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Governing socio-technical change: Orchestrating demand for assisted living in ageing societies

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Abstract

In recent years, there has been an increasing interest in innovation studies towards grand challenges, and in how demand-side policy instruments can supplement traditional supply-side policy measures. To contribute to an improved understanding of how demand-side policy requires new governance responses, this article presents a case study of trialling assisted living technologies to address the grand challenge of demographic ageing. The article departs from an innovation policy framework that incorporates theorising on transformational system failures, governance modes, and policy mixes. This framework serves as an entry point to explore how different modes of governance condition the ways in which demand for assisted living in healthcare is orchestrated across multiple stakeholders. The case study is embedded in a wider system shift from a reactive to a proactive system of healthcare provision, enabling the elderly to live independently at home longer and thus avoiding or postponing institutionalised care.

Key words: policy; governance; demand; innovation; healthcare; assisted living

1. Introduction

Throughout the past decade, there has been growing attention paid to the question of how research and innovation policies can contribute to solving pressing megatrends or grand challenges (European Commission 2011; Weber and Rohracher 2012; OECD 2015, 2016; Schot and Steinmueller 2016). Such a broadening of scope has raised the level of ambition from improving existing systems of innovation towards system innovation, understood as 'a horizontal policy approach that mobilises technology, market mechanisms, regulations and social innovations to solve complex societal problems in a set of interacting or interdependent components that form a whole socio-technical system' (OECD 2015: 7).

The latest generation of innovation policies contains broader measures than traditional supply-side R&D and innovation policy measures that have traditionally aimed to boost (systems of) innovation in existing industries and sectors. In order to meet the current social, economic, and environmental challenges, policies aimed at technology development and industry growth are supplemented by new approaches. Here, demand for innovation looks different than in traditional innovation policies, as it not only recognises the 'pull' from business but also from citizens, users and public policy in more direct ways (Steward 2012). The prominent features seem to be the

involvement of a wider variety of stakeholders and tools, such as innovative public–private partnerships, smart regulation, and greater attention for social innovation (Kuhlmann and Rip 2014; OECD 2015). Moreover, such complex societal challenges are often seen as open-ended which, in turn, requires continuous adjustments and reflexivity among several involved stakeholders. However, less is known in terms of how governance responses can address, organise, and facilitate such change processes across actors and policy levels in practice (Schot and Steinmueller 2016). In order to meet this lacunae, the objective of this article is to improve our understanding of how various roles and modes of governance interact and co-exist to orchestrate demand for new socio-technical solutions in system innovation.

To achieve this aim, we study a government-led initiative to trial assisted living technologies as part of a shift from a reactive to a proactive healthcare system. Here, independent living at home is sought to replace institutionalised care for significantly larger user groups than previously through the use of interactive technologies such as sensors, Global Positioning System (GPS), and health-monitoring devices. Nonetheless, these technologies require a restructuring and re-organisation of supply and demand in healthcare services. Based on a case study of assisted living in Norway, the article addresses how this emerging socio-technical niche is formed and how it

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unfolds through an orchestration of demand, i.e. arranging for 'concerted action' (Kuhlmann and Rip 2014) between various actors and forms and levels of governance.

The research questions guiding the article are:

- What are the roles of multiple stakeholders in governing assisted living trials in Norway?
- How are different modes of governance orchestrating the demand for new socio-technical solutions in the transition towards a new healthcare regime based on assisted living?
- How can the variety of roles and modes of governance be interpreted through the notion of policy mixes?

The article is structured as follows. Section 2 presents the background for the current quest for assisted living in healthcare. Section 3 accounts for the conceptual building blocks of the article, consisting of: 1 theorising on transformational system failures as ways to legitimise policy intervention (and thus roles for policy) in system change 2 modes of governance as principles for working practices in governance, and finally 3 the notion of policy mixes as a tool for conceptualising the diversity of roles and modes for governance. Section 4 accounts for the data collection and the method applied. Section 5 presents the case study and places this into context. Subsequently, based on an application of the analytical framework to the case study, Section 6 discusses the findings from the analysis. Finally, in Section 7, conclusions are drawn.

2. Addressing ageing societies by assisted living

One of the grand challenges that currently requires attention is demographic ageing (OECD 2009; United Nations 2013; WHO 2014). There is widespread recognition that current systems of healthcare provision are in need of drastic reform in order to address prevalent and persistent problems of cost increases in combination with increasing pressures on public health services and the declining quality of delivery. Consequently, it is believed that merely increasing productivity in the provision of existing public health services is no longer sufficient. Instead, observers call for fundamental changes to re-think and re-arrange how healthcare services are organised and delivered (OECD 2010; European Commission 2011).

By 2050, it is expected that the population aged 60 years or over in developed countries will increase from 23 per cent to 32 per cent of the total population (United Nations 2013). The share of the population aged 65 years or older is rising in all Organisation for Economic Co-operation and Development countries and is expected to continue to do so for many decades. In Norway, it is predicted that, by 2050, the proportion of citizens aged 67 years and over will have risen from 13 per cent in 2009 to 21 per cent (SSB 2009). The projected demographic ageing is a result of decreasing fertility rates and an increase in life expectancy, which can be ascribed to an improvement in public health, new medical treatments and improved diagnostic tools. Together, these developments will increase the share of chronic and lifestyle conditions and gradually replace acute conditions (OECD 2010, 2011).

These predicted demographic changes will place great pressure on public health services, and call for a shift from a reactive to a proactive healthcare system (Teknologirådet 2009; NOU 2011: 11; Meld. St. nr. 29 (2012–13)). The answer being highlighted is a shift towards 'assisted living', a proactive and distributed healthcare system based on support for self-sufficiency and often home-based and patient-centric services, enabling the elderly to manage their own lives at home for as long as possible. This system is enabled by the integration of information technologies, sensor technologies and GPS tracking, and assisted and realised by various types of self-monitoring healthcare devices. While earlier versions of assisted living technology have existed, directed at certain chronical diseases and risk-factors relating to cognitive and physical impairments, what is new is a closer integration of existing technologies and an ambition to upscale the provision of healthcare services based on assisted living technologies to become the mainstream model in healthcare provision. Trialling these new integrated technological solutions has prompted wider changes in the way in which the healthcare system is organised and structured. The introduction of such technologies has triggered various responses, not least in terms of a need to arrange for experimentation, interaction and learning across users, private subcontractors and public service providers (Bugge et al. 2017). In this manner, societal demand for innovative healthcare needs to be organised and orchestrated across multiple stakeholders in order to tackle the societal challenges associated with ageing societies.

