Age-friendly housing: navigating through a complex multi-regime environment

Master thesis

Innovation Science

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Abstract

Demographic change poses significant challenges for housing and healthcare, that deems current practices as uncontainable. Reforms in long-term care resulted in the closure of institutional residences, like nursing and care homes, which made new forms of housing including care services - necessary. Age-friendly housing as an envisioned solution for older adults to live at home independently as long as possible, can facilitate a transition of these sectors. Alterations in the home environment in the spatial, physical, and technological sense are used to facilitate longer independence at home. Age-friendly housing solutions as a response to the challenges of demographic change, are trying to facilitate older persons to live independently at home, as long as their health and care needs are met.

Applying the multi- system approach, based on the multi-level perspective, this study develops an integrated framework capturing the dynamics of three sectors: housing, healthcare and ICT by exploring local initiatives and its system interactions. A focus is put on determining the constellation of actors, and the niche-regime interactions. This study developed an integrated framework that captures the dynamics from three sectors: housing, healthcare and ICT. The multi-level perspective (MLP) is useful to capture the transition processes of one sector, however understanding the involvement of three sectors, the multi-system approach is used, to advance from the MLP. Local initiatives are explored in a variety of contexts, to determine the multi-system interactions.

A qualitative approach in form of a multi-case (n=10) design performing semi-structured interviews (n=18) is conducted. The analysis is performed on three levels: the individual case, groups of similar cases, and all the case together.

The cases embody various configurations of actors and strategies. Three directions among the cases are identified based on the solution and the related vision: new living concepts, home modifications, and integrated solutions. A set of cases are found to develop new solutions without being hampered by the healthcare regime, while others that try to alter healthcare practices found resistance. To accomplish radical innovation in healthcare there is a need for the involvement of actors coming from housing and ICT.

This study contributed to the understanding of the multi-system approach by investigating the multi-system interactions in relation to the emerging domain of age-friendly housing. Multiple socio-technical systems have to be included to truly understand complex transitions. In the future, age-friendly housing could either constitute multiple transitions, or form a new regime on its own.

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1 Introduction

Demographic change will trigger an inevitable transition of healthcare and housing systems in most Western countries, to sustain systems which meet the needs of older persons in the future. Key challenges which countries need to prepare for, consist of (1) a rise of old-age dependency on care and social services due to a rising life expectancy; (2) the increasing gap between the declining working- age population (15-64) versus the 65+; (3) the growing divide between rural versus urban population requiring adequate and affordable housing, as well as innovative healthcare services (Commission, 2018; Margaras, 2019). These key challenges are interrelated. While life expectancy is rising, the old-age dependency on care and social services also rises considerably. It will depend on the capacity of countries if they are able to prepare for these long-term processes that will have a considerable impact on society. The current way of working of providing intensive care in nursing and care homes cannot hold out with the increasing numbers of older adults. As a result, current deployed practices are not expected to be able to maintain the increasing pressure, therefore a transition of healthcare and housing systems is necessary to ensure that the needs of the ageing population can be met in the future.

The Netherlands serves as a good example where different policies are set up to tackle the growing needs of housing forms with care possibilities for older adults (Adams, Verbeek, & Zwakhalen, 2017; Beerens et al., 2016; de Bruin, de Boer, Beerens, Buist, & Verbeek, 2017; van Hoof et al., 2019). In 2018 a national policy is set out for 'longer living at home', facilitating the independent living of older adults through varies ways, with support and care in a home that matches their personal needs. The program is divided on three dimensions: (I) support and care at home, (II) caregiving and voluntaries in care and welfare, and (III) housing. The values that are embodied in the program are most prominently autonomy and independence of older adults, wherein older adults participate in society as long as possible in the ways that they can. As a result, more and more older adults (75 and above) feel autonomous, caregivers are better supported, and more older adults deem their dwelling adequate for their life stage and condition.

Key of these policy interventions are the initiatives that have emerged in response, involving multiple sectors coming together to develop a solution (Dutch Ministry of Health, 2019). When these are successful, they can be diffused and facilitate a transition to tackle the key challenges mentioned above. Most notable actors are healthcare providers, insurance companies, local municipalities, housing corporations, IT-developers, software developers, and construction companies. The array of actors come from housing, ICT and healthcare sectors in order to develop solutions together. It is this unique mobilization of actors that normally do not interact with each other, that sparks cross-domain practices. The gathering of these actors in their attempt to come up with answers for the current societal challenges make it relevant to investigate.

Current solutions are merely informed by the perspective of one's own practice, and might fail due to mismatching with other practices (Arentshorst & Peine, 2018). Thus, there is a need to look beyond a one-sided perspective that describes the need for 'technology', but more on what that would mean in a home environment of an older adult supporting their independence. The healthcare sector in the Netherlands has undergone many reforms to transition from nursing-home institutionalization to longer independent living under government intervention. However, this leaves a gap for new forms of housing in combination with care. Older adults that used to receive care in a nursing home are now expected to live longer at home. Therefore, the housing sector going to play increasing role to support adults in late stages of life,

as many older adults tend to move or make changes to their home environment in order to increase the chances of independency, and delay institutionalization. The demands for different types of housing for older adults with varying degrees of care needs are rapidly changing (Alders & Schut, 2019), because the current housing stock is not ready to support independent living over the life course, not in Europe (Peine et al., 2015), and also not in the Netherlands (Daalhuizen et al., 2019). New age-friendly approaches are developed and implemented on local scales which creates a seabed of new interesting solutions, consequently different actors from various fields are coming together and are trying to breakthrough to mainstream markets (van Hoof, Kazak, Perek-Białas, & Peek, 2018). The built environment is increasingly recognized as an opportunity to deliver new ways to support the ageing population (Stevenson & Grabowski, 2010). New technological opportunities enable for solutions to be implemented at home, to support the independent living of older adults and improve their quality of life (Carnemolla, 2018).

New policies aim to support age-friendly housing[1], as an envisioned solution to enable people to live longer independently at home (Alders & Schut, 2019). Depending on the capacity of the older adult, it is often required to make transitions in their living environments, either by adapting their current residence, or by relocating them to a more supportive environment (Perry, Andersen, & Kaplan, 2014). The age-friendly housing concept comes from an emerging theme that has concerned itself with the need to create what has been termed "age-friendly cities and communities". This approach initiated by the World Health Organization (2007), reflects attempts to develop supportive communities for older adults, which Alley et al. (2007) define as "… place where older people are actively involved, valued, and supported with infrastructures and services that effectively accommodate their needs" (see also Beard & Montawi, 2015). The WHO guide has since become one of the most frequent used tools to assess age-friendliness in terms of service provision, built environment and social aspects (Plouffe, Kalache, & Voelcker, 2016).

The combination of the built environment (housing, outdoor spaces, building), and service provision (health services, communication and information) is of special interest, as it is an important component of policies to support older people (Wiles et al., 2012). The built environment has therefore become one of the focal point in research and policy to address the demands of the ageing population, which also has to deal with the pressure of urbanization and other societal challenges like climate change (Kazak, Van Hoof, Świąder, & Szewrański, 2017). The growth in popularity of the age-friendly movement has contributed to the development of multiple frameworks and initiatives, whom can be found under a variety of terms in literature: age-friendly, aging-friendly, liveable, and lifetime neighbourhoods/ communities/ cities/ environments (Fitzgerald & Caro, 2014; Steels, 2015). These themes have also been a central focus in other scientific fields, most notably Gerontology[2].

The domain of age-friendly housing lacks clarity on what is meant with age-friendly housing, and who should and need to be involved. What's more, is that future ambitions for the housing sector like social housing or sustainable housing, overlap with the concept of age-friendly housing (Savini, Boterman, van

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[1] Age-friendly housing is closely related to ageing-in-place as one of the most discussed concepts in the research for ageing populations (Vasunilashorn et al., 2012). Ageing in place means the enabling of older adults to continue living in their own homes for as long as possible or by making such adaptations to their homes that will allow them to do so.

[2] The idea that the environment in which older adults dwell impacts their lives has first been put forward by the seminal work of Lawton (1982). The field of gerontology has since then taken home environments and other environments as explicit fields of study for ageing in place (Gitlin, 2003; Kendig, 2003). For a review see Perry et al., (2014).

Gent, & Majoor, 2016). However, there seems to be a common pattern for age-friendly housing policies that focuses on supporting ageing in place (Alley et al., 2007). To advance, there is need for continuous engagement and mutual learning to solve the "age-friendly housing and neighbourhoods puzzle" (Peine & Arentshorst, 2016). Currently, there are many different initiatives that try to drive the age-friendly domain, and serve as a platform to exchange information and offer a way for collaboration (Buffel & Phillipson, 2018).

These various local initiatives thus have to involve the collaboration with other societal sectors like housing and ICT that can assist in the realization of new solutions, these together then are part of the transitions toward age-friendly housing. Transitions in transition studies have been defined as long-term, multi-dimensional, and fundamental transformation processes through which the established system shifts to a more sustainable modes of production and consumption (Brown, Farrelly, & Loorbach, 2013; Markard, Raven, & Truffer, 2012). However, the transition towards age-friendly housing is not a question of sustainability, rather it is a solution to help people live longer independently. Thereby reducing costs of long-term care, while responding to the rising needs for care and social services, and increasing gap the working-age population and the older population. Therefore De Haan et al. (2014) suggest to understand transitions as a concept that moves away from satisfying the direct needs across generation, and more as 'a benefit to societal and external systems'.

It is in these local projects where actors can come together that normally would not, therefore the study of these initiative is relevant for understanding possible answers to the demographic change. The multi-sectorial involvement results in a great variance of local age-friendly housing initiatives, it is strived for to include most of these variations in this study. To study transitions the Multi-level perspective (MLP) is often employed, it is a framework consisting of three layers: the niche, the regime, and landscape developments. The strategic interaction, in the sense of linkages between these layers, is what can constitute a transition of the regime itself. According to the MLP, actors in local initiatives (niche) enjoy a lower degree of structuration as established practices (regime), and are allowed ample room to navigate among the different regimes, meaning different fields or sectors. Investigating how these local age-friendly housing initiatives relate to the different sectors can help identify growth opportunities, and result in specific policy measures towards barriers. Taking in account all the sectors that the age-friendly housing domain has to deal with: healthcare, housing and ICT, is in that regard a new approach.

The study of new alliance formations among actors in their deliberate strategic attempt to change the system is the main focus of this study. What constitutes an alliance is the alignment of actor's actions to cultivate alternatives to the current system: which can include organizations, corporations, networks or movements (de Haan & Rotmans, 2018). An *initiative* is then the formal organized endeavours of actors with the aim of making alternative solutions, and often consolidated in a legal entity. Whereas a *project* is similar in that it also constitutes an organized endeavour of actors with an aim and vision, but then often set within a fixed timeline and budget. In the case of age-friendly housing that means that it is expected that healthcare providers have to come together with actors that can support changes in the built environment, to make the built environment a more integrated part of the healthcare services, while exploring the new ICT solutions that can facilitate it. A commodity that links these initiatives is that they try to support older adults in their independence, and try to facilitate their autonomy and participation of society while under the influence of chronic conditions or impairments.

Considering that radical innovations develop in initiatives outside the regime on the niche level, it is important to study these initiatives as they are crucial to facilitate a transition. Therefore, the purpose of this study is to investigate initiatives of age-friendly housing in a variety of contexts which relates to their sectorial backgrounds, to determine the multi-regime interactions between the housing, healthcare, and ICT sector from a niche perspective. Important are the frontrunners that help shape and progress these initiatives, as well as their knowledge and skills that they bring (Rotmans & Loorbach, 2009). Meaning, the actors that capitalized early on the changes set in motion in the system itself. The goal is to identify patterns among the identified initiatives that can be targeted by policy and other actors, in order to stimulate its further development and the growth of the age-friendly housing domain to answer the demographic change. This leads to the following research question:

"How do actors engaged in age-friendly housing initiatives navigate their way through a complex multi-regime environment?

The investigation of the niche formations coming from different sector systems is central, to analyse how the actors organized in initiatives try to form the age-friendly housing domain, and how they try to facilitate a transition in the relevant systems (Geels, 2004). Understanding that transition studies generally concern with sustainable transition the transition of age-friendly therefore has to be conceptualized. In addition, can the main research question be subdivided in the following themes: how multi-regime constellation relate to the development in the niche, and what strategies actors use engaging the multi-regime constellation. The main research question of this study is therefore subdivided in three sub-questions:

(I)   How can the emerging field of age-friendly housing and its dynamics be conceptualized in relation to multiple socio-technical regimes?

(II)   How does a multi-regime constellation relate to the actors involved in initiatives?

(III)   What strategies do actors in the niche use when engaged with multiple regimes?

The development of age-friendly housing is expected to influence the constellation at the regime and vice versa. Therefore, an increasing exchange seems imminent, and makes it vital to broaden the understanding of multi-regime interactions. New insights from this study can help further our understanding of niche formation under the influence of multi-regime interactions. Sectorial change through local initiatives that deal with multiple sectors questions the previous MLP framework, which concerned it itself predominately with a singular niche-regime outlook in one system. However, a transition towards age-friendly housing implies that for sectorial change influences outside the current sector also have to be considered. Transition studies inherently began with the sustainability developments answering climate change, but now have to spread broader. This study contributes to these studies by investigating one of these broadening themes, and taking demographic change as a problem that needs to be answered, for which age-friendly housing seems to be one of the possible solutions.

2 Theory

Transition studies aim to explain how transitions unfold and how a transition towards a more sustainable industry can be achieved (Markard et al., 2012; Van Den Bergh, Truffer, & Kallis, 2011). The recent transition research agenda (Köhler et al., 2019) shows that the field has grown significantly, and diversified into several streams. However, current transition research is predominately focused on energy, mobility and agro-food systems, which is well reflected in the studies cited in the agenda (Kanger, 2020). Köhler et al. (2019) explain that transition research emerged to address grand societal challenges like climate change, loss of biodiversity and resource depletion, however not mentioning other grand societal challenges like demographic change, or the impact of climate change on healthcare itself (Costello et al., 2009).

The Transition Management framework is often used in healthcare related transition studies (Broerse & Grin, 2017; Johansen, Loorbach, & Stoopendaal, 2018; Johansen & van den Bosch, 2017), where scholars criticize the socio-technical perspective associated with the Multi-level perspective (Lawhon & Murphy, 2012; Markard et al., 2012), with that ignoring significant conceptual research on the dynamics of transitions (Köhler et al., 2019). Transition management (Loorbach, 2010; Rotmans & et al, 2001) is a policy-oriented framework, which combines ideas from complexity science and governance studies. However, for this study, transition management is rather limiting, as it is prescriptive and demands a well-grounded comprehension of what the societal problem is (Rauschmayer, Bauler, & Schäpke, 2015). The transition for demographic change is in relatively early stages, for that reason is the societal problem not adequately mapped yet. This study therefore opts to use the more open-ended heuristic framework of the Multi-level perspective (Geels, 2011).

This study will contribute to the field of transition studies by further exploring a multi-sectoral transition including healthcare, housing and IT from a transition studies point of view in response to demographic change. Few attempts have been made to investigate transitions in healthcare: care-farming (Hassink, Grin, & Hulsink, 2018), elderly care services (Pekkarinen & Melkas, 2019), assisted living (Bugge, Coenen, Marques, & Morgan, 2017). It is becoming clear however that healthcare is equal if not more complex than sectors like energy and mobility, which is also facing the necessity for radical change. Especially urban studies are exploring new directions for transition studies that are relevant to consider. For instance Newton (2012) argues that liveability and sustainability are key principles for a transition of urban infrastructure systems, showcasing new views on transitions. Urban sustainability transitions as a subfield are empirically and conceptually distinct from sector-specific transitions (Frantzeskaki et al., 2017), which displays an interesting new perspective on transition studies.

Transitions towards sustainability are defined as: long-term, multi-dimensional, fundamental transformation processes through which established modes of production and consumption are shifted towards more sustainable modes, due to challenges risen through the current modes, that cannot be addressed by incremental improvements, but require more radical shifts (Elzen, Geels, & Green, 2004; Grin, Rotmans, & Schot, 2010). The term 'socio-technical' transition is often used to describe fundamental changes in 'socio-technical' regimes which is the conceptualization of sectors like energy supply, water supply or transportation (Markard et al., 2012). The concept of the socio-technical regime has been developed to capture and analyse the substantive shift of these 'rules of the game' that guide future developments, which is one of the most central concepts of transition research (Markard et al., 2012). The definition of socio-technical regimes includes the following three elements: actors, technology

(resources, material aspects) and social behaviour that accompanies it (rules, institutions) (Geels, 2011). Socio-technical transitions are therefore often described as a shift from one socio-technical regime to another.

A growing number of studies is expanding the field of transitions studies with social practice studies (Shove & Walker, 2010; Spaargaren, 2011), and social movement innovation (Seyfang & Smith, 2007). Loorbach, Frantzeskaki, & Avelino (2017) distinguish between socio-technical, socio-institutional and socio-ecological approaches, which are also associated with different sectors. Therefore, it is fruitful to review core concepts and ideas in the field of transition studies, so that a conceptual contribution to the field as a whole can be made. Key concepts and frameworks in transition studies are explained in 2.1, like regimes, niches and the Multi-level perspective. Followed by a discussion on the interaction between the key concepts in 2.2. For this particular study, the emerging branch of multi-system approach is discussed in 2.3 to investigate transitions across systems. Finally, in section 2.4 an integrated framework is proposed and the most relevant concepts for this study are chosen.

2.1 Core concepts and frameworks

To better understand transition processes and the emergence of age-friendly housing as a domain in particular, current literature is used to explain the main principles of a transition, and how the development of such a transition is cultivated. First, the core framework Multi-level perspective is discussed to explore the main concepts of landscape, regime and niche. After that, another core framework Strategic Niche Management is explored to further examine what constitutes niche in itself. Finally, more recent work on socio-technical experimentation as a form of sub-niche activity is investigated to better grasp niche-activity, and to further the understanding of niche-formation.

