability transitions who represented different roles and locations in the socio-technical system to unveil if their positioning in the system had influenced their agency and life courses. Our interviewees were selected based on their activity, but the actual setting, or environment, of the action could vary. For that reason, we selected agents from different fields—for example, from the energy sector and from the food system. Our interviewees represent the private, public, and third (i.e., voluntary or non-profit) sectors of Finnish society. Table 1 presents our interviewees in the two tentative agent categories of niche and regime agents; we have described the agents by categorizing niche agents in blue and regime agents in red.

The categories were selected based on the agents' affiliations and sustainability activities in relation to their lives. Based on our sample of agents, the majority of agents appeared to hold a sustainability-related degree. While we wanted to categorize our agents into groups to describe the agentic positions throughout the socio-technical system, we acknowledge that in reality, agents may have many ambivalent rationales, depending on their interests and different roles in life, all of which may mean that they fall into several categories rather than one single

category. In addition, the dichotomy between niche and regime actors is somewhat crude, since agents may have several interactions between the niche and regime levels. For example, a regime representative may promote niche innovations deliberatively.

Table 1. Agent categories and their positioning in the socio-technical system

Category	Location in the MLP	N	Male [N]	Female [N]	Sustainability or environmental degree(s)
NGO actor	Niche	**4**	0	4	4
Sustainability professional in industry	Regime	**4**	1	3	2
Green consumer	Niche	**2**	2	0	0
Public actor	Regime	**2**	1	1	2
Academic	Regime	**2**	1	1	1
Entrepreneur	Niche	**2**	1	1	0
Total		*16*	*6*	*10*	*9*

We chose to conduct open interviews for our data collection, since such interviews give the respondents a voice and allow them to create narratives and talk freely about their lives, interests, rationales, and strategies related to sustainability actions [60]. Open interviews also allow flexibility to react to every individual interview setting accordingly. Our objective was to exploit qualitative narratives regarding individuals' lifelines in order to find crucial events or periods of time in individuals' lives that may have resulted in agency formation or explained why the agents stayed engaged in sustainability transitions. The use of open interviews provides an avenue for succeeding in this objective. We recorded all the interviews (which were conducted in Finnish); afterward, the interviews were transcribed so that we could later return to the transcriptions for our data analysis. The translations of the interview extracts in this paper have been slightly edited for clarity in English, although the editing has not changed their meaning in any way. The duration of the interviews varied from 30 minutes to just over two hours; the total recorded material amounted to 16 hours and 17 minutes.

The majority of our interviews were conducted in face-to-face conversations, but three interviews were conducted via Skype with video, and one was conducted via telephone. To ensure the anonymity of the interviewees and to stimulate openness during the interviews, the names of the individual respondents and their affiliations have been kept from this paper. We conducted all interviews in Finland between fall 2016 and fall 2017.

Our interview questions were generally concerned with agents' life courses from childhood to the present. We asked about agents' relation to sustainability from several points of view—for example, the development path of their actions, what obstacles respondents had encountered during their life courses in relation to sustainability, and how they perceived the current system in relation to sustainability—and elaborated on the critical events that had led to their deliberative actions. We also asked if our interviewees had specific values that had influenced their lives. We addressed the connection between agents' values and agents' actual deliberative actions with specifying questions. Since the interviews were open format, some questions varied among different interviews, but all the central themes and questions were covered in every interview. More detailed interview themes and questions may be found in Appendix A. Since our objective was to find active agents of sustainability transitions, we also asked agents to position themselves in the matrix shown in Figure 2.
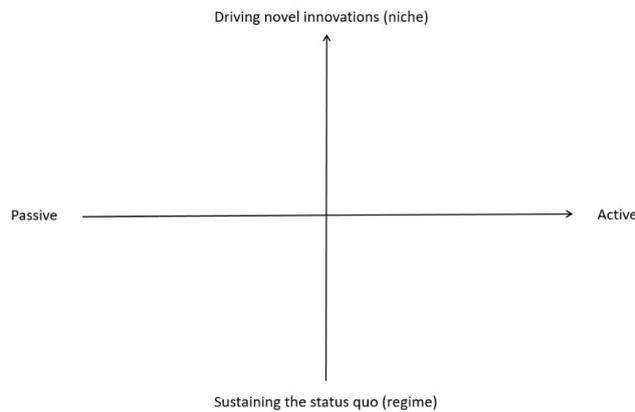
Driving novel innovations (niche)

Passive — Active

Sustaining the status quo (regime)

Figure 2. Agent matrix

We also examined agents' stances toward the existing regime. Our initial objective was to find agents who were active and willing to engage in sustainability transitions with the hope of shaping the existing regime. In addition, our aim was to examine if agents' positions within the socio-technical system (niche or regime) influenced their interpretations of themselves. The "Driving novel innovations" section in Figure 2 describes agents' aspirations toward niche development, whereas the "Sustaining the status quo" section illustrates their willingness to uphold the existing regime. This distinction is again rather crude, but our intention was to find agents' rough stands about the existing system. We also acknowledge that the answers the actors provided were obtained within a certain setting, and individual responses always reflect agents' subjective positions and opinions, which may differ from the objective reality. We still argue, however, that open interviews with subjective narratives can provide insights into the process of interests developing into deliberative actions.

For our data analysis, we followed the principles of grounded theory by using data comparison and data reduction in order to create categories from our interviews and to move toward a more conceptual direction [61, 62]. Our objective was to find a few aggregate levels from the data that could provide more rigor in comparison to simply categorizing the data. We implemented our data analysis in three main phases. Our aim was to analyze the data using the principles of grounded theory [61] and then to continue by indicating aggregate levels from the data [62, 63]. We first collected a set of narratives that described both agency-formation processes and agents' rationales to remain resilient while engaging in sustainability transitions. Second, we identified integrative themes that connected the first-level narratives. The main objective of the third phase was to answer our research questions and to identify the conditions and triggers for the formation process of agency and the rationales for remaining engaged within sustainability transitions. We also explored whether agency was a niche-driven phenomenon. The aim of the third analysis phase was to structure the data into more theoretical categories and to create aggregate dimensions [62, 63].

4. Who are the active agents of sustainability transitions?

The following section presents the agents' responses about their views on the existing system and their positioning in the socio-technical system. We then found various explanatory

factors in the agency-formation process and in the actors' abilities to sustain their agency within the context of sustainability transitions.

4.1. Where are the agents located in the system?

We created a collection from the agents' self-interpretations of their level of actions regarding sustainability and from their enthusiasm either to sustain or replace the existing system. Figure 3 shows the agents' positions. The blue color refers to agents whom we tentatively categorized into the "niche" group, while agents who are in the "regime" group are shown in red.
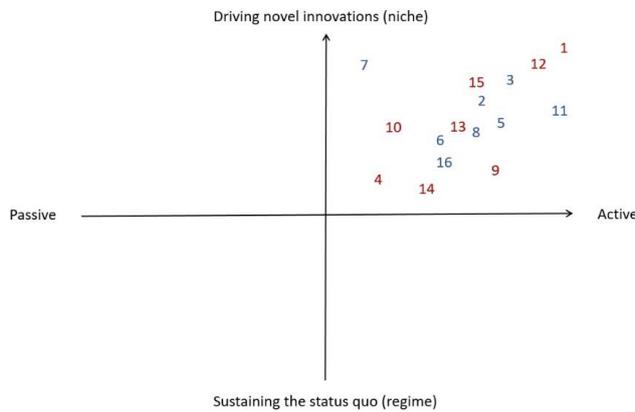

Figure 3. Agents' positioning in the socio-technical system

Whereas the purpose of this categorization was to find particularly active agents of sustainability transitions, the agents themselves also appeared to position themselves within the "active" category. And, even though some agents represented the existing system, or regime, all the selected agents stated that they were willing to transform the current system. While the most cautious agents of our study appeared to represent the existing system, the most reformist, or innovative, agent of our sample was initially categorized as a representative of the regime. In addition, every one of the respondents mentioned serious challenges related to the existing system.

Overall, the agents who were categorized within the "niche" category appear in the matrix to be somewhat more active, and the dispersion between their positioning is smaller compared to the agents who represented the regime. Table 2 compares our tentative agent categorization to the agents' own attitudes about the existing system.

Table 2. Agents' institutional affiliation vs. agents' own stance

Category	Institutional affiliation: niche vs. regime	Agent's own stance: niche vs. regime	N
NGO actor	Niche	**Niche**	1
NGO actor	Niche	**Niche**	1
NGO actor	Niche	**Niche**	1
NGO actor	Niche	**Niche**	1

Sustainability professional in industry	Regime	**Niche**	**1**
Sustainability professional in industry	Regime	**Niche**	**1**
Sustainability professional in industry	Regime	**Niche**	**1**
Sustainability professional in industry	Regime	**Niche**	**1**
Green consumer	Niche	**Niche**	**1**
Green consumer	Niche	**Niche**	**1**
Public actor	Regime	**Niche**	**1**
Public actor	Regime	**Niche**	**1**
Academic	Regime	**Niche**	**1**
Academic	Regime	**Niche**	**1**
Entrepreneur	Niche	**Niche**	**1**
Entrepreneur	Niche	**Niche**	**1**
Total			***16***

Despite our tentative agent categorization, the distinction between the niche and regime agents in the matrix is not as clear as we have stated. The regime agents appeared to be as eager as the niche agents to shape the current system. All the agents of our sample appeared to view themselves as niche development driving agents rather than agents who were sustaining the existing system. This situation provides implications that the regime includes so-called regime agents who are also active agents of sustainability transitions, which leads us to the conclusion (regarding our first research question) that sustainability agency may not always be a niche-driven phenomenon.

Although the agents' positions were their subjective interpretations, this distinct positioning in the "active" category implies that the agents we interviewed were more actively engaging in sustainability transitions compared to the mainstream, regardless of their positioning in the socio-technical system. By "mainstream," we refer to other actors of the socio-technical system who do not actively engage in sustainability transitions.

4.2. How is agency formed and sustained?

It should be noted that our study set out to examine the rationales of individual agents through their life courses. In practice, however, different agents had several overlapping themes in their interests and rationales. We found several overlapping themes that appeared among almost all of the 16 interviews. Through our three-phased data analysis, we indicated four aggregate concepts that aimed to answer our research questions about agency formation and sustaining. Our aggregate dimensions can explain either the agency-formation process or can explain why individuals are capable of sustaining their agency even when they encounter challenges or experience difficult conditions. The four aggregate dimensions we identified include *life path*, *individual vs. collective*, *mind-set: belief vs. critique*, and *holism*.

We scrutinize all four of the aggregate dimensions later in our analysis related to our research questions and to the eight lower-level themes, which were integrated from the overlapping themes that appeared and that were conceptualized within the first phase of our data analysis. The second-order themes of our data analysis included (1) upbringing and education, (2) an awakening moment that altered an agent's life course, (3) intrinsic motivation to overcome collective expectations, (4) a feeling of inadequacy, (5) a strong belief in a sustainable future, (6) criticism of the current system, (7) a lack of a value-action gap, and (8) socio-physical unity.

Of our four aggregate dimensions, the life path appears to be an essential factor in explaining the agency-formation process. Two aggregate dimensions, individual vs. collective and holism, are more descriptive of the rationales for sustaining the agency than of the actual agency-formation process. In addition, the aggregate dimension of "mind-set: belief vs. criticism" could explain both agency formation and the maintenance of agency. Figure 4 shows the data structure of our analysis that led to the aggregate dimensions as well as describing the agency-formation process and how agents sustain their agency. The data shown in Figure 4 was generated from the internal worlds of the active agents of sustainability transitions through their life courses.
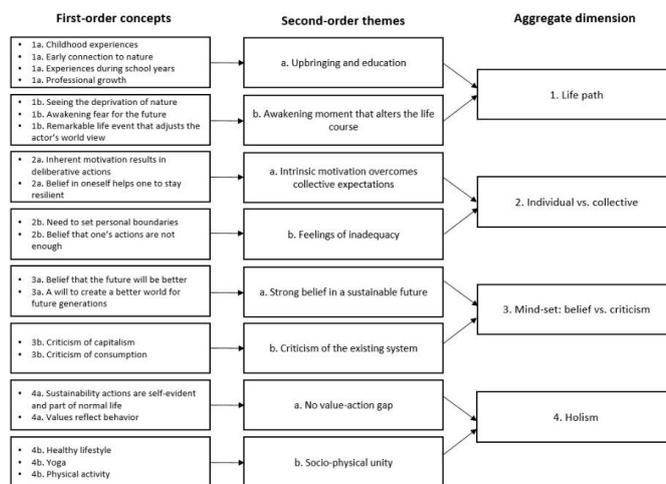

Figure 4. Data structure that led to explaining agency formation and maintenance

In the following sections, we portray how our four aggregate dimensions relate to and explain our research questions.

4.3. Agency formation—1. Life path

Based on our data, the life path arises as an essential factor in explaining the formation process of agency. We indicated the aggregate level of "life path" through the perceived narratives of our first-order concepts that related to our second-order themes of upbringing and education or awakening moments that altered the agents' life courses.

4.3.1.1a. Upbringing and education

The agents' narratives about their upbringing and education typically portrayed a path from childhood events that had created interest about sustainability and had eventually led to deliberative actions in the future. Some agents, for example, described how they had played in the forest as children or had spent their summers at cottages in the country in their youth. Agents were able to determine that their later integration with nature and their sensitivity toward nature had originated from these meaningful moments. In addition to childhood memories, several respondents stated that their time in school influenced their present sustainability activities.

Some agents, for example, discussed how sustainability-related studies felt like a calling to them.

A few interviewees also stated how they had pursued sustainability studies at a time when actual sustainability studies were absent or were only recently emerging. This situation was partly explained by the fact that many of the interviewees had sustainability-related degrees. Still, it appeared that their time in school had influenced several agency-formation processes. In addition to their studies, many of the interviewees also described how their professional growth had shaped their views on sustainability and had strengthened their will to act on behalf of a sustainable future. For example, some agents stated that sustainability challenges were evident in their typical workdays, and the constant information they received about sustainability challenged their views about the world and made them engage in sustainability actions in both their professional and personal lives. Table 3 presents several representative quotations from the first phase of our data analysis in relation to the associated first-order concepts. (As noted earlier, these quotations have been edited slightly for clarity in English.) Table 3 covers the concepts under the second-order theme "upbringing and education."

Table 3. Data supporting the aggregate dimension of *life path* regarding "upbringing and education"

Associated first-order concept	Representative quotations
Connection to nature in their early years	**3.1** "This somehow started in early childhood, when I played around in the forest a lot. Today I also understand the significance of forests through my work. I mean, the rainforests are irreplaceable, and the northern coniferous forests act as carbon sinks. But I still think that forests are also extremely important places for calming down and for healthy living."
Experiences during studies	**3.2** "My interest in biodynamic farming developed during my studies one summer, when I learned how much the forestry sector uses pesticides. There was this one guy who used so much pesticide every day, all the time, that it was insane. It also meant that we needed to clean our stuff every day, all the time, and take showers constantly."
	3.3 "I remember that at the Helsinki University of Technology, it was so modern at the time. It was not in the chemical department—it was in the wood-processing department. But yes, they had courses called the 'basic course on environmental technology 1 and 2.' I was immediately, like—I am of course exaggerating a bit—'Wow, I want to go there, and how amazing that engineers are able to create something for the end of the pipe and help the environment.'"
Professional growth	**3.4** "Sustainability issues are part of my professional position. For example, at the Center for economic development, the focus was on top soil. But later [the center] had a wider focus on environmental policy and waste management, for example. Today I'm working with the same issues, but now the approach is through NGOs."
	3.5 "I think a lot about human rights, especially through the supply chain. I mean, if you think about those so-called risk countries in the Far East and in East Africa, you need to consider those issues immediately. So I've been thinking about these things a lot through my work."