The Norwegian healthcare system is primarily based on public hospitals, care institutions, and state funds. Medical treatment is organised in Regional Health Authorities overseen by the Ministry of Health and Care Services and each municipality administers basic care services. In a new national healthcare plan, a healthcare strategy named the Interaction Reform was implemented in 2011 to set the guidelines for the new healthcare system in Norway. In particular, the Reform addressed the organisation and task allocation between the state and municipal levels. One important principle was that the patient should receive treatment and care as near as possible to his or her home. Assistive technology was a central part of this Reform (NOU 2011: 11).

3. Conceptual framework

3.1 Broadening research and innovation policies to address grand societal challenges

Traditional research and innovation policy has, over the past decade, become increasingly geared towards the demand-side of innovation by means of 'responsible research and innovation' (European Commission 2011; Owen et al. 2012) and 'mission-oriented innovation policies' (Edler and Georghiou 2007; European Commission 2012; Mazzucato 2015; Sarewitz 2016). Within this new setting, demand-oriented instruments, such as public procurement for innovation, are increasingly applied (Edler and Georghiou 2007; Edquist and Zabala-Iturriagagoitiaa 2012). However, demand-side policies should not be seen in isolation, but rather alongside supply-side innovation policies (Edler and Yeow 2016). Tentative evidence suggests that technology policies become most effective when combining supply-side and demand-side policy measures (Guerzoni and Raiteri 2015). This argument is even more compelling in a context of innovation policy to address grand societal challenges.

The orientation towards grand societal challenges can be seen as a new wave or paradigm for innovation policy. In light of this shift, Schot and Steinmuller (2016) argue for the importance of innovation policy 3.0—the explicit mobilisation of science, technology, and innovation for meeting social needs—as 'innovation policy should focus considerably less on products, processes, firms, and R&D, but instead on the achievement of system-wide transformations, since optimisation of existing systems will not be a sufficient answer' (p. 17). The question, however, remains how such social needs are translated into demand for innovation.

Grand societal challenges are often perceived as complex and ill-defined, and require specialised knowledge and innovative solutions that can only be found through collaboration in broader constellations across the public, private, and voluntary sectors (Rittel and Webber 1973; Kuhlmann and Rip 2014). One of the key features of grand challenges is that they cannot be 'defined, assessed or solved by any single scientific or technological discipline or within one specific sectoral policy framework' (Leijten et al. 2012). Many different actors are involved that represent different interests, have different perceptions of problems, and advocate different solutions. This requires the setting of collective priorities (Stewart et al. 2012) and calls into attention matters of directionality, values, politics, resistance, and contestation to orchestrate demand for innovation processes.

Reflecting the increasing interest in, and emphasis on, these complex societal challenges, we have witnessed the development of various frameworks that help us to study the ways in which policy and governance may enable and constrain system change (e.g. Weber and Rohracher 2012; Kivimaa and Kern 2016; Schot and Steinmueller 2016; Rogge and Reichardt 2016).

3.2 Roles for governance in system change

The notion of governance is here understood as referring to how public decisions are made and how public actions are carried out (Offe 2009). Moreover, governance relates to execution, or what has traditionally fallen within the domain of public administration, as opposed to politics (Fukuyama 2013). The concept transcends the public sector, in the sense that it is often used to describe how public decisions and actions are made and carried out through the involvement of both the private and civic sectors (Offe 2009).

System change is not expected to unfold on its own, but rather requires active governance. It is possible to distinguish three ways of justifying innovation policy intervention, where each refers to its respective historical epoch: 1 to correct market failures, 2 to correct innovation system failures, and 3 to achieve certain societal missions (Borrás and Edler 2014; Schot and Steinmueller 2016). *Market failure* legitimises public intervention due to limited incentives for, and short-term returns from, private investments in R&D. Innovation *system failures* legitimise policy intervention to correct various forms of systemic deficiencies on the supply side, demand side, or regarding the interplay of the two in innovation systems. *Transformation failure* legitimises policy intervention to address societal challenges. Drawing upon theorising on legitimacy for policy intervention in supporting systems of innovation (Klein Woolthuis et al. 2005), Weber and Rohracher (2012) have delineated four possible types of policy failures in transformative change: 1 directionality failure, 2 demand articulation failure, 3 policy coordination failure, and 4 reflexivity failure.

Directionality failure refers to a deficit in moving innovation efforts and collective priorities in a certain direction to meet societal challenges. *Demand articulation failure* refers to a deficit in anticipating and learning about user needs, resulting in inappropriate and misleading specifications guiding development through, for example, procurement or policy programmes. *Policy coordination failure* refers to a deficit in managing and synchronising the inputs from different policy areas in order to meet societal challenges. Such coordination might include coherence between policies at international, national, regional and municipal levels (vertical coordination failure), or across different sectors (horizontal coordination failure). *Reflexivity failure* refers to a deficit in the learning feedback loops

and in the ability to continuously monitor the progress of ongoing innovation processes and to adjust the course of action once underway. Alongside the existing categories of market and system failures, such forms of transformational system failure constitute a more comprehensive framework and legitimacy for policy intervention and formulation.

Weber and Rohracher's framework has commonalities with earlier theorising within the umbrella of Strategic Niche Management (SNM), which has emerged in parallel with the Multi-Level Perspective. SNM focuses upon how, and the degree to which, system shifts can be governed through processes of socio-technical experimentation in real-world trials (Kemp et al. 1998; Smith and Raven 2012).

SNM is defined as 'the creation, development and use of promising technologies by means of experimentation, with the aim of: (1) learning about the desirability of the new technology, and (2) enhancing the further development and the rate of application of the new technology' (Kemp et al. 1998: 186).

In terms of managing change processes, Kemp et al. (1998) present three different strategies often taken in policy. *First*, changing the incentive structures associated with an existing regime is considered crucial in order to mobilise demand by individual actors. It is acknowledged that such policies need to be drastic in order to have an impact, considering the prevalence of existing technologies and their socio-technical and socio-economic underpinnings. A *second* strategy relates to planning for the creation and building up of a new socio-technical regime, although this can prove challenging due to the many involved stakeholders and fragmented governance structures. A *third* strategy implies supporting ongoing change in desired directions. In this respect, it is seen as central to ensure that supply and demand together result in desired outcomes. This is understood as process management (i.e. modulation), in which policy is seen as a reflexive component engaged in experimentation and variation in continuous change processes (Voß et al. 2009).