The Multi-Level Perspective (MLP) has been used and further developed extensively within innovation studies in the past decade to explain how such a regime shift takes place (Elzen et al., 2004; Geels, 2002). The MLP allows for a conceptual link between micro-level innovation processes and large-scale socio-technical regimes, while taking into account grand societal landscape developments. The interplay between these three layers is what allows for the transition or regime shift to take place. According to the MLP a regime shift occurs through a combination of (macro) landscape pressures and (micro) niche developments (Geels & Schot, 2007). Landscape developments revolve around global or societal trends like a crisis or public dispute, these can be shock events like mentioned before, or developments that guide a trend like digitalization or growing individualism. The micro-level innovation or niche development, relates to the local levels of innovation processes, commonly referred to as protected spaces or incubation rooms. Such spaces are often were new technologies or socio-technical practices emerge and develop (Geels, 2005).

With that, the MLP conceptualizes overall dynamic patterns in socio-technical transitions, shown in figure 1. Each layer refers to a heterogeneous configuration of elements, where the landscape (top layer) is seen as more stable and slower, and the niche layer (bottom layer) is seen as more diverse and more instable, where radical innovation can emerge and room for agency can be exploited (Geels, 2011). Traditionally, the regime represents the 'deep structure' that accounts for the stability of an existing socio-technical system (Geels, 2004). It captures the semi-coherent set of rules that orient and coordinate activities within

the socio-technical system. Ultimately, it can lead to a lock-in, which makes any radical changes in the system rather impossible (Unruh, 2000). Studies using the MLP show that when pressure is exerted on the regime through the landscape, it will destabilize, which creates a window of opportunity for the niche layer to break through to the regime, creating a regime shift (Geels, 2002).
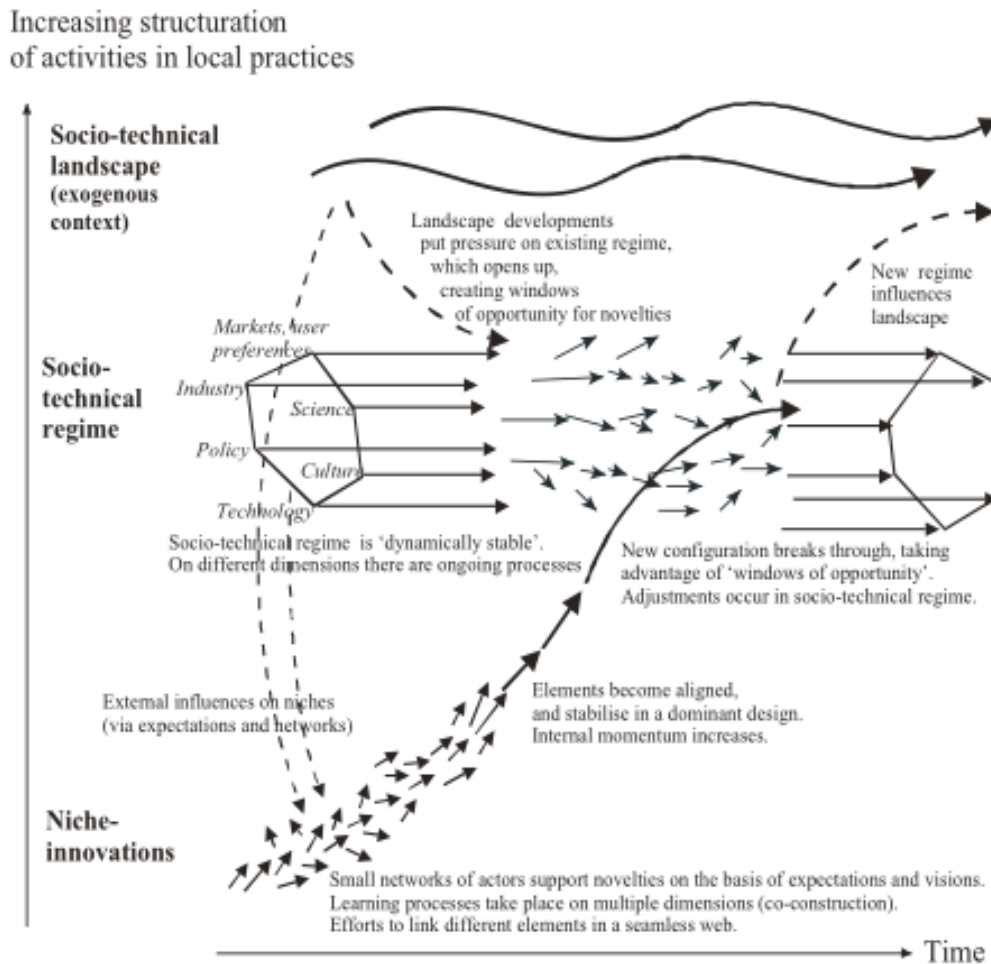
Figure 1. Multi-level perspective on transitions. Source: Geels, 2011

Raven (2005) proposed to combined the strategic niche management (SNM) approach with the Multi-level perspective to better understand regime transformation. It is not assumed that a stable regime will change through processes of niche development / accumulation, niche experiments must be connected to regime instabilities and other regime dynamics, including landscape movements (Geels, 2005; Hoogma, Kemp, Schot, & Truffer, 2002; Kemp, Schot, & Hoogma, 1998). The SNM framework describes specific internal niche development processes for the radical innovation to create an innovation trajectory (Schot & Geels, 2008). Schot & Geels (2008) describe the following important internal niche processes: managing expectations and vision articulation, two modes of learning and network building. It is acknowledged that external processes are just as important but not captured in the SNM approach, that is where the MLP can help on mapping external processes. Niche developments can be conceptualized as progressing at two level: levels of projects in local projects and the global niche level (Schot & Geels, 2008). The sequence of local projects may gradually lead up to an emerging field niche, that is when the learning processes in

local projects are compared and aggregated (Geels & Raven, 2006). While early SNM-contributions focused on the emergence of radical innovations through a sequence of projects (Hoogma et al., 2002), more recent work has started to address the diffusion of niches, investigating how projects 'escape their protective spaces' (Smith & Raven, 2012). A typology of core niche processes of shielding, nurturing and empowerment has been proposed (Raven, Kern, Verhees, & Smith, 2016; Smith & Raven, 2012). Where (I) shielding is defined as: processes that hold at bay certain selection pressures from mainstream selection environments. (II) Nurturing defined as: expectation management, social learning and actor network building (Schot & Geels, 2008). (III) Empowerment referring to the niche-innovation becoming competitive by engaging in the selection environment in ways favourable to the niche-innovation (Smith & Raven, 2012). Empowerment activities can help explain how niches interact with regime of niches, which is further discussed in the next section.

A key aspect of the Strategic Niche Management is to design socio-technical experiments in such a way that they contribute to the three nurturing processes described above (Sengers, Wieczorek, & Raven, 2016). Niches forms a seabed of sub-niche experimentation like local projects, through which a niche can develop and accumulate, also described in different socio-technical experimentation forms. It is the alternative socio-technical configuration embodied in experiments through which its learning and demonstration effects add to the momentum of emerging configurations (Sengers et al., 2016). The authors review several streams of experimentation: niche experiments, bounded socio-technical experiments, transitions experiments, grassroot experiments, and sustainability experiments. Sengers et al. (2016) found four commonalities between the streams that puts them next to each other. First, socio-technical entity and its specific meaning with its introduction to society. Second, the recognition that of an experiment in the context of system innovation, recognizing its material, institutional and cognitive obduracy. Third, agreement that experiments are an attempt of novelty, and that is challenge-led to overcome certain societal problems. Fourth, the common standpoint that experiments need to include a variety of engaged social actors with the objective of connected social learning in relation to the new socio-technical configuration. However, also what the authors mention themselves, is that there is yet an understanding to be formed over the different forms of micro-politics, power and agency in experimentation.

2.2 niche & regime interaction

After establishing the main concepts and framework in transition studies, different niche & regime interactions are further explored. The formation of age-friendly housing is expected to come from different regime and or niches. Therefore, the different interactions possible between these concepts have to be investigated. First, niche-niche interactions are explored to better understand niche-formations. Second, niche-regime interactions are explored as core principle of transition studies. Third, regime-regime interactions are discussed to offer an alternative view on transitions, not coming from the niche.

Niche-niche interactions are less explored in sustainability transitions research. Niches function as the building blocks for radical innovation as an alternative configuration to that of the regime requires more nuance. The concept of 'niche' helps to explain the dynamics and formation of radical innovations, that can challenge its respective regime. Nykvist & Whitmarsh (2008) show that complementarities between multiple niches can support the niches momentum. The authors explored different routes of niche

formation, where the niches together challenge the respective regime through compatible activities, but also have their own direct interests. Verbong, Geels, & Raven (2008) explored the patterns of succession of different niches in terms of attention and expectations. Showing that four different technological innovations have similar problems in gaining momentum, which bounds them together. Alternatively, it is also possible that separate radical innovations aim for the protection of the same actors and financial resources, which puts these innovations in the same niche in competition to one another (Bakker, van Lente, & Engels, 2012).

The niche-regime interactions form the core of transition research. Original typology of socio-technical transition pathways included different multi-level interactions and takes agency more explicit to answer a presumed bottom-up niche-driven bias (Geels & Schot, 2007). It is important to note that these pathways focus on interactions between layers within one socio-technical system. That typology is based on combinations of two dimensions: time and nature, which lead to the four transition pathways: transformation, reconfiguration, technological substitution, and from de-alignment to re-alignment - which is also an multi-niche competition pathway (Geels & Schot, 2010). More recent work, (Geels et al., 2016), reformulated the typology in terms of endogenous enactment, articulating the mechanisms for actors, formal institutions and technologies. In addition, they explored the possibilities of shifts *between* transition pathways, which emphasizes a non-linearity and directional change possibilities of transitions. The authors opt for research to focus on comprehensive transition analysis that includes *multiple* niche-innovations with the existing regime. In the MLP it is assumed that the determination of niches and regimes are clear-cut, however when a niche consists of actors from multiple regimes this might not be as apparent. Often, it is suggested that a niche will eventually make it to one socio-technical regime.

Another outlook on niche-regime interactions, are those interactions that not necessarily lead to transition in a clear-cut manner. Elzen et al. (2012) developed three forms of niche anchoring. As the niche develops it might recruit actors from existing regimes, the network anchoring. Secondly, the development of the new technology to meet regime needs, technological anchoring. Thirdly, the changes in social values, rules and markets negotiated between niches and regimes, accounting for the institutional anchoring. Another perspective is the selective translation of niche elements into regimes (Smith, 2007). Smith (2007) shows a non-exhaustive set of translation processes including: regimes problems guiding niches, socio-technical practice exchange, and translations altering the context which brings regime and niche closer together. Political struggles between niche and regimes actors seems more explicit, like coalition formation and support gain from countervailing industrial organizations (Hess, 2016). Sutherland et al. (2015) showed in the agriculture sector niches anchoring successfully in multiple regimes, and that the innovation comes from actors who are integrated into different systems. This implies that niche actors should at least be aware of regime influences. In addition, they suggest that all three types of anchoring needs to occur in order for niches to develop successfully (Darrot, Diaz, Tsakalou, & Zagata, 2014). Geels et al. (2016) found different collaborations between incumbent firms and new entrants, and resulted in shifts between transition pathways.

Recent SNM-literature emphasizes the pressure regimes face, not just from landscape developments, but also from externally-oriented activities of niche-actors themselves (Raven, Kern, Verhees, & Smith, 2016). These scholars identified various 'empowerment' activities (Smith & Raven, 2012), and 'upscaling' activities (Jolly, Raven, & Romijn, 2012) with the aim to change regime-level selections environment, and thereby facilitating the diffusion of the niche innovation. Smith & Raven (2012) describe two main empowerment processes: 'fit-and-conform', defined as the niche becoming more competitive with

mainstream socio-technical practices, and 'stretch and transform' defined as processes that change mainstream selection environments to make them more amenable for the niche. These insights illustrate a more 'active' stands of niche-innovations, which is in contrast with the outlook of niches as 'protected spaces'. Turnheim & Geels (2019) plea for considering regime-niche interactions more extensively, as they show that SNM-concepts are relevant, but that the role of incumbent actors from neighbouring regimes, guided and less open search paths, and the importance of single landmark projects deviate from the generally bottom-up perspective. Therefore, not just niche-regime interactions should be studied, but also regime-to-niche activities have to be included. In addition, including niche actors from a variety of regime backgrounds seems fruitful.

Other interactions that can be relevant for transitions are regime-to-regime interactions. Raven (2007) showed that two originally independent regimes co-evolved to a mutual beneficial and integrated relationship, which therefore have to be considered as important dynamics for transitions processes. Raven & Verbong (2007) found multi-regime interaction in the energy sector that can lead to four different interactions: competition, symbiosis, integration and spill-over. These processes are dependent on when regimes start fulfilling similar societal functions (competition), mutual benefits from cooperating (symbiosis), becoming one regime (integration), or transferring regime elements to the other regime (spill-over). Geels (2007) showcases the evolved regime-to-regime interaction in the music sector, where the interaction progressed from competition to symbiosis. Another outlook of multi-regime interaction is based on functional (e.g. shared supply chains), and structural (shared infrastructure or representation) couplings among gas, water, electricity and telecommunication regimes (Konrad, Truffer, & Voß, 2008). These studies show that also other interaction beside niche-regime interactions can be instrumental in the transitions towards sustainability. Consequently, this means that transitions cannot be considered the consequence of a singular niche-regime interaction. Rather, transitions should be seen as outcomes of contestation between multiple regimes and niches in complex spatial setups. Current literature on multi-regime interactions are often between regimes, with a missing focus on the role of niche developments or landscape level pressures (Sutherland et al., 2015).

The above has implications for the foundational understanding of a transition as a *regime shift*, as now multiple regimes and multiple niches are involved, which begs the question whether these can be considered as part of one system (niche, regime, landscape constellation), and whether *multiple* regime shifts can be seen as a transition? A socio-technical system as fulfilling a societal function (e.g. transport, communication, nutrition), where systems are often seen as sectors (Geels, 2019), technology is seen as a crucial element to fulfil those functions: hence sub-functions are distinguished as production, distribution and consumption (Geels, 2004). Therefore, for the case of age-friendly housing it is to be expected that a multitude of these systems: healthcare, housing, and IT are involved in the socio-technical experimentation. Then, to understand how the different systems can relate to one another a *multi-system approach* needs to be developed, which is discussed in the next section.

2.3 Multi-system approach

The discussion on niche & regime interaction shows that these interactions should not be considered isolated to one socio-technical system, but that these interactions can also occur between socio-technical systems. This part explores the growing field of multi-system approach (Papachristos, Sofianos, & Adamides, 2013) to discuss the possible interactions between these systems. But first, a discussion about the boundaries of a system.

A socio-technical system can be thought of as a set of heterogeneous elements that fulfil a societal need. The dynamic, stable state of these elements constitutes a regime, where novel configurations that deviate from the regime are cultivated in the niche, which form around markets or technologies (Papachristos et al., 2013). A word on terminology, the Multi-Level Perspective is understood to give a *system* perspective on transitions including (I) a network of actors and social groups, (II) formal, cognitive, and normative rules that guide their activities, and (III) material and technical elements as artefacts and infrastructures (Elzen et al., 2004). However, with the understanding of the previous section, how do we then investigate both *multiple* niche-innovations and *multiple* regimes?

The Multi-Level Perspective originally emerged as an important corrective approach in contrast to approaches within innovation studies that only focused on individual, technologies, firms and industries (Smith, Voß, & Grin, 2010). Doing so by conceiving systems and regimes, often delineated at electricity, mobility, agro-food, as comprised of multiple, as heterogenous elements, and understanding system transitions as requiring major changes along the whole production-consumption chain. However, in case of studies about energy transition with the aim electricity generation, the focus is mostly on single green niche-innovations (Kern, Smith, Shaw, Raven, & Verhees, 2014; Smith, Kern, Raven, & Verhees, 2014), while other studies have focused on electricity consuming practices (Monreal, McMeekin, & Southerton, 2016; Mylan, 2015). While in all cases the distribution of electricity has largely been ignored.

McMeekin, Geels, & Hodson (2019) therefore propose a *whole system reconfiguration*, a configuration resulting from multiple change mechanisms. The conceptual building block for this is the Multi-level Perspective, as this framework understands system transition at a level of large societal domains, such as mobility, electricity, and agri-food, unfolding through interactions niches, regimes and landscape developments. Which means that whole system can consist of sub-systems (the MLP's), in which elements are interacting with each other, and possibly with elements from other sub-systems. The three sub-systems may experience relatively autonomous and distinct change processes on one hand, as reconfiguration processes between the subsystems can change, these can be temporarily locked, as shown in figure 2.
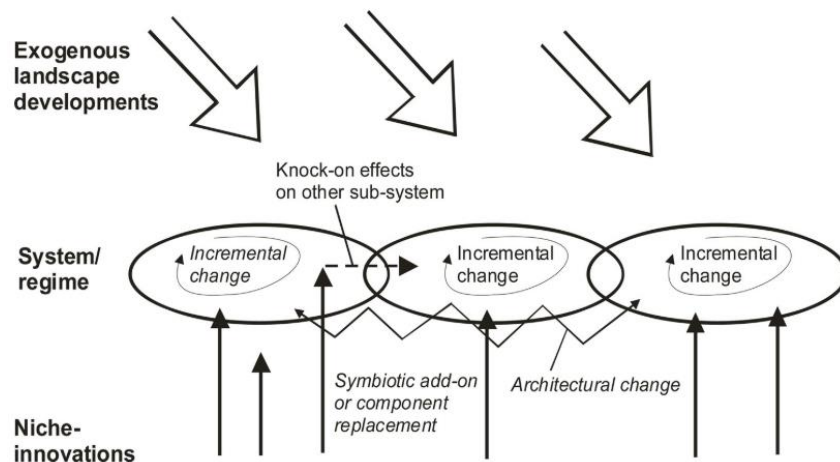
Figure 2 Multiple niche-innovations and sub systems in elaborated multi-level perspective. Source: McMeekin, Geels & Hodson, 2019

Age-friendly housing should therefore be studied as a domain with system interactions and analysed in terms of the architecture of the configuration (McMeekin et al., 2019). The common 'resource focused outlook' requires more nuance for the case of age-friendly housing, as production and consumption are less driven purely by material artefacts as they are in the electricity socio-technical system. Age-friendly housing is about what does it means to age well at home. A whole system transition is then not seen as a breakthrough of singular disruptive innovations, but is better understood as system reconfiguration. Geels, McMeekin, Mylan, & Southerton (2015) suggest that system reconfiguration could involve not only the adoption of niche-innovations with existing regimes, but also incremental regime improvements, changes in its relative size, or new combinations between niche and regime elements that changes the systems architectures. Geels (2018) therefore proposes three extensions on the multi-level perspective: (I) investigate multiple landscape developments that may differentially affect various regimes, which also may be the result of different translations (Rosenbloom, Berton, & Meadowcroft, 2016), (II) regime-level processes are crucial, as they are not static or inert, but 'dynamically stable' (Geels & Schot, 2007; Raven & Verbong, 2007), (III) multiple niche-innovations can affect regimes through different mechanisms like: replacing, adopted, create new linkages between regimes, or change consumption demands.