4.3.2.1b. Awakening moment altering the life course

In addition to the "upbringing and education" life path, in six interviews, the agents described awakening moments in their narratives that had influenced their life courses. The changes in their life courses had resulted in the agency-formation process. Some of these meaningful moments were positive by their very nature. For example, one agent described the experience of a golden eagle flying extremely low over him. This moment had triggered his lifelong interest in bird watching.

Some interviews, in contrast, included certain elements of crisis that had radically altered the existing trajectory of the actor's life course. Most of the respondents also portrayed learning moments or points that had led to a chain reaction where the sustainability actions had gradually started to grow. For example, one agent described how he had awakened to taking deliberative sustainability action after he had calculated his carbon footprint; he was simultaneously forced to consider the consequences of his actions while thinking of possibilities for making a difference.

Some of the actors' awakening moments appeared as seeing the deprivation of nature, for example, or as an awakening of being frightened about the future. These moments shaped the agents' life courses in such a way that they started to engage in sustainability transitions. Table 4 includes representative quotations of concepts under the second-order theme "awakening moment altering the life course." Overall, the aggregate level of "life path" appears to describe the individual, or agent's, personal growth in different forms.

Table 4. Data supporting the aggregate dimension *life path* regarding "awakening moment altering the life course"

Associated first-order concept	Representative quotations
Seeing the deprivation of nature	**4.1** "Before the coal industry had all these purification systems, these emissions caused coniferous trees to drop their needles. At the time, in Kokemäki [a town in southwestern Finland], Kemira had a fertilizer-manufacturing plant, and when we traveled through Kokemäki to Pori, we could actually see these black forests. Actually they weren't black—they were frayed. The needles of the pine trees were half bald."
Awakening concern about the future	**4.2** "These things started to interest me when I was a teenager. Actually, they started to frighten me. At the time, the main thing was climate change. I can remember how unpleasant it was. It was 2006 when Al Gore's movie [*An Inconvenient Truth*] came out. I couldn't even watch it, and I was so scared—[climate change] felt like such a huge problem."
Remarkable life event that adjusted the agent's world view	**4.3** "I had promised to study Finnish corporations in the Amazon. Then, of course, first I needed to figure out which firms were relevant for the study. Among others, there was Pöyry Oy, which had done some sort of forest consulting over there; then there was a Valmet Oy factory in São Paulo, or somewhere nearby, and they sold tractors for removing the rainforest. Several paper companies were also operating there. At the time, Finland's export, or international, business, was quite biased toward the forestry industry. Okay, then I did most of my interviews for the study in or near São Paolo, but since part of the travel plan was to go to the Amazon, I also went there. We traveled via riverboat from the Atlantic coast (from Belém) a couple of days upstream to

Manaus. From there I traveled to the middle of nowhere. I mean, Manaus is already in the middle of nowhere, but it's still a pretty large city in the Amazon. From there I traveled even farther; I flew in a small plane for a couple of hours to *really* the middle of nowhere, to a small town called Rio Branco, where no one spoke anything but Portuguese. Fortunately I had a translator with me. I also did interviews in Rio Branco, and I had already met with a few administrative representatives. I had formed kind of a general view about the phenomenon. Okay, so now we get into the core of this issue. At the time, the deforestation of the Amazon was all over the news in Western countries, since, for example, the Body Shop had a campaign called 'Stop the burning.' This means that within environmentally conscious circles, people acknowledged that the Amazon rainforest was being destroyed for cultivation. At the time the understanding was that the rainforests of the Amazon are equivalent to the lungs of the Earth; of course, now we know that this is not the case. But at the time, the understanding was that the Amazon was the lungs, and people thought that the lungs of the Earth were now being chopped down. At the time, climate change was not a topic, but the label of destroying an area of rainforest equaling the area of several football fields a day for cultivation was bad. The method they used to remove the rainforest was called 'slash and burn,' so the rainforest was actually being burned down in order to acquire farmland. Then I was there, and I saw how the rainforest was being burned down and turned into farmland, and I saw how the neighboring areas had already been changed into farmland. The people who did this came from southern Brazil, which was already overpopulated then—not to mention how overpopulated the place is today. So they had left southern Brazil with the hope of a better life and for subsidies from the Brazilian government. Of course, the subsidies were really small—I mean, my travel expenses were big compared to these subsidies. But anyway, they left for the Amazon because they got money from the government to 'remove the rainforest.' So one viewpoint for looking at this issue is to think that Brazil subsidized the deforestation of its own rainforest. I mean, that's one viewpoint. Another viewpoint is from the tractor seller's point of view, like 'Okay, there will be fields. There will be a need for tractors, so there's a market.' This was the viewpoint of one Finnish company. Then there was this viewpoint of the actual operator of the process [of cutting down the trees]. [The job] was a possibility for a better life, or at least for a more independent life, in any case. But all in all, it was a possibility to achieve a normal life through farming. And Westerners moralized this whole thing in their heads. So when you think about this, everyone was actually acting rationally from their own viewpoint. So the Body Shop campaign, the Westerners' ideas, the family who's run away from the favela, the tractor seller, and the Brazilian government—they all acted reasonably, according to their own viewpoints. Still, the end result was that the rainforest was being destroyed. So at the beginning, I didn't realize what was going on there, since at the time—during my studies or anywhere else—I'd never heard the phrase 'external costs.' Then at some point, I learned that this thing was an 'external cost,' and I don't even remember how I discovered these basic concepts from environmental economics. Probably from some article, but how I found that, I don't remember, since at the time there was no Internet. But somewhere I found this

information, and then I understood that, within this operation, the external costs were invisible. For that reason, stupid things were being done at the system level, even though at the individual or stakeholder level, things made sense; the price was the destruction of the environment, or contamination, if those were thought of as emissions. This was actually the starting point for me to get in touch with the terminology, and then I started to think, 'None of this seems to make sense, but still, people are doing things this way. Why are things done like this?' So basically, I've been solving this problem ever since."

4.4 "When I lived abroad, I often took yoga and meditation classes on Sundays, since, especially at the beginning, I didn't have as big a social circle as I'd had in Finland. I thought that was a bit odd, and I wondered if I'd gone there just to sit every Sunday at one woman's meditation class. I found [the situation] really weird, but then I noticed how I'd also gotten a lot out of [the yoga class]. I wasn't sure what I'd actually gotten from it, but I knew that there was something. I remember that, after I'd been going to the classes every Sunday for about two or three years, I was spending the time thinking about the meaning of life and what our bigger purpose was in life. Then one Sunday I came home, and I started to write in my journal. I did that quite a bit already, but then I also started to take these flip charts out, and I just completely filled my house with these flip charts, where I wrote down my mission in life. I was very confused, since something like 'The meaning of life is to save the world from environmental catastrophe by using human potential' came up. I looked at the text and was like, 'This is kind of frightening, since my current professional career has almost nothing to do with this. This all sounds nice, but it's out of my reach.' I just thought how my professional path didn't match with this goal. But then I also started to think how the meaning of life was now written down on these charts, and I thought that this would be a great dream to pursue for the rest of my life. After that moment, I started to somehow more actively take notice of this field [i.e., sustainability] and to create links to the field. I started to be partially aware of this thing, and I experienced this personal awakening."

4.4. Sustaining the agency—2. Individual vs. collective

We indicated earlier that the dichotomy between individual and collective expectations was a strong incentive for the agents we studied to sustain their agency. This distinction between individual and collective expectations appeared as a strong paradox in the lives of the agents.

4.4.1.2a. Intrinsic motivation overcomes collective expectations

It was typical for the agents to feel that their motivation was stronger than those expectations that arose from outside their internal world. Based on the interviews, most of the agents had clearly encountered difficulties during their time of being engaged in sustainability actions. For example, some agents spoke of how they had felt forced to change their professional positions or career paths in order to connect their work with sustainability actions. One respondent also described how her whole professional career had been very scattered, and how her longest contract of employment had lasted only two years.

The strong intrinsic motivation and belief that agents were "doing the right thing" helped them to remain resilient, even if the existing system did not enable the agents' sustainability-related actions. For example, one agent described how she had encountered a lot of bullying during her early years because of her choice of actions, but she was certain that her choices were better for the environment, so she maintained her resilience even though her surroundings did not support it. Another agent portrayed how she had actually grown stronger through her tribulations; she stated how it would not have mattered if she lacked money or a good position, since she would have been happy without any material status. Table 5 portrays the first-order concepts with selected representative quotations in relation to the second-order theme of "intrinsic motivation overcomes collective expectations."

Table 5. Data supporting the aggregate dimension *individual vs. collective* regarding "intrinsic motivation overcomes collective expectations"

Associated first-order concept	Representative quotations
Intrinsic motivation results in deliberative actions	**5.1** "There was a market demand, which resulted, in a way, that we needed to start our own firm, since no already-established company could have done this—because the already-established ones didn't want to do this. If you think, for example, of Pöyry Oy, they couldn't even think that they would do environmental management consulting, since those were 'wingnut' kinds of things. I mean, really, at the time, environmental management consulting was a wingnut thing. So there was no other way to execute this mission than to establish a firm with a few friends." **5.2** "The last year [at Finfood] was really difficult whenever I had to act against my values, and I thought, 'Is this really something that I can do?'"
Belief in oneself helps one to stay resilient	**5.3** "If I were to stop doing this for some reason, I would tear every part of myself away along with it. For example, my friends are largely doing these same things, too." **5.4** "I found it really nice to start doing these sustainable-development tasks. But since my background is in business administration, where the values are very techno-economic in nature, many of my friends from that world were like, 'What crazy stuff is that?' since they didn't know at the time what sustainability was. Fortunately nowadays, people appreciate this kind of work. Even the skeptics appreciate our work, even if they don't want to do it themselves. I still frequently receive hate mail, though, most recently today. But I know that we're doing the right thing, and then I have this group. It's great to just open this door and come here—I have an organization where we all pull together, and that is unbelievably great. I simply believe that when we go forward in a positive and goal-oriented way, we will make a change."

4.4.2.2b. The feeling of inadequacy

Whereas the agents described their strong commitment to sustainability actions as being the result of strong intrinsic motivation and from a belief in themselves, some of the narratives had a different kind of tone: several agents outlined a concern that their individual actions would not be enough to change the future. Many of the agents had also worked to restrain themselves

regarding certain sustainability issues in order to prevent themselves from getting burned out. For example, one agent described how she had taught herself to be gentler with herself and to keep in mind that she did not always need to do everything by herself.

The agents also indicated that they often felt that there was much more to do and that their own input was simply inadequate. For example, one agent described how, if she allowed it to occur, she felt a constant sense of world-weariness. This sensation of inadequacy, however, also led agents to stay engaged in sustainability transitions. Table 6 presents the first-order concepts with several quotations in relation to the second-order "feeling of inadequacy" theme.

Table 6. Data supporting the aggregate dimension *individual vs. collective* regarding the "feeling of inadequacy"

Associated first-order concept	Representative quotations
Need to set personal boundaries	**6.1** "Realistically, we need to set boundaries for ourselves in order not to burden ourselves too much, or even to burn out. At the end of the day, I still believe that even one person can make a difference. I pay special attention to not doing any work during the evenings and on the weekends. Instead I do something nice; it's crucial to have something else, too. It brings me some peace that on Fridays, I know I've done important things, and now I can concentrate on something else. When I was in my twenties, I was really close to burning out, so it was necessary for me to learn my own limits." **6.2** "Somehow I've recognized that we only have 24 hours in a day, which means that we have to make conscious choices about our careers and personal lives. We need to strictly protect our resources. I'd really like to do a lot more. I'd like to be able to divide myself into five versions of me, and I'd like to work day and night, and I feel bad, since I can't do more."
Belief that one's actions are not enough	**6.3** "…but when you know how much more you should do, your bad conscience is always present. I mean, of course I do a lot, but still…" **6.4** "Sometimes I wonder how I can make a difference if, in Finland, for example, 200 people think these things, when somewhere else, 2 million people are acting in the opposite way."

4.5. Agency formation and sustaining the agency—3. Mind-set: belief vs. critique

Our third aggregate dimension is the dichotomy between strong belief and strong critique within agents' mind-sets. We indicated that this dichotomy in the agents' mind-sets was an explaining factor for the agency-formation process as well as for sustaining the agency. This dichotomy appeared where agents had a clear vision about a more sustainable future while simultaneously being heavily critical of the existing system and its practices.

4.5.1.3a. Strong belief in a sustainable future

Agents described how their hope for a more sustainable future had led them to engage in sustainability-related actions. The vast majority of our interviewees had a strong sense that the future would be brighter, even though they also stated how they were concerned about the current situation. For example, one agent portrayed how she had to constantly think about

various sustainability-related threats in her work, and for that reason, she thought that all the ingredients for a catastrophe were in place. Despite these negative feelings, she still had a strong belief that society would find solutions for these threats. Another agent described how he typically did not hold a particularly optimistic view of the world, but he nevertheless stated that without a belief in positive change, he already would have given up on his sustainability actions. In other words, this belief in the future had helped the agents to sustain their agency.

Another repeating theme during the interviews was the strong will to create a better future for future generations. As one respondent stated, it was crucial for her to try to ensure that the children of the future would be able to live decent lives. These themes created more belief for the agents and helped them to engage and stay engaged in their sustainability transitions. Table 7 shows the first-order concepts with selected quotations in relation to the second-order theme of "strong belief in a sustainable future" under the aggregate theme of *mindset: belief vs. critique*.

Table 7. Data supporting the aggregate dimension *mindset: belief vs. critique* regarding "strong belief in a sustainable future"

Associated first-order concept	Representative quotations
Belief that the future will turn out better	**7.1** "…I have learned what a huge amount even a small number of people can achieve. It's extremely important for me to maintain hope. I guess I couldn't do anything if I didn't believe that we were still capable of solving these problems. But it will still demand a pretty big change in our collective thinking." **7.2** "The importance of sustainability is definitely increasing. After the Paris agreement, the future looks brighter to me."
Will to create a better world for future generations	**7.3** "At the end of the day, I can say to the kids, 'Hey, at least I tried.'" **7.4** "I find education extremely important, since I tend to spend a lot of time with kids."

4.5.2.3b. Criticism of the existing system

In addition to their belief in shaping the current system for the better, the agents showed a strong mind-set of criticism. Their criticism was typically targeted toward the existing system. Many agents described during their narratives how something should be done to the existing system, which is based on capitalism and on increasing consumption. They said how it would be crucial to limit growth and consumption, even if these things were not widely discussed outside their niche. One agent stated how all consumption harms the environment; another respondent expressed his concern about the oil industry, and how the debate about energy systems is still concentrated on the fear of running out of oil, rather than on creating competitive, and more sustainable, alternatives to oil.

One agent pointed out this criticism by hoping for a new economic paradigm in which environmental values would be as important as economic values. This criticism of the existing system both formed the agency as well as sustaining it. Table 8 shows the first-order concepts among representative quotations related to the second-order theme of "criticism of the existing system" under the aggregate theme of *mind-set: belief vs. critique*.