Such an inclusive, sensitive, and participative policy has previously been identified as an embedded mode of governance (Evans 1995), and which has been contrasted with the notion of an autonomous, dirigiste, and top-down mode of governance operating at arm's length to interactive learning in coordinated development processes (Rodrik 2004; Meadowcroft 2011). There is a need for maintaining a balance between these different roles of the state in processes of innovation. The independent role of the state reflects the need for accountability, democracy, and impartiality, whereas the embedded role is seen as necessary when taking part in innovative learning processes. The embedded role of the state is understood as a discovery process focusing on the design of the policy *process* rather than policy *outcomes*. Here, the public sector is expected to take part in strategic collaboration with the private sector and together aim to overcome obstacles in order to reach common goals.

An embedded mode of governance implies that the public sector increasingly takes an active and integrated role in strategic collaboration with different societal stakeholders in addition to, or even as a substitute for, other forms of intervention, from regulation to fiscal instruments (Evans 1995; Hartley 2005; Osborne 2006; Bason 2010; Sørensen and Torfing 2011; Flanagan et al. 2011; Mazzucato 2013; Benneworth et al. 2014). In contrast to governance paradigms such as traditional bureaucracy and New Public Management, the public sector increasingly tends to act as a learning partner in close interplay and coordination with various types of societal stakeholders to address and solve societal challenges (Hartley 2005). As such, there seems to be growing recognition that the public sector

often takes an active role in addressing societal challenges—in terms of combining supply-side measures such as R&D support (Mazzucato 2013), and demand-side and mission-oriented innovative public procurement policies (Edquist and Hommen 2000; Edler and Georghiou 2007; Aschhoff and Sofka 2009; Edquist and Zabala-Iturriagagoitiaa 2012), or through pre-commercial procurement (European Commission 2006; Edquist and Zabala-Iturriagagoitia 2014).

In line with such an engaged and embedded mode of governance, Schot and Geels (2008) argue that 'SNM as a policy tool does not suggest that governments create niches in a top–down fashion, but focuses instead on endogenous steering, or steering from within'. The role for public policy-makers is understood as 'an enabling actor and catalyst rather than a regulator or technology sponsor' (Kemp et al. 1998: 191). Within this perspective, the challenge for governance is to ensure that processes of co-evolution of technological supply and demand lead to desired outcomes (Ibid, p. 191). In contrast to such a bottom-up and embedded policy mode, others assert that more traditional state intervention remains essential, as important change processes implied by SNM can only be engineered through political processes, and legitimised and enforced through institutions of the state (Meadowcroft 2011). Whereas earlier contributions of SNM have considered system shifts to emerge through bottom-up processes originating in niches and in close interaction with policy, later theorising understands innovations in niches in closer connection with developments at the regime and landscape levels (Schot and Geels 2008). In this sense, there appear to be different ways of understanding the roles and modes for governance to take in SNM and system change.

Such a heterogeneity in roles and modes for policies can also be approached in light of a 'policy mix' perspective, which refers to a dynamic interplay of different policy measures applied at multiple scales simultaneously (Nauwelaers et al. 2009; Flanagan et al. 2011; Borrás and Edquist 2013; Martin 2016). Reflecting the notion of an embedded governance mode, and in line with a collaborative role for governance, the literature on policy mixes emphasises how the policymaker is seen as a learning agent who adjusts policy measures to the context in question and with a limited ability to direct the development (Laranja et al. 2008). This way of seeing policy as a learning agent is also paralleled in SNM (Kemp et al. 1998) and actualises the notion of reflexivity in system change.

The traditional policy-mix concept can be viewed as somewhat limited and one-dimensional in the sense that policy intervention becomes somewhat technocratic and surgical and where the challenge for the policy-maker is to combine different policy instruments and to learn about their effects into an optimal balance for its expected outcomes.

In order to address this shortcoming, Rogge and Reichardt (2016) have recently outlined an extended concept of the notion of policy mixes for sustainability transitions including the three building blocks: policy processes, elements (including strategy and instrument mix), and characteristics.

The policy-mix concept is defined as a combination of the three elements. Both strategies and processes are understood in terms of their characteristics, including their consistency and coherence. Nonetheless, they acknowledge a need for a deeper understanding of the interplay between the three building blocks, as well as of the direct and indirect influence of politics and the determinants and relevance of policy mix characteristics.

With reference to the research questions posed: 'What are the roles of multiple stakeholders in governing assisted living trials in Norway (i.e. directionality, demand, coordination and reflexivity) orchestrated across the multiple stakeholders involved?'; 'How are different modes of governance (i.e. dirigiste versus embedded) conditioning orchestrating demand for new socio-technical solutions in the transition towards a new healthcare regime based on assisted living?', and 'How can the variety of roles and modes of governance be interpreted through the notion of policy mixes?', the article seeks to apply and combine theorising on the legitimacy for transformation policies in system change with theorising on modes of governance and the policy mix perspective. The conceptual framework is illustrated in Figure 1, below.
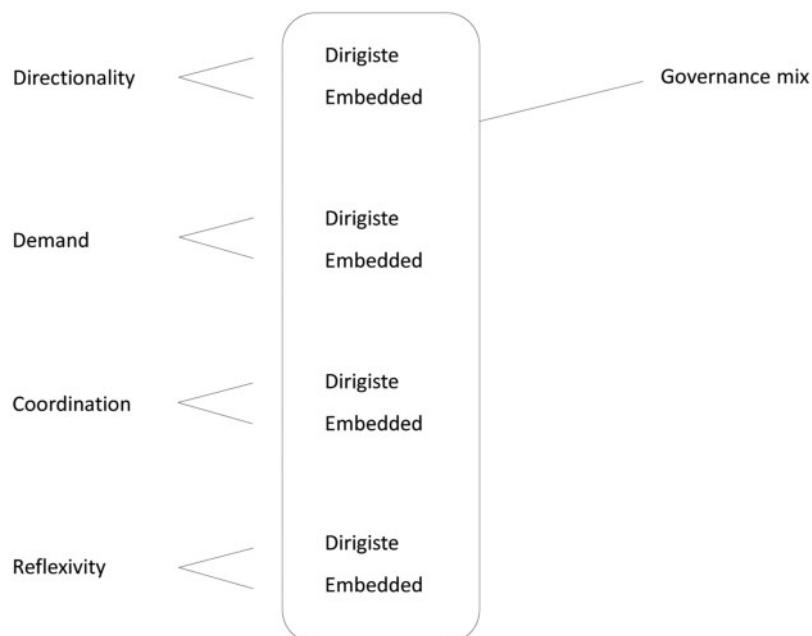

Figure 1. Illustration of analytical framework.

4. Research design and method

The data collection is based on data triangulation between: 1. desk-top and document studies, 2. participation in policy and industry seminars, and 3. interviews. The rationale for the study design is based on a qualitative and holistic approach in which various view-points and perspectives each represent different pieces of a larger picture and a more comprehensive understanding of the processes taking place.