From the discussion above it can therefore be concluded that a multiple system or whole system approach seems fruitful but challenging to investigate. Considering the relevancy of different sectors for the developments age-friendly housing it seems fruitful to determine the systems architecture and its current reconfiguration.

2.4 Integrating a conceptual framework

The discussion of the literature in the previous section provided core concepts to use in the exploration of age-friendly housing, these are further discussed in this section for developing the conceptual framework. First, the integrated framework is proposed and explained. Second, the most relevant concepts are chosen and further explained.

The case of age-friendly housing can, at the time, be considered as the whole system domain[3] as part of demographic change transitions, where socio-technical systems from healthcare, housing and IT are expected to be part of. Socio-technical systems as defined by the fulfilment of a particular societal function, in this case age-friendly housing, is then not static. Each of the systems involved are under the influence of landscape developments, namely demographic change. Therefore, the transformation of (I) networks of actors, social groups, (II) formal, cognitive and normative rules, and (III) material and technical elements in a response to or inspired by the landscape developments in the form of new housing solutions as part of ageing at home, is what constitutes the domain.

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[3] Meadowcroft (2009) argues that the identification of precisely which systems are of interest, and what sort of transition they undergo, is far from trivial. As regimes are reproduced by the actors and institutions that take part in its structuration, it is necessary to unfold the actions of these actors more clearly. Papachristos (2013) argues that transitions involve changes in the rules and institutions, as well as the social and technological subsystems related to the fulfilment of a societal need, therefore a socio-technical transition can be initiated in any domain that is considered exogeneous. The rules and institutions are what brings these actors together, which is further consolidated in material and technical elements. A multi-system or whole system approach can include multiple socio-technical regime constellations, for instance (Geels, 2018) distinguishes for the mobility whole system multiple transport regimes (trains, cars, cycling, walking, bus/metro/tram), with radical innovation relating to these regimes as biofuels, smartcards, mobility apps as their respective niches.

Figure 3, down below, illustrates the conceptual framework for this study. It encompasses the interactions between the different systems, or regimes in particular, and the development of age-friendly housing itself which is formed by the combination of interactions in the middle. Important to note is that the landscape development is likely to be translated differently by each regime or actors. From the introduction it became clear that the housing and ICT systems play an important role in the realization of new housing solution for older adults that support independent living. The interactions between the emergence of age-friendly housing and the different sites of interactions of regimes is not explicitly displayed, but falls under the intention of the model. To summarize, this model has two intentions: (I) to highlight the interaction between regimes as an answer to the landscape pressures, and (II) to underline the emergence of age-friendly housing while interacting with multiple regimes.

The whole system or multi-system outlined in Figure 3 is a collection of socio-technical systems in their transitions towards new forms of housing for ageing-in-place, named age-friendly housing. As part of the transition certain systems do overlap at the level of the regime, as they are interlinked based on their interactions because neither of them can respond on their own. At the niche level new initiatives emerge, which is where actors from different systems can interact more easily due to their lower levels of structuration and more room for agency. This is also where different niches can develop and accumulate, but also interact with each other based on their strategies and interests. These interactions are next to niche-regime interactions that take place when the niche developed and engages in empowerment or shielding activities.
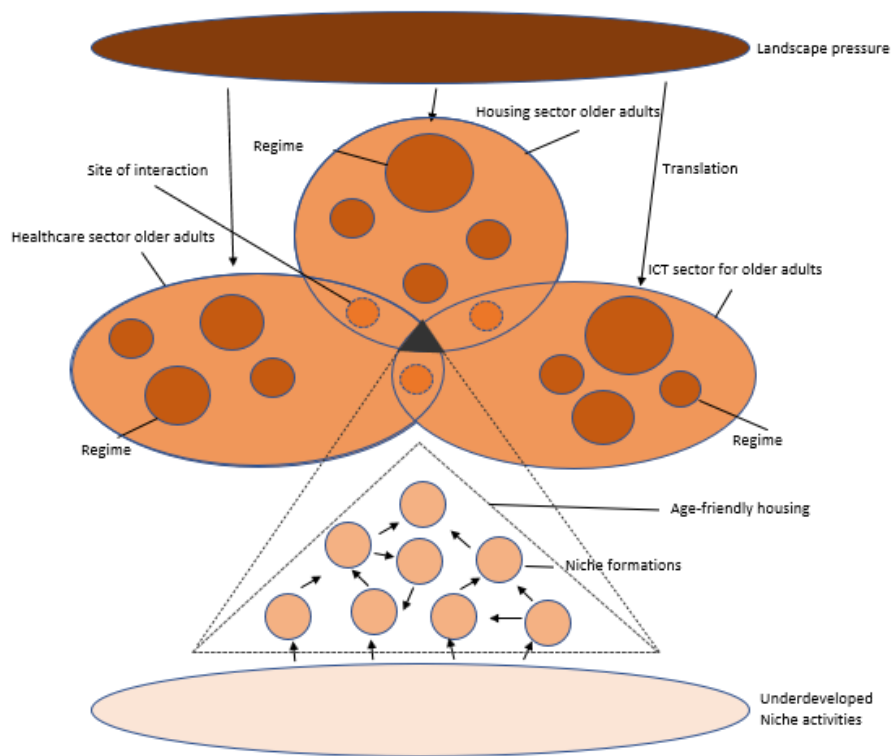

Figure 3. Conceptual framework

Figure 3 is still mostly conceptually framed, and it is important to consider the various interactions, however for this study not every part of it can be investigated. To investigate the emergence of age-friendly housing as a possible domain, the emerging niche activities will be studied as a form of socio-technical experiments. The interplay among actors being influenced by their environment, as well as trying to change these through empowerment activities is the main focus of this study. Empowerment activities from actors in the niche will either try to change these pressures or try to adhere to them that will benefit the niche development. These pressures therefore provide a guidance in determining the different strategic activities from the actors in the niche.

Empowerment processes as a niche function in the Strategic Niche Management literature (Smith & Raven, 2012) is useful to investigate the interactions between the niche and the regime. A variety of strategies that fit-and-conform (not changing the regime), or strategies that focus on stretch-and-transform (changing the regime), can be captured in these processes. Empowerment processes cannot be seen separately from other niche activities like shielding and nurturing, as events cannot be classified to be one particular niche process. These processes overlap and influence each other, and a singular event or action can influence all three of these processes. Therefore, when necessary the processes of shielding and nurturing will be discussed. Nevertheless, the main focus remains on the empowerment processes.

The concept of institutional logics (Battilana et al., 2009) is also helpful for revealing the niche-regime interactions from a different perspective. Institutional theory has recently become very influential in transition studies (Fuenfschilling & Binz, 2018; Fuenfschilling & Truffer, 2014, 2016). institutional logics in particular provides a perspective that focuses on the shared understandings of goals, and how they are to be pursued. Although not widely discussed in this study as it has been a more recent development, it seems fruitful for research. Logics are capable of identifying the different understandings of what age-friendly housing means to actors and how that best can be reached. As this transition is still early-staged, it is expected to encounter a high variety of outlooks on age-friendly housing.

The concept of anchoring (Elzen et al., 2012) helps to captures the variety of actors coming together and forming initiatives. These actors can come from different regimes to nest in the niche in order to develop solutions. Furthermore, these niches are expected to engage with the regimes, however this might not be purely to facilitate a regime shift, as this is still too early to detect. Anchoring is the process in which a novelty becomes newly connected, connected in a new way, or connected more firmly to a niche or a regime. These types of connections can be done through networking, meeting technical standards, or exchanging social values, rules and markets. The further the process of anchoring is, meaning the more and stronger connections are, the bigger the chances are that these connections can become long-term.

Thus, this study will investigate the gathering of actors in the age-friendly housing niche using the concept of anchoring. Moreover, the niche to regime interactions will be determined with the use of empowerment processes and institutional logics. To put the transition towards age-friendly housing in perspective, the multi-system framework is used to provide a macroscopic outlook. It is assumed that the actors engaged in such work are most aware of the logics present at the regime levels. As this will help to determine how actors operate while under a multi-regime constellation. An outline of these concepts which will guide the empirical part, is displayed in the table 1 below on the next page, which concludes the first sub-question.

Table 1. Used concepts for data collection and analysis

Concept	Definition	Example
Shielding (Smith & Raven, 2012)	Processes that hold at bay certain selection pressures from the mainstream selection environment	References to the mobilization or existence of spaces such as geographic locations, innovation schemes or cultural milieu.
Nurturing (Schot & Geels, 2008)	The combination of interactive processes for social learning, articulating (technological) expectations, and social network development	References to vision creation, managing expectation among actors, the sharing of information and skills, as well as network activities.
Empowerment - Fit and conform strategies (Raven et al., 2016)	Actions from (technology) advocates aimed at making age-friendly solutions more competitive with mainstream socio-technical practices in otherwise unchanged selection environments.	R&D efforts or public policies targeting lower costs and (incremental) performance improvements.
Empowerment - Stretch-and-transform strategies (Raven et al., 2016)	Actions from (technology) advocates aimed at changing mainstream selection environments in ways that more amenable for the niche innovation. Selection pressures: • Established industry structures • Dominant technologies and infrastructures • Markets and dominant user practices • Guiding principles and socio-cognitive processes in the knowledge base • Public policies and political power • Cultural significance attached to a regime	Attempts at reforming mainstream selection environments or institutions. For example, regulatory frameworks, organizational networks, changes in user-producer relations.
Anchoring (Elzen et al., 2012)	Anchoring is the process in which a novelty becomes newly connected, connected in a new way, or connected more firmly to a niche or a regime. The further the process of anchoring progresses, the larger the chances are that anchoring will eventually develop into durable links. The two types are based on the three general dimensions of innovation processes by (Geels, 2004)	Technological anchoring: the further specification of technology to meet regime needs. Network anchoring: recruiting actors from an existing regime, and or intensify contact and exchange among the actors involved.
Institutional logic (Battilana et al., 2009)	A field shared understanding of the goals to be pursued and how they are to be pursued.	References to general guidelines and perspectives that drive the activities and mindset of actors. For example, older adults are fragile and need to be cared for, healthcare professionals are anti-technology, real estate is not personalized.

3 Method

The focus of this study is to investigate initiatives that are part of the emerging age-friendly domain to gain insights in how these initiatives deal with the multi-regime constellation. Transition research is an highly interdisciplinary field which grew exponentially in the past years, which attracted researchers from many different areas, who bring different approaches (Zolfagharian, Walrave, Raven, & Romme, 2019). Consequently, this brings methodological challenges, as the bridging of fields has to transcend the methodological traditions in which the fields are inherently distinct. Geels (2011) positions the MLP as a middle-range theory, arguing that an open framework may be more suited to investigate the co-evolutionary dynamics of a transition.

The previous chapter explains that a multi-system approach is most suited to investigate the multi-regime constellation associated with age-friendly housing, and an integrated theoretical framework is presented. The key concepts chosen to as part of the framework need to be operationalized. A qualitative methodology with a focus on the niche's development as a novelty in comparison with the regime based on the logics, as well as niche-regime interactions based on strategic empowerment activities, is chosen as an approach. The research design is then to compare multiple cases. These cases are useful for exploratory studies when the objective is to gain a profound understanding of how dynamics unfold in real-life settings (Yin, 2009). Extreme or outlier cases are strived for in the sampling strategy, read radical cases in contrast to existing regime practices. The variance is assumed to come from the variety of involved organizations coming from different systems leading the initiative, as well as the different solutions employed by the initiatives. An qualitative approach is necessary to gain deeper insights in the strategic actions and considerations of actors in the initiatives, as well as how they determine their position.

The Netherlands is taken as empirical boundary because of its plentiful niche activities that can facilitate the transition. New local initiatives display relevant cross-sector collaborations in the attempt to transition towards age-friendly housing in response to demographic change. The buildup of this section is as follows: (1) case selection, (2) data collection, and (3) data analysis. The first section explores current practices in the healthcare regime and explains the selection of 10 initiatives as cases that embody alternative solutions. The next section delves into the used databases for desk research and the 18 semi-structured interviews, using purposive sampling and snowballing. The third section defines the three levels of qualitative data analysis: on individual cases, grouped cases, and all cases together.

3.1 Data selection

Niches as locus of change are important areas where experimentation can take place to develop novel solutions of age-friendly housing. Therefore, the study of these initiatives can bring meaningful insights in current attempts to develop solutions for the challenge of demographic change. The development towards ageing in place, longer independent living via age-friendly housing is assessed through the analysis of age-friendly housing experiments that supports this.

Before radical innovation in the initiatives can be identified, it needs to be clear what the regime already is doing. Therefore, to set in contrast, the regime tried to come up with new solutions as well, however

these are more incremental in nature. An overview of regime house typologies and current services from the regime are shown in table 2 below so that more radical experimentations can be easily identified. The table is based on the work of Daalhuizen, Dam, Groot, Schilder, & Staak, (2019) and Mohammadi et al. (2019). The table include a typology of housing for older adults with a varying degree of care needs, with the service-flat porch-flats reflecting the lowest, and the nursing homes the highest needs for care. Detached homes, gallery flats, terraced house, and semi-detached homes are not included as living concepts as these are not built specifically for older adults, or with care, service needs in mind (TNO, 2016). However, since the far majority of older adults live independently home modifications can still prove to be valuable to adjust the environment.

Table 2. Overview of homes types and adjustments from the regime

Regime housing solutions	Form	Explanation
Living concept, for which people have to move	Nursing homes, large or small-scale	An inpatient facility for chronically ill patients that cannot live independently and need 24/7 care and services.
	Residential / care homes	Inpatient facility with residences that contain a bedroom and (shared) living rooms, kitchen and bathroom. Is used for long stay or permanent stay of older adults in need of daily care services.
	Service-flat / Porch flat	Declining living type, which is apartment living with fixed services, like reception, cleaning, kitchen service. Shared spaces like a common area is often included.
	Residential care centre / Lean-to house	Has both residential apartments as well as inpatient facilitates. It concerns living spaces in close proximity of a care / nursing home. Therefore, care of service packages can be bought by the residents.
Home modifications	Modifications for detached and semi-detached homes	Usually for detached homes but sometimes also for other home typologies. Most commonly includes a stairlift, and bathroom adjustments like a chair in the shower.
	Modifications of equal flooring typologies	Usually when care needs increase older adults move to a lean-to house of similar. There, adjustments can include: clearing entryways, lift for transferring a person, toilet adjustments, wider door-openings, and electrical door opener and more.

Taking the overview of table 2 in mind cases were selected that show a novel form of age-friendly housing. The selection criteria is based on: (I) a materialized novelty either already on the market or as a prototype, (II) involving organizations from at least two systems as part of the alliance, (III) showcasing interactions between a niche and regime, (IV) a solution that alters the home environment in a physical, spatial or technological sense that support the independence of older adults at home. Criteria II is based on desk researching the involved organizations, by looking at organizational history, mission and current operations. Criteria III is based on desk research about the case, where is shows that the case is engaging with the regime. This can be observed via multiple ways, most important are the mission and vision of the case, which can for instance be to change the way healthcare organizations provide care. When the case is in executing phase then there are niche-regime interactions expected where the case tries to change the way healthcare organizations provide care. A different way are explicit interactions with the regime observed through media, such as interviews, blogs or articles about the case.

The cases are taken as a whole, which can either be embodied by one legal entity, but often is formed by an alliance between organizations. Focusing on the actor's involvement in the niche it is plausible to distinguish actions based on the embeddedness, meaning specific strategies while under the influence of institutional structures, or for this study logics.

Therefore, the most relevant cases are the cases that showcase the type of movement where the involved actors move between systems. This can be in various ways as hypothesized in figure 4 below. Those actors that are already part of one system but now operate in a new system are of most interest for this study. With that in mind, these actors most certainly would have to deal with multiple logics.

Especially for criteria II but also III the cases selected had to display involvement of organizations coming from different systems than the aimed system. With the healthcare system being the most likely focal system. The relations between the organizations had to be observable through an established initiative or a formalized network with a shared degree of value and vision. This is illustrated in figure 4.
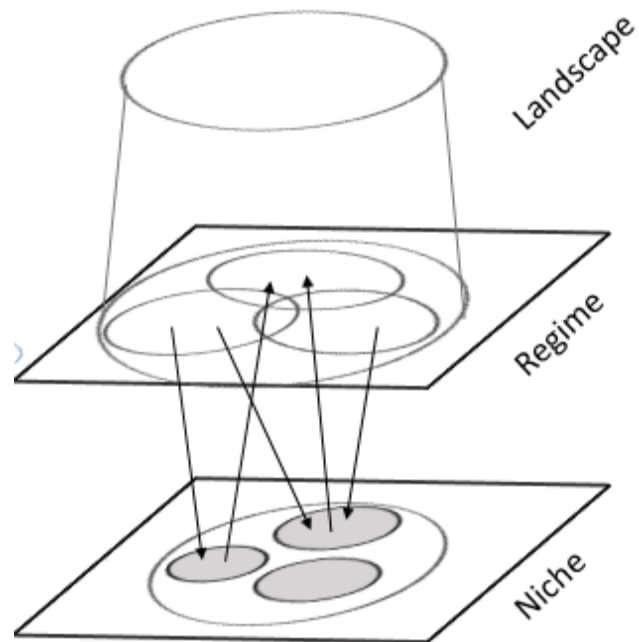
Figure 4. Actors movement between systems

A total of 10 cases were selected within the borders of the Netherlands as part of the purpose sampling strategy. The identification of the case and the different organizations involved was based on desk research. The list with cases is mapped in terms like: its stage, description of solution and vision, interesting remarks about the case, type of actors involved, and the actual involved actors. Each case is shortly described in table 3 on the next page for overview purposes, the description column shortly explains the goal and mission of the cases, and based on which selection criteria the cases are included. All selection criteria are met in almost cases, except for a few slight deviations. Cases 1 and 2 have their

initiatives consolidated in a legal entity, therefore the collaborations with other actors are slightly differently arranged than in other cases. Actors from other systems are involved but less directly in the conceptual development. In addition, do cases 4 and 5 deviate on criteria I of consisting of physical materialized solutions, rather they have developed digital impressions and tools. These cases are still included because of their unique solutions and approach to their solutions, and thus relevant for this study. Moreover, because the initiatives are still in their development stages these are likely to change in the near future.