Table 8. Data supporting the aggregate dimension *mindset: belief vs. critique* regarding the theme "criticism of the existing system"

Associated first-order concept	Representative quotations
Criticism of capitalism	**8.1** "Just now I thought about energy policy, and how it's married with our economics. For example, we can talk about how wind energy and solar energy are unprofitable, and how taxpayers subsidy these things. I mean, we could do so much for this [type of energy]. I mean, really, if we would honestly talk about how much countries have spent in support of oil drilling over time, it would be a huge topic." **8.2** "If you think about the big picture after the industrial revolution, I think we've gone too far with this capitalistic mode of excessive growth and the excessive industrial profit-seeking world view."
Criticism of consumption	**8.3** "We're living in a culture of dishonesty of intelligence, and this culture of dishonesty of intelligence is still in charge, since earlier, the increasing material wealth actually brought more wellness." **8.4** "Oh boy, I always think that, as a consumer, like, 'Okay, I don't consume,' but then I see these 'Wish [Wish.com] Finland' Facebook groups with 100,000 members, for example, who are excited about cheap copies [of brand products]."

4.6. Sustaining the agency—4. Holism

As our final aggregate dimension, we identified "holism," which describes how deeply sustainability is included in the everyday lives of the agents; holism also describes how agents are capable of sustaining their agency.

4.6.1.4a. No value-action gap

Overall, the sustainability actions of everyday life, such as preferring a vegetarian diet or choosing to ride a bicycle instead of driving, were self-evident and integral parts of the normal lives of the agents. For example, one agent stated how he commuted to work by bicycle every day, whether it was winter or summer. Another agent questioned if recycling was even a sustainability action, since it was so self-evident for her. Another repeating concept during the interviews was how agents' values reflected their actual behavior.

Several respondents indicated how they aimed to act on what they believed, and they provided several examples from such situations. For example, one respondent said that he did not want to do anything that would harm either animals or the environment. Another respondent described how she felt that it was only natural that she used renewable energy in her household, rode a bicycle to work, recycled everything she could, and grew some of her own food herself. Table 9 presents the first-order concepts with representative quotations in relation to the second-order theme of "no value-action gap."

Table 9. Data supporting the aggregate dimension *holism* regarding the "no value-action gap" theme

Associated first-order concept	Representative quotations

Sustainability actions are self-evident and part of normal life	**9.1** "So, everything here [in the office] is recycled." **9.2** "Every time you buy something, you try to make better choices. Well, today I put cardboard boxes in the recycling bin. But, you know, those are the kinds of things you've always done, and you don't even think of those as being environmentally friendly acts."
Values reflect behavior	**9.3** "As an organizational leader, I'm ambitious about our organization, and of course I'm proud of all the results we've been able to achieve. But all the time I've been here, I've always highlighted the fact that we're all doing this together. It doesn't matter who does something, as long as we're able to do something good." **9.4** "I find that I'm very lucky and privileged, since I'm able to work in accordance with my values—I mean, environmental protection and taking care of all that—people here have a good place to work."

4.6.2.4b. Socio-physical unity

Agents' everyday sustainability-related actions were evident, but they also described how overall, taking care of their personal lives helped them to stay resilient and to continue with their sustainability actions. For example, they highlighted the role of exercise and proper sleep. One agent described how she systematically aimed to eat a healthy diet, sleep better, and generally be positive.

Another prominent concept in our data on socio-physical unity was yoga, which appeared to be an interest that assisted the agents in maintaining their agency. For example, one agent spoke of how his father had been influenced by the yoga philosophy in the 1970s, and for that reason, the whole family had eventually adopted a vegetarian diet, which was revolutionary at the time. Table 10 shows selected quotations from the first-order concepts under the second-order theme "socio-physical unity."

Table 10. Data supporting the aggregate dimension *holism* in the "socio-physical unity" theme

Associated first-order concept	Representative quotations
Healthy lifestyle	**10.1** "I almost never drink alcohol, I don't smoke, I try to eat a healthy diet, I exercise a lot, and I prefer an active everyday life."
Yoga	**10.2** "Many people who are associated with organic farming also do yoga, and so do I. I'm a yoga instructor for two yoga groups. I assume that the central idea of yoga's non-violence approach can be linked with the view of avoiding pesticides in organic farming."
Physical activity	**10.3** "My environmental consciousness has grown from a sensitivity toward nature—or maybe from a love of nature—and from the fact that I feel so good when I'm in the forest, and of course when I'm at a lake or by the ocean."

4.7. Synthesis

Based on our analysis, we now aim to describe how the different aggregate levels relate to two of our research questions: (1) How does agency form? and (2) How do agents stay engaged in sustainability transitions? Figure 5 presents the dynamics between the indicated aggregate levels. As mentioned earlier, we have divided our aggregate levels into two categories: agency formation or sustaining of the agency.
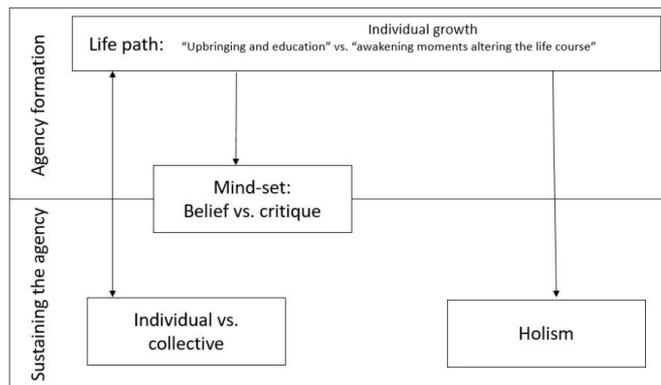

Figure 5. Dynamics of active sustainability agency formation and maintenance

We were able to distinguish one clear rationale that had led the agents to engage in deliberative sustainability actions: the aggregate dimension of "life path." Our findings provide implications that agency formation occurs either through an agent's upbringing and education or through remarkable events that change the agent's course of life. Many of the agents we interviewed described memories related to sustainability (which might appear as sensitivity toward nature, for example) and stated that their interest in sustainability had grown during their life course. Other agents stated that their interest had been awakened, or at least significantly increased, because of a meaningful life event—for example from seeing a lock-in mechanism of deforestation in practice.

We have also indicated two main rationales that helped agents to sustain their engagement in sustainability transitions, which were the aggregate dimensions of "individual vs. collective" and "holism." The aggregate dimension of individual vs. collective showed how agents deeply engaged in actions based on their endogenous interests. Strong individual desires, which often originate from agents' interests, overcome collective expectations. For example, some of the agents stated that they believed so strongly in their cause that it helped them stay resilient and to overcome any hurdles they encountered within their life courses. Many agents had even chosen their career paths because of sustainability interests. Some agents had chosen entirely new careers, since their earlier professional paths had not met their sustainability-related values and interests. Still, even though the agents' sustainability actions were varied, and they strongly believed that individual actions mattered, they also mentioned sensations of inadequacy numerous times. Sometimes they even questioned the overall influence of any one individual. Despite this dichotomy in our data, this feeling of inadequacy appeared to be a rationale for actions and urged the agents to stay engaged in sustainability transitions. This dichotomy also influenced the agents' life paths, since the feeling of inadequacy appeared to be the largest dichotomy related to their life course.

The aggregate dimension of "holism" unveils how agents' lifestyles were so strongly connected with their values that their sustainability actions of everyday life, such as using public transportation or decreasing their consumption, were a self-evident and natural part of life. In addition, agents often preferred healthy lifestyles, which helped them to relax and stay resilient. The indication from these two aggregate dimensions is that agents' interests and rationales for action kept them engaged in sustainability transitions rather than contributing to the formation process of agency.

The aggregate dimension of "mind-sets: belief vs. critique" also described individuals' interests, which not only resulted in deliberative actions but also sustained their agency. This situation means that the dimension of mind-sets fell into both categories: as an explaining factor for agency formation and for sustaining the agency. The mind-set provides rationales for the agents in terms of deliberative action; agents often also described their rationales for engaging in (and especially staying engaged in) deliberative sustainability actions as the desire to create a better future for forthcoming generations. They were also strongly critical of the existing system. Our findings suggest that the agents of sustainability are more resilient than the mainstream, both in terms of engaging in sustainability transitions as agency formation but also in sustaining their agency capabilities.

The aggregate dimension of "life path" appeared to portray a meta-level that included all the other aggregate dimensions, which may partly be explained by the fact that our interview questions were intentionally focused on examining agents' life courses. But one's life course and individual growth during life—whether the growth is the result of upbringing and education or through awakening moments—typically include a whole psycho-cognitive construct of an individual. Hence, our other aggregate levels—agents' mind-sets, the dichotomy between agents' internal worlds and pressures resulting from collective expectations, and agents' holistic lifestyles—were seen to be derived from agents' life courses.

5. Discussion

To better understand the role of individuals in creating a more sustainable future, the aim of this paper was to examine the agency of sustainability transitions through three research questions: (1) How does agency form? (2) How do agents sustain their agency? and (3) Is sustainability agency a niche-driven phenomenon? Because our interest is the role of individuals in the transition process of creating a more sustainable system, we will now add to the existing literature with four contributing remarks.

5.1. Contributions

Our main contribution is to offer a more explicit portrayal of the agents of sustainability transitions. While previous research has portrayed agents in sustainability transitions as tools of transformation, we wished to explore the social dimensions of agency. To this end, we used life courses as our analytical lens. The study of life courses helped us to create a more nuanced portrayal of agents of sustainability transitions and their lives. To the best of our knowledge, this is one of the first papers to undertake a life courses approach to the study of active agents in sustainability transitions.

In particular, we observed agents who had a high level of intrinsic motivation for their sustainability actions, since their rationales for engaging in action were derived from pure interest in sustainability rather than from pursuing a reward of some kind. Past research on individuals' motivations for engaging in action has emphasized how individuals' intrinsic motivation drives them to pursue activities for the sake of self-interest and for enjoying what

those activities provide, which also leads individuals to perform these activities at fairly high levels [e.g., 64, 65, 66]. This intrinsic motivation may also explain the agents' high levels of resilience and holistic views on life.

In addition to the distinction of formation of agency and sustaining that agency, our analysis unveiled several dichotomies within the agents' life courses. Based on our findings, most agents seemed to have a life course tinted with extremities. To begin with, the agency-formation process was also divided into two categories: those who had grown into sustainability agency and those who had awakened into sustainability agency. Second, the agents were torn between the expectations that the existing system sets and their individual desires and aspirations. This distinction also appeared as strong criticism of the practices of the existing system, whereas the agents still sustained their beliefs in a different, better, and more sustainable future.

The second contribution of this paper was to provide insights into the formation process of sustainability agency. We were able to identify two main paths for agency formation. Based on our analysis, we acknowledge that agency typically forms either through upbringing and education or through certain awakening moments. The dichotomy between upbringing and education and awakening moments is a widely discussed theme in the social sciences, especially in sociology and social psychology. This dichotomy is typically portrayed as different levels of life courses: as the level of historical change and the level of life experience [e.g., 67, 68]. In addition, within the transition-management framework, Loorbach et al. [69] have stated that crises tend to create space for agency and consequently for system transitions. This statement implies that the understanding of the influence of historical change and life experiences is also beginning to emerge within the transition literature. To our knowledge, however, an understanding of individuals' internal worlds and the effect on the agency-formation process have been absent to date. Hence, our findings provide implications that the same development path (which has already been acknowledged in other social sciences) is also evident within the formation process of agents in the context of sustainability transitions, especially when considering their internal worlds.

As our third contribution, our analysis led us to identify two main rationales for agents to sustain their agency. First, the dichotomy between individual and collective expectations appeared as an incentive for the agents to sustain their agency; second, holism also appeared as an incentive for the agents to sustain their agency. Both rationales for sustaining their agency could be associated with the agents' personalities. Our findings imply that the features related to an agent's personality, or cognitive entity, can explain why an agent might remain engaged in sustainability transitions. Based on our analysis, sustainability actions appear to be integral parts of agents' lives but also as a meaningful component of their self-image. In addition, we found that agents' critical yet hopeful mind-sets both formed agency but also sustained that agency. This finding highlights not only the agents' internal struggles between extremities but also the personalities of the agents.

Overall, our findings draw a sample picture of a sustainability agent as someone who is (1) more resilient than the mainstream, (2) possesses a personality that supports both sustainability agency formation activities but also helps in sustaining the agency, and (3) has a high level of self-knowledge and clear reasoning for engaging and staying engaged in sustainability actions.

Our fourth contribution was the tentative implication that sustainability agency is not only a niche-driven phenomenon. Based on our analysis, the agents of sustainability transition cannot be categorized only as niche agents or as regime agents. Even though some of the agents in our sample represented the current regime (at least according to their affiliations), they also

indicated their willingness to shape the existing system. In addition, the agents in our tentative agent categories did not display any particular differences in their answers. For example, the firm representatives portrayed similar interests and rationales as the entrepreneurs or NGO representatives. It is necessary to note that in this study, we only examined the most active agents of sustainability transitions; agents who were somewhat active or passive were absent from the study. In addition, we did not examine the potential differences between agents' varying roles in life. Some agents, for example, may target their actions differently within their personal lives compared to their professional lives. In this study, agency was examined from a holistic viewpoint. In order to gain more detailed knowledge about sustainability agency, this ambivalence about agents' different roles in life in relation to their sustainability actions should be studied further in the future. Whereas our analysis revealed that agents of sustainability transitions appear more resilient and more willing to shape the existing system than the mainstream, their positioning within the socio-technical system did not appear to have an effect on these tendencies.

5.2. Limitations and future research directions

This study does have certain limitations. First, our study set out to examine only the most active agents of sustainability transitions; this limitation implies that a study on the less active, or perhaps incumbent, representatives of the socio-technical system could provide entirely different types of findings. Typically, the transition literature emphasizes the dichotomy between regime and niche agents [16], even though regime agents appear to have competing rationales [5]. While our sample of agents set out to study the active agents of sustainability transitions, we also included agents who represented the regime (again, according to their affiliations). The regime agents in our study perceived themselves as being as active as the niche agents of the study. Hence, we follow Bakker's [5] path and state that regime representatives may appear as active agents of sustainability transitions who hope to alter the status quo without the restrictions of the current system. But in order to better understand agents who are somewhere between activity and passivity, the life courses of such "in between" actors should also be studied.

A second limitation concerns the study's setting, which took place in the context of a specific European country. This limitation indicates that our findings may be altered in a different setting. But the results from a setting of a highly industrialized Western country may provide implications of the formation processes and maintenance of agency in similar countries around the globe.

A third limitation relates to the seeming linearity of the life courses we observed. This linearity is partly explained by the very nature of life course studies: individuals tend to create linear paths when asked, whereas the reality is likely more disorganized than that. But the explicit narratives and descriptions we obtained related to the agents' life courses indicated that the agents were extremely capable of describing their life paths and rationales for their actions. This finding may also be a meaningful difference between the active agents of sustainability transitions and the mainstream; the agents had considered their positioning in the socio-technical system and had good reasons to engage in sustainability actions. One reason for this high level of self-knowledge may be explained by the fact that the agents had encountered many challenges during their life courses, and they had been forced to consider their choices as the consequences of their actions. This high level of self-knowledge might also be one component in explaining the strong resilience that appeared within our sample of agents.