The document studies primarily consist of collecting relevant material from government documents and policy reports. In addition to the document analysis, the data collection includes participation at 22 industry-, policy- and research seminars (i.e. workshops, breakfast meetings, dialogue conferences, product presentations, and conferences) in the period from 2011 to 2015.

The seminars targeted different audiences and spanned various themes, from the coordination of the pilot projects within the National Programme for Assisted Living, the presentation of technological solutions and market opportunities in assisted living—as well as of experiences with these—innovation in the public sector and public procurement for innovation, both of assisted living technologies and in general. In this sense, not all the seminars addressed assisted living as such, but overall they provided a solid understanding of the policy landscape, debates, and central actors in this field. Our participation at these events primarily entailed observing the discussions, but at some points we have also taken a more active part in terms of raising questions. Nonetheless, this 'interference' with the object of study is not expected to have affected the patterns and dynamics we observed.

Interviews with thirty-five relevant stakeholders have also been conducted, primarily in 2014 and 2015. A total of fifteen interviews have been conducted with subcontractors of assisted living solutions. These interviews were part of the research project 'Trygghetspakken' which has been one of the ten pilot projects in the National Programme for Assisted Living. The interviews with the subcontractors were, on average, 45 minutes long, and were conducted by telephone. The interviews with the subcontractors related to how the subcontractors view the possibilities and challenges in the market, their practices, needs, and capacities. The respondents among the subcontractors were also asked about their experiences from their respective collaboration projects with the municipalities.

The remaining twenty interviews were conducted with key informants representing the policy apparatus, research and innovation policy programmes, interest organisations, and municipalities. These interviews also followed a semi-structured format, they were conducted face to face, and lasted, on average, one hour. This bulk of interviews focused on the respondents' experiences with, and views on, the development process within assisted living, including drivers, challenges, and barriers to these processes. The interviews primarily revolved around aspects such as strategy, technology, organisation, competencies, learning, and innovation.

A semi-structured approach was chosen in order to ensure coverage of desired topics, while at the same time allowing for unexpected aspects to arise during the conversation. The selection of respondents is partly based on an understanding of the central players in this field stemming from the participation in policy and industry seminars. Additionally, the selection of respondents partially followed a snowball approach, where interviewees were asked to name potentially relevant candidates for subsequent interviews.

5. A case study

5.1 The introduction of assisted living

At centre stage for the case study is a national policy programme addressing the societal challenge of demographic ageing and the exploration of the possibilities associated with assisted living in Norway.

The notion of 'assisted living', as defined by the Norwegian government, comprises three groups of technologies: 1. technologies that increase safety and enable living at home longer (e.g. safety alarms, GPS trackers, fall sensors), 2. technologies that stimulate social participation and thereby counteract solitude (pictures and videos, video communication, and 3. (medical) technologies that enable people to manage their own (chronic) health conditions (e.g. measuring blood pressure, blood sugar, etc.), and often in closer contact with family members and next of kin (NOU 2011: 11). Moreover, all these technologies can be applied in mobile solutions, in (smart-)home-based solutions, and in terms of solutions in nursing homes (Table 1).

In the policy analysis targeting the potentials in assisted living technologies, it has been emphasised that there are expected to be positive effects from ensuring safety for the elderly, which are assumed to enable and increase social contact which, in turn, prevent cognitive impairment. Such extended effects legitimise efforts at developing new solutions that enable the elderly to live at home for longer (NOU 2011: 11).

Table 1. Description of different elements of home-based safety technology (SINTEF 2012).

Main elements	Description
Teleguard	Sensor-based solutions which automatically detect dangerous situations and report these to given persons or to a central alarm. Safety alarms where the user calls for help.
Ambient control	Automatic control of doors, windows, light and heating. The purpose is to facilitate living at home. This could, for instance, involve cameras showing who is outside, combined with remote control to open the door and automatic lighting when movement is sensed at night
Self-mastery and support to kin	Solutions stimulating social contact and a healthy and active lifestyle
Cognitive support	Solutions that support the user in achieving day-to-day activities despite cognitive impairment. Examples include smart-calendars reminding the users about day-to-day tasks and programmes and GPS providing safety when outside of the home
Tele-health	Continuous monitoring of the health condition of users living at home. This is often a combination of monitoring performed by the user (e.g. blood pressure) and regular follow-up via telephone or video. This might be extremely effective for chronic patients and may be cost effective due to reductions in acute hospitalisation
Communication and interaction	A precondition for almost all solutions is a stable network and infrastructure for communication. Additionally, this involves interactive services such as video calls, which may provide improved inspection and increase social contact

5.2 The national programme for assisted living

The data collection is structured around the National Programme for Assisted Living.[1] The programme was launched in 2013 by the Norwegian Directorate of Health—an executive agency subordinate to the Norwegian Ministry of Health and Care Services. Drawing on the previous official reports on the healthcare sector, the overall aim of the programme is to ensure that assisted living technologies will be an integrated part of public healthcare services by 2020. The main tasks for the programme are to develop and test assisted living technologies and services in the municipalities, to generate and diffuse knowledge on assisted living, to develop good models for the introduction and use of assisted living technologies, as well as to develop standards and Information Technology (IT) architecture on assisted living technologies. The National Programme for Assisted Living is primarily directed towards the municipal healthcare services, but will nonetheless also contribute to an increased use of assisted living technologies in the specialised health services (national level) and in the private sphere.

The government's attention has largely been directed at increasing productivity in the municipal healthcare service system through technology projects aimed at testing assisted living technologies such as digital sensors, digital alarms, people tracking systems and safety systems. The government has directed financial support and expertise towards municipalities wishing to test such technologies in the patients' own homes, in specialised apartments, or to include assisted living technologies when renovating or building new care facilities.

The National Programme for Assisted Living consists of four phases:

1. Establishment and preparations, 2013–14.
2. Testing, 2014–16: The testing phase is to run until mid-2016 and its objective is to generate experiences and to develop methodologies and practical tools and service models as well as to facilitate training for the municipalities to implement solutions based on assisted living.
3. Upscaling, 2015–20: The upscaled programme is planned to involve 320 municipalities by 2019. By 2020, 80 per cent of the population should have access to healthcare services including assisted living as a natural part of the public health services.

4. Consolidation, 2020: The objective for the consolidation phase is to ensure usage of the solutions based on assisted living by the end of the programme period.

As part of the initial test phase, the programme has funded ten pilot projects involving thirty-one municipalities (out of a total of 428 municipalities nationally). These pilot projects primarily focus on digitising, developing, and upscaling safety alarms.