Table 3. Overview of investigated cases

	Cases	Description	Selection criteria fulfilled			
			I	II	III	IV
1	Knarrenhof	Reinvigorating courtyard ("hofjes") way of small-scale community living for older adults.	X	(X)	X	X
2	Het Ouden Huis	Living form that combines older adults that have a need for care and those who don't need care. Where older adults can receive all the care they need.	X	(X)	X	X
3	Zorgbutler	Small scale living community with shared spaces for those with mild care needs, with a central care coordinator that lives in-house.	X	X	X	X
4	Nije Spiker	Giving new purpose to a closing nursing home, transforming it for citizens to create a new environment for housing and care.	(X)	X	X	X
5	Langer thuis in eigen huis	Stimulating small home adjustments tailored to different housing types through the creation of local networks.	(X)	X	X	X
6	Eware	Improving the lifestyle of people with dementia and their caregivers through the use of robotics and lifestyle monitoring.	X	X	X	X
7	Izi gezond langer thuis	A living lab and demonstration apartment to bring technology and older adults closer together, increase awareness and stimulate diffusion.	X	X	X	X
8	Guiding environment	Smart sensor technology that can guide a person through their daily activities	X	X	X	X
9	Technology Thuis nu	Four different adapted homes created tailored to common chronic conditions.	X	X	X	X
10	I-evAALution	The creation and evaluation of different technologies as an integrated solution.	X	X	X	X

3.2 Data collection

The local age-friendly housing initiatives are identified in the Netherlands using desk research through searching for projects at the national funding agency ZonMw[4], and international funding joint programme AAL[5] screening on terms like: 'longer independent living', 'healthy living', 'ageing at home' and similar search terms. Subsequently, were summaries, goals, and visions of the cases read to judge its relevance. Another strategy deployed was using intermediary organizations like a knowledge institute or branch organization[6] as a database to look for relevant cases, using the same screening method. Databases like the global database of age-friendly practices, and the reference sites from the European Innovation Partnership on Active and Healthy Ageing on age-friendly housing initiatives, as well as the network of the Covenant on Demographic change, were used without much result[7]. Snow-balling was also used during the data collection process by asking the interviewee about similar initiatives.

A total of 18 interviews corresponding to 10 cases were conducted with key individuals from organizations that were part of the cases. Most of the interviewee's were coming from outside the healthcare system. Table 4 down below presents an anonymized overview of all the persons interviewed, including information to which case they are related, what type of organization they come from, what the position actor holds, and from which sector they come. The interviews were audio recorded using a 'sound recorder' application on the mobile smartphone, and the recordings have an average time of 29 minutes, with a total recording time of 520 minutes. The data collection was done in two main phases: November – December 2019, and January – February 2020. Initially the goal of this study was to include initiatives from Austria as well, so that a comparison between the Netherlands and Austria would be possible. However, during the data collection process this proved to be more difficult than anticipated. Thus, the choice was made to expand the number of cases in the Netherlands, and to make it a one-country analysis instead. Consequently, the first half of the cases are done face-to-face, while the second half is done via telephone.

Key actors from each case are interviewed, this resulted in most cases that an individual of two organizations involved were interviewed to get multiple perspectives on the initiative. Unless there was recommendation from an interviewee, was first contact established via e-mail. The set-up of the interview was usually also done via e-mail. The interview guide was not sent beforehand, except for one case however this did not lead to useful data or an interview. Furthermore, three other initiatives were explored after recommendations from interviewees resulting in three additional interviews, however these did not reach the selection criteria and were thus excluded. Gaining two perspectives on each case was not reached, therefore a few cases have one interview. There were a couple of organizations which did not see the use of the interview, or did not have the time. The chosen organization for the interview had to come from a different system than the healthcare system, like a software developer of architect, or present itself as a key organization in the development of the case. Two interviewees from one case preferably had to come from two systems.

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[4] ZonMw has multiple databases, see for example: AAL and AAL2
[5] Active and Assisted Living Programme database: link
[6] See for instance: Platform 31, BNA, or OTIB
[7] These are mentioned because they are relevant for other age-friendly initiatives that focus on the eight domains of age-friendly cities and communities. Therefore, the logical choice is to search for age-friendly initiatives in there.

The case list is during the data collection and analysis processes iteratively extended or amended. For the desk research the following sources were used when available: the cases website, description on funding agent's website, media articles or interviews, internal documents like year report or strategic document, and other media outputs. Almost all the cases had a website dedicated to the initiative, or sometimes did have one organization hosting a webpage about the initiative. When possible, was the person directly involved in the initiative contacted, when this was not clear the organization was asked who was the most relevant person involved in the initiative. Overall, did this not lead to any problems, all the persons interviewed seemed knowledgeable about the initiative. It was not always possible to get in the touch with the preferred organization, in these situations was a different organization part of the initiative contacted.

An interview guide is setup to guide the initial interview, which also left room to deviate and continue on the answers given the interview. The interview guide is found in appendix I. During the interview the most guiding concepts were: actors rationales (Bakker, 2014), empowerment strategies (Smith & Raven, 2012), and institutional logic (Battilana et al., 2009). To be more precise: actors rationales correspond to questions 1-3, with the focus on what triggers the actor in terms of interests and expectations about the initiative. Empowerment strategies correspond to questions 4, 5, 7, 11 & 13, and deal with question related to how the initiative deals with practices from the regime. The questions revolve around how the actors position the initiative in relation to the regime, and how they try to make their initiative competitive. Institutional logics correspond to questions 3, 8, 11 & 12, which are about how age-friendly housing best can be reached. The concept of anchoring (Boelie Elzen et al., 2012), will help to gain insights in how the niche connect to the regime not just from an empowerment point of view but also through networking and setting technical standards. These concepts together are used to describe age-friendly housing as a domain which is done by taking the cases collectively. Table 4 below shows all the actors interviewed for the data collection part.

Type of question used in the interview guide are based on the work of Kvale (1996). Interviews started with more introducing question, like how the organization and initiative got started. Followed by, follow-up questions when openings to topics from the interview guide presented itself. Structuring and interpreting questions were used to for clarification. The interviewer was careful with the use of probing or prompting question to not guide the interview too much. After the initial few interviews, the interview guide is slightly adjusted, most notably by changing the third set of questions towards the way of working and generally working in a sector. This was done because the earlier questions seemed a bit difficult to understand by the interviewee, these questions revolved around the differences actors experienced in working in different systems.

Table 4. Overview of persons interviewed

N	case	Type of organization	Interviewee's position	Sector
1	Knarrenhof	Foundation	Leading actor, entrepreneur	Housing
2	Knarrenhof	SME	Architect	Housing
3	Het Ouden Huis	SME	Leading actor, entrepreneur	Housing
4	ZorgButler	One-man business	Healthcare entrepreneur	Healthcare
5	ZorgButler	Corporation	Franchise developer	Housing

6	Nije Spiker	Housing corporation	Housing consultant	Housing
7	Nije Spiker	Architect firm	Architect, developer	Housing
8	Langer thuis in eigen huis	Network organization	Project developer	Civil society
9	Eware	Healthcare provider	Healthcare manager	Healthcare
10	Eware	SME	IT developer	ICT
11	IZI Gezond langer thuis	Municipality	Leading actor, project leader	Government
12	IZI Gezond langer thuis	Housing corporation	consultant	Housing
13	Guiding environment	SME	Software developer	ICT
14	Guiding environment	SME	IT developer	ICT
15	Technologie thuis nu	SME	Technical installer	ICT
16	Technologie thuis nu	Branch organization	Program manager	Housing
17	i-evAALution	Business integrator	Business developer	ICT
18	i-evAALution	Healthcare provider	Policy officer	Healthcare

3.3 Qualitative data analysis

The qualitative data obtained through interviews was transcribed with the use of Express Scribe Software, and so that all the data from the interviews could be used for the analysis. Next, codes were created for pieces of text based on the chosen concepts. In other words, pieces of text deemed in relation to actor's rational, empowerment strategy, institutional logic or anchoring were labelled to capture its main message. This process was done independently by the author, as soon as the transcript was ready. To ensure the codes adhered to the interviews, interview transcripts are read in their entirety two or three times. To support the analysis, process a colour scheme was used to label the pieces of text in accordance to a concept, e.g. empowerment strategies coloured red, institutional logics blue etc. Lastly, coding on the basis that all previously defined categories are unified into what are deemed 'core categories'. According to Corbin & Strauss (1990) a 'core category' is representative of the central phenomenon under study.

After the codes of interest were identified, the codes were grouped based on their concept color scheme. Within each concept categories interrelating codes in these broader categories were grouped in sub-categories to allow for variance and to stay close to the data. Different levels of analysis exist, namely: (I) the level of the case itself describing its dynamics, (II) multi-case description, taking multiple cases together, and (III) gathering all the data together to investigate age-friendly housing as a whole. Due to the high variance between the cases they cannot be taken collectively without losing the diversity of the cases itself. As seen in table 3 the cases embody a variety of different solutions in terms of products or services.

The different levels of analysis are separate from the coding process. The built up of coding into sub-categories, categories and core-categories is done for each level. Codes identified in the transcripts relating to one case were used to describe the dynamics of the case. To establish the relation between the cases in the niche to the regime(s) they deal with, the multi-case level was used to determine niche-

regime *directions*. The direction helps visualize to which regime the cases relate to in terms of *anchoring* or *empowerment*. It is assumed that cases are aware of the practices at the regime level to which they position themselves to. To capture their position and their vision in relation to the regime they target, the direction is determined. It is also a way to capture *multiple* niche-regime interactions, between multiple niches and regimes. The multi-case level is accomplished by grouping cases together that deploy a similar solution and vision, for instance solutions that focus on adjustments in the current home environment, or solutions that develop whole new home environments. The analysis of age-friendly housing as a whole is done by gathering all the identified codes among the cases.

Considering the subject at hand on strategies and considerations, it expected that the telephone interviews did not hamper data quality as perhaps expected (Sturges & Hanrahan, 2004). To ensure the validity of the coding process as much as possible, were these processes reviewed a few times. This meant that the codes were read and related to the concepts found in literature. This was done to check whether relevant information was coded.

The analysis of initiatives on age-friendly housing is conducted to see what factors can determine the diffusion of the age-friendly domain, and to see if a generalizable pattern can emerge. The strategic niche management approach can help identify strategic activities between the niche and the regime using the empowerment concept, and institutional theory will help uncover used logics to increase legitimacy and vision creation. It is analysed how actors are to engage in empowerment activities and how that relates to the encountered logics. The multi-case study approach allows for a detailed and contextualized analysis of age-friendly housing initiatives. Interactions are explored not just within one socio-technical system, but between socio-technical system, based on the strategies employed by the initiatives. Hence, the directions that the cases move into.

The socio-technical experiments found in the cases all attempt to develop products or services that facilitate longer independent living of older adults. All cases include some degree of inter-sectoral collaboration, which is displayed by the different organizations involved. A common feature in these cases is the involvement of healthcare organizations or professionals, which is a way to legitimize the project as well as enabling access for proper testing and experimentation. Subsidies and funding also play an important role, therefore a funding or government agency was also commonly involved as well.

There is a difference between the cases that develop one product or service for a particular purpose, which can then be implemented, and cases that develop a new vision of what independent living for older adults should look like. These cases attempt more specifically, a deeper structural change than just a material artefact, and in that sense are more 'radical' in their socio-institutional dimension. The cases that focus just on products form an experimentation space in collaboration with regimes, however can still display the different collaborations and (new) actor's involvement. More interestingly are the cases with a clear vision, new routines, social practices, that require structural changes as they are often in conflict with logics. Concretely, this results in a multi-case approach performed in the Netherlands, which makes it possible to investigate a variety of patterns.

4 Results

This chapter presents the key findings of this research, based on the findings in the different cases investigated for this study. Section 4.1 gives an overview of the different cases, where each case is investigated using the chosen concepts, namely: SNM terminology empowerment, and institutional logics. Section 4.2 provides an investigation on the multi-case level, grouping similar cases together to determine directions from the age-friendly domain among the cases. Finally, section 4.3 presents a synthesis of all the cases together to determine patterns and dynamics of age-friendly housing as an emerging domain, taking all the cases together.

Below figure 5 shows a diagram useful to describe the different cases used for this study. As mentioned in the theory, three different systems are expected to be involved. It is assumed that there are interactions on different levels, which could lead to a temporarily 'overlap' between the systems, as part of the system configuration. It is therefore fruitful to illustrate the cases on the diagram for overview purposes. The relation between the niche and the regime levels is captured via the empowerment strategies and by looking into the logics that belong to them. Which can either be a gap that could grant an opportunity, or in a conflict which would correspond to the strategy deployed. Naturally will each case have a short description of its current standings to provide the context that they are in.
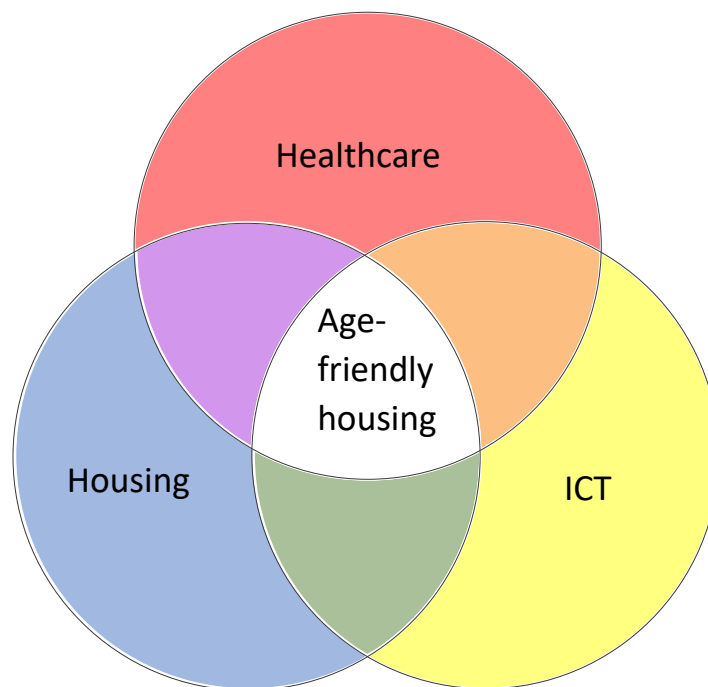
Figure 5. Diagram for case description

4.1 Overview of cases

In presenting the findings, first each case is described alongside the chosen concepts, this also includes a general description of the case itself. Utilizing the main research question, after each case is explored. Each case description starts off by explaining its origins by looking into the interest and expectation of actors, and by describing who is involved. This is followed by describing the solution that the case develops. Finally, the concept of empowerment strategies and institutional logics are used to describe the niche-regime interactions, to stay close to the data quotes will be used.

1 Knarrenhof

Already in 2009, did the entrepreneur behind the Knarrenhof, interviewee 1 leading actor, propose a new business model for the sector. The housing sector was hit hard by the financial crisis, and it was time for reflection. Especially social housing and lower segments were hit the most. Interviewee 1 the entrepreneur, recognized the chances for new forms of corporate social responsibility, as trust was very low, and published an article the in Cobouw, an important journal for real estate, which lead to positive responses. With the reforms of healthcare in 2015, and the new housing law of the same year, the entrepreneur saw opportunities. The reforms put more emphasis on participation and taking responsibility by older adults for their own living situation. In addition, there were also budgets cuts for long-term care services, and the closing of two-thirds of the nursing homes. This increased the pressure on the current housing stock.

The Knarrenhof concept is built on the empowerment of older adults by supporting the formation of a community between the residents that intend to live together. The organization works with memberships, after a certain threshold, about 20 registrations, for a certain location the members are invited to form a living community. The future residents can design their own homes within certain limits, as interviewee 2 notes, the architect-developer, to prepare the home for future adaptations. These include for instance: a wide ground floor so that a bedroom can be formed, and multiple sewage connections so that a toilet can be placed, if these options becomes necessary in later stages of life. These elements be interpreted as a form of standardization of the concept, which is then also used to guarantee quality and connect with the focus on longer independent living initiated by the regime.

The main principle of 'older adult empowerment' is in total contrast with existing production and consumption processes in both healthcare and housing sectors. Common practices in these sectors include designing and building a home environment from the experts' point of view, only after its construction are residents looked for. Knarrenhof makes the residents themselves owners of their own building projects right from the start, and offers guidance and expert support. This approach plays perfectly in the values of 'participation' and 'self-empowerment' that pressures the regimes, for which they do not seem able to offer a solution. Knarrenhof is in conflict with the common logic that older people do not want to move and need to be prescribed what is good for them. Shielding processes are less prominent in this case. Knarrenhof embodies a clear vision of their type of housing that makes it easy to scale and therefore the niche is quicker in maturing.