A fourth and final limitation relates to the small sample size of the agents in the study. Given that the phenomenon of agents' social dimensions that we studied is relatively unknown, we selected qualitative methods, which are typically used to locate phenomena and capture any insights. Hence, the sample of 16 interviewees was large enough for our aim of unveiling the life courses and formation processes of the agents. Since our study was conducted using qualitative methods, we recommend that this study be continued using quantitative methods. Our research has provided initial implications to understand how sustainability agency forms and is sustained, but a great deal more room exists for research on the different dimensions in the study of agency within sustainability transitions.

Several exciting research avenues related to agency within sustainability transitions are available for future study. For example, one of the largest theoretical debates in the transition discipline is currently focused on the question of how to more explicitly conceptualize and integrate actors and agency into the study of socio-technical transitions [28]. The integrated influence of agency should thus be examined further. For example, we examined agents' life courses without any distinctions (such as different roles in life), but in order to achieve a comprehensive portrayal of agency, the possible differences in agents' different roles in life (for example, agents' business roles and home roles) should be examined further. The distinction between regime and niche agents should also be explored more in future studies. In order to gain more knowledge about those agents who are somewhere between activity and passivity, the life courses of such agents should also be studied.

Our analysis has provided several implications for our research question of how individual agency forms in the context of sustainability transitions; scholars could expand those implications and hypothesize that similar trajectories will also apply for collective agency formation. The way in which individual agency grows into collective agency was not a focus of our study. In order to achieve a truly sustainable system, the bridge between individual and collective sustainability agency should be studied more explicitly.

6. Conclusions

With this paper, we set out to explore how the agency of sustainability transitions forms and is sustained through agents' life courses. Our object was to address three different questions. First, we explored how agency forms. Second, we explored how agents sustain their agency. Third, we examined if sustainability agency is a niche-driven phenomenon. In this paper, the life courses of agents were seen to unveil the formation process of sustainability agency and to explain why agents remain engaged in sustainability transitions. We argue that sustainability agency forms either from the experiences agents have had in their early years or from certain awakening moments that have shaped their life courses.

We identified two main rationales for agents to sustain their agency. First, the dichotomy between individual and collective expectations was a rationale in sustaining agency. Second, holism in every aspect of life appeared to be a rationale for the agents in sustaining their agency. In addition, we were able to identify that agents of sustainability transitions may represent either regime or niche development. We would like to argue that this paper has added to the literature by starting to build a more explicit portrayal of agents of sustainability transitions, although further studies will be necessary to narrow the gaps in existing agency research. With this paper, we hope to encourage further work on understanding the entire role of agency in sustainability transitions in order to achieve a truly sustainable future.

Appendix A

THEMES OF THE INTERVIEWS

Who is the agent, and where does he/she come from?
What is his/her relation to sustainability and to sustainability transitions?
       —What is the timeline regarding this relation?
       —What situational factors influence this relation?
       —What rationales influence this relation?
How have the agent's actions related to sustainability developed over time?
Why is the agent interested in sustainability?
What were the agent's most recent actions related to sustainability?
What has challenged the agent's path in terms of sustainability issues?
How does the agent perceive the current system?
How does the agent perceive the future of sustainability?
What values does the agent have?
       —How are these values manifested in the agent's life?

References

1. Geels, F. The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, **2011**, 1, 24–40, https://doi.org/10.1016/j.eist.2011.02.002.
2. Klitkou, A.; Bolwig, S.; Hansem, T.; Wessberg, N. The role of lock-in mechanisms in transition processes: The case of energy for road transport. *Environmental Innovation and Societal Transitions*, **2015**, 16, 22–37, https://doi.org/10.1016/j.eist.2015.07.005.
3. Grin, J.; Rotmans, J.; Schot, J. On patterns and agency in transition dynamics: Some key insights from the KSI programme. *Environmental Innovation and Societal Transitions*, **2011**, 1, 76–81, https://doi.org/10.1016/j.eist.2011.04.008.
4. Cashmore, M.; Wejs, A. Constructing legitimacy for climate change planning: A study of local government in Denmark. *Global Environmental Change*, **2014**, 24, 203–212, https://doi.org/10.1016/j.gloenvcha.2013.09.019.
5. Bakker, S. Actor rationales in sustainability transitions – Interests and expectations regarding electric vehicle recharging. *Environmental Innovation and Societal Transitions*, **2014**, 13, 60–74, https://doi.org/10.1016/j.eist.2014.08.002.
6. Mercure, J-F.; Pollitt, H.; Bassi, A.; Viñuales, J.; Edwards, N. Modelling complex systems of heterogeneous agents to better design sustainability transitions policy. *Global Environmental Change*, **2016**, 37, 102–115, https://doi.org/10.1016/j.gloenvcha.2016.02.003.
7. Smith, A.; Stirling, A.; Berkhout, F. The governance of sustainable socio-technical transitions. *Research Policy,* **2005**, 34, 1491–1510, https://doi.org/10.1016/j.respol.2005.07.005.
8. Genus, A.; Coles, A. Rethinking the multi-level perspective of technological transitions. *Research Policy*, **2008**, 37, 1436–1445, https://doi.org/10.1016/j.respol.2008.05.006.
9. Koistinen, K.; Teerikangas, S.; Mikkilä, M.; Linnanen, L. Agent based change in facilitating sustainability transitions – a literature review and call for action, in *Handbook of Engaged Sustainability*, Dhiman, S. & Marques, J. (Eds.), Springer International Publishing, Switzerland, **2018**, 1–23. ISBN 978-3-319-71312-0.
10. Geels, F. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy*, **2002**, 31, 1257–1274, https://doi.org/10.1016/S0048-7333(02)00062-8.
11. Geels, F.; Sovacool, B.; Schwanen, T.; Sorrel, S. Sociotechnical transitions for deep decarbonization. *Science*, **2017**, 357(6357), 1242–1244, DOI: 10.1126/science.aao3760.
12. Upham, P.; Lis, A.; Riesch, H.; Stankiewicz, P. Addressing social representations in socio-technical transitions with the case of shale gas. *Environmental Innovation and Societal Transitions*, **2015**, 16, 120–141, https://doi.org/10.1016/j.eist.2015.01.004.
13. Bergek, A.; Hekkert, M.; Jacobsson, S.; Markard, J.; Sandén, B.; Truffer, B. Technological innovation systems in contexts: Conceptualizing contextual structures and interaction dynamics. *Environmental Innovation and Societal Transitions*, **2015**, 16, 51–64, https://doi.org/10.1016/j.eist.2015.07.003.
14. King, B. A Social Movement Perspective of Stakeholder Collective Action and Influence. *Business & Society*, **2008**, 47(1), 21–49, https://doi.org/10.1177/0007650307306636.
15. Wiek, A.; Ness, B.; Schweizer-Ries, P.; Brand, F.; Farioli, F. From complex systems analysis to transformational change: a comparative appraisal of sustainability science

projects. *Sustainability Science*, **2012**, 7(1), 5–24, https://doi.org/10.1007/s11625-011-0148-y.

16. Geels, F.; Schot, J. Typology of sociotechnical transition pathways. *Research Policy*, **2007**, 36(3), 399–417, https://doi.org/10.1016/j.respol.2007.01.003.

17. Geels, F.; Verhees, B. Cultural legitimacy and framing struggles in innovation journeys: a cultural-performative perspective and a case study of Dutch nuclear energy (1945-1986). *Technological Forecasting and Social Change*, **2011**, 78(6), 910–930, https://doi.org/10.1016/j.techfore.2010.12.004.

18. Lehner, M. Translating sustainability: the role of the retail store. *International Journal of Retail & Distribution Management,* **2015**, 43(4), 386–402, https://doi.org/10.1108/IJRDM-02-2014-0013.

19. Heijden, A.; van der Cramer, J.; Driessen, P. Change agent sensemaking for sustainability in a multinational subsidiary. *Journal of Organizational Change Management*, **2012**, 25(4), 535–559, https://doi.org/10.1108/09534811211239218.

20. Walker, G.; Devine-Wright, P.; Hunter, S.; High, H.; Evans, B. Trust and community: exploring the meanings, contexts and dynamics of community renewable energy. *Energy Policy*, **2010**, 38, 2655–2663, https://doi.org/10.1016/j.enpol.2009.05.055.

21. Fudge, S.; Peters, M.; Woodman, B. Local authorities as niche actors: the case of energy governance in the UK. *Environmental Innovation and Societal Transitions*, **2016**, 18, 1–17, https://doi.org/10.1016/j.eist.2015.06.004.

22. Shove, E.; Walker, G. CAUTION! Transitions ahead: politics, practice, and sustainable transition management. *Environment and Planning A*, **2007**, 39, 763–770, https://doi.org/10.1068/a39310.

23. Fuenfschilling, L.; Truffer, B. The structuration of socio-technical regimes—Conceptual foundations from institutional theory. *Research Policy*, **2014**, 43(4), 772-791, https://doi.org/10.1016/j.respol.2013.10.010.

24. Rotmans, J.; Kemp, R.; van Asselt, M. More evolution than revolution: transition management in public policy. *Foresight*, **2001**, 3(1), 15-31, https://doi.org/10.1108/14636680110803003.

25. Quist, J.; Thissen, W.; Vergragt, P. The impact and spin-off of participatory backcasting: From vision to niche. *Technological Forecasting and Social Change*, **2011**, 78(5), 883-897, https://doi.org/10.1016/j.techfore.2011.01.011.

26. Wittmayer, J.; van Steenbergen, F.; Baasch, S.; Feiner, G.; Omann, I.; Quist, J.; Loorbach, D. Pilot projects on a roll. Year 2 pilot specific reports. Deliverable 4.3. InContext: EU ENV.2010.4.2.3-1 grant agreement n° 265191, **2012**, Available online: http://www.incontext-fp7.eu/sites/default/files/Pilot%20projects%20on%20a%20roll,%20Year%20Two%20Status%20Report.pdf (accessed on 07.02.2018).

27. Quist, J.; Wittmayer, J.; van Steenbergen, F.; Loorbach, D. Combining backcasting and transition management in the community arena a bottom-up participatory method for visions & pathways for sustainable communities and consumption. In: Quist, J., Wittmayer, J., Umpfenbach, K. & Bauler, T. (eds) Pathways, transitions and backcasting for low-carbon and sustainable lifestyles. Sustainable consumption transition series, issue 3. Proceedings of SCORAI & Incontext Workshop 7.-8. October, **2013**, Rotterdam. Available online: https://repository.tudelft.nl/islandora/object/uuid%3Aabde24ee-a1c4-4a9b-929c-9d5c48f4fb36 (accessed on 07.02.2018)

28. Fuenfschilling, L.; Truffer, B. The interplay of institutions, actors and technologies in socio-technical systems — An analysis of transformations in the Australian urban water sector. *Technological Forecasting and Social Change*, **2016**, 103, 298–312, https://doi.org/10.1016/j.techfore.2015.11.023.

29. Giddens, A. *The Constitution of Society*, University of California Press, Berkeley, CA, **1984**; 402 p. ISBN 9780520052925.

30. Archer, M. *Realist Social Theory: The Morphogenetic Approach*, Cambridge University Press, **1995**; 368 p. ISBN 0521484421.

31. Law, J. Notes on the Theory of the Actor-Network: Ordering, Strategy and Heterogeneity. *Systems Practice*, **1992**, 5, 379-93, https://doi.org/10.1007/BF01059830.

32. Latour, B. *Reassembling the Social*, Oxford University Press, UK, **2005**; 320 p. ISBN 978-0-19-925604-4.

33. Stones, R. *Structuration Theory*, Palgrave Macmillan, Basingstoke, **2005**; 240 p. ISBN 9780333793770.

34. Dean, W.; Sharkey, J.; Johnson, C. The Possibilities and Limits of Personal Agency. *Food, Culture & Society, An International Journal of Multidisciplinary Research*, **2016**, 19(1), 129–149, https://doi.org/10.1080/15528014.2016.1145006.

35. Grin, J.; Rotmans, J.; Schot, J. *Transitions to Sustainable Development,* London: Routledge, **2010**; 398 p. ISBN 9780415876759.

36. Coad, A.; Jack, L.; Kholeif, A. Strong structuration theory in accounting research. *Accounting Auditing & Accountability Journal*, **2016**, 29(7), 1138-1144, https://doi.org/10.1108/AAAJ-07-2016-2625.

37. Schwandt, D.; Szabla, D. Structuration Theories And Complex Adaptive Social Systems: Inroads To Describing Human Interaction Dynamics. *Emergence: Complexity and Organization*, **2013**, 15(4), 1-20, doi: 10.emerg/10.17357.83a02f74fd3ac7032b1c947f9fa0500d.

38. Aldous, D. Understanding the complexity of the lived experiences of Foundation Degree sport lecturers within the context of Further Education. Sport. *Education and Society*, **2014**, 19(4), 472–88, DOI: 10.1080/13573322.2012.674506

39. Fjellstedt, L. Examining Multidimensional Resistance to Organizational Change: A Strong Structuration Approach. Doctoral Thesis. The George Washington University, District of Columbia, US, August 31, **2015**.

40. Upham, P.; Dütschke, E.; Schneider, U.; Oltrad, C.; Salad, R.; Lores, M.; Klapper, R.; Bögel, P. Agency and structure in a sociotechnical transition: Hydrogen fuel cells, conjunctural knowledge and structuration in Europe. *Energy Research & Social Science*, **2018**, 37, 163–174, https://doi.org/10.1016/j.erss.2017.09.040.

41. Garud, R.; Karnøe, P. Path Dependence as a Process of Mindful Deviation. *Path dependence and creation*, **2001**, 1–40. DOI: 10.1561/100.00000006.

42. Stones, R.; Jack, L. The bridge between ontological concepts and empirical evidence: an interview with rob stones. *Accounting, Auditing and Accountability Journal*, **2016**, 29(7), 1145-1151.

43. Settersten, R. *Lives in time and place: the problems and promises of developmental science*. Amityville, NY: Baywood Publishing Company, Inc., **1999**; 318 p. ISBN 0895032007.

44. de Vries, B.; LeBlanc, A.; Frost, D.; Alston-Stepnitzc, E.; Stephenson, R.; Woodyatte, C. The relationship timeline: A method for the study of shared lived experiences in relational contexts. *Advances in Life Course Research*, **2017**, 32, 55–64, https://doi.org/10.1016/j.alcr.2016.07.002.

45. Elder, G. The life course as developmental theory. *Child Development*, **1998**, 69, 1–12, DOI: 10.2307/1132065.

46. Mitchell, B. Life course theory. International encyclopedia of marriage and the family, **2013**. Available online: http://www.encyclopedia.com/doc/1G2-3406900275.html (accessed on 29.11.17)

47. de Vries, B., Blando, J., Southard, P. and Bubeck, C. The times of our lives, in *Narrative gerontology: Theory, research, and practice*, G. Kenyon, P. Clark, and B. De Vries (Eds.), New York: Springer, **2001**, 137–158. ISBN 978-0826113894.

48. Jang, Y., Haley, W. E., et al., Life events and stress, in *Encyclopedia of aging*, D. Ekerdt, R. Applebaum, K. Holden, S. Post, K. Rockwood, and R. Schulz (Eds.), New York: Macmillan Reference USA, **2002**, 748–789. ISBN 978-0028654720.

49. Bühlmann, F.; Levy, R. Towards a socio-structural framework for life course analysis. *Advances in Life Course Research*, **2016**, 30, 30–42, https://doi.org/10.1016/j.alcr.2016.03.005.

50. de Vries, B.; Suedfeld, P.; Krell, R.; Blando, J.; Southard, P. The Holocaust as a context for telling life stories. *The International Journal of Aging and Human Development*, **2005**, 60(3), 213–228, https://doi.org/10.2190/TFHA-D5K5-KQKK-8DE4.