Since its launch in 2013, the pilot programme has had a budget of approximately 3.5 million Euros annually. This should indeed be seen in conjunction with other parallel government funding of active ageing. Within the (top-down) umbrella of the national policy programme, the pilot projects were formed (bottom-up) by the respective consortia across municipalities and subcontractors. Nine out of the ten pilot projects test various solutions associated with safety technologies (e.g., GPS tracking, alarm reception, fall detectors, motion detectors, and smart house solutions such as electronic door locks). In addition, two of the pilots test medical technologies such as electronic medicine pill dispensers and logistics for effective home-based services. The ten pilot projects are being accomplished in different groups of municipalities ranging from one to nine municipalities in each pilot project. Alongside the pilot projects, a number of demonstration flats[2] have been set up in order to present and to make the new solutions accessible and understandable in real-world contexts.

The goal of the policy programme is to move from centralised healthcare provision in nursing homes to an increasing share of distributed and patient-centric healthcare provision at home. Enabling the elderly with multiple diagnoses to live longer at home also implies a shift from reactive to proactive healthcare service provision. In order to arrange for such a shift, the National Programme for Assisted Living seeks to develop digital solutions such as safety technologies and digital monitoring devices that are either installed in the homes of the user or held by them. The programme, in this sense, aims to move from analogue, uni-functional and (stationary) home-based safety alarms to mobile, multi-functional and digital safety alarms allowing for increasing independence and self-monitoring of own health. Such a shift involves creating a new architecture for data sharing, as illustrated in Figure 2, where local
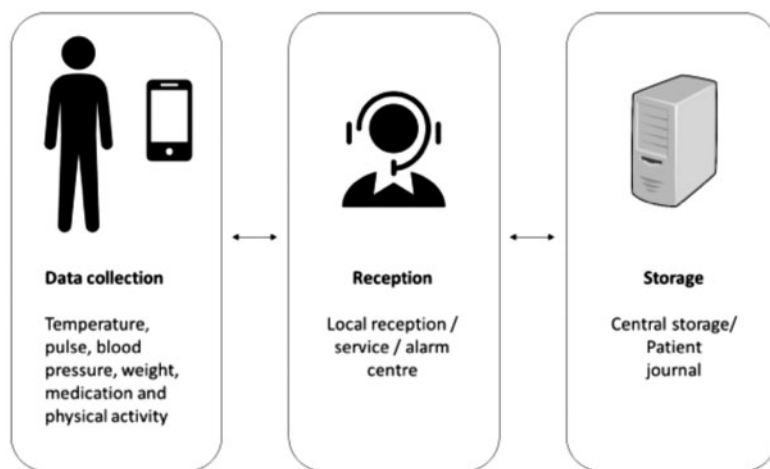
Source: Based on the Norwegian Directorate of Health

Figure 2. User-generated data from personal health technologies.

or regional service centres serve a range of users based on the digital monitoring and/or phone calls.

Nonetheless, the new digital alarms allow for an additional eco-system of healthcare 2.0 services and solutions, and which represents a reconfiguration of the architecture of current healthcare services. Moreover, reflecting the goals of the policy programme, it appears from the interviews that there are signs of a mentality shift associated with active ageing, where patient empowerment is central. Among municipal healthcare workers, this is manifested in a move from passive (reactive) nursing and care to (proactively) arranging for enabling the elderly to lead independent lives through 'everyday rehabilitation'. This represents differences in epistemic cultures associated with the existing and the new regime, and which may constitute a potential barrier to overcome in the upscaling and implementation of the new healthcare regime.

Finally, the planned changes to the architecture of healthcare services in terms of setting up joint alarm centrals simultaneously serving multiple users also strengthen interpreting this as a system shift. Such an establishment of local or regional service centres serving multiple users living at home would represent a new way of organising the production and delivery of healthcare services. However, this still represents an unresolved issue. Additional factors that have been highlighted by the respondents as challenges towards the emergence of the new regime include instability in mobile networks, legislation associated with data sharing, and public funding and portfolio of public healthcare services available.

5.3 Policy context

The analysis and knowledge base that constitutes the primary backdrop to the focus on active ageing and the innovative potential of assisted living is to be found in the official report 'Innovation in Care' launched in 2011 (NOU 2011: 11) and the whitepaper on 'Tomorrow's Healthcare' (Meld. St. nr. 29 (2012–13)). Here, a national health innovation plan (Ministry of Health and Care 2015) is outlined, aiming at developing new solutions and services within healthcare services. This long-term plan contains a programme for assisted living, a programme for next of kin, and a programme for professional re-alignment. Preceding these policy documents, a report from the (Norwegian) Technology Council had also highlighted the increasing importance of assisted living (Teknologirådet 2009) in Norway.

Another important element of the socio-political landscape surrounding the efforts targeting active ageing is the Healthcare 21 strategy process developing a research and innovation strategy for the healthcare sector (HelseOmsorg21 2014). Moreover, since 2012, the so-called 'Cooperation reform' (Samhandlingsreformen 2008–09) has transferred power and responsibility in healthcare provision from the state to the municipality level and which also seeks to (proactively) prevent healthcare needs rather than to provide (reactive) care. Succeeding the Cooperation reform there is also an ongoing Municipality reform (Meld. St. 14 (2014–15)), which seeks to ensure larger, more robust, and more professional municipalities. Moreover, official reports have also pointed to the potential for working more strategically and consciously with innovation in the public sector in general and with innovation in health services and in terms of innovative public procurement in particular (NOU 2008).

In parallel with the National Programme for Assisted Living, other initiatives have also been introduced to support innovation in healthcare services and innovation in public procurement. Among these is an initiative by the Ministry of Trade and Fisheries, which sponsors the National Programme for Supplier Development.[3] The programme is initiated and run by the Confederation of Norwegian Business (NHO) and the Organisation of Local Governments (KS). Another central initiative is InnoMed,[4] which is a national competence network for needs-driven innovation in the healthcare sector established by the Norwegian Directorate of Health on behalf of the Ministry of Health and Care Services. Other national initiatives include the Programme for Health and Care Services (2011–2015) initiated by the Norwegian Research Council and the coordinated efforts by the Regional Research Funds in targeting assisted living and elderly care.

In summary, these initiatives constitute important parts of the landscape for the current system shift. Although the National Programme for Assisted Living is the most prominent initiative to address assisted living in Norway, this context shows how the policy programme has not arisen in a vacuum.

6. Findings

6.1 Setting the direction towards the assisted living regime

The case study has illustrated how governance and policy has been proactive in the current transition processes in healthcare. The state has taken a lead role and pointed out the direction of this transformational change. It has been proactive in establishing the policy programme itself; the policy programme has provided resources and legitimacy, which, in turn, have carved out a protected incubation space that is partly shielded from competition and selection criteria in the established care system.