Knarrenhof employs a clear stretch-and-transform strategy by changing mainstream selection environments, more in particular: dominant user practices, and public policies. Interviewer 1 observed

that some policies towards longer independent living were a direct consequence from learning about the Knarrenhof concept. This is illustrated by the following quote:

"Even though a housing and care incentive scheme was aimed on the first Knarrenhof [in 2017], we can up until day not make any use of it. … Execution is a lot harder than policy. Between policy and execution are in the Netherlands a whole lot of laws, protocols, rules, and practical objections." interviewee 1, leading actor

In other words, actors from the regime are trying to stimulate similar initiatives like the Knarrenhof, it still has difficulty in cultivating them, as they are adjusting public policies on longer independent living. An impression of the Knarrenhof is shown in figure 6 below.

Figure 6. Impression of the Knarrenhof in Zwolle Netherlands.
Source: https://www.hetkanwel.nl/2016/12/29/knarrenhof-zwolle/

2 Het Ouden Huis

Initiated in 2015, the concept of Het Ouden Huis is built on personal experience, both initiators have experienced the process towards residential care of relatives in a nursing home, and experienced the pressure as a caregiver along the way. The consequence of moving away, without partner, increased the difficulty of providing care, in addition to the loss of autonomy and personal freedom. The reforms of long-term care in 2013-2015 asked for new living forms where care can also be delivered. As a result, these developments were interpreted as an opportunity for Het Ouden huis to start developing.

Het Ouden Huis is a building with about 20 households, where about 1/3 of the household already has a need for residential care. Interviewee 3, the entrepreneur, explains that due to the number of households with need for intensive care, it is possible to provide it. It is still possible that other tenants may need light forms of homecare, as this is quite common for older adults. However, the aim is that older adults can live in a place they can call home and were they can stay independent of their care needs, and don't have to

move to a nursing home. Shared rooms like a shared living room and kitchen can facilitate social interaction, while residents still have their own homes as well, see figure 7.

Het Ouden Huis employs a stretch-and-transform strategy by engaging with mainstream selection environments. According to interviewee 3, is the dominant belief in the healthcare regime that most older adults do not want to move, and that they want to stay in their own home. However as Het Ouden Huis proves: older adults do want to move one more time if they know they can keep living there, in a location of their choice, in their own home, where they can self-manage as much as possible. With that attempting to change dominant user practices for care and living. In addition, does the entrepreneur create a narrative articulating the benefits of their concept in comparison to the current way of working. The entrepreneur is very conscious on the developments on the regime level, and explains how they are different:

"Recently the commission 'Toekomst zorg thuiswonende ouderen' published a report called 'Oud en zelfstandig in 2030' ... and they make several suggestions of which direction it has to go. It is nice to see that on one hand they make suggestions which plays in the needs of us, like more buildings, and cluster forms, use of digitalization. ... They also make suggestions to change the system, what happened in 2015, ... they suggest to get rid of the [Persoonsgebonden Budget], and modular package home for long-term care. In my eyes you are denying the trend that people want to self-manage, and what I find miraculous is that they write in their report about societal trends, while I find barely or no information about new initiatives. These remain unknown while suggestions to change the system are made, without taking in account how new initiatives can answer the societal trend. That is very surprising." Interviewee 3, leading actor

Het Ouden Huis runs on utilizing 'Persoonsgebonden budget', which also provides freedom for citizens to choose their own care services. This is a new form of financing which is very different from the more common way of financing called 'Zorg in Natura'. In the latter way of financing are care services contracted on a fixed basis, without any change of input from the citizen point of view. Through this, Het Ouden Huis wants to change dominant market practices and support a cultural change.

Figure 7. Impression Het Ouden Huis in Bodegraven Netherlands.
Source: https://www.platform31.nl/nieuws/wooninitiatief-het-ouden-huis-een-extramurale-voorziening-met-intramurale-trekjes

With the first living units realized in 2017 the Zorgbutler already established itself on the market. The organization behind the Zorgbutler is experienced with developing similar concepts aimed at different target groups: like people who have a cognitive impairment, mental disability, and now also older adults with a light to mild care need. Due to the long-term care reforms of 2015 the organization recognized the need for new living concepts that can support older adults with light care needs, as well as facilitation of social cohesion between elderly. As a result of the reforms there is gap between the nursing home and healthy independent living. A lot of nursing homes closed down and older adults are expected to manage through with the help of their surrounding and family members.

The Zorgbutler offers small-scale housing for older adults, while still living independently, and having a contact person who is also a certified nurse, inhouse. With spaces like a shared living area and kitchen, social cohesion can be stimulated, whilst still have personal space and autonomy. The organization specifically aims at older adults with a light to medium care need, and that they offer care services in accordance to their needs.

The organization plays into the 'participation society' trend, by facilitating the self-empowerment of older adults by supporting and not taking over. The inhouse nurse supports the older adult with the different healthcare application forms and contacting relevant healthcare professionals when needed, but do not take over, interviewee 4, healthcare entrepreneur "we are very careful with that, terms like fraud are quickly mentioned in those cases". With that changing the industries structure by letting health professionals live in the same building as the ones they are taking care off.

The Zorgbutler is an example of stretch-and-transform strategy, as are the other similar concepts from the same organization. Most notably changing the industries structure. A clear strategy of the organization is to codify the concept like the Zorgbutler in a franchise, by defining what it is and what it is not. This makes it easier to scale up the formula to other places. However, the current industry structures, like regulatory authorities, reject the notion of franchises and the use of personal budgets (persoongsbonden budget) in the healthcare because they claim it is not transparent and they do not have the jurisdiction to regulate its activity. This is illustrated by the following quote:

"We do not share the vision of the 'Taskforce Integriteit Zorg'. We believe in our franchise approach because it puts the responsibility of care in the right place. … The [persoongebonden budget] is a way of financing and people have their opinions about it. It is labeled as fraud-sensitive, when there is a case of fraud it always makes the newspapers. We emphasize a transparent way of working. A few years ago, we also received negative media attention because an accused case of fraud, where in fact the administration wasn't in order. The [persoonsgebonden budget] is under constant fire, however we do not see an alternative way of financing our organizational form." Interviewee 5, Franchise developer

The Zorgbutler is using the 'personal budget' type of financing because they see it as way to offer new better and cheaper ways of care, while the current regime creates a narrative of fraud-sensitive operations that are impossible to regulate. Even though other finance forms in healthcare like 'zorg in natura' or contracted care have a history of higher imbursements than actual costs. With that attempting to make a cultural change, by not offer services on location as a care home, but allowing older adults themselves choose the care they want. See figure 8 for an impression.

Figure 8. Photo impression Zorgbutler, Rotterdam, The Netherlands. Source: https://www.sor.nl/sor-woongebouw/zorgbutler-pietje-bell-huis

4 Nije Spiker

In late 2018 a nursing home owned by a healthcare provider had to close due to the long-term care reforms and the bad condition of the building itself in a rural area. The building was previously owned by a different healthcare provider who had filed for bankruptcy. However, there was still a need for care, but then in a new form. The local municipality, citizen group, housing corporation, healthcare provider, project-developer, architect company and healthcare insurance company got together to develop a new concept.

The project-developer, regional economy consultant and architect company have proposed several options of renovating the building, after having consulted all the various parties involved. The proposal holds different types of transformation, the building as a whole, part of the building, or temporary transformation, these variations include the creation of a new meeting place, and various dwellings in a courtyard-form, where homes can be rent or purchased.

However, after 2 years the execution phase has not been reached, even though all the involved organizations have agreed on the proposal, see figure 9. In the course of the project have the actors' roles differed, this is illustrated in the following quote:

"The most difficult part of this project was that, in the beginning was the local municipality proactive and were they functioning as chair of the project group, and was the building-owner and other healthcare organizations more cautious. And at a certain moment tilted that unfortunately, and even though the healthcare provider, housing corporation and healthcare insurance company were ready to make the investments, pulled the local municipality out. And when an organization doesn't co-invest, they also do not feel responsible, and that is why it is currently in a pause." Interviewee 7, architect

Figure 9. Impression of a possible 'Nije Spiker' in Ternaard, Netherlands. Source:
https://www.spechtarchitecten.nl/werk/een-woon-welzijn-en-zorglandschap-
voor-ternaard/

Interestingly, there do not seem to be a conflict with mainstream selection environment coming from a sector, rather incumbent regime organizations are ready to support a new living concept for the closing of the nursing home. Actors rationales in terms of interest and expectations seem to eventually being aligned. However, as a result of the reforms does the local municipality carry a duty to provide care however they do not want to be negatively correlated with the closing of the nursing home and forced moving of the people who lived there. As a result, none of the other parties, most notably, the housing corporation and healthcare insurance company do not want to individually commit to the project, as it is deemed too risky.

"*We have a proposal to build lifecycle-dwellings (levensloopbestendige woningen), but since ownership of the building is currently unclear, is the proposal positioned in the fridge while we wait for the sale of the building. … Currently we see that healthcare providers do not want to commit to long-term rent contracts. Therefore, at the moment we want to stick with commonplace real estate (courant vastgoed), because then we can keep our wider scope, and can rent the home out to a different actor, so our risk is not that high.*" Interviewee 6, Housing corporation.

These strategies can be interpreted as a form of fit-and-conform strategies, the mainstream selection environment is not changed, overall do the actors not want to (radically) change their approach to longer independent living. The organizations do support the cause but are not willing to engage in a change on their own, or willing to lead one.

In recent years a lot of studies have been conducted to investigate home adjustment possibilities to stay longer at home. What is missing however are the spatial scenarios for realizing the home adjustments, adjusted to the typical housing stock among elderly. Therefore, 'Langer thuis in eigen huis' commenced in 2016 to investigate the housing stock and possible home adjustments for older adults. The project group consisted of: local and regional municipality, architect branch association, research center, architect advisory foundation, and alliance 'Wonen met Gemak'.

In eight team of architects, urban planners and healthcare professionals are typical postwar housing types investigated and older adults involved in the creation of a set of home adjustments tailored to each housing type. The different housing types include: terraced houses, porch flats, semi-detached houses, high-rise flats and patio bungalows. The proposed adjustments range from re-designing the home like changing the entrance, or rearrange the rooms in orientation or sizes, making it wheelchair accessible, to several technological solutions like electronic locks, lighting and automation technologies. For an impression see figure 10a-c on the next page.

After the projects end in late 2016 were the results consolidated in the architect advisory foundation and alliance 'Wonen met Gemak'. Both organizations sprung up to actively engage with the mainstream selection environment, more specifically the dominant user practices, public policies and guiding principles. The architect advisory foundation recently emerged as an organization that offers free advisory consultations aimed at older adults, reaching out to individuals. For most, is getting in contact with an architect for advice out of their scope, the architect advisory foundation wants to change that. The alliance 'Wonen met Gemak' steers the formation of local networks to stimulate home adaptation among older adults, engaging with local actors and the local municipality. The local networks, often run by volunteers, reaches out to local older adults and providing 'home scans', and get them in contact with local actors who can support in the realization of the home adjustments. Therefore, a stretch-and-transform strategy is identified: mostly concerned on changing user practices, and foremost establishing new industry structure based in local networks.

Local municipalities can shape their own policies; however, they are responsible for providing care opportunities. The alliance 'Wonen en Gemak' actively engages with local municipalities, and older adults living in the region to stimulate home adjustments for longer independent living:

"*The follow-up after the project was missing actually, that is why we are reaching out to older adults. We want to trigger local municipalities to look at their housing stock to see which opportunities are there to facilitate older adults in living longer independent. … When we look at it numerically, then you can never solve it with the construction of new buildings. You have to get in action with the current housing stock. … We bring awareness to older adults, stimulate and facilitate in the decision-making, and the execution of that. … Bringing together housing corporations, healthcare providers, and local municipalities.*" Interviewee 8, project developer

Therefore, the Alliance "Wonen met Gemak' can be considered as sense-making advocates trying to influence a powerful actor through outward-orientated network activities in a different institutional position, the local municipality for instance, who can frame the challenge of age-friendly housing differently in that older adults have to found their way through the help of their social network.

Figure 10a. Example of housing situation of older adult (only ground floor):
Source: https://langerthuisineigenhuis.com/oplossingen/oplossing-5-senioren-
eengezinswoning-groenen/

Figure 10b.. Possible home modification, moving the kitchen to create a bedroom and bathroom on the ground floor.

Source: https://langerthuisineigenhuis.com/oplossingen/oplossing-3-rolstoelvriendelijke-slapen-en-baden-in-aanbouw/

Figure 10c. Possible home modification, creating a bathroom and bedroom out of the garage.

Source: https://langerthuisineigenhuis.com/oplossingen/oplossing-2-rolstielvriendelijke-woning-ombouw-garage/

Started in 2017 the project is aimed at reducing caregiver's distress and thereby extending the period that the informal caregiver can sustain the care and support needs of the person with dementia. Focusing on patient's quality of life and social costs. Thereby, addressing the societal trend of demographic change and growing numbers of person's with dementia, who cannot be cared for through institutional care but do form a strain on the caregiver. This novel technology aims to fill that gap, supporting early stages of dementia in the home environment by facilitating communication, monitoring and guidance. The project group includes a range of actors: research institute (3), sensor-maker, robot-maker, healthcare provider (3), University, ICT supplier (2), software developer,

For the project an eco-system will be developed where two existing technologies will be integrated, namely lifestyle monitoring via motion and open/close sensors, and a social robot technology. The eco-system is accessible for the caregiver via a mobile application, on which both solutions will be connected. The lifestyle monitoring provides insights in daily activities, which can be used for information purposes, or to react on situations. The social robot can then give verbal input to the person with dementia, this can be done both by formal and informal careers. The social robot can also support the person with daily living, giving reminders, or giving suggestion, which are tailored to the person. See figure 11 for an impression.

Figure 11. The Tinybot connected to a smartphone. Source: https://www.han.nl/onderzoek/werkveld/projecten/tinybots/

Shielding processes are important here as the technology has not matured yet, but is being further developed in an active space. The project utilizes technology specific policy on a European level, namely the Ambient Assisted Living (AAL) program. People and resources are mobilized for the project to provide knowledge, skills, and expertise from different areas, as well as financial commitment as the program does not cover all the expenses. The technology is not ready to enter the market, and has to proof its effectiveness. As such, inward-oriented network activities are still an important part of the project's development, which falls under empower activities. These processes complement the nurturing of the niche, as currently expectations are not aligned, and the project remains at first-order learning. Nevertheless, outward-oriented empowerment activities do already form part of the project's activities, which resemble best stretch-and-transform strategies. Most notably are: changing the knowledge base, changing dominant market and user practices, and enacting new media discourses influencing cultural beliefs. This is illustrated by the following quote that shows actors actively looking to transform user practices and guiding principles:

"You sometimes have that people with dementia are in a crisis situation and then they are temporarily taken cared for in a nursing home, often after they have delayed that as much as possible. After the admission they do want to receive a placement in a nursing home, but then there is no room for them, and then they do have to go back home. Which puts you in a situation that is actually not suited, what are we going to do with it? There is no alternative. … So, what can we offer the people in those and similar situations, there is room to experiment with that." Interviewee 9, healthcare provider

Still, the project is dealing with conflicts in institutional logics, as older adults or health professionals are seen as having a passive and anti-technology behaviour, and so actors are trying to change that, illustrated by the following quote;

"we see in healthcare that, at the moment, there is a labour shortage. … we see that technology in care is difficult due to the low acceptance, sometimes obsolete infrastructure in healthcare, the knowledge and skills of technology among healthcare professionals being low. They see the effectiveness of the technology as having less time with the client … so we have developed new formats for technology introduction, one of them being an inspiration session which is about creating a dialogue and understanding of what role technology can play in healthcare, and that we are still talking about care, and not a technological narrative … but, for instance, have to show that due to better coordination with the help of technology, the professionals have more time with the clients that need it." Interviewee 10, IT developer

The actor quoted recognizes the resistance for technology in care, as professionals are afraid it will make their profession obsolete, while having to deal with an increase in pressure and labour shortage. Therefore, the actor wants to create a dialogue and how that the technology can serve the professional, for example by better coordination and reducing the work pressure these professionals experience.

7 IZI – Gezond langer thuis

In 2016 the project started with the aim to support longer independent living of older adults via stimulating the use of different technologies in the home environment. The assumption was that social cohesion and use of technologies could support independent living. Thereby, was the project initiated to respond to the demographic change, play into technological advances, and stimulate new forms for independent living of older adults. The project group consisted of: the local municipality, medical centre, university, university of applied science, welfare organization, technical university, intermediary organization, an incubator, and several IT-suppliers.

The project created a 'living lab' where older adults can test and develop current and new technologies, to see if they function properly and if they match with the needs of the older adult. In addition, is a test home developed, that should represent a typical dwelling of an older adult. The home itself has around 90 different technological solution implemented which can then be experience by the older adult in its functionality. Moreover, it is even possible for older adults to stay-over and spend a few days in the apartment. The test-apartment therefore functions as a demonstration place, which is run by voluntary older adults, who provide tours and instruction of the apartment. See figure 12 on the next page for an impression.

Shielding processes plays a role, in that a passive space is provided for several technologies to be developed and or tested, and to reach out to older adults in a safe environment. In terms of nurturing processes: expectation and vision management were mostly done by the local municipality to which the involved actors could easily align with. The network building is mostly done on a regional scale. The project uses a combination of empowerment strategies, fit-and-conform for the most part, and stretch-and-transform to some degree, illustrated by the following quote:

"How can people help each other, that is the community, what can they do for each other, mostly in the senior housing. … We don't see it as our task, we are managing the stones, but we do find it important, and that is why we facilitated the community forming and provide space for the test-apartment. … I find it important that there is a focus on housing participation, which really made progress here, where there is a common goal. … That goal is longer healthy living at home" Interviewee 12, housing corporation

The housing corporation does support the movement by providing space for incubation, and does facilitate knowledge dissemination, but is not active in changing mainstream selection environments. Therefore, it is seen more as a fit-and-conform strategy because the organization does support the further development and competitiveness.

Figure 12. Examples of home modifications, from left to right: cutlery with extra thick handles, toothpaste dispenser, automatic door opener with camera, and doorstep helper.