51. de Vries, B. Lifelines: A review of content and context. *The International Journal of Reminiscence and Life Review*, **2013**, 1(1), 31–35.

52. Bruner, J. *Actual Minds, Possible Worlds*. Harvard University Press, Cambridge, MA, **1986**; 222 p. ISBN 9780674003668.

53. Czarniawska, B. *Narrating the Organization: Dramas of Institutional Identity*. University of Chicago Press, Chicago, IL, 1997; 242 p. ISBN 9780226132297.

54. Pentland, B. Organizations as networks of action, in *Variations in Organization Science: In Honor of Donald T. Campbell*, J. Baum, B. McKelvey, (Eds.), Sage, Thousand Oaks, CA, **1999**. 237–253. ISBN 978-0761911265.

55. Bartel, C.; Garud, R. The Role of Narratives in Sustaining Organizational Innovation. *Organization Science*, **2009**, 20(1), 107–117, DOI: 10.1287/orsc.1080.0372.

56. MacLeod, M.; Davidson, E. Organizational storytelling and technology innovation. Proceedings of the 40th Hawaii International Conference on System Sciences – **2007**.

57. Kern, F. Ideas, institutions, and interests: explaining policy divergence in fostering 'system innovations' towards sustainability. *Environment and Planning C*, **2011**, 29(6), 1116–1134, https://doi.org/10.1068/c1142.

58. Geels, F. Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy*, **2010**, 39, 495–510, https://doi.org/10.1016/j.respol.2010.01.022.

59. Swedberg, R. Can there be a sociological concept of interest? *Theory and Society*, **2005**, 34(4), 359–390, https://doi.org/10.1007/s11186-005-1986-3.

60. Kvale, S. *InterViews: An Introduction to Qualitative Research Interviewing*. Sage Publications, London, 1996; 344 p. ISBN 978-0803958203.

61. Glaser, B.; Strauss, A. *The discovery of grounded theory: Strategies for qualitative research*. Chicago, IL: Aldine, 1967; 282 p. ISBN 978-0202302607.

62. Gioia, D.; Corley., K.; Hamilton, A. Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, **2012**, 16(1) 15-31, https://doi.org/10.1177/1094428112452151.

63. Corley, K. and Gioia, D. (2004). Identity ambiguity and change in the wake of a corporate spin-off. Administrative Science Quarterly, 49, 173–208.

64. Csikszentmihalyi, M. *Beyond boredom and anxiety*. San Francisco: Jossey-Bass, **1975**; 231 p. ISBN 978-0875-89261-0.

65. Grolnick, W.; Ryan, R. Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology*, **1987**, 52(5), 890–898, DOI: 10.1037/0022-3514.52.5.890.

66. Amabile, T. Creativity and Innovation in Organizations. Harvard Business School, **1996**, 1–15.

67. Elder, G. Linking Social Structure and Personality. *American Behavioral Scientist*, **1973**, 16(6), 785–800, https://doi.org/10.1177/000276427301600601.

68. Elder, G. Time, Human Agency, and Social Change: Perspectives on the Life Course. *Social Psychology Quarterly*, **1994**, 57(1), 4–15, DOI: 10.2307/2786971.

69. Loorbach, D.; Avelino, F.; Haxeltine, J.; Wittmayer, T.; O'Riordan, P.; Weaver, P.; Kemp, R. The economic crisis as a game changer? Exploring the role of social construction in sustainability transitions. *Ecology and Society*, **2016**, 21(4), 15, http://dx.doi.org/10.5751/ES-08761-210415.

Publication IV

Koistinen, K., Laukkanen, M., Mikkilä, M., Huiskonen, J., and Linnanen, L.

Sustainable system value creation: Development of preliminary frameworks for a business model change within a systemic transition process

Sustainable system value creation: Development of preliminary frameworks for a business model change within a systemic transition process

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ABSTRACT

Although corporate sustainability has gained more attention and companies have recently showed a growing interest in sustainable practices, the progress towards sustainable development has been slow leading to increasing environmental and social challenges. . Business model innovations are recognized as a key to the creation of sustainable business and as a bridge between company level and system level changes. Sustainable business model innovations create, deliver and capture economic, social, and ecological value for customers and other stakeholders in various societies.

The aim of this article is to deepen the understanding of the ways how companies create and capture sustainable value through business models in a larger operation system. From the theoretical perspective, the article adopts the transition theory and the concept of strong sustainability for understanding socio-technical transitions and business model changes towards sustainability. Here the focus is on companies' dualistic role pursuing sustainable development targets – both contributing to sustainability within the business dimensions, and assisting the broader systemic change through the new sustainable business models. Furthermore, the article deals with the external factors that either enable or hinder companies to transform their existing business models towards sustainability.

By reviewing previous literature, this study develops preliminary frameworks combining the approaches of transition management, sustainable value creation and corporate sustainability levels. The work aims to decrease the existing gap between the literature of system transition and business models. The frameworks can be applied in the future in analyzing new sustainable business models, value processes, value creation and capture, and broader systemic changes towards sustainability.

INTRODUCTION

The number of publications on corporate sustainability has increased exponentially since the early 1990s (Linnenluecke & Griffiths, 2013), and companies overall are showing increasing interest towards corporate sustainability practices (e.g. Lacy et al., 2012). However, the progress towards sustainable development has been slow, and ecological and social problems are increasing. Dyllick and Muff (2015) identified a significant disconnection between the organizational, micro-level concepts of corporate sustainability and sustainable business and the global, macro-level concept of sustainable development. Company-level actions contribute marginally to global sustainability if corporate sustainability and sustainable development are disconnected, and consequently, the performance measures remain disconnected. Three conceptual challenges disconnecting the concepts of corporate sustainability and sustainable development were addressed: 1) the poor integration of all three dimensions (economic, ecological and social) in the business sustainability discourse, 2) the insufficient integration of the societal macro level with the organizational micro level, and 3) the focus on economic success as the dominating performance measure.

The concept of the business model is presented as a bridge between changes at the company leve, micro level, and the system level, macro level (Boons & Lüdeke-Freund, 2013; Boons et al., 2013). Monumental challenges, such as climate change, resource depletion and inequality, question the traditional manner in which companies create value. Innovations promoting the sustainable performance of companies are more crucial than ever for long-term success, and sustainability issues should be fully integrated into the strategy and operations of a company (Lacy et al., 2012). Sustainable business model is an approach for firms to reconceptualize their purpose and value creation logic to improve their economic, environmental and social sustainability (Bocken et al., 2014)., and sustainability can be seen as a central driver of innovation (Nidumolu et al., 2009). Although the question of how companies can transform their business models towards sustainability is highly relevant for society and management, and sustainable business model literature is evolving, companies have been slow to adopt sustainability strategies and sustainable business models. Sustainability transitions are complex and unique because sustainability is a collective good, which means that most sustainable solutions do not offer direct user benefits (Geels, 2011). It is therefore unlikely that sustainable business model will be able to replace existing systems without wider system level changes, such as changes in regulatory frameworks and industry level policies.

Firms are capable of contributing to sustainability through multiple transition pathways (Geels & Schot, 2007; Geels, 2014) when firms can be interpreted as agents of sustainability transitions. Transition literature typically perceives business enterprises as external agents that challenge the status quo, whereas the internal processes of firms are often underplayed. The processes of value creation and capture within business environments are needed to understand both business model change and system transition.

In addition, business models are typically considered from the viewpoint of a focal company, and to date, business model research has predominantly focused on company level analyses

and examples, whereas sustainability often requires a broader, system level perspective (Abdelkafi & Täuscher, 2016; Gorissen et al., 2016; Pedersen et al., 2016). Internal activities through which companies enhance sustainable business are greatly affected by the business environment in which the companies operate (Zott & Amit, 2007). It is thus important to take a step beyond the business model of the individual company and identify and analyze driving forces and barriers that have an impact on sustainable business models. A deeper understanding is required on the mechanisms on how the business model concept can bridge corporate sustainability and system level innovation. System level change and industry transformation require the joint efforts of several actors and the change of more than one company's business model.

This study contributes to these calls by applying transition theory to explain both the business model change at the company level and wider socio-technical transition towards sustainability. Transitions emerge through agency that can be, for example, an individual, a business enterprise, or a governmental or non-governmental organization. The article aims at explaining the mechanisms of sustainable value capture and creation at the company level but within a larger operating system.

This paper is organized into two main sections and conclusions. The next section reviews the literature from different disciplines and presents the central concepts of the study and the theoretical background related to them. The following section integrates the disciplines and ends up presenting preliminary frameworks emerging from the relevant theories. The initial integration of different disciplines may help to reduce the gap between system transition literature and business model literature. The final section draws conclusions and presents implications and avenues for future research. Since the focus of this chapter is theoretical, the proposed future research directions include testing the frameworks empirically.

THEORETICAL AND METHODOLOGICAL BACKGROUND

Previous literature was reviewed in order to create the basis on understanding socio-technical transitions and business model change towards sustainability. The qualitative literature analysis (see e.g. Marshall and Rossmand, 1999, Miles and Huberman, 1994) was conducted in two iterative stages. First, we identified the main concepts and conducted the literature review. Second, we used constructive research to synthesize the findings from the previous literature and to develop the integrative frameworks. We used the Scopus database and the following keywords and their combinations to find relevant articles: 'business model', 'sustainability', 'transition management', 'system transition' and 'systemic change'. (Scopus is an extensive database and probably the best tool available for literature searches, particularly for articles published after 1995 (Falagas et al., 2008). Falagas, M.E., Pitsouni, E.I., Malietzis, G.A. & Pappas, G., 2008, "Comparison of PubMed, Scopus, Web of Science, and Google Scholar: Strengths and weaknesses", *FASEB Journal,* vol. 22, no. 2, pp. 338-342.)

Based on three key concepts identified – namely, sustainability, business model and system transition – the conceptual framework was outlined for integrating business model change and system transition towards sustainability (Figure 1). The key concepts are discussed in this

section. The synergy between the disciplines is created based on the findings of the discussion in the following section.
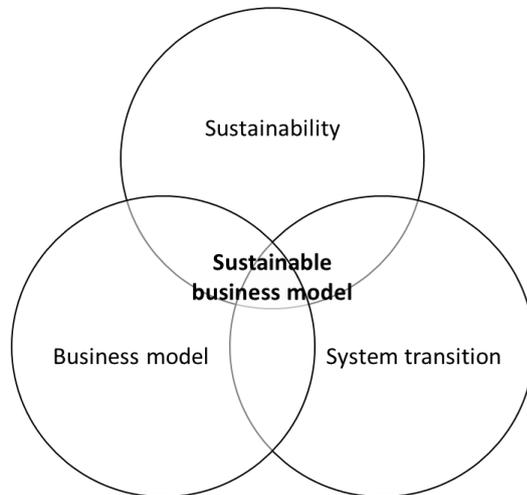

Figure 1. Conceptual framework for sustainable value creation

Concept 1: Sustainability

Planetary boundaries
Since the world faces mounting sustainability threats and great challenges, researchers have attempted to determine sustainable limits to human activities. After the Industrial Revolution, human actions have been the main drivers of global environmental change, hence pushing the Earth outside of its stable environmental state with consequences that are detrimental or even catastrophic for large parts of the world. Rockström et al. (2009) have developed "planetary boundaries" that define the safe operating space for humanity with respect to the Earth's system and are identified in terms of the planet's biophysical subsystems or processes. Steffen et al. (2015) addressed the impact of accelerating economic growth and equity for the changing safe operating space. Milne et al. (2006) emphasized management approaches to corporate responsibility in this context. The debate has led to investigating on the contribution of companies to the degradation of the nine specific boundary processes on different focal scales (Whiteman et al. 2013).

Sustainability
WCED (1987) defined sustainability as the development meeting the present needs without compromising the ability of future generations to meet their own needs. Within this view, pursuing sustainability is seen as a process of gradually conjoining demands on and the supply of resources, the infinite and finite aspects of human life (Williams & Millington, 2004). Traditionally, sustainable development is portrayed as a convergence, or a triple bottom line,

of three different pillars: economic, ecological and social (e.g. Mikkilä, 2006, Mikkilä et al., 2015).

The debate by scholars and practitioners culminated into the categories of weak sustainability and strong sustainability. The distinction between weak and strong sustainability was derived from the attempts to operationalize sustainability in a purposeful way. Weak sustainability refers commonly to a need to expand the stock of resources by, for example, developing renewable resources, making more out of existing resources or finding technological solutions to environmental problems (Williams & Millington, 2004). The idea underlying strong sustainability is to revise the demands on the Earth. For instance, the consumption should be decreased, rather than adapting the Earth to suit human needs (Williams & Millington 2004). The distinction between weak and strong is, however, rather crude and the reality much more diverse.

Sustainable development related to corporate sustainability
The idea of sustainable development is often dominated by the macro level. Baumgartner and Ebner (2010) argued that sustainable development is designated only at the macro level of societies. Comprehensive corporate sustainability strategy eventually have positive effects on societies at large. This micro level sustainability refers commonly to corporate sustainability or responsibility including the three dimensions of economic, environmental and social sustainability (Mikkilä, 2006; Mikkilä et al., 2015) Corporate sustainability is a value-bound concept that varies in place and time depending on the surrounding, dominating regime. Corporate sustainability and responsibility refer commonly to the operation environment: natural resource based industries favor corporate sustainability, whereas several other sectors apply corporate responsibility (Mikkilä & Toppinen, 2008; Mikkilä et al., 2016).

The research on how corporations can contribute to sustainability has continued over the past decade and, for example, Dyllick and Muff (2015) have introduced a four-level typology for corporate sustainability in order to clarify when business is truly sustainable. These levels are "business-as-usual", "refined shareholder value management", "managing for the triple bottom line" and "truly sustainable business". The first focuses on producing economic value in the form of profit and shareholder value, and externalized costs are not understood or measured. At the second level, the business objective is to create shareholder value, but environmental and social concerns are considered in decision-making and actions as economic risks but also opportunities for business. At the third level, value creation goes beyond shareholder value, including social and environmental values. This means a broadened stakeholder perspective, pursuing a triple bottom line approach, and creating sustainable value not just as a side-effect of business activities but as the result of deliberately defined goals. The highest level, truly sustainable business, shifts the perspective from the traditional "inside-out" approach to "outside-in", referring to the creation of a significant positive impact in critical and relevant areas for society and the planet in addition to the mitigation of negative impacts. Sustainability challenges are turned into business opportunities making "business sense" of environmental and social issues.

Concept 2: Business model

Business model innovation
A business model describes the rationale on value creation, delivery and capture of organizations (Osterwalder & Pigneur, 2010). It reflects the company's realized strategy (Casadesus-Masanell & Ricart, 2010), emphasizes a holistic approach to explaining how companies "do business" (Zott et al., 2011) and provides a link between an individual company and the larger production and consumption system (Boons et al., 2013). The business model describes *how* and to *whom to do business in addition to what* a business does (Zott & Amit, 2010).

Business model innovation is widely acknowledged as a source of innovation (Zott & Amit, 2007; Amit & Zott, 2012) and as a key source of competitive advantage (Baden-Fuller & Morgan, 2010; Chesbrough & Rosenbloom, 2002; Teece, 2010). It is also recognized as key to the creation of sustainable business (e.g. Boons et al., 2013; Boons & Lüdeke-Freund, 2013; Carayannis et al., 2014) and the enhancement of the transition towards a circular economy (e.g. Lewandowski, 2016; Planing, 2015). Comprehensive sustainability efforts are more likely to take place in organizations that demonstrate high levels of business model innovation (Pedersen et al., 2016).