> '*To gain acceptance for a national architecture one must be clear.*' (Respondent in the Norwegian Directorate of Health).

The state has also taken a lead role by setting the agenda and pointing out the direction and long-term goals, of which assisted living shall form an integrated part in public healthcare services by 2020. Other ways in which the state has been setting the direction for system change are by formulating the conditions for demand through defining the technologies to be studied and initiating the pilot activities and networks within the framework of the national policy programme; by enabling interaction and mutual learning between municipalities and industry (which subsequently will also affect demand (re-)articulation), and, not least, by providing technological and service standards for a market to emerge.

Moreover, the Norwegian Directorate of Health has agreed to apply the international Continua framework. Continua is an international alliance consisting of a number of organisations which point to various established international standards which will ensure interoperability and allow for a diversity of solutions based on the same IT architecture. Continua will constitute a recommended standard from 2016 and will be considered to be compulsory from 2019.

The arrival at the Continua standard can be seen as a way of establishing a technological infrastructure for the emerging assisted living regime and thus as an expression of constructing part of the institutional set-up of the new healthcare regime of home-based care. Through these methods, the state has helped create legitimacy for the current system change. According to a respondent from the Norwegian Directorate of Health:

> '*Our task is to establish and recommend a framework and, subsequently, it is up to the municipalities whether they wish to use this or not.*'

This demonstrates that a transition requires leadership (in this case by the state) that initiates and guides this process and confirms the critique that the governance of transition processes cannot be fully understood as a self-organising process (Shove and Walker 2007).

6.2 Mobilisation and orchestration of stakeholders for articulating demand

The arrival at the Continua standard can also be regarded as a way to arrange for a market for new solutions based on assisted living. However, although the state has taken a lead role in this system shift, the roles of other actors such as the municipalities and non-public actors should not be underestimated.

> 'We will not succeed in making municipalities adopt welfare technology on a large scale if we fail to ensure the establishment of a viable market.' (Respondent in the Norwegian Directorate of Health).

Within the boundaries of the programme, the pilot projects, including the municipalities, have been vital in terms of testing new solutions in interaction with the private subcontractors and end users. The experiences generated in the different pilot projects can thus be viewed as an important component of the constituents for the articulation of demand.

To the degree that the state and the prevailing regime have set the goals for the new regime and initiated the policy programme to reach this goal, the new niches can be seen as arising from, or at least being supported by, drivers within the existing regime. The policy programme and the pilot projects within the programme may, in this sense, be perceived as a catalyst for the emergence and upscaling of the new niches constituted by technologies enabling rehabilitation and distributed healthcare provision in terms of home-based care.

Reflecting the embedded role of the municipalities, in the interviews with the subcontractors of assisted living technologies it was commonly stated that, in order to gain knowledge into their own solutions, they needed to be deeply involved in dialogue with municipal care professionals. Seeing the products in use (by patients and service providers), and hearing about the experiences and the wider implications of the technology on the social system surrounding the patient, represented vital inputs to the developing firm. It was observed by both the healthcare service providers and the firms that making the technology work for every patient was demanding in the face of the multiple user situations and the variability of user capacities.

Through this, we see that the assisted living business actors depend on customer contact and dialogue with users in order to successfully enact product and service innovations. To learn about the interplay between technologies, values, norms and practices, the firms need to have an understanding of the dynamic interaction between these user segments. This means that the municipal care services are the only arena for the realistic testing of assisted living technology.

According to the interviewed managers of subcontracting firms, one of the greatest obstacles in the assisted living market was the lack of awareness of new equipment on the demand side. A manager in one of the companies selling mobile alarms claimed:

> 'There are, of course, differences regarding the level of knowledge about assistive technologies in the municipality-level care units, but the general impression is that it is too low. Their knowledge about technologies and available products is not up to date.'

These informants addressed the lack of management efforts to update the municipal homecare service on the relevance of new assistive living products. The firms, in general, considered that the professional healthcare community is prone to 'stick to the old ways' and to be sceptical about becoming involved with actors from the private sector. They thought the market was developing too slowly. A manager for a firm selling GPS tracking devices claimed:

> 'The market here in Norway is way too slow for firms to try and survive by innovating. To have other well-established products has been absolutely crucial for us in order to survive.'

Moreover, the professional community's notions regarding assisted living mirror the awareness and attitudes of the public in general. Accordingly, the Norwegian Directorate of Health, the Organisation of Local Governments, and several trade organisations have made efforts to influence public opinion in general and the home-care sector in particular towards a greater willingness to acquire innovative products and take a more open attitude towards assisted living.

In addition to being perceived as 'immature' by most informants, it was also thought to be susceptible to sudden plunges, such as when the Norwegian Directorate of Health recommended that the municipalities should temporarily stop purchasing digital equipment until a common standard framework (Continua) was in place. However, given this 'immaturity', some thought that some governmental intervention was justified. A manager in a firm selling digital alarm equipment had the following reflection:

> 'When the Ministry of Health intervened and advised the municipalities to stop buying anything until they had decided on a common standard, it was devastating for us vendors, but on the other hand, I think we need a book of rules for the future. So that is actually very welcome.'

In our view, this illustrates assistive living in Norway as a transforming system in which top-down governance was needed in order to create the terms of collaboration and competition.

Related to the perception by the firms that the market is growing too slowly, was the municipalities' and governments' need to manage technology risks. This, in turn, was tied to the level of technological newness of assistive products. At an early stage in the process, some vendors of assistive equipment complained that 'the test periods tend to take much more time than expected.'

In their view, pilot testing concerned the technical aspects, which was a relatively narrowly defined process—although a complex one—while the municipal service providers focused on the organisational and professional implications of the new technologies, which could only emerge over time. In the initial phase, the fact that some actors were oriented towards new technologies independent of their social and organisational application and implementation in municipal service contexts challenged the collaboration. There is, however, an increasing understanding among the firms that the testing in the pilots should focus on organisational and institutional challenges and characteristics of services and not just on targeting the technology itself. Such a perspective is supported by the Norwegian Directorate of Health, which is also increasingly placing stronger emphasis on the standardisation of services across municipalities.

The data collection illustrates how the municipalities become an important gatekeeper for learning and innovation between the

subcontractors and the users. At the same time, the municipalities face the delicate challenge of finding a balance between an embedded state role being engaged in the joint innovative development processes in the pilot projects on the one hand, and being an accountable, righteous, and formal procurer of responsible solutions on the other.

6.3 Platform for concerted action and coordination of stakeholders

The national policy programme in this case study appears as an appropriate arena and an innovative platform for bringing various stakeholders across the public, private, and civic sectors (e.g. the users and next of kin) together and in terms of combining supply-side and demand-side innovation policy measures. As such, it demonstrates the need for concerted action and serves as an example of orchestration of actors and perspectives, which has subsequently enabled a process of coordinating and formulating demand.