Source: https://www.voorall.nl/index.php/goed-geregeld-in-den-haag/749-slim-veilig-en-zelfstandig-wonen-probeer-het-in-de-izi-ervaarwoning-2

8 Guiding environment

Guiding environment forms a part of a larger program that is called 'Empathic living'. Initiated in 2017 in a response to the demographic change, and expected rise in demand for care while there is a shrinkage of labour force in care. The aim is to develop the 'guiding environment' technology that will enable older adults with early-stage dementia to live longer independently. Participating organizations are: technical university, university of applied science, research institute, healthcare providers (2), software developer, It-developers (2), and a construction company.

The developed technology is expected to support and facilitate the older adult with early-stage dementia in everyday living. The philosophy is that the technology will identify user patterns so that it can shape a safe and comfortable home environment. Where the technology is completely integrated in the home itself, and not needing any action of the person with dementia. The technology is a combination of sensor technology integrated in the floor, connected via a platform that can respond with different lighting for example on the floor or elsewhere. Through which the person can be guided with lighted symbols. For an impression see figure 13.

Figure 13. Impression of the guiding environment. Source: (Mohammadi, 2017)

Active shielding is used to gather advocates and create a prototype of the integrated technology in a safe environment, the effectiveness of the technology is still to be seen. Empathic living is envisioned as a new way of living where the surrounding, with the help of technology and design, becomes more integrated in daily living for persons with care needs. This approach is aimed at: stimulating prevention, facilitating care processes, and creating a more 'human friendly' environment. Stretch-and-transform strategies are used, mostly inward-orientated activities as there is still a need for practical development of the socio-technical configuration. This is illustrated by the following quote:

 "The solution that we developed now is more like a 'piece of string' concept, so they are for us a proof-of-concept, so they proof that there is value, but this is not yet scalable. … Because we are talking about providing a 'total concept', and that can only be done via collaboration, and then is the question: are you the main supplier. Looking at our role position, absolutely not, but would it likely be another organization. Normally, in other markets we have a different position, and offer directly to the end-user." Interviewee 13, software developer

The quote provides insight in the creation of the narrative of the solution, however it does still require practical development of the socio-technical configuration. The organization is interested in its further development but at the moment doesn't see the possibility to enter the market. In other words, nurturing also still place a prominent role. Another perspective illustrated in another quote:

"the more diverse actors you bring together how difficult it becomes to come together. Because healthcare wants to heal, businesses want to make business, and knowledge institutes want to publish. … The concept of empathic living is promising, but I have doubts, it has to be very trustworthy in the Netherlands, and the more technology you put in the home the more expensive it gets. … Or we say we thin it out and we start small". Interviewee 14, IT developer

Due to the variety of actors involved the interviewee understands it can be difficult to come together on one solution, especially on the focus of developing an integrated solution. This goes to show that expectations might have been different at the start of the development. Because of its progress 'guiding environment' is less able to actively start empowering its solution.

9 Technologie Thuis Nu

Back in 2006 did a series of projects started under the name of Technologie Thuis Nu. One of the reasons to set up the program was because of the demographic change, with the expectancy that demands for care will increase throughout the years. The rationale was that with an increase in older adults, also comes an increase in chronic conditions, as older adults have a high risk of developing such conditions. While simultaneously the labour force providing that care will decrease. The program was not to develop new technologies, as plenty were already available, but the aim was to increase collaboration between the healthcare and installation sector and to develop home adjustments so that older adults can live longer at home. The project group consisted mainly of a university of applied science, technical installation branch association, and business association for the installation sector and technical retail. Already anticipating on the Social Support Act when it was first introduced in 2007.

Four demonstration homes were built as part of the project, aimed at different target groups: adults with visual impairments, mobility loss or chronic long conditions, dementia, and a more general lifecycle home. The input for these homes came from various sources but mainly different professionals and organizations from both the sectors involved, and older adults with the various conditions. The demonstration homes were based on the regular housing stock, to which a collection of homes adjustments is made like: use of different materials, variations in designing, and use of technological tools. The project also resulted in various courses and trainings for installers of the branch

Figure 14. One of the demonstration homes, this is the demonstration home for people with dementia. Source: https://www.kcwz.nl/thema/woonzorgtechnologie/dementie_modelwoning_laat_technologische_oplossingen_zien

organization, as well as standardization of guidelines for the homes for the different conditions. For an impression see figure 14.

The demonstration homes were built and maintained until 2019, after which they are digitalized and can be reached online. The different parties involved as well as the local municipality contributed financially, creating a more passive space for the development of the niche. The vision for the project was early on established and the different actors could easily align themselves with it. In later stages of the project was the network extended to more installation and housing companies, as well as patient organizations and healthcare providers. Both modes of learning is reached, with in the later years a large focus on knowledge dissemination, resulting in many visits from educational centres, as well as other organizations.

A clear stretch-and-transform strategy is employed, aimed at changing: technology and infrastructures by setting new standards, knowledge base via the different dissemination activities, user's relations and markets via changing installers work ethic via the different trainings offered. Outward-oriented network activities make up the majority of these activities, creating a narrative that can provide for instance work endeavours for the installation branch, reshaping the possibilities of the branch. This is illustrated via the following quote:

"I have 2 years given lessons [in the test homes] to different educational classes. The goal was to bring education, healthcare and technique together to create a common language. To create a normal sized living space, designed according to the needs of the client. … the goal was not to create new technologies, but to find each other in supporting older adults living independently." Interviewee 15, technic installer

The actor shows that most of the strategy was aimed at creating a common knowledge base of what the installation branch can do to facilitate older adults, aimed at the different needs that they have in accordance with the condition. A different perspective is given by another interviewee that talks about the new role installers have to take:

"You really have to look at the needs of the consumer or patient, to know which adjustment I can advise, so a lot more based on the individual needs, to come to needs articulation via a conversation or the scale of the home, and based on that to provide a solution." Interviewee 16, branch organization.

The interviewee explains a new viewpoint of installation branch on their work, it is on conflict with the belief that every home is the same and should be treated as such. In this new narrative is the identification of the personal needs much more central, to which the installer can provide different solution depending on the context and situation. A much deeper understanding of difficulties at home caused by common chronic conditions is necessary to provide that service. Therefore, it is a shift in knowledge base and user practices.

10 i-evAALution

Initiated in 2018 the project attempts to find solutions for the demographic change, and more specifically support longer independent living at home. Worries and insecurity of older adults about their capacity to live independently and perform daily activities independently can cause a burden for the older adult self and for the social surrounding. The aim is to support longer independent living through the combination of existing ICT technologies, developing an integrated solution. The idea is to evaluate the interoperability and compatibility of several of these technologies, as well as develop these technologies further with

several testing rounds. The project group consists of: research institutes (3), university, several healthcare providers, business integrator, IT developer (2), IT supplier.

The technologies involved consist of: a watch that functions as a mobile service and emergency system combining localization and voice communication functionalities, a set of home automation products, and tablet-like device which allows for care documentation, management of other technologies and other tablet-like functionalities. The different technologies are all developed separately, so the focus is on evaluating the integrated use of the technologies together. Therefore, the integrated solution is tested in different testing rounds. For an impression see figure 15 below.

Figure 15. The different technologies used, from left to right: a safety watch with receptor, than different wireless devices for home automation, and lastly a tablet-like device for managing and communication tasks.
Source: https://www.i-evaalution.eu/i-evaalution-bundle/

The main focus is to make these technologies competitive, therefore clear empowerment strategies are employed. Shielding activities are less prominently present, while the technologies are further matured. A combination of outward-oriented and inward-oriented network activities are deployed that resembles best an stretch-and-transform strategy. Inward oriented strategies are at further maturing the technology with the help of the different end-user organizations. While a positive narrative is developed to attract more actors for its deployment.

"we have a huge number of households that we have to recruit. … At first was the idea to get households in high flats and to do the installation there, but now we want to spread it out to different type of households. … Healthcare providers are also contacted to see if they are interested in joining the project, because they are also important users." Interviewee 17, business integrator

The interviewee shows that network activities form an important part of i-evAALution. A narrative is created about the technology in order to recruit more users, which can be individual households or healthcare providers.

4.2 Multi-case level: directions among multiple cases

After the analysis of each case individually, the cases are now taken together to determine patterns and strategies that are similar to each other, with that describing the multi-case level. Considering the variety of solutions being developed by the cases, this is an attempt to identify pattern between cases by grouping them together in different subgroups. The aforementioned steps then allow for the identification of directions between the groups of cases.

The development of the niche in a direction can facilitate the transition of the relevant regime(s), therefore identifying patterns and similarities among the cases provides interesting and relevant insights in the possible directions of the transition itself, and how it can be influenced. Due to the multi-regime nature of this domain, that could also mean *several* transitions happening simultaneously. Representing the grouped cases in the Venn-diagram there are three different directions visible, see figure 6 down below.

To determine the case's directions, the novel solution the cases develop and related vision are analysed. Three main directions are identified: (I) new living concepts aimed at the overlapping field of care and nursing homes, (II) new types of home adjustments aimed at the overlapping field of homecare, and (III) new integrated solutions aimed at the overlapping field of smart home technologies. Subsequently, each of these directions will be investigated by looking at how these cases reach their new outlook on age-friendly housing, how that new solutions differs, and how the actors deal with the several systems involved.
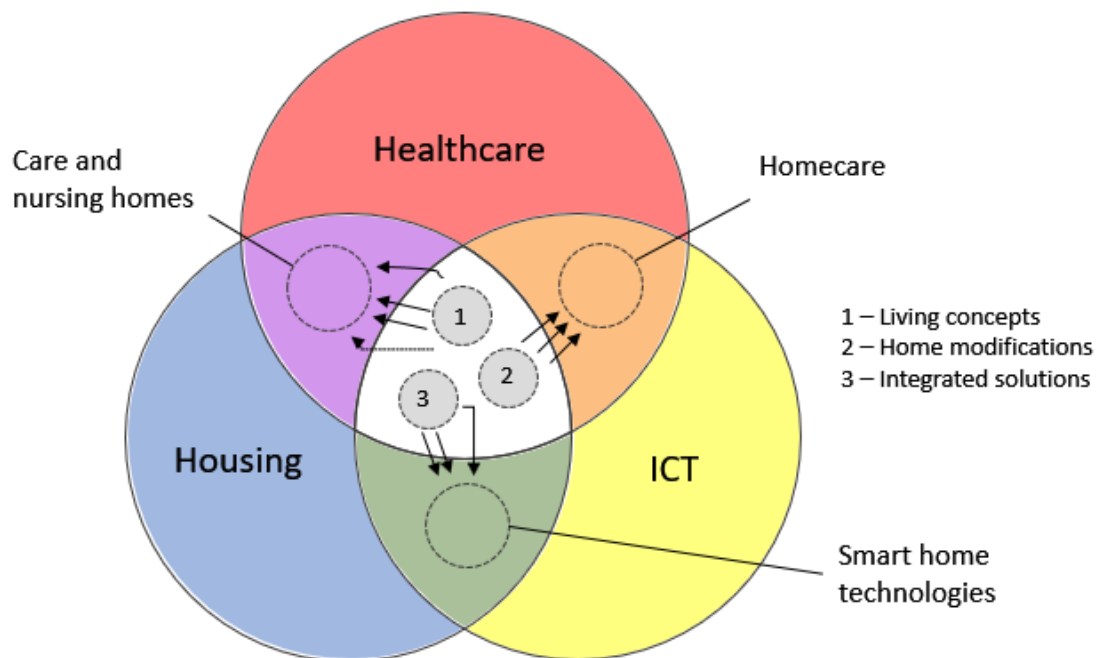

Figure 16. Diagram with the grouped cases, the multi-case level.

4.2.1 Living concepts

Cases 1 – 4 are grouped together under living concepts because each case develops new residences, with that requiring for older adults to move. The closing down of care and nursing home leaves a gap that these cases try to fill. Hence, they are targeting the current care and nursing home market that is reorganizing itself. The cases that develop a new living concept 1-3 are relatively developed and active on the market. Business models have formed in the cases and the concept is internally substantiated. These cases distinguish themselves from the current healthcare care and nursing home market that is reorganizing itself as a result of the long-term care reforms due to the landscape pressure. Case 4 is a clear example where the existing market failed to answer these changes, which resulted in the loss of a care home with no substitute available. In that case there is an overlap between healthcare and housing actors who try to reorganize a housing solution for older adults, but neither take a leading role in it.

Cases 1-3, though in slight variations, exemplify new logics where older adults want to move and create their own living community with care services close by. These new logics are not supported in the existing market, and like in case 4 no regime actor offers a similar solution. The current logic in the regime is that older adults should live longer independently at home, in the current homes which they have lived their whole life's. However, what the cases 1-3 do is they show a different variation of what that home can be. The new logics of these cases are in contrast with the existing logic built up through institutional care (i.e. classic large-scale nursing home) that determines the housing for the older adult, with very limited variations. With that, do the cases embody a logic that older adults want to determine themselves how their homes are designed, thereby also showcasing an alternative development process of the home environment through actively involving older adults in the process. Case 1 is the most radical in that regard, as it allows for a group of older adults to have a lot of input in the designing and development of the construction process, including even the search for land to build on.

Overall, the new living concept cases deploy stretch-and-transform strategies which are aimed at small-scale community forming. Cases 2 and 3 have a more bounded outlook on the living area, that has to consist of apartments, while case 1 supports more radical housing types. Where they, cases 2 and 3, differ is in their target group and community forming. Case 2 aims for a variety of older adults with light and heavier forms of care needs. Whereas case 3 specifically aims at older adults with light care needs and does not aim to support older adults with heavy (residential) care needs. These outlooks are in stark contrast with how institutional care was organized, especially the entrepreneur from case 2 is very aware of this. As the entrepreneur from case 2 explains, once the need for care became too great the patient would be transferred to a nursing home in a distant location, where the patient would occupy a small standardizes bedroom. With all the consequences of moving, leaving family, and one's home behind. Therefore, does case 2 want to offer a home that people can call home, and where they can stay until the end of their days without having to move somewhere along the way. A summary of the case characteristics is found in table 5 down below.

Interestingly, the leading actors from cases 1-3 are not originating from the healthcare system, rather the actors are coming from *outside*, in this case the housing system. The cases connect to the healthcare system by focusing on older adults with care needs and developing an alternative solution for them. The cases use network anchoring to connect to healthcare organizations in order to be able to offer the care services. The cases showcase an alternative outlook on how the home environment can be supportive for

the older adult, while still being able to offer regular health and care services. Therefore, it is not solely a different outlook on what that support should be, but rather how that support can be formed and developed taking other factors like community forming explicit. Thus, it can be concluded that cases in this direction: consist of actors that cross systems and are able to develop a niche by connecting to actors and organization of the focal system while using their knowledge and expertise from the system they are coming from.

Table 5. Overview of case characteristics, not displayed case 4.

Case	Empowerment strategy	Existing logics	New logics
1. Knarrenhof	Relies on the organization of older adults, who under guidance are part of the development process.	Professionals know what housing older adults need.	Older adults want to determine themselves how they want to live.
2. Het Ouden Huis	Providing a living environment for older adults with light or heavy care needs, where both can live and stay.	Older adults don't want to move.	Older adults do want to move to prepare for later stages of life.
3. Zorgbutler	Small-scale community with an in-house health professional	Older adults can rely on their surrounds and family members	Older adults want to live in a community with care close by.

4.2.2 Home modifications

Cases 5 – 7 are grouped together based on their similar solutions that focus on adjustments in the home environment. Current home modifications fall mostly under preventive measures and homecare. The cases 5-7 developed new solutions of home adjustments that are related to how homecare is organized, where cases 5 and 7 are already active on the market, and case 6 is still maturing its technological solution. These cases are less uniform in their strategies. Case 5 actively involves older adults in its diffusion and sets up local networks to offer its different solutions to older adults. Case 6 develops a technological solution for healthcare professionals that can facilitate care services in a radical way. Case 7 developed a demonstration apartment with a multitude of existing technologies, where older adults, professionals and IT developers come together. This way of working is different from how home adjustments are offered at the regime level.

Cases 5 and 7 relate to a gap, as older adults are lost as to how and which home adjustment they should realize that can benefit independent living. The regime uses complicated regulations and facilitates only very limited types of home adjustments. Case 6 develops a solution by actively involving older adults and health professionals in its development process, which is a different approach from the more regular approach of providing technical solutions after they are finalized. When the latter occurs, it usually does

not allow for alterations, and thereby it is often difficult to match the exact needs of its user. Therefore, it often leads to resistance and closed stance from older adults and health professionals.

Cases 5 and 6 deploy a stretch-and-transform strategy, the strategy from case 7 is less clear to be defined as such, it leans more towards a fit-and-conform strategy. Case 7 facilitates the gathering of user and producer, while demonstrating several technological solutions in the home environment. However, since it showcases a lot of solutions, >90, it is not tailored towards a specific target group, and offers solutions in a more open-ended fashion. In contrast, case 5 trains older adults to execute home scans and provides home solutions that are more radical in nature, by altering the physical and spatial structure of the home. In addition, case 5 uses a more active approach in facilitating these home adjustments, by the use of social learning among older adults, and changing dominant practices by bringing older adults and providers in direct contact through networking.

Case 6 targets healthcare providers directly where it addresses conflicts in the collaboration between healthcare and ICT sector, and the conflict of longer independent living and the need for admission. The latter refers to the inability of the current system to offer similar care services that were offered in care homes. The pressure to live independent as long as possible leads to the admission of patients in crisis situations who are then only temporarily supported via a residential care. Therefore, case 6 seems to be the most radical among the cases that tries to radically change the dominant practices in the healthcare system. A summary of the case characteristics is found in table 6 down below.

The development of new home adjustment comes for the majority from actors outside the healthcare systems, mostly from the ICT system. Most notably, the leading actors from case 6 are coming from the ICT system and are not embedded in the healthcare system. Therefore, is case 6 dependent on linking with healthcare organizations through networking, so that it can involve them in its development. Cases 5 and 7 have networking more explicit in their approach as part of their solution, and are the involvement of actors more diverse. Case 5 actively involves civil society in its diffusion and also collaborates with local municipalities, next to IT and construction companies. Case 7 does networking to a lesser extent, which is also spatial bounded to a demonstration apartment, but also mobilizes IT developers from the IT system and health professionals from the healthcare system. Thus, it can be concluded that cases in this direction mobilize actors from multiple systems in order to develop novel solutions in the niche environment.