Business model for sustainability
Business models for sustainability, i.e. sustainable business models, significantly increase positive impacts or reduce negative ones for societies by changing value creation, delivery and capture by organizations and their networks (Bocken et al., 2014). According to Schaltegger et al. (2012; 2016), sustainable business modeling aims at identifying opportunities that allow firms to capture economic value whilst generating environmental and social value, thereby establishing the business case for sustainability. A business model that contributes to sustainable development needs to create value to the whole range of stakeholders and the natural environment, beyond customers and shareholders (Schaltegger et al., 2016). Upward and Jones (2016) have presented a more theoretical approach; they discuss weak and strong sustainability and compare more profit-oriented business models to strongly sustainable business models building on the natural and social science of sustainability. They see that strongly sustainable business models do no harm but create positive environmental, social, and economic value throughout the value networks, thereby sustaining the possibility that human and other life can flourish on this planet forever. Strongly sustainable business models take financial, societal and environmental costs into account and measure financial rewards, social benefits and environmental regeneration – so called tri-profit.

Stubbs and Cocklin (2008) defined a sustainable business model to draw economic, environmental and social aspects of sustainability in defining a company's purpose and measuring its performance, considers the needs of all stakeholders, treats nature as a stakeholder, and encompasses both a system and a company-level perspective. Abdelkafi and Täuscher (2016) emphasized the system-level perspective by conceptualizing a sustainable

business model, that enables the company to reinforce the mutual interdependencies between the value created for its customers and the environment as well as the value captured for itself. The more value the company can create for its customers and the wider environment, the higher the value it captures for itself.

The literature has identified a wide range of examples on specific companies aiming at contributing to business model innovation for sustainability, for example Interface Inc. and Bendigo Bank (Stubbs & Cocklin, 2008), and British Sugar (Short et al., 2014). Some examples show solutions and mechanisms of extended producer responsibility and end-of-life strategies (Rizzi et al., 2013), product-service systems (Tukker, 2015), base of pyramid solutions (Chaurey et al., 2012), and collaborative consumption (Bardhi & Eckhardt, 2012)..

Business model change towards sustainability
Business model innovation covers changes from incremental adjustments to more radical and systemic changes (Cavalcante et al., 2011). The innovations required for sustainable development need to move beyond incremental adjustments (Johnson & Suskewicz, 2009; Boons et al., 2013). Gauthier & Gilomen (2016) proposed a four-stage typology of the business model transformations where the first two stages represent business as usual or incremental innovation and marginal modifications to business model elements without major changes to the whole value delivery system, and the latter two more radical innovation. These four stages are: "business model as usual", "business model adjustment", "business model innovation", and "business model redesign". Business model innovation refers to major business model transformations and the strong potential of new value propositions and value creation mechanisms, and business model redesign refers to a complete rethinking of companies' business model elements to bring radically new value propositions to the market. From the sustainability perspective, the first stage could mean pollution prevention, cleaner production and good working conditions within legal and other external standards, whereas designing products for sustainability, resource efficiency and sustainable marketing and communication with stakeholders are covered at the second stage. The third stage highlights designing whole processes for sustainability. At the highest, the fourth level, companies see sustainability as a real business opportunity and source of differentiation. Companies translate sustainability challenges into business opportunities by making "business sense" of societal and environmental issues (Dyllick & Muff, 2015). Shifting from traditional energy business to solar energy-based solutions business represents an example of a sustainability based business.

Concept 3: System transition

System transition and multi-level perspective (MLP)
Previously, the literature on environmental innovation was dominated by single technologies, such as developing wind turbines or biofuels. The multi-level perspective brings together both technological and social approaches to system transition, hence being one of the leading theories regarding sustainability transitions in the socio-technological system (Geels, 2011). MLP explains trajectories of sustainability transitions. Emerging sustainability innovations challenge and aim at replacing the existing, typically unsustainable system (Geels & Schot,

2007; Geels, 2011). MLP is based on the assumption of the three-level structure: niche level, regime level and landscape level. Technological trajectories locate in the socio-technical landscape, consisting of a set of deep structural trends, such as economic growth or oil price (Geels, 2002).

The landscape is described as an external structure or context for interactions of actors. Regimes refer to rules that enable and constrain activities within communities, whereas the landscape refers to wider technology-external factors. (Geels, 2002) The landscape is constantly transforming, but relatively slowly compared to regimes. Regimes generate incremental innovations, whereas radical innovations are generated in niches (Geels, 2002).

Genus and Coles (2008) and Berkhout et al. (2005) criticized the definition of transitions being problematic overall, being challenging to specify the start and end of transitions. Markard and Truffer (2008) argued that the definition of a regime is incoherent in MLP and regimes can bedefined at different levels of combination and from different perspectives. Moreover, MLP has steadily discussed policies as steering methods within the framework, but the policy is often an external force that is not actually implemented in the socio-technical transition (Smith et al. 2010). One of the critiques against MLP considers agency and how it isunderplayed in the framework. Sometimes MLP falls to focus on the technological transition rather than agency that has the capability to transform the existing regime (Smith et al., 2005; Genus & Coles, 2008).

Agency and MLP
Agents are capable of creating and advancing sustainability transitions and sustainable value. Agency is understood here as the capacity of performing acts that contribute to sustainability. The representations of agency can appear as both individuals and larger groups, such as firms pursuing sustainability. Several scholars recognize that agency plays a crucial role in sustainable transitions as a part of MLP. For example, Grin et al. (2011) and King (2008) suggested that agency creates change, having a necessary role during particular episodes of a transition. Agency typically possesses abilities, means, and power for deliberative action on multiple scales to contribute to sustainability (Wiek et al., 2012). Agency also deeply influences the internal translation and interpretation of sustainability and helps to embed it further (Lehner, 2014; Heijden, van der Cramer & Driessen, 2012).

Agency shaping the system
The power of agency lies in its potential to shape the prevailing regime. Most pioneering studies suggested that agency could be the most effective element in creating lasting transition for better future (Walker et al., 2010; Fudge, Peters & Woodman, 2016). MLP framework recognizes the agents to be capable to introduce transitions outside the prevailing regime, and discursive activities at regime and niche levels eventually result in cultural repertoires at the landscape level (Geels & Schot, 2007; Geels & Verhees, 2011; Geels, 2011). The ability of achieving a more sustainable system ultimately depends on agency, which drives niche innovations and implements regime changes or connects niches and regimes (Grin, Rotmans & Schot, 2011).

Agents shape the prevailing system by challenging the current regime. To challenge the prevailing regime, niche innovations have to achieve legitimacy, which is required for an innovation to initially become relevant and in the end dominant in the system (Bork et al. 2015; Haxeltine & Seyfang, 2009). Legitimacy is achieved by surpassing resistance to change. Resistance from the current regime is likely since agents ultimately challenge the existing system. The current regime also embodies power: the rules, resources and actor configurations which are part of the regime will privilege particular practices over others (Grin, Rotmans & Schot, 2011). Whereas the incumbent regime uses its power to create resistance towards transition, it is also true that regime changes eventually result in changes in power relations (Grin, Rotmans & Schot, 2011). The challenge for regime shaping agents lies in making transition dynamics and the political dynamics associated with it to reinforce each other generously to gradually destabilize the harmony of power and legitimacy between incumbent and sustainable practices, which consequently may lead to merging through common visions or through the graduate, self-reinforcing structuring of practices (Grin, Rotmans & Schot, 2011).

From multi-level perspective (MLP) to triple embeddedness framework (TEF)
MLP has dominated the related sustainability transition theories even though it has been rather policy oriented and paid marginal attention to the business environment. To address this gap, Geels (2014) developed a new conceptual framework, the triple embeddedness framework (TEF) acknowledging interactions between incumbent business firms and operation environments. The interactions between business industries and their economic and socio-political environments were conceptualized as bi-directional.

The major global challenges, such as climate change, energy security, transport and resource efficiency, and food safety, are results of negative externalities for incumbent firms in industries, such as, oil or coal (Geels, 2014). These typically unsustainable systems are rigid and filled with various lock-in mechanisms (Geels, 2011). A stable incumbent regime is the outcome of various lock-in processes and it reinforces itself as conflicting to novel innovations (Klitkou et al. 2015). In addition, incumbent firms typically embody power and internal resources and incumbents use their adaptive capacity to orient emerging transition trajectories into a path set in the parameters of the current regime (Geels & Schot, 2007). For this reason incumbent firms tend to prefer incremental change and the continuation of existing trajectories (Geels, 2014). However, incumbent firms can also adopt innovations that are developed in niches and then utilized in regimes, which gradually trigger further changes in the regime (Geels & Schot, 2007). In addition, large incumbent firms can also develop and market radical innovations and hence have an influence on confronting grand challenges (Geels, 2014). Incumbents may display many ambivalent strategies (Bakker et al., 2012). Consequently, incumbent firms bear the potential in contributing to sustainability through multiple pathways.

The underlying assumption of TEF is that a mismatch between widespread institutions, such as broadly accepted norms, values, belief systems, and industry-specific institutions, does not

generate pressure on firms as such. Pressure is rather created through activities – for example, complaints, demands and criticisms by socio-political actors, such as consumers, policymakers, civil society and social movements (Geels, 2014). Consequently, the purpose of TEF is that increasing pressure towards incumbent industries might result in incumbent firms to overcome lock-in mechanisms and reorient towards more radical innovations (Geels, 2014). This is crucial since in addition to incremental innovations, the mounting challenges of the world need radical innovations. Since large firms are capable of pursuing sustainability, they can be seen as agents of sustainability transitions, and consequently, creating sustainable value. Since sustainability transitions have multiple possible pathways, transitions also include multiple types of agency (Geels & Schot, 2007). Firms as agencies can be interpreted as two-fold. Firstly, firms are able to contribute to sustainability within the limits of the current regime related with the concept of weaker sustainability and sustainable development through incremental innovation. Secondly, large firms are capable of acting as agents of radical innovations of sustainability if they are able to overcome the lock-in mechanisms of the existing system.

BUILDING AN INTEGRATION BETWEEN DIFFERENT DISCIPLINES

Integrative concept: Value

Different forms of value
Value is a multifaceted and elusive concept, which is used as a central construct in the form of value propositions when analyzing market opportunities (Anderson et al., 2006) and designing business models (Osterwalder & Pigneur, 2010). From the economic point of view, the two most common notions of value are exchange value and use value. The first one refers to the price of an item in the market, and the latter is determined by how useful an item is to a given person or situation (value-in-use, value-in-context). The latter view has been promoted especially by the service researchers since services are more intangible (e.g. Vargo et al., 2006). In business, it is most relevant to analyze value from the customer's point of view; that is, the value of the supplier's offering for the customer. In this view, value is normally understood as some form of assessment of perceived benefits against sacrifices required by the customer (e.g. Woodall, 2003). Customer value is, however, a narrow definition of value if we look at larger systems of stakeholders and different perspectives into value. From the system's point of view, besides customer value, we should also consider value for the organization, ecosystem and society, and understand value as not only economic, but as a psychological, sociological and ecological concept (den Ouden, 2012). Only then can we approach what sustainable value as a whole in a system under study could be.

Sustainable value
The idea of value leads to ponder further the relation between sustainability and value within business environments. Sustainability is stated to be one of the firm's key success factors in the long term business strategy (Kuosmanen & Kuosmanen, 2009). Since firms use economic, environmental and social resources to produce goods and services to help the society to satisfy its needs, firms are at the same time both drivers and burdens to sustainable

development (Hahn, Figge & Barkemeyer, 2007). The sustainability performance of firms needs to be measured to encourage sustainability instead of burdening it.

The concept of sustainable value (SV) was developed by Figge and Hahn (2004) to measure firms' contributions to sustainability based on opportunity costs. The additional value created by a firm is measured ensuring that every environmental and social impact is in total constant because the idea of strong sustainability requires that each form of capital is kept constant. SV is inspired by the concept of strong sustainability, taking into account corporate eco- and social-efficiency as well as the absolute level of environmental and social resource consumption; in other words, the efficiency and effectiveness of all three dimensions of sustainability (Figge & Hahn, 2004). The outcome of SV is a value that expresses how much more value is created because a firm is more efficient than a benchmark company and because the resources are allocated to the firm and not to benchmark companies (Figge & Hahn, 2004). The target of SV is to measure the potential advantages from the reallocation of resources and to identify firms to or from which resources should be allocated (Kuosmanen & Kuosmanen, 2009). SV steers businesses towards strong sustainability, hence enabling a stable economic position while adapting human activities – in this case business operations – to meet the boundaries of natural resources.

By creating SV, firms are also acting as agents of sustainability transitions since the value creation process ultimately results in stronger sustainability performance. Consequently, the adoption of SV approach can support the firms meeting their sustainability targets at large. First, by adopting the SV approach, the company's business operations contribute to sustainability in all of its dimensions. Second, firms that engage in SV creation challenge the current system. Firms that have created SV have also benchmarked their operations. By gaining a leading position (regarding sustainability) in the markets, firms are able to apply pressure to their competitors. Eventually, this leads to increasing pressure on the whole business sector and at the same time on the prevailing regime. Also in this case, a firm's agency can be seen as two-dimensional: as agency towards the whole regime but on the other hand also as agency towards competing actors. If SV is closely associated with the concept of strong sustainability, the transition trajectory should proceed towards more radical innovations. However, various elements are likely to contribute to whether the competition caused by the SV approach results in transition pathways set by the parameters of the current regime or stir the transition more towards novel trajectories.

Business models as tools for creating and capturing sustainable value
The idea underlying sustainable value associated with business models is to unveil how SV is created, delivered and captured through business models. Den Ouden (2012)expressed the economic value for the expected users of the system, product or service to be the value for money, which reflects the usefulness of a product/service and value or the price of a product/service compared to the value or price of another product/service. The economic value that companies strive for is profit, and for an ecosystem it is financial stability and resilience. The economic value for society is summarized as wealth. The concepts of ecological value refer to an individual's ecological footprint, eco-effectiveness at a company level,

sustainability at the ecosystem level and the livability of the environment at the society level. The livability of the environment relates to biodiversity as well as the physical beauty of nature. The social value for the user translates into belonging, which is an important parameter in determining people's happiness. At the company level, the social value is summarized as social responsibility, which represents the impact of a firm's behavior on society. Value at the ecosystem level from a social perspective translates into reciprocity, reflecting a system to which all parties contribute and from which they benefit. At the societal level, the ultimate value is the greatest happiness of the greatest number of people and meaningful life.

Sustainable business models propose sustainable value, but in practice, the value can be either captured or destroyed or missed (Bocken et al., 2013; 2015). Captured value represents the positive benefits delivered to users and other stakeholders. Destroyed value includes the negative outcomes of the business, such as greenhouse gas emissions, resource scarcity, biodiversity loss, unemployment, the neglect of health and safety, unfair competition and inequality. Missed value represents situations where stakeholders fail to capitalize on existing assets, capabilities and resources, or fail to benefit from the network, which might be due to poorly designed business models.