> 'Seeing things concerted and coordinated at an overall level - I think that is one of the key elements of this national programme.' (Respondent in trade organisation).

Moreover, it has allowed for collaboration and interaction with subcontractors, users, and their next of kin that is conducive to increasing the alignment of emerging and immature technologies with existing values, norms, and practices in care provision. The fragmented municipal structure may be seen as having conditioned a need for the top-down and coordinated structure of the development programme.

> 'We wanted a national initiative to avoid that each municipality should resolve these common challenges because it would require too much effort.' (Respondent in Norwegian Association of Local and Regional Authorities).

Nonetheless, it is acknowledged that this type of experimental development work can be challenging:

> 'Many municipalities—perhaps large municipalities in particular—have big challenges in this work because it is so complex and involves so many actors. [...] These include the relationship with suppliers, immature technologies, specialised systems, and how to survey needs. They are not used to working that way with the users.' (Respondent in Norwegian Association of Local and Regional Authorities).

At a national level, the various initiatives taken have had a top-down character led by the Norwegian Directorate of Health and Norwegian Association of Local and Regional Authorities.

The National Programme for Supplier Development has also been an important co-driving force and constitutes a national and industry-oriented policy programme. As such, the governance approach to the assisted living regime consists of: 1. municipal sector-based healthcare policies, 2. national industrial policies, and 3. national coordination of sector-, municipal- and regional-policies in the policy programme. Indeed, prior to the establishment of the national policy programme, many municipalities had already pilot-tested new technological solutions in small-scale projects.

The predominantly top-down approach and national coordination should, in part, be seen against the background of experiences from Denmark, where the 'Assisted Living Funds'[5] were, from 2008, discontinued due to coordination challenges across a multitude of fragmented and smaller projects. According to the subcontractors, there is a lack of knowledge among the municipalities regarding existing solutions within assisted living and the implications for their use, which

suggests that the same challenge applies to Norway. The Norwegian Policy Programme for Assisted Living therefore constitutes an important mechanism to coordinate the fragmented municipal landscape.

6.4 Quest for reflexivity and learning across governance modes

The establishment of the policy programme can be seen as a platform preparing for and enabling the concerted exploration of possible solutions. However, despite the predominantly top-down characteristics of the policy programme, the public sector is, in many ways, heavily involved and engaged in the ongoing processes. The Norwegian Directorate of Health and the Association of Local and Regional Authorities have facilitated and arranged information meetings and seminars for learning and knowledge exchange between municipalities, subcontractors and other relevant stakeholders, both within and beyond the boundaries of the national policy programme.

> 'We travel around the country and organise meetings and seminars to share experiences with local authorities which are not included in the programme.' (Respondent in Norwegian Association of Local and Regional Authorities).

> 'We've involved the subcontractors extensively through this programme, and I think they actually have become a little more mature.' (Respondent in the Norwegian Directorate of Health).

All the municipalities that are included in the National Programme for Assisted Living are also part of a network to facilitate knowledge exchange, one of which is coordinated and run by the Norwegian Directorate of Health and the Association of Local and Regional Governments. Each group of municipalities in the programme has selected respective research partners to be involved in practice-oriented research activities running alongside the project phases. The Centre for Care Research at Gjøvik has been commissioned with the task of running a research network and to synthesise and disseminate research results from the programme.

This is not to say, however, that the state has lived up to the label of a so-called embedded governance mode at all levels. The participating municipalities of the ten pilot projects have been expected to take an active and involved role in their respective pilot projects in collaboration with subcontractors and users. While they have, in this sense, arranged for an embedded governance mode at the municipal level, the state-level Norwegian Directorate of Health and its associated partner organisations (KS, NHO) maintain a distance to the pilot projects and thus seem to take a more dirigiste role in terms of initiating innovative processes while still remaining relatively independent outside these processes. In this sense, the National Programme for Assisted Living arranges for bridging a traditional dirigiste role with an embedded governance mode associated with the implementation of the new assisted living technologies:

> "The implementation of state policy has always had a project perspective but has never followed the project from the project phase to actual implementation. [...] So we work in a slightly different way than usual." (Respondent in the Norwegian Directorate of Health).

Meta-governance and modes of governance calls for notion of governance-mix

This form of balancing between different governance roles and modes also actualises questioning to what extent the notion of 'policy mix' manages to cover the characteristics and complexity of system change. The notion of policy mix originated, and emerged in,

Table 2. Summary of findings from the case study.

Governance role	Governance mode	Manifestation of 'governance mix'
Directionality	Dirigiste	Political priorities and professional legitimacy for the direction aimed at
	Embedded	Arriving at the Continua framework standard and definition of technologies to be explored
Demand	Dirigiste	Initialising the national policy programme and the ten pilot projects. The policy programme serves as a catalyst for nurturing and empowering the assisted living niche
	Embedded	Arriving at the Continua framework standard and description of requirements from welfare technologies services
Coordination	Dirigiste	Setting up and mobilising various types of societal actors to the pilot projects in the policy programme
	Embedded	Exploring technological solutions and user experiences in the joint pilot projects
Reflexivity	Dirigiste	Facilitation of learning arenas such as conferences for the sharing of experiences across the pilot projects and initialisation of research groups to document and synthesise ongoing experimentation.
	Embedded	Municipalities acting as gatekeepers for learning across firms and users

an innovation system context in which the objective has been to improve our understanding of how various types of policy measures across policy domains, governance levels, geography and time interact towards certain desired outcomes (Flanagan et al. 2011).

Later the term has been extended to also comprise policy processes, strategies and characteristics (Rogge and Reichardt 2016). Acknowledging and seeking to further develop such a broadening of the policy mix concept, this paper has shown how the notion of co-ordination and reflexivity becomes more important when applied to a case of system change. The ability to manoeuvre through an open-ended process requires continuous learning feedback loops across the various stakeholders involved and also a corresponding ability to adjust the course underway. This implies that policy makers should engage in collaboration, exploration, and development work with other actors and that skills, user-needs and technological solutions should accompany the selected policy tools.

However, despite the extension made to the policy mix concept, it does not include the sense of 'depth' in governance as illustrated in the present paper in terms of balancing between dirigiste and embedded governance modes. This paper suggests that diversity in policy objectives, such as developing new technological infrastructures for assisted living on the one hand, and various services and solutions to operate on these new platforms on the other, constitutes such a depth.