Table 6. Overview of case characteristics

Case	Empowerment strategy	Existing logics	New logics
5. Langer thuis in eigen huis	Training older adults to do 'home scans' and creating local networks to realize home adjustments	Professionals need to inform older adults about the possibilities.	Older adults can play an active role in facilitating home adjustments.
6. Eware	Filling gaps in the long-term care solutions and actively involving older adults and health professionals in the development process	Health professionals and older adults are not open for technical solutions	Health professionals and older adults are open for the use of technical solutions

7. IZI gezond langer thuis	Showcasing a demonstration apartment with several technological solutions implemented run by older adults	Older adults and health professionals are not aware and not convinced of the possible technical home adjustments	Showcasing technical solutions implemented in a demonstrating apartment can facilitate the use of the technologies.

4.2.3 Integrated solutions

Cases 8 – 10 are grouped together because of their integrated solutions that they offer, these solutions integrate multiple elements in their solution may it be several technologies, spatial and physical alterations, or both together. These cases relate for the most to the smart-home market, that focuses on automation, and home devices that are connected to the internet and can give real-time information. Cases that develop a more integrated solution 8 and 10 are mostly in the technological maturation process, while case 9 has a longer track record and has therefore already had more time to change user practices. These cases distinguish themselves from the overlapping regime of housing and ICT that is reorganizing itself towards the changes in the housing situation of older adults.

Different ICT solution are more and more finding its way in the home environment also in other fields, like smart meters and home automation. These cases are more specifically aimed at older adults and their chronic conditions or impairments. Case 9 is a clear example of crossing that boundary and training installers to be able to better address the needs of the older adult. The different demonstrations homes that they created proved to be clear link for exchange between the fields. Cases 8 and 10 are more focused on technological development to create novel solutions. Case 8 is the most radical in that regard, integrating smart sensor technologies with 'environmental stimulation' mostly done via lighting. Were the technology is reacting to the needs of the user. Case 10 is less focused on developing a new comprehensive solution but rather the collaboration and added value of multiple technologies together. The general logic among these cases is that person and environment, technology with technology, and person with other persons need to create a common language to exchange information, knowledge or data.

All of these cases use a stretch-and-transform strategy which is aimed at creating integrated home environments to support older adults, as a more radical novelty from the incremental adjustments of the home environment that are commonly found. These cases differ from cases from the previous section, cases 5-7, in that they have a more holistic approach towards the home environment and use different logics. Especially case 8 has a different outlook on the role of the environment as an 'organism' that can understand the people living within it, and is able to adjust to their needs. Case 9 is the least radical in that regard, they did not focus on developing new technologies but rather on finding common ground and demonstrate a home environment with physical, spatial and technological alterations towards a specific target group, older adults with a specific chronic condition. Case 10 integrates several solutions in the home environment like home automation technologies, wearables and a tablet. Rather than considering one technology or solution these cases consider more radical changes of the whole home environment, and therefore provide a profound different outlook of how that environment should look like. A summary of the case characteristics is found in table 7 down below.

Considering the actors involved, it is remarkable that in all of these cases a variety of actors from all three systems are involved. Actors from the housing and ICT system dominate, healthcare professionals are involved for further developing and testing. However, it seems that for the majority the interaction between the other systems is central in the maturation of the technology. Therefore, these cases display a radical new outlook on what age-friendly housing can be through the various alteration possible, and the road to the development of these solutions involves a large degree of actors. Where it is not just about creating solution but also finding each other in facilitating home modifications, see case 9. Thus, it can be concluded that for cases in this direction: actors developing new solutions for one system, can come from another system, while also involving actors from a third system.

Table 7. Overview of case characteristics

Case	Empowerment strategy	Existing logics	New logics
8. Guiding environment	Developing socially intelligent technology that understand the user and empathize with the user	Houses and technology are a means to an end	Houses and environments can become adaptive organisms that 'care' for us.
9. Technologie thuis nu	Creating demonstration homes as a platform for exchange, and train technical installers on chronic conditions	We need to develop new technologies	We need to create a common language
10 I - evAALution	Internal empowering by recruiting users and healthcare organizations to mature the technologies in a protective space.	Solutions have to work independently	Solutions should work together with other solutions

4.3 Age-friendly housing: a synthesis of cases

The cases together embody the experimentation activities that reflect the emerging niche age-friendly housing. After the investigating of the cases individually and in groups, this sections now explores the domain as a whole, by taking all the cases together.

Unique of this emerging domain is the cross-system collaboration that is foundational for the niche experiments. Overall does every case include actors from multiple systems, as actors from outside the healthcare system are the ones that are key in developing new solutions. Thus, inherent for the healthcare system is that they are dependent on the knowledge and skills from actors of other systems. This might be due to the many rules and regulations in healthcare that restrict experimentation room for more radical solutions. Most interesting is that all of the cases are aware of the pressure of demographic change on the regimes. The interpretation can be different from actor to actor, but the niche activity in response to these pressures is directed towards filling the gap that the closure of care and nursing homes leave. What unites these cases is they all develop new ways of housing and care. In the housing systems actors acknowledge the shortage of adequate housing for older adults, in healthcare organizations actors

recognize the increasing work pressure, and in the ICT system actors recognize the increasing demands for technologies. It is a broad understanding of these challenges for the regimes that can help niches to exploit novel solutions.

Particular about the cases is that the novelty developed is rather diverse, from entire new living concepts, integrated solutions, to small home adjustments. This also resembles the variety in care needs of the elderly. Some experiments match the development of technical niches like cases 6, 8 and 10. While other experiments are quicker developed into market niches like cases 1, 2, and 7. Notable is the focus on diffusion and accumulation as a primary goal of the cases 5 and 9. The diversity of solutions is also represented in the logics developed, however taking these combined allows for the identification of the general trend that the older adult plays an increasing role in niche experimentation, and that healthy living of older adults is not captured in one solution. The predominately stretch-and-transform strategy used by most cases resembles a very active niche, that due to its diversity might be considered as multiple niches together that fall under the domain of age-friendly housing.

Considering the relatively low direct involvement of healthcare actors, like in cases 1 and 5, provides a more nuanced perspective on the necessity to link with actors from the focal system. Nevertheless, network anchoring plays a part especially in cases 6, 8, and 10, where case 6 has even the explicit vision to change the way healthcare providers work. However, a central role of healthcare actor's role is questionable. Naturally, do the developed solutions need to be able to meet the regime needs, and in this case able to facilitate care services or create an added value to support care services. The latter would then require direct involvement of healthcare actors and the creation of legitimacy among them. In the majority of cases, like in cases 3 and 5, there is a direct link with the user. However, in other cases there is a need to actively involve healthcare providers as an indirect link towards the end-user. This together does showcase a view of experimentation for the healthcare systems that is occurring *outside* the system for the most part. It is likely to be due to the high specificity and heavy regulation that experimentation in the healthcare system is more difficult. In addition, do cases also display a vivid interaction between niche and regime actors early on in the niche development, co-occurring with other niche processes like shielding and nurturing. For these cases it is important to start with empowerment early on to develop solutions.

5 Discussion

This chapter provides a reflection on the empirical insights presented in the previous chapter, and the theoretical framework. First, niche – regime interactions are discussed. Second, a reflection is given on multi-regime transitions. Both of these sections will first reflect on the concepts using empirical findings, and end with future directions. Finally, the implications of this research, limitations and alternative approaches are explored.

5.1 Niche-regime interactions

An objective of this study was to investigate the niche-regime interactions. To accomplish this, the concepts of empowerment strategy and institutional logics were used. This section is starting with a reflection on the concept of empowerment processes followed by examples from the empirical findings. Subsequently, the use of the institutional logic concept reflected, also through the use of examples from the results. The section ends with suggestions for future research on niche-regime interactions.

Empowerment processes

Empowerment processes resembles the way that the case or niche is developing competitiveness which allows for increasing widespread diffusion (Smith & Raven, 2012). Empowerment strategies are subsequently divided into strategies to gain competitiveness without changing the selection environment, and those who do, are fit-and-conform and stretch-and-transform empowerment strategies respectively. These strategies can be internally oriented to help develop the niche, or more outward-oriented for promoting and diffusing the niche. Smith & Raven (2012) also argue that these processes occur simultaneously with other niche processes of shielding (shielding the niche from the regime), and nurturing (developing the niche). From the results of this study, it can be argued that these occur in different variations among the cases.

Interactions in how empowerment strategies are used to internally develop the case so that it can become more competitive are most prominently seen in the cases that focus on technological innovations, such as case 6 (using robotics), case 8 (guiding environment), and case 10 (integrating several technological tools). For technological maturation to occur these cases *need* to involve regime actors so that the solution can become competitive. As such, the strategy is closely related to nurturing processes of the niche like actor networks and learning processes, and they need to coincide to even develop the niche further. The "*creation of a dialogue with healthcare professionals … letting them experience the technology is important*", interviewee 10, IT developer case 6, which is something that can be done in a 'shielded' environment' of a project setting.

The recruitment of these regime actors is then already a step towards enrolling support for the development of the technology. These settings then could also lead to empowerment of the niche when these organizations continue their collaboration after the project has run. This would be the ideal situation, according to interviewee 10. Interviewee 17, business integrator case 10, confirms these steps '*we have a huge number of households to recruit … so we can test the technology*". These cases thus show that empowerment is an important process of nurturing the solutions itself.

The deployment of stretch-and-transform or fit-and-confirm strategies are not that clear-cut, as these can also happen simultaneously. Cases 2 *Het Ouden Huis*, and 3 *Zorgbutler* both have developed new living concepts where older adults can live together, while including the ability for 'regular' care services to take place. It is not the way care is delivered that these cases change, it is the setting and the environment where that care takes place, that is different.

These cases hinge on a current financial regulation of the regime, the cases are in that aspect vulnerable, interviewee 3 from case 2 says: "*if that [regulation] would fall away, then we have a serious problem*". Thus, these cases exploit an opportunity of the regime to offer new ways of living with care close by. Therefore, it is for interviewee 5 from case 3 something they promote at government agencies. What these cases do change is the setting that these types of care are delivered. Case 2 provides a clear alternative to nursing homes, by bringing older adults together both with care needs and those without, while allowing for these older adults to stay in their own homes independent from the type of (nursing home-like) care they need. Thus, these cases bring a nuanced perspective to the conceptualized empowerment strategies that includes the deployment of both these strategies.

In summary, these cases showcase that empowerment and nurturing processes go hand in hand for the development of technological solutions which alter the way care is delivered. Secondly, cases display a delicate strategy that includes both fit-and-confirm and stretch-and-transform elements in the development of their cases.

Institutional logics

Institutional logics capture a fields shared understanding of the goals to be pursued, and how they are to be pursued (Battilana et al., 2009). These are generally specific to a certain organizational field, also seen as industry sector (Brodnik & Brown, 2017). The approach emphasizes that institutions have both symbolic and material elements which are intertwined together. They together influence the individual's practice, interest and outlook on, in this case, how independence of older adults can be best supported in the home environment. Institutional logics reflect then the practices and beliefs that guides actors' behaviour and thinking (Fuenfschilling & Truffer, 2014). The concept allows for the observation how the niche behaviours differently from the regime as they embody different logics. With that, logics can be in conflict with each other which would lead to political conflicts (Thornton & Ocasio, 1999). However, the existence of two sets of logics can also be complimentary to each other. Thus, they can be used to illustrate the niche-regime interaction in the sense of different logics and how they interact with each other.

Logics enable for the characterization of different types of organizations, and with that organizations that are similar that form an organizational field. Different organizations coming together, bringing different logics into a case, can allow for logics to interact. This is most prominently seen in case 8, *guiding environment,* where various types of organizations come together: universities, IT-developers, software developer, construction company, and healthcare providers. The logics express themselves in different outlooks on the goal of the collaboration as well as the way to reach it. Therefore, the exchange of logics between the niche and regime at large can already occur to some degree in the niche itself via the involvement of similar actor groups. The difference is however that the individual organizations collaborating in a 'protected space' - such as a niche - can allow for an incumbent space to experiment. This can then also influence the course of the case development, for instance case 8 is led by a university which focused on the development of the concept of guiding environment, which is a different approach to that of interviewee 14, IT developer, had in mind : " *Two years ago I did emphasize that always when*

you are developing a product, or a new concept of housing, you have to make a business case, that is neglected up till now. But that means that you will lose time before you can realize the product in practice". Interviewee 14 also underlines that due to these delays it could happen that some organizations pull out of the case. This case therefore illustrates a clear difference in what the goal of the collaboration is between organizations, and what steps need to be taken to reach that goal. The different understanding of collaborations then plays into expectations, businesses are involved to see what opportunities can be interesting to explore, while the university is involved to develop a concept scientifically. The interaction of these logics is thus crucial for the case to develop and to gain competitiveness so that I can engage with the regime. Cases that do succeed in aligning these different logics can develop their case more effectively.

Logics also enable for the conceptualization of different set of rules or routines between the niche and regime (Smink et al., 2015). The exchange of these logics between niche and regime can help uncover how the stable arrangements of the regime can or cannot be transformed (Fuenfschilling & Truffer, 2014). This conceptualization of logics can then also be helpful to identify the niche-regime interactions between multiple niches and regimes. The identification of different directions among the cases is based on the solution that they pursue, however that analysis can also be extended using logics. The cases that develop new living concepts 1 – 3 exhibit a different outlook on the meaning of age-friendly housing than that of the regime. These cases overlap in that outlook by focusing on small-scale and community building among older adults. They differ in the *way* they reach that goal.

Most distinctly is the approach of case 1 *Knarrenhof* that relies on the active involvement of older adults in the process preceding the actual construction of houses. While cases *2 Het Ouden Huis* and 3 *Zorgbutler* create the home environment without the direct involvement of older adults. Similarly, cases 1 and 2 focus on developing a home environment where older adults can stay and live independently as long as possible, while case 3 chooses not to cover nursing-home-like type of care. This means that when older adults get this type of care indication at case 3, they still have to move to a care-home for them to receive that type of care. Actors in the cases are very aware of these differences as it is a way through which they can highlight their competitiveness through their unique approach, according to interviewee 3 from case 2. Thus, the concept of logics helps to identify a niche movement that embodies a new outlook on age-friendly housing, while allowing for variance among the cases on how that can best be pursued.

In conclusion, it can be stated that the concept of institutional logics can help identify the practices and beliefs among organization fields that come together in the niche. In addition, the use of institutional logics allows for the identification of different niche-regime interactions where logics between cases can be complimentary to each other, and for the variation in the niche itself which would possibly lead to conflicts.

Future research directions

This study took cases as the unit of analysis which consist of different actors, and although these are explained, a clear typology of actors is not distinguished (Avelino & Wittmayer, 2016; Wittmayer, Avelino, van Steenbergen, & Loorbach, 2017). Actors that have formed alliances and launched initiatives can play different roles to support the initiative. The approach for this study was to gather different perspectives by interviewing multiple actors from one case, and by taking the development that case as a whole.

Empirical findings in this study show a mixture of niche and regime actors collaborating in the development of cases. For instance, case 6 and 10 depend on the involvement of established organizations in the healthcare system to be able to test and mature the technology that they develop. In order to connect these different actors' intermediary action is required. This type of action can coincide in actors that also develop the technology itself, but can also reside as the goal of an organization as a whole. Case 5 showcases this type of organization in its coalition more explicitly, most of its niche activities is tailored towards creating local networks and linking actors together. Case 1 provides an ever more nuanced example, as it supports the linking of citizens together to form a living community and develop their own housing. Therefore, intermediary action seems important to consider the niche development more explicitly.

So far, intermediary action is explored between niche and regime levels, however less explored is the intermediary action between socio-technical systems. Kivimaa et al. (2019) provide fruitful work on different type of intermediary actors that can transcend multiple niches, regimes and spatial scale like systemic intermediary actors (operating on the system level). However, as this study uses a multi-system framework to explore cross-system collaboration (McMeekin et al., 2019; Papachristos et al., 2013), intermediary action across multiple systems is less explored. The use of institutional logics (Battilana et al., 2009) helped map the different patterns of beliefs, values associated with the different sectors involved (Rao & Giorgi, 2006). Multi-system collaboration proved to be crucial in the development of new age-friendly housing solutions, therefore a better understanding of how these diverse actors with various patterns of beliefs and values can be broad together is important.

5.2 Multi-regime transitions

Another contribution of this study was to gain insight in transitions that include multiple socio-technical systems. The emergence of age-friendly housing as a domain allowed for such an approach, for which the concept of anchoring was used. Now this section will reflect on the empirical findings and how that might change the outlook on transitions. This section will end with recommendation for future research.

Central to this study is the incorporation of the multi-system approach (McMeekin et al., 2019; Papachristos et al., 2013), which is used to frame the emerging age-friendly housing domain. It helped to identify different actor groups belonging to different socio-technical systems. The Multi-level Perspective understood as a system perspective on transitions, consisting of actors and social groups, semi-coherent rules that guide activities, and material and technical elements and infrastructure, is then used as a baseline (Elzen et al., 2004). With the expansion from the multi-level perspective towards multi-system analysis a reconsideration of the understanding on transitions is necessary, as transitions are generally understood as a regime shift from one regime to another. However, with the inclusion of multiple regimes and multiple niche that understanding can be expanded.

Anchoring

Transitions are generally seen as a singular niche-regime interaction belonging to the same socio-technical system. However, the results from this study showcase that niches can also come from another system that linked itself to a different regime. In that sense it is crossing the systems, and thus can expand the understanding of niche-regime interactions not being limited to one socio-technical system. The concept of anchoring (Elzen et al., 2012) is useful to highlight these interactions. The authors developed three

forms of niche anchoring. As the niche develops it might recruit actors from existing regimes, the network anchoring. Secondly, the development of the new technology to meet regime needs, technological anchoring. Thirdly, the changes in social values, rules and markets negotiated between niches and regimes, accounting for the institutional anchoring.