None of the companies on their own are able to achieve the system level goals (e.g. sustainability goals), but it is possible within a wider ecosystem where companies operate (Hellström et al., 2015). The business model of an individual company can reflect only part of the overall value creation, but it can be seen as a unit that serves a certain function in the ecosystem, thereby enabling system value creation. Firms can be interpreted as individual agents that trigger transitions that can gradually change the wider business environment and eventually the whole system. Hellström et al. (2015) summarize that the overall system-level value is created in the transactions and non-transactional links between the companies. Thus, to understand the sustainable value created and captured, value analysis and assessment at both the company level and the system level are needed. Sustainable value is created and captured on a system level, but the company level approach is equally important because the value capture of each individual company is ultimately the main incentive for engaging in collaboration.

On the way towards sustainable value creation and capture through business model innovation and strong sustainability, there is a wide range of recognized barriers in three primary areas: regulatory, market and financial, and behavioral and social barriers (Laukkanen & Patala, 2014). It is obvious that companies and regulatory bodies need to take individual and combined action to overcome all these. Companies' task is to create new radical innovations towards sustainability, and well-functioning, consistent and long-term regulatory frameworks should support this development by creating a favorable innovation environment (e.g. Hekkert et al., 2007). To accelerate the transition towards strong sustainability, companies must not remain passive with respect to the system level either, but rather collaborate actively with relevant stakeholders to form common norms that support the creation of sustainable business model innovations.

Preliminary frameworks for integrated sustainability through different disciplines

Synergy between corporate sustainability, business model and system transition literature
The main theoretical elements of the literature review were sustainability, business model and system transition. In this chapter, the synergy between these elements emerges as sustainable business models that create sustainable value. Since none of the companies on their own are able to achieve the system level goals of sustainable development through their business models, system transition had to be integrated into business studies.

Sustainability literature emphasizes the dichotomy of strong and weak sustainability (Williams & Millington 2004). The distinction between strong and weak sustainability describes the general target levels of sustainability. The underlying assumption is that firms should pursue strong sustainability to shift the paradigm towards a sustainable society even if weak sustainability were an improvement compared to the previous circumstances. The literature suggests that companies are able to pursue different levels of sustainability. For example, both business model literature and literature on system transition recognizes firms' sustainability transition capabilities (i.e. Cavalcante et al., 2011; Boons et al., 2013; Geels, 2014). In addition, both disciplines acknowledge that businesses are also able to orientate themselves more towards radical innovations or niche-driving transitions if enough pressure is expected from other system actors or from stakeholders (i.e. Cavalcante et al., 2011; Boons et al., 2013; Geels, 2014). In the literature of business model change, the pathway towards strong sustainability is perceived as a trajectory from incremental innovation through business model innovation and business model redesign to radical innovation (i.e. Boons et al., 2013; Gauthier & Gilomen, 2016). System transition portrays a similar path from a sustainability transition set by the parameters of the current regime through transition where the current regime adopts niche innovations eventually to sustainability transition where niche innovation pressure alters the current regime (i.e. Geels & Schot, 2007; Geels, 2014). Corporate sustainability literature also recognizes the pathway from weak sustainability to strong sustainability. In the corporate responsibility literature, the trajectory is seen as an ongoing process from business as usual through refined shareholder management and triple bottom line management to truly sustainable business (i.e. Dyllick & Muff, 2015). This implies that in the literature of different disciplines, the terminology varies but the actual phenomena often overlap. To sum up the interdisciplinary literature review, an integrative conceptual framework is proposed in Figure 2 as the outcome of the analysis.

Change typology

System transition
- Sustainability transition via parameters set by the current regime
- Sustainability transition via development in niche level and adopted by regime level
- Sustainability transition via pressure from niche level

Business model change
- Incremental innovation
- Radical innovation
- Business model as usual
- Business model innovation
- Business model adjustment
- Business model redesign

Corporate sustainability
- Business as usual
- Truly sustainable business
- Refined shareholder value management
- Managing for the triple bottom line

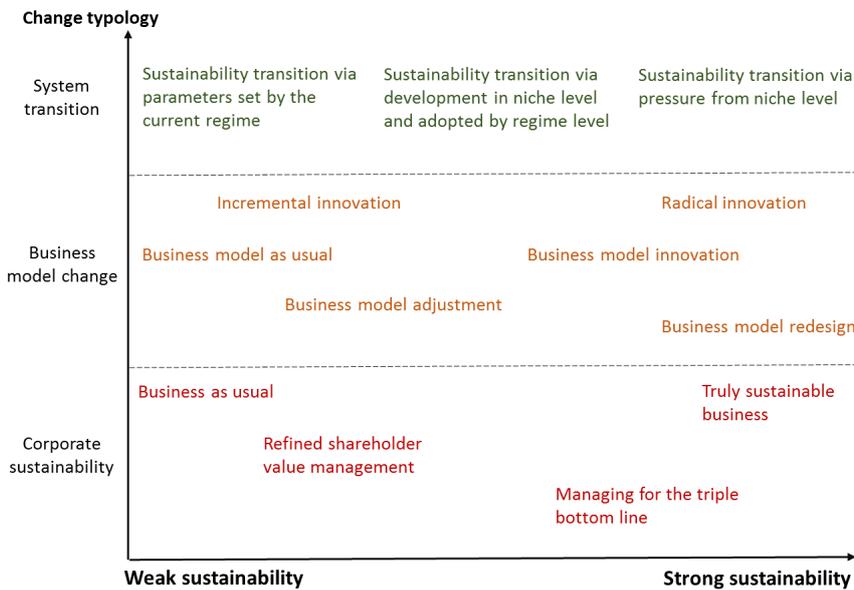Weak sustainability — Strong sustainability

Figure 2. Proposed integrative framework (adapted from Geels, 2014; Gauthier & Gilomen, 2016; Dyllick & Muff, 2015)

Despite the scattered terminology, the capability of firms to create sustainability through agency and sustainable value through business models is acknowledged. The proposed integrative framework could be utilized in the future in analyzing new sustainable business models, system value, and value creation and capture, and eventually in evaluating how strong the sustainability performance of the company is. The proposed framework is an outline that employs a variety of terms for similar phenomena. Understanding similar phenomena in different disciplines may help to reduce the current gap between literatures of system transition and business models.

Illustrations of phenomena are always simplifications of reality, and Figure 2 demonstrates the pathway towards strong sustainability rather roughly. On the end of "weak sustainability" is "business as usual", "incremental innovation", and "sustainability transition via parameters set by the current regime" – not because these phenomena could not contribute to sustainability but because they are typically strongly restricted by the existing environment and hence unable to meet their full sustainability potential. For example, typical end-of-pipe methods that remove already formed emissions do contribute to sustainability but not to the extent as new material saving technology. At the other end of the line, "strong sustainability" encompasses "truly sustainable business", "radical innovation", and "sustainability transition via pressure from the niche level". Figure 2 shows that these phenomena pursue strong sustainability through "refined shareholder value management", "triple bottom line management", "business model adjustment", "business model innovation", and

"sustainability transition via development in niche and adopted by regime". The reason why radical innovation and sustainability transition via niche pressure are situated at the end of the strong sustainability is because the radical innovations and niche pressure help the business to overcome the lock-in mechanisms set by the current regime and become truly sustainable.

In reality, the phenomena might overlap also in a vertical sense. In addition, there are multiple transition trajectories, and for that reason, Figure 2 does not imply that only radical innovations are relevant to achieve holistic sustainability. Sustainability transitions are effected, for example, by timing and spatial conditions (Geels & Schot, 2007; Markard & Truffer, 2008). Radical innovations are needed in addition to incremental innovation to achieve major sustainability changes, transform industries and consequently move towards strong sustainability and truly sustainable businesses.

Integration of business model change towards sustainability and system transition
The gap between the system transition research and business model literature remains clear. For example, Markard and Truffer (2008) presented the synergies and differences of transition literature and innovation studies, but the holistic integration is still incompletely researched. Business model literature pays little attention to system level effects on the process of business model change; instead, the focus stays on the company's internal operations (e.g. Abdelkafi & Täuscher, 2016; Gorissen et al., 2016). Transition literature emphasizes system level changes and underplays the role of individual companies. Recently, Geels (2014) emphasized the need for bidirectional interaction between firms and larger systems in the new conceptual framework, TEF. However, these attempts still overlook firms' internal operations. Firms are mainly interpreted as external agents of sustainability transition.

Moreover, the business model literature often leans on reliance on market forces (i.e Dyllick & Muff, 2015; Gauthier & Gilomen, 2016). On one hand, relying solely on markets involves the risk that sustainable development remains slow and weak since markets are driven by other incentives. On the other hand, transition theory often emphasizes governmental steering in creating sustainability (i.e. Geels, 2002; Geels, 2010; Smith et al., 2010; Berkhout et al., 2005). Consequently, the operation of companies is restricted by laws and regulations. This implies that business model literature would need stronger understanding of how policy pressure or governmental steering influences business model change and hence also value capture. In turn, transition literature would benefit from more detailed knowledge of how firms' internal operations affect sustainability transitions and how the agency of firms is represented. Figure 3 visualizes the integration of the two disciplines. The framework is a tentative proposal for the early integration of business model change literature and system transition literature, and therefore, it also has several simplifications.
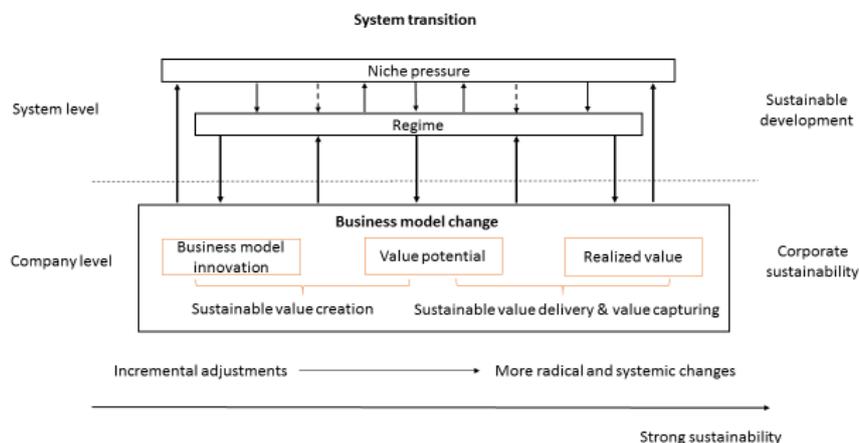
Figure 3. Tentative integration of business model change and system transition

At the company level, the framework introduces business model change towards strong sustainability. The idea underlying sustainable business model is to create economic, ecological, social and psychological benefits for the wide range of stakeholders in the society where the firm operates, to enhance corporate responsibility and further sustainable development. The framework illustrates that the potential and impacts of the sustainable business models are measured through sustainable value created, delivered and captured. First, the idea of business model change towards sustainability is to strengthen the value propositions, i.e. value potential through the business model elements (Osterwalder & Pigneur, 2010), such as key resources, key activities and partnerships that are needed to create value. Second, the framework highlights the fact that the potential value is not always equal to the actual realized value. Potential value can be either captured, destroyed or missed (Bocken et al., 2013; 2015). The overall objective is to increase the realized sustainable value through different value delivery and capture mechanisms. The framework shows that firms can have a dualistic role in their aspirations to meet their sustainability targets. First, by adopting the sustainable value approach, firms contribute to sustainability within all of the firm's dimensions. Second, firms that engage in sustainable value creation challenge the current system. Actions of businesses pursuing sustainability are interpreted as agency that appears both within individual firms but also within the wider business environment. Firms are able to act as internal sustainability agents through business model change in addition to simply being external agents of sustainability transition. On the other hand, literature (i.e. Hellström et al., 2015; Geels, 2014) stated that individual firms are not able to achieve the system level goals, i.e. sustainable development, since for that bidirectional actions within firms and a wider ecosystem where firms operate are also highlighted. Regime pressure can affect both created potential value and realized value positively or negatively.

At the system level, the framework introduces a sustainable regime towards sustainability. To achieve strong sustainability, a sustainability oriented regime is needed as a gatekeeper for (1) unsustainable niche innovations and for (2) steering through policies or through a regime's legitimacy , business environments towards business model change and hence to capturing sustainable value. Niche pressure is emphasized because niche agency often enables sustainability transitions by driving innovations, implementing regime changes and eventually connecting niche and regime levels (Grin, Rotmans & Schot, 2011). Niche agency is crucial for sustainability transitions since it bears the potential for system level changes and radical innovations (Geels, 2011). This implies that niche pressure is needed for effective sustainability transitions.

Since stable regimes are the outcome of various lock-in mechanisms, they typically reinforce themselves against innovations (Klitkou et al., 2015). This means that regime actors are constrained by parameters from the existing regime. Hence, sustainability transitions enacted by regime actors were found to be path-dependent and trajectories are set by the current regime, thereby evolving through incremental innovation (Geels & Schot 2007). The regime can be a significant barrier for radical innovation to overcome, and typically radical innovations occur only if they are protected in niches (Markard & Truffer, 2008). In reality, transitions happen through multiple trajectories. The interactions of niche and regime levels should be studied more since regime actors may have ambivalent motivations (Bakker, 2014). As lock-in mechanisms typically reinforce a certain pathway of transition, the opportunity of upscaling a given niche depends on the characteristics of the regime in question (Klitkou et al., 2015). For example, Geels and Schot (2007) have presented four different pathways for sustainability transitions: transformation, reconfiguration, technological substitution, and dealignment and realignment. They have also noted that certain transition pathways can shift from one to another. This suggests that even if niche pressure is often crucial for sustainability transitions multilevel interactions are evident and regime conditions, such as policy drivers, also play a role in the transition process. Further, both company level and system level components that create or hinder sustainability transitions need to be concretized in more detail.

CONCLUSION

This work contributes theoretically to existing sustainable business model literature in three ways. First, the paper presents how sustainable business models can be used to create sustainable value. Sustainable value is captured through business model change from business as usual to truly sustainable business. Challenges in sustainable development, and therefore in corporate sustainability, in business model change and value capture are related to the poor integration of the system level and company level and also to the slow progress towards strong sustainability. However, a firm's capability to act as an agent of sustainability is acknowledged through different disciplines. Sustainable value steers firms towards strong sustainability, hence creating possibilities for a stable economic position while adapting human activities – in this case business operations – to meet the boundaries of natural

resources. Hence, value creation can be interpreted as a bridge to sustainable business and later as a component of larger system level transition.

Secondly, the paper presents pathways towards sustainability in relation to companies in different disciplines. Different disciplines use scattered and often overlapping terminology to describe the change from weak sustainability to strong sustainability. A stronger understanding of overlapping typology, while the phenomena remain much the same, can ultimately advance the integration of different disciplines.

Thirdly, the findings imply that there is still a lack of integration between system level (system transition) and company level (business model change). To adopt sustainable business models and hence sustainable value, firms need to consider system level influences on the change process. Since the current regime strongly puts pressure on firms' operations – for example, via legislation – a sustainable regime would assist companies in adopting sustainable business models. To achieve strong sustainability, more synergies between the system level and business environments is needed. This interplay between policy oriented system transition and business model change that focuses on business environments could also be associated with private-public partnerships that aim for cooperation between the public and private sectors.

The focus was theoretical. Since it is likely that the somewhat scattered phenomenon of firms acting as intermediates of sustainability is close to operationalization, the framework should be tested empirically to see the actual adjustment of the framework in business environments.

REFERENCES

Abdelkafi, N., & Täuscher, K. (2016), Business models for sustainability from a system dynamics perspective, *Organization and Environment*, 29(1), 74-96.

Amit, R., & Zott, C. (2012), Creating value through business model innovation, *MIT Sloan Management Review*, 53(3), 41-49.