In order to orchestrate a governance process such as this, comprising multiple stakeholders and drawing upon other policy programmes, there is a need for a notion of meta-governance along with 'normal' governance. The orchestration across different arenas and the creation of the assisted living policy platform for empowering system change can thus be perceived as a meta-level policy tool or ability in its own right. The case of assisted living has illuminated how the heterogeneous breadth of actors and dimensions of governance roles and modes requires a further broadening of the notion of 'policy mixes' into something that may be termed 'governance mixes'. A governance mix would consist of the policy mix, but also the meta-governance of orchestration as well as the switching between the various governance modes. In this respect, the findings in the case study appear to legitimise a discussion of setting up, orchestrating and continuously coordinating the joint learning process across a broader mix of politics, modes of governance, professional knowledge from several domains, user preferences and insights about (socio-technical) solutions (Table 2).

7. Conclusions

This article has sought to improve our understanding of the role of governance to orchestrate demand for new socio-technical solutions

in system innovation. This has been achieved by exploring the various roles and modes of governance in the current shift towards a pro-active and home-based healthcare system enabled by assisted living technologies. Moreover, the paper has reflected upon how the orchestration of diverse stakeholders in system change in the current healthcare system shift can be conceptualised and understood in relation to the notion of policy mixes. Responding to the research questions posed at the outset of the paper, we have arrived at three main findings:

Firstly, the study has suggested how the National Programme for Assisted Living can be regarded as an innovative governance platform for trialling emergent technologies in a context of system shift. The article has found that the state, in the form of the National Directorate of Health, has, in multiple ways, given direction to the current system shift. Moreover, the policy programme has established central technological standards as a way of creating an institutional set-up surrounding the new assisted living healthcare system. This implies establishing the rules of the game for a new market of assisted living solutions and services to emerge. Moreover, the study has shown the importance of dialogue and interaction across multiple actor groups to facilitate joint learning and reflexivity, which is seen as crucial to articulating demand for the new solutions of a new healthcare system. The study has also illuminated the different ways in which the policy programme has coordinated the process and brought different types of societal actors together to embark on exploration processes in the pilot projects. The notions of directionality, demand, coordination and reflexivity (Weber and Rohracher 2012) appear to be continuously and mutually influencing and affecting each other. The degree of coordination and reflexivity may, for example, affect the ability to continuously re-adjust the direction of and demand for ongoing development processes. In these ways, the study has exemplified the relevance of the four types of role for policy intervention in system change.

Secondly, the article has added depth to the notion of governance by documenting how demand orchestration balances between dirigiste and embedded governance modes at both national and municipal levels. The study has emphasised how demand orchestration for emergent technologies that are part of a system shift in healthcare involves multiple and parallel roles of governance and which comprises a delicate balancing act between dirigiste and embedded governance modes, which can be challenging to coordinate and bridge. This finding illustrates how these contrasting roles and expectations are associated with a dirigiste governance mode (e.g. accountability, control, responsibility, and risk-aversion) on the one hand, and with an embedded governance mode (e.g. interactive, exploration, and

risk-taking) on the other. A dirigiste governance mode corresponds to the responsible government of the existing healthcare system both pointing out the direction in terms of making sense of the external societal trends and pressures, as well as initiating the experimental pilots and the move towards a new healthcare regime. Conversely, the embedded municipal actor represents the innovative niche-level exploration. As has been highlighted, the municipalities also struggle with balancing between a dirigiste and embedded governance mode, as they are both responsible for the provision of existing healthcare services as well as for the procurement of new and innovative services. Moreover, the governance of the system change also seems to struggle with grasping the interconnections across the different niche activities on the one hand, and between the (local/regional) niche activities and the national level on the other. This represents challenges associated with coordination and reflexivity, and may have consequences for the learning feedback loops and, subsequently, for the continuous adjustment of direction and formulation of demand in the ongoing transformation. In order to more extensively exploit the knowledge created and to facilitate the standardisation of services across municipalities, it appears necessary for the state to more closely bridge its dirigiste and embedded governance modes in terms of enabling and harnessing the systematic learning and knowledge feedback loops generated in the pilot projects and beyond.

Thirdly, the articlr has drawn attention to our understanding of how the diverse and complementary roles and modes of governance and meta-governance can be interpreted as an expression of a form of 'governance mix'. Interpreted through the lens of the notion of 'policy mixes', the case study has exemplified a combination of various types of policy approaches in terms of demand-side policies, sectoral policies, and challenge-driven policies. The policy programme has included various types of stakeholders and has combined supply-side R&D support and demand-side procurement of innovative solutions at the municipal level. In this sense, the notion of policy mix seems appropriate for characterising the present case. However, in line with identified gaps in the literature (Markard et al. 2012; Borrás and Edler 2014; Rogge and Reichardt 2016), the case has emphasised the need for a more fine-grained and dynamic understanding of governance in system change. The dynamic nature of governance in system change is exemplified through the move from an initial focus on ensuring interoperability through arriving at technological standards towards a subsequent concern with social aspects related to the contents of the actual services offered.

The balancing between dirigiste and embedded governance modes actualises a discussion of whether the notion of 'policy mixes'—despite its recent extension—is sufficient and appropriate for covering the complexities of system change. The insights on governance for system change derived from this study—and facilitated by the four types of transformational policy failures, i.e. directionality, demand, coordination, and reflexivity—suggest that the notion of 'policy mix' should be supplemented by a broader term of 'governance mixes'. Although not new to the policy studies literature, such a form of 'governance mix' transcends the established notion of 'policy mixes' used in innovation studies literature. In addition to appropriate policy processes, strategies, instruments, and characteristics, such a term would imply a further broadening of Rogge and Reichardt's (2016) framework ascribing more depth to the notion of policy mixes through the balancing between different governance modes observed. In addition to including new types of actors, politics, negotiations, professional knowledge from different domains, user preferences and insights regarding technical solutions, a broader set of interactive and reflective skills and learning abilities have proven to be necessary in such a multi-modal, dynamic and open-ended process. Therefore, in order to grasp the meta-governmental, dynamic and multi-modal characteristics of system innovation and socio-technical transitions, governance seems to require a broader perspective than that captured by the notion of 'policy mix' as derived from a system of innovation tradition.

Notes

1. <https://helsedirektoratet.no/velferdsteknologi> accessed 5 Feb 2018.
2. Some examples of these are Fru Poulsen, Henie Onstad, Almas Hus / A-Hus Hospital, Innovatoriet, Buskerud and Vestfold University College.
3. National Programme for Supplier Development, <http://innovativeanskaffelser.no/about/> accessed 5 Feb 2018.
4. <http://innomed.no/information-in-english> accessed 5 Feb 2018.
5. The ABT funds (Applied Citizen-centric technology).

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