The conceptualization of anchoring between niche and regime is helpful in identifying the linkages they possess. Most interesting is the niche development originating from one socio-technical system linking up to the regime of another. The cases that develop new living concepts, cases 1-3, mostly consist of actors coming from the housing system. These actors developed a solution for age-friendly housing for which they cooperated with healthcare organizations. The cases develop a solution that consists of a form of community living while still being able to offer care services. The way they do so is interesting, cases 2 and 3 allocate a healthcare professional in-house that helps coordinate the community. Therefore, these cases had to recruit healthcare professionals willing to provide these care services in a different setting. But the needs of care services which are not different from that of the regime can still be accommodated in the new environment. Thus, was the anchoring to the healthcare system from the cases 2 and 3 with quite ease concerning network and 'technical' anchoring. Although technical standards are not relevant for these cases, rather it is the ability for providing similar care services to that of the regime, however these do not depend on technical elements. A successful institutional anchoring is difficult to determine, however these cases are still in their infancy so a transition has not been reached.

Anchoring to multiple systems of cases is also relevant for transitions. In line with what Papachristos et al. (2013) theorizes, niches and regimes can exert influences on other systems without always resulting in a transition. However, that also depends on to what extend cases engage in changing the regime. For instance, universities were found to be regular taking part in supporting cases, however a transition in the educational system is not likely to be a result from that anchoring. Cases that develop new ways to deliver care services like case 6, 8 and 10 are more likely to facilitate a transition of the healthcare system. Even more interesting is the linkage of a niche to multiple regimes, implications of these kinds of movements are found in cases 5 *Langer thuis in eigen huis*, and case 9 *Technologie Thuis Nu*. Case 5 in particular has the network anchoring as a way to reach its goal, its main approach involves the setup of local networks between established actors. While case 9 actively network anchored with established organizations in healthcare and education, in order to advance their outlook on independent living by older adults. In addition, did case 9 enact a change in the housing system by developing a new professional standard of technic installers. Thus, the anchoring of niches to regimes can be seen as a way to develop or grow a niche further, but also as a way to facilitate transitions in multiple regimes.

Using the anchoring concept would allow for the consideration of multiple transitions happening at similar times, and how these can influence each other as a whole system. These can be complementary to each other depending on the interrelating factors, or these can be in competition with each other if they aim to make a shift in the same regime. Another outlook would be to consider the emergence of the age-friendly housing domain consisting of multiple transitions and with that emerging itself as a proto-regime.

Future research

The utilization of anchoring provides an interesting premise that allows for the identification of cross-system linkages. Current literature, however, still conceptualizes transitions in terms of one *system* or *sector*, as it is generally believed that socio-technical regimes evolve inside a given sector (Boschma et al., 2017). However, the consideration of a socio-technical regime or system to equate to a sector is problematic, as (Geels, 2018) shows that passenger mobility of part of the transport sector encompasses a constellation of multiple regimes and multiple niches. The author also considers the parallel regimes of spatial planning and work, with the niches compact city and home-working respectively, however these developments are only seen as influencing the demands for mobility and not fully integrated in the whole system analysis. This study shows that these parallel systems can play a much more integrated role in the niche developments. Therefore, the identification of socio-technical systems one their own and in combination needs more nuance to further the understanding of transitions across multiple systems.

Rosenbloom (2019) highlights that sites of interaction between multiple systems can help to interrogate the actor's interactions. These sites embody a range of potential factors that could modulate system boundaries, from innovations (new material solutions), to policy and planning processes (consultations and collaborations), to business models (broadening or changing services), to landscape forces (the translation of the landscape pressure for the actor). These sites of interactions are believed best to be captured in experimentations attempting to answer the landscape pressures. In other words, niche experimentation is a great unit to further study multi-system interactions.

Landscape developments are one way of capturing developments that transcend one socio-technical system, however other grand societal trends are expected to be influential as well. Schot (2016) & Schot & Kanger (2018) capture trends in overarching developments as the *first deep transition*, referring to the creation and expansion of a wide range of socio-technical systems in a similar direction. Example of these similar directions are mechanization, mass production coupled with individual consumption, increasing energy- and resource-intensity (linear production), and growing ecological footprint (Kanger & Schot, 2019). Among the cases there seems to be a trend noticeable, going from community type of living in the 1950's towards individualism, and back to community living again in 2020. This particular societal trend could make it more difficult for, for example home adjustments to grow and expand, when citizens would prefer community-type of living solutions. It is however unclear whether these could be considered as landscape movements or overall societal dynamics and how these influence transitions or niche / regime dynamics in general. One could for instance look into the ability of actors (regime of niche) to act on these trends, and how that influences the transition itself. Or, whether these overarching societal trends can pose additional challenges.

5.3 Implications, limitation and alternative approaches

This last section revolves around the implications of this study for various actor groups, the limitations of this study, and alternative approaches that could have led to different findings. First, the implications of this study are discussed. Second, the limitations of this study that could have had an effect on this study. Finally, alternative approaches are explored.

Implications

Age-friendly housing is an excellent example of how transitions can transcend system boundaries, and teaches an important lesson to look beyond one defined system or sector. Healthcare is a sector where radical innovation can difficult manifest, and therefore depends on actors from other sectors to cross into healthcare. Therefore, if policy makers would want to facilitate radical innovation in healthcare there should be an emphasis on mobilizing actors from other sectors. Not only because they would enjoy more room for agency, but also because they bring valuable skills and knowledge that are not commonly found in healthcare.

Regarding individual actors, the cross-system collaboration seems to be a prominent feature of initiatives that develop new ways for housing and care. To help tackle the difficult task of building age-friendly housing solutions actors should look beyond their own system or sector. The home environment reflects the personal preferences and values of a person, while someone's health condition and personal situation requires a personalized care approach. Thus, both of these factors make it a multi-system challenge by definition.

Limitations

The choices made for this study allowed for a specific investigation in age-friendly housing experimentation, but also carries its limitations. Considering the stage of the transition in the Netherlands, it is still too early to make any meaningful conclusion about its direction. The age-friendly movement initiated in 2009 by the World Health Organization only recently sparked specific policy measures in the Netherlands since 2015. Foundational for the field of transitions studies has been the macroscopic historical case studies (Geels & Schot, 2010). These case studies made it possible for the reconstructing of transitional processes unfolding over several decades or more, and provided deeper understanding and explanation of transition dynamics. However, the importance of engagement with innovation systems in-the-making is underlined by transition governance (Voß, Smith, & Grin, 2009), with a turn towards the actors dynamics of contested and uncertain attempts at innovation (Hoffman & Loeber, 2016). Thus, this study contributed towards understanding transition dynamics of transitions in-the-making.

As the aim of this study was to investigate how actors navigate their way under a multi-system constellation, the more open-ended conceptualization of experiments as ways to develop novelties proved to be fruitful to investigate the early-staged age-friendly housing domain. The identification of cases on the basis of their goal to support independent living of older adults with material elements in their solution (e.g. housing elements) provided a high variety of cases. With that a broad development of the age-friendly housing domain could be identified. This study considered 10 cases, however with a higher number of cases it is deemed likely that even a higher level of variance could have been achieved. The domain proved to be very diverse in itself. In addition, there seems to be a dependency on actors from other systems to develop solutions for the healthcare system, hence the focus on material artefacts in the cases did not hamper the identification of cross-system collaboration.

Individual actors as unit of analysis could have provided more detailed strategic movements (Brown et al., 2013; Farla, Markard, Raven, & Coenen, 2012). As some (individual) actors contribute more than others in initiatives, it would allow for a more detailed lens on these actors. Also, the different roles of actors could then be identified to determine the (changing) interactions and relations *between* actors (Wittmayer et al., 2017). Initiatives as formal alliances between actors (de Haan & Rotmans, 2018) are objectifiable, although the network of supporting actors might very well be broader than that. Consequently, the focus on individual actors could reveal also a higher degree interactions and relations. In addition, the focus on actors might also support further actor categorization and clearer levels of aggregation, as it remains difficult to consider actors activities as reflecting an individual's behaviour or that as part of organizational movements (Avelino & Wittmayer, 2016).

Alternative approaches

An alternative outlook is the specific consideration of political processes underlying transitions, in the sense that different individuals and groups can either agree or disagree about desirable directions and the appropriate way to steer the direction. The issues of *politics* and *power* received more explicit attention in transition studies (Hendriks & Grin, 2007; Kern & Howlett, 2009), these issues are closely related the governance of transitions. These authors draw on well-known policy process theories from the field of policy science, see Kern & Rogge (2018) for a recent overview.

Power in the socio-technical perspective is predominately associated with 'conflicting goals and interests' between actors and social groups, and as the outcome of 'conflicts, contestations, lobbying, coalition building and bargaining' (Geels, 2014; Geels & Schot, 2007). Grin et al. (2010) conceptualizes different types of power related to the different levels of the MLP, distinguishing relational, dispositional, and structural types of power related to niche, regime, and landscape levels respectively. In addition, did scholars propose a 'horizontal' understanding of power in transitions (Avelino & Rotmans, 2009, 2011), which allows for the analysis of relational and dispositional power across different actors. Avelino & Wittmayer (2016) integrated these suggestions in a Multi-actor Perspective as a heuristic framework for specifying different categories of actors at different levels of aggregation. The usage of which could help explore political implications of sustainability transitions, in terms of shifting power relations between and within sectors, organizations, and individual actors.

Conclusion

In this study, the emerging domain of age-friendly housing is investigated in The Netherlands via a qualitative analysis of 10 cases. Age-friendly housing refers to a domain that addresses the increasing societal need for adequate housing solutions allowing older adults to live independently as long as possible, despite the potential onset of chronic conditions and impairments. This increased need is a result of demographic change as a societal challenge, leading to a large group of older adults aged 65 and above, for which the current health and housing systems are not prepared for. Therefore, this study investigated the emergence of age-friendly housing as a distinct field that develops radical innovation to facilitate a transition. The study of this domain brought new insights in how actors navigate across multiple socio-technical systems and what strategies they use in relation to multiple regimes. The main research question formulated for this study was:

"How do actors engaged in age-friendly housing initiatives navigate their way through a complex multi-regime environment?"

To help answer the main research question three sub-questions are formulated. The sub-questions include both theoretical and practical perspectives to help structure the research. First, a sub-question is aimed at reviewing conceptual literature in transition studies, as the socio-technical perspective received criticisms and has a limited literary footprint in age-friendly housing or similar topics. Second, a sub-question aimed at the coming together of actors from different systems, to determine patterns from actors moving between system while taking in account the regime and niche levels. Finally, the last sub-question is related to the strategic activities of actors in the niche level towards the regime. Answering the first sub-question helped form a conceptual framework that guided the research, while the other two sub-questions helped bring analytics focus for the data collection, and subsequent analysis.

The first sub-question was formulated as: *How can the emerging field of age-friendly housing and its dynamics be conceptualized in relation to multiple socio-technical regimes?* The socio-technical transition approach and the Multi-level Perspective in particular profit from a large body of research dating back to 2002 with an exponential publication rate. The Multi-level Perspective allows for the study on social transformations to sustainability, focusing on transitions in systems (for instance, energy, transport, housing). The approach consists of three layers that interact: the landscape, regime and niche level. In addition, the Strategic Niche Management framework presents a valuable set of concepts that focuses on the introduction of new technologies and social practices that contribute towards a sustainable transition. For the study of actors across socio-technical systems, is the Multi-level perspective useful as heuristic device, and with actors coming from different systems these can be combined to create a multi-system or *whole system* approach so that the involvement of multiple sectors can be taken into account.

The conceptual framework for this study is built up from the combination of multi-level perspectives, one MLP for the healthcare system, one for the housing system and finally one for the ICT system. These sectors cannot be taken as a whole, rather as systems aimed at housing solutions for older adults. The connection between various actors from multiple systems can be captured with the concept of 'anchoring' also named 'linking' to help describe the support that helps develop the niche. To answer the strategic activities from the niche actor's literature from **Strategic Niche Management** literature is used, more specifically **empowerment as functional property of the niche**. Empowerment as processes from an

evolutionary perspective help to identify actions that relate to selection pressures coming from the regime. Empowerment as opposed to shielding and nurturing which are about minimizing selection pressures and development of the niche respectively, shows how niches are strategically active in relation to regimes. This is especially important, when considering that multiple regimes are involved, these processes however are not distinctive events but occur simultaneously. **Empowerment activities** are broadly distinguished in activities that engage with regimes in their terms (fit-and-conform), or activities that engage with regime to *change* the selection pressures (stretch-and-transform). In addition, does the concept of institutional logic, as a shared understanding of how the home environment can be supportive for the older adults' independence, help uncover the sense-making used by actors. Taking these concepts together can help identify the emerging age-friendly housing domain, which might also be fruitful for similar research topics that transcend socio-technical systems.

A second focus of this study was to gather insights regarding how actors from multiple systems coincide in niche activities formulated via the sub-question: *How does a multi-regime constellation relate to the actors involved in initiatives?* By considering the type of organization, skills and experiences and markets they operate in, actors that are or were active in multiple systems could be distinguished. Ten cases were identified that are developing innovative age-friendly housing solutions, however they differ greatly in their solution that they develop. Among the cases selected, three categories are mapped based on the solution being developed and the related vision, which results in the categories: living concepts, types of home modifications, and integrated solutions.

Living concepts as a direction that several cases take, is aimed at developing new types of housing for older adults to live to prepare for later stages of life. These cases are characterized by their focus on small-scale living and community building among older adults. Remarkable is that the cases have connected with healthcare providers to provide care services in the new setting they provide, while key actors from these cases do not originate from healthcare but predominately from the housing system.

Cases that develop new solutions in the form of **home modifications** range from physical alteration of the home environment to technological solutions as additions to the home environment. Most notably here is, that the actors who develop and offer these solutions are not embedded in the healthcare system. The cases that develop technological tools for the home environment are in that regard the most reliant on the linking up with healthcare organizations to help mature the technology before it can become part of healthcare practices.

Lastly, cases that develop **integrated solution**s have the most diverse group of actors involved coming from all three the systems. These cases mobilize a large number of actors embedded in at least one system. Linking up with various organizations internally, already proves as a test for wider diffusion. The internal alignment of organizations for the development of the case can facilitate the linking with other organizations. Taking all the cases together, there seems to be a large reliance on actors from outside the healthcare system to develop new solutions that facilitate independent living of older adults. Healthcare organizations can impose requirements for the delivery of care services which are important when the new solution is related to that delivery. In these cases, linking up with healthcare organizations is crucial. However, cases found in all case directions prove that connecting with healthcare organizations is not always necessary.

After having gained insights in the involvement of actors in the cases related to the multi-system context, the third sub-question dives deeper in the specific strategies used by actors in the niche in relation to the regimes: *What strategies do actors in the niche use when engaged with multiple regimes?* Taking the findings on the second sub-question in consideration, it can be stated that the novel solutions in the cases are quite diverse, which is also reflected by the variety of actors involved.

Following the three established directions of cases, it can be noted that cases that develop **living concepts** focus on the empowerment of older adults in the creation of a home. They showcase that older adults want to form a living community and want to move and prepare for later stages in life. The strategies used are in line with these new logics. They vary from relying on the organization of older adults among themselves, to creating a home environment that older adults can call "home" independent from the care they need.

The cases that develop **home adjustments** in contrast focus on modifying the current home environment in ways that can support their independence. Their development reflects the adaptability of the home environment, which is nested in the usage of older adults and demonstration rooms as ways to diffuse existing solutions for home adjustments. Older adults can adapt and are open to new (technical) solutions and can even play an active role in its dissemination. For the most part, the strategies employed revolve around linking actors together to facilitate its growth.

The cases that develop **integrated solutions** are in between singular home modifications and new living concepts. The solutions are generally heavily based on technological innovations that become an integrated part of the home environment and attach drastic new meaning to that environment. Technological development in a 'protective space' becomes much more relevant here. The cases embody a logic that empowers the environment to take on an active role in supporting the older adult in daily living and in care processes. In addition, it is about embedding actors from one sector into the other, creating a dual identity. The strategies revolve around empowerment inside the niche, to support its construction which occurs simultaneous to other processes that support its nurturing and shielding. The recruitment of actors, older adults and healthcare organizations, from different levels therefore is already integral part of the niches development while it is still maturing its technology.

In conclusion, it can be stated that actors engaged in age-friendly housing initiatives come from different socio-technical systems, most notably housing and ICT where they are embedded. The solutions they develop offer a great variety of products and services which resembles the diversity of care older adults need. Depending on whether the cases include a different way of delivering care services, the linking up with healthcare organizations can be of limited importance. Which means that actors embedded in other systems are able to construct new solutions with a relatively low degree of resistance from the regime. The reason for this can come from the high specificity and heavy regulations that dominate the healthcare system, which does not leave much room for experimentation. In contrast, when solutions try to alter the ways that care is delivered, usually with technological innovation, actors in the niche become evenly dependent on linking with healthcare organizations early on to mature. These cases need to prove the added value of the solution, and therefore are in need of a protective space. Subsequently, more time and effort are required, as opposed by the cases that do not rely on these linkages. The long incubation time and high variety of actors involved make the niche both vulnerable and create incredible potential. In the future, age-friendly housing could either constitute multiple transitions, or form a new regime on its own.

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Appendix I: Interview guide

1. Kunt u vertellen wat uw organisatie doet binnen het project?
2. Kunt u omschrijven hoe uw organisatie betrokken is geraakt bij dit project
3. Heeft u eerdere ervaringen met dergelijke projecten? Zo ja, hoe is dat gegaan?

4. Wat betekent voor u 'goed wonen'? (wat is uw visie)
5. Hoe probeert uw organisatie bij te dragen aan het langer zelfstandig wonen?
6. Wat vind u specifiek interessant aan dit project?
7. Wanneer is het project geslaagd voor u?
8. Hoe verloopt de samenwerking binnen het project? Botst er weleens iets binnen project?

9. Hoe positioneert u het project, onder welke industrie of sector?
10. Verschilt dat met andere sectoren waar u in opereert?
11. Is uw werkwijze, hoe u te werk gaat veranderd? Zo ja, waarom?
12. Hoe ziet u het werken binnen de gezondheidszorg voor u? Hoe ervaart u dat?

13. Welke uitdagingen zouden er overkomen moeten worden door uw organisatie?
14. Zijn er plannen om verder te gaan met dergelijke projecten?