Anderson, J.C., Narus, J.A. & van Rossum, W. (2006), Customer Value Propositions in Business Markets, *Harvard Business Review*, 84(3), 91-99.

Bakker, S., van Lente, H. & Engels, R. (2012), Competition in a technological niche – the cars of the future, *Technology Analysis and Strategic Management*, 24 (5), 421–434.

Bakker, S. (2014). Actor rationales in sustainability transitions – Interests and expectations regarding electric vehicle recharging. Environmental Innovation and Societal Transitions, 13, 60–74.

Ballantyne, D., Frow, P., Varey R.J. & Payne, A. (2011), Value propositions as communication practice: Taking a wider view, *Industrial Marketing Management*, 40 (2011), 202–210.

Bardhi, F., & Eckhardt, G.M. (2012), Access-based consumption: The case of car sharing, *Journal of Consumer Research*, 39(4), 881-898.

Baden-Fuller, C. & Morgan, M.S. (2010), Business models as models, *Long range planning,* 43(2-3), 156-171.

Baumgartner, R. J. & Ebner, D. (2010), Corporate sustainability strategies: Sustainability profiles and maturity levels, *Sustainable Development*, 18(2), 76–89.

Bergek, A., Hekkert, M., Jacobsson, S., Markard, J., Sandén, B., & Truffer, B. (2015), Technological innovation systems in contexts: Conceptualizing contextual structures and interaction dynamics, *Environmental Innovation and Societal Transitions*, 16, 51–64.

Berkhout, F., Smith, A., & Sterling, A. (2005), Socio-technological regimes and transition contexts, In Boelie Elzen, Frank Geels and Ken Green (eds), *System Innovation and the Transition to Sustainability: Theory, Evidence and Policy*, Camberley: Edward Elgar Publishing

Bocken, N.M.P., Rana, P., & Short, S.W. (2015), Value mapping for sustainable business thinking, *Journal of Industrial and Production Engineering*, 32(1), 67-81.

Bocken, N.M.P, Short, S.W., Rana, P. & Evans, S. (2013), A value mapping tool for sustainable business modelling, *Corporate Governance (Bingley)*, 13(5), 482-497.

Bocken, N. M. P., Short, S. W., Rana, P., & Evans, S. (2014), A literature and practice review to develop sustainable business model archetypes, *Journal of Cleaner Production*, 65, 42-56.

Boons, F. & Lüdeke-Freund, F. (2013), Business models for sustainable innovation: State-of-the-art and steps towards a research agenda, *Journal of Cleaner Production*, 45, 9-19.

Boons, F., Montalvo, C., Quist, J. & Wagner, M. (2013), Sustainable innovation, business models and economic performance: An overview, *Journal of Cleaner Production*, 45, 1-8.

Bork, S., Schoormansb, J., Silvester, S., & Joored, P. (2015), How actors can influence the legitimation of new consumer product categories: A theoretical framework, *Environmental Innovations and Societal Transitions*, 16, 36–50.

Carayannis, E.G., Sindakis, S. & Walter, C. (2014), Business Model Innovation as Lever of Organizational Sustainability, *Journal of Technology Transfer*, 40(1), 85-104.

Casadesus-Masanell, R., & Ricart, J.E. (2010), From strategy to business models and onto tactics, *Long range planning*, 43(2-3), 195-215.

Cavalcante, S., Kesting, P., & Ulhøi, J. (2011), Business model dynamics and innovation: (re)establishing the missing linkages, *Management Decision,* 49(8), 1327-1342.

Chaurey, A., Krithika, P. R., Palit, D., Rakesh, S., & Sovacool, B. K. (2012), New partnerships and business models for facilitating energy access, *Energy Policy*, 47(SUPPL.1), 48-55.

Chesbrough, H. & Rosenbloom, R.S. (2002), The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spin-off companies, *Industrial and Corporate Change*, 11(3), 529-555.

Dyllick, T. & Muff, K. (2015), Clarifying the Meaning of Sustainable Business: Introducing a Typology from Business-as-Usual to True Business Sustainability, *Organization and Environment,* 29(2), 156-174.

Ebner, D. & Baumgartner, R. (2006), The relationship between Sustainable Development and Corporate Social Responsibility, *Corporate Responsibility Research Conference*, 4th-5th September, Dublin, Ireland.

Figge, F. & Hahn, T. (2004), Sustainable value added – measuring corporate contributions to sustainability beyond eco-efficiency, *Ecological Economics*, 48(2), 173–187.

Fudge, S., Peters, M. & Woodman, B. (2016), Local authorities as niche actors: the case of energy governance in the UK, *Environmental Innovation and Societal Transitions*, 18, 1–17.

Gauthier, C & Gilomen, B. (2016), Business Models for Sustainability: Energy Efficiency in Urban Districts, Organization & Environment, 29(1), 124-144.

Geels, F. (2002), Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study, *Research Policy*, 31, 1257–1274.

Geels, F. (2010), Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective, *Research Policy*, 39, 495-510.

Geels, F. (2011), The multi-level perspective on sustainability transitions: Responses to seven criticisms, *Environmental Innovation and Societal Transitions*, 1(1), 24-40.

Geels, F. (2014), Reconceptualising the co-evolution of firms-in-industries and their environments: Developing an inter-disciplinary Triple Embeddedness Framework, *Research Policy*, 43, 261– 277.

Geels, F. & Schot, J. (2007), Typology of sociotechnical transition pathways, *Research Policy*, 36(3), 399–417.

Geels, F. & Verhees, B. (2011), Cultural legitimacy and framing struggles in innovation journeys: a cultural-performative perspective and a case study of Dutch nuclear energy (1945-1986), *Technological Forecasting and Social Change,* 78(6), 910–930.

Genus, A., & Coles, A.-M. (2008). Rethinking the multi-level perspective of technological transitions, *Research policy*, 37, 1436-1445.

Gorissen, L., Vrancken, K. & Manshoven, S. (2016), Transition thinking and business model innovation-towards a transformative business model and new role for the reuse centers of Limburg, Belgium, *Sustainability (Switzerland)*, 8(2), 1-23.

Grin, J., Rotmans, J., & Schot, J. (2011), On patterns and agency in transition dynamics: Some key insights from the KSI programme, *Environmental Innovation and Societal Transitions*, 1, 76–81.

Hahn, T., Figge, F. & Barkemeyer, R. (2007), Sustainable value creation among companies in the manufacturing sector, *International Journal of Environmental Technology and Management*, 7(5), 496–512.

Haxeltine, A. & Seyfang, G. (2009), Transitions for the People: Theory and practice of 'Transition' and 'Resilience' in UK's Transition Movement. Tyndall Centre for Climate Change Research, Norwich. Working Paper 134, Available at: http://www.tyndall.ac.uk/sites/default/files/twp134.pdf (accessed 01.03.17).

Heijden, A., van der Cramer, J. & Driessen, P. (2012), Change agent sensemaking for sustainability in a multinational subsidiary, *Journal of Organizational Change Management*, 25 (4), 535–559.

Hekkert, M. P., Suurs, R. A. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. H. M. (2007), Functions of innovation systems: A new approach for analysing technological change, *Technological Forecasting and Social Change,* 74(4), 413-432.

Hellström, M., Tsvetkova, A., Gustafsson, M., & Wikström, K. (2015), Collaboration mechanisms for business models in distributed energy ecosystems, *Journal of Cleaner Production*, 102, 226-236.

Johnson, M.W. & Suskewicz, J. (2009), How to jump-start the clean-tech economy, *Harvard business review*, 87(11).

King, B. (2008), A Social Movement Perspective of Stakeholder Collective Action and Influence, *Business & Society*, 47(1), 21–49.

Klitkou, A., Bolwig, S., Hansem, T. & Wessberg, N. (2015), The role of lock-in mechanisms in transition processes: The case of energy for road transport, *Environmental Innovation and Societal Transitions*, 16, 22–37.

Kuosmanen, T. & Kuosmanen, N. (2009), How not to measure sustainable value (and how one might), *Ecological Economics*, 69, 235–243.

Lacy, P., Haines, A. & Hayward, R. (2012), Developing strategies and leaders to succeed in a new era of sustainability: Findings and insights from the United Nations Global Compact-Accenture CEO Study, *Journal of Management Development,* 31(4), 346-357.

Laukkanen, M. & Patala, S. (2014), Analysing the barriers to sustainable business model innovations: innovation systems approach, International Journal of Innovation Management, 18(6).

Lehner, M. (2015), Translating sustainability: the role of the retail store, *International Journal of Retail & Distribution Managemen*t, 43(4), 386–402.

Lewandowski, M. (2016), Designing the business models for circular economy-towards the conceptual framework, *Sustainability (Switzerland)*, 8(1), 1-28.

Linnenluecke, M.K. & Griffiths, A. (2013), Firms and sustainability: Mapping the intellectual origins and structure of the corporate sustainability field, *Global Environmental Change,* 23(1), 382-391.

Markard, J., & Truffer, B. (2008), Technological innovation systems and the multi-level perspective: Towards an integrated framework, *Research Policy*, 37, 596-615.

Marshall, C. & Rossman, G., B. 1999. Designing qualitative research. Sage Publications. Thousands Oaks-London-New Delhi. 224 p.

Milne, M. J., Kearins, K. & Walton, S. (2006), Creating adventures in Wonderland: the journey metaphor and environmental sustainability, *Organization*, 13, 801–39.

Mikkilä, M. 2006. The many faces of responsibility: Acceptability of the global pulp and paper industry in various societies. Dissertationes Forestales 25. http://www.metla.fi/dissertationes/df25.pdf.

Mikkilä, M., Panapanaan, V. & Linnanen, L. (2015), Corporate responsibility in Finland – From local movements to global responsibility. In Idowu, S. O., Schmidpeter, R., Fifka, M. S. (Eds.), Corporate Social Responsibility in Europe (pp. 209-228). Springer. Available at: http://link.springer.com/chapter/10.1007%2F978-3-319-13566-3_12

Mikkilä, M., Panapaan, V. & Linnanen, L. (2016), The Pursuit of Responsible Business: Corporate Responsibility of Finnish Companies in Their Global Operations. Chapter 8 in Idowu, S. (ed.): Key Initiatives in Corporate Social Responsibility, CSR, Sustainability, Ethics & Governance. Springer. DOI 10.1007/978-3-319-21641-6_8.

Mikkilä, M. & Toppinen, A. (2008), A qualitative analysis of corporate responsibility reporting in the world's largest pulp and paper companies. Forest Policy and Economics 8: 500–506. DOI 10.1016/j.forpol.2008.05.002.

Miles, M. B. & Huberman, A. M. 1994. Qualitative data analysis. An expanded sourcebook. Sage Publications, Thousands Oaks-London-New Delhi. 338 p.

Nidumolu, R., Prahalad, C.K. & Rangaswami, M.R. (2009), Why sustainability is now the key driver of innovation, *Harvard business review*, 87(9).

Osterwalder, A., & Pigneur, Y. (2010), *Business model generation. A handbook for visionaries, game changers, and challengers*. New Jersey: John Wiley & Sons.

Den Ouden, E. (2012), *Innovation design. Creating value for people, organizations and society*. Springer.

Pedersen, E.R.G., Gwozdz, W. & Hvass, K.K. (2016), Exploring the Relationship Between Business Model Innovation, Corporate Sustainability, and Organisational Values within the Fashion Industry, *Journal of Business Ethics*, article in press, 1-18. doi:10.1007/s10551-016-3044-7

Planing, P. (2015), Business Model Innovation in a Circular Economy Reasons for Non-Acceptance of Circular Business Models. *Open Journal of Business Model Innovation*, available online http://www.scipublish.com/journals/BMI/papers/1250

Rizzi, F., Bartolozzi, I., Borghini, A., & Frey, M. (2013), Environmental management of end-of-life products: Nine factors of sustainability in collaborative networks, *Business Strategy and the Environment*, 22(8), 561-572.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F., Lambin, E., Lenton, T., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., de Wit, C., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R., Fabry, V., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., & Foley, J. (2009), A safe operating space for humanity, *Nature*, 461 (22), 472–475.

Schaltegger, S., Lüdeke-Freund, F. & Hansen, E.G. (2012), Business cases for sustainability: The role of business model innovation for corporate sustainability, *International Journal of Innovation and Sustainable Development*, 6(2), 95-119.

Schaltegger, S., Hansen, E. G., & Lüdeke-Freund, F. (2016), Business models for sustainability: Origins, present research, and future avenues, *Organization and Environment*, 29(1), 3-10.

Short, S. W., Bocken, N. M. P., Barlow, C. Y., & Chertow, M. R. (2014), From refining sugar to growing tomatoes: Industrial ecology and business model evolution, *Journal of Industrial Ecology*, 18(5), 603-618.

Smith, A., Stirling, A., & Berkhout, F. (2005), The governance of sustainable socio-technical transitions, *Research Policy*, 34, 1491-1510.

Smith, A., Voβ, J.-P., & Grin, J. (2010), Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges, *Research Policy*, 9(4), 435-448.

Steffen, W., Richardson, K., Rockström, J., Cornell, S.E. Fetzer, I. et al. (2015), Planetary boundaries: Guiding human development on a changing planet, *Science*.

Stubbs, W. & Cocklin, C. (2008), Conceptualizing a "sustainability business model", *Organization and Environment*, 21(2), 103-127.

Teece, D.J. (2010), Business models, business strategy and innovation, *Long range planning*, 43(2-3), 172-194.

Tukker, A. (2015), Product services for a resource-efficient and circular economy - A review, *Journal of Cleaner Production*, 97, 76-91.

Upward, A., & Jones, P. (2016), An ontology for strongly sustainable business models: Defining an enterprise framework compatible with natural and social science, *Organization and Environment*, 29(1), 97-123.

Vargo, S. L., Lusch, R. F. and Morgan, F. W. (2006) Historical perspectives on service-dominant logic. In The Service-Dominant Logic of Marketing: Dialog, Debate and Directions, (eds) R. F. Lusch and S. L. Vargo, pp. 29–42. M.E. Sharpe Inc., Armonk, New York.

Walker, G., Devine-Wright, P., Hunter, S., High, H. & Evans, B. (2010), Trust and community: exploring the meanings, contexts and dynamics of community renewable energy. Energy Policy 38, 2655–2663.

WCED. (1987), WCED Our Common Future. World Commission on Environment and Development. Oxford University Press, Oxford (1987)

Whiteman, G., Walker, B., & Perego, P. (2013), Planetary boundaries: Ecological foundations for corporate sustainability, *Journal of Management Studies*, 50(2), 307–336.

Wiek, A., Ness, B., Schweizer-Ries, P., Brand, F., & Farioli, F. (2012), From complex systems analysis to transformational change: a comparative appraisal of sustainability science projects, *Sustainability Science*, 7(1), 5–24.

Williams, C. & Millington, A. (2004), The diverse and contested meanings of sustainable development, *The Geographical Journal*, 170(2), 99-104.

Woodall, T. (2003). Conceptualising 'value for the customer': An attributional, structural and dispositional analysis. *Academy of Marketing Science Review*, 2003, 12.

Zott, C. & Amit, R. (2007), Business model design and the performance of entrepreneurial firms, *Organization Science*, 18(2), 181-199.

Zott, C. & Amit, R. (2010), Business model design: An activity system perspective, *Long range planning*, 43(2-3), 216-226.

Zott, C., Amit, R. & Massa, L. (2011), The business model: Recent developments and future research, *Journal of Management,* 37(4), 1019-1042.

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