POLICIES AND PRACTICES IN WELFARE TECHNOLOGIES: A COMPARATIVE STUDY OF NORWAY AND JAPAN

Bendik Bygstad, Dept. of Informatics, University of Oslo
Gjermund Lanestedt, A-2 Norge AS

ABSTRACT

Many rich countries experience two opposite demographic trends: a growing number of elderly who will need care over a long period of time – and a decreasing work force of young people. This "gap" represents an economic and organisational challenge, and politicians in many countries expect welfare technologies – especially digital technologies – to contribute to bridging it. In this paper we report from a multi-level study conducted in 2013-14, were we compared the current status of the field in Norway and Japan.

Our findings reveal similarities between the two countries, which are echoed in many other countries: Although government expectations are high, the field of welfare technology is in its infancy, and only rather simple solutions (such as safety alarms) are widely used. However, our findings also highlight key differences in innovation strategies for welfare for the two countries, where Japan seem to be aiming for vertical integration through large corporations' solutions, while Norway aims for a more open innovation arena, through standardization. We think the two countries have something to learn from each other, but in particular, we recommend them both a more platform-oriented approach.

1. INTRODUCTION

In this paper we present the results from a comparative study of welfare technology in Norway and Japan. The background is that most developed countries have ageing populations and shrinking work forces. In 1950, less than 1 % of the world population expected to reach 80 years of age. In 2010, this figure had grown to 4 %. In 2050, we expect the proportion of people older than 80 years in OECD countries to be almost 10 % (Colombo et al., 2011). For Japan, the most severely targeted country when it comes to ageing, the development has been particularly dramatic: In 2014, 23 % of the population is over 65 years, and in 2030, the share will be 39 %.

Both in Norway and Japan, a person that has reached the age of 65, will live averagely 20 more years, most of these in relatively good health. The many elderly in the coming decades will, more than previous generations did, expect that their last years of life are characterized by meaning, purpose and personal well-being. However, increasingly looser family ties will accompany the ageing of the population as well – especially in the industrialized part of the world. These facts imply a re-addressing of the care burden, from the family to the community and tax-financed public services.

The established systems for long-term care services will indeed be challenged. OECD data (Colombo et al., 2011) shows that between 1 and 2 % of the total workforce in the OECD area currently is employed in care work outside the health care sector – that is the kind of care services municipalities are responsible for both in Norway and Japan. On average for the OECD member states, total public and private costs of such care is already 1.5 % of GDP. For many countries, this percentage will become doubled or tripled by 2050.

While these challenges call for a broad and integrated approach of political, economic, and social measures, there are high expectations to the transforming potential of technology in care services, in particular information technology. In 2011, a Norwegian green paper pointed out four categories of care and welfare technologies (Ministry of Health and Care Services, 2011) that will be of importance in the years ahead:

- *Safety technologies*, such as safety alarms, sensors and GPS applications
- *Compensation (assistive) technologies*, such as robots
- *Social contact technologies*, such as social media for maintaining relations with family and friends

- *Treatment technologies,* such as devices and sensors for measuring health status

Seen together, it is argued, these technologies represent a vast potential for innovation and higher quality of life. Possibly – they will be of significant help to reduce public expenses for care and welfare services for the elderly. The field is, however, in its very infancy, and there are many unsolved issues (Molka-Danielsen et al., 2013). While national policies are very ambitious, the situation on the ground is not yet reflecting this. Also, authorities lack the knowledge on how to support the successful evolution of a new ecology of welfare and care services and technology.

In our investigation, we extend the above definition of welfare technology to include *the co-ordinating technologies that are used in the care of the elderly.* We believe that it is fruitful to regard welfare technologies as emerging digital infrastructures, not as isolated gadgets and measuring instruments. Building on this perspective, we focus on digital welfare technologies, as we investigate two questions:

(i) What is the status for the visions and the practical use of digital welfare technologies in Norway and Japan, respectively?
(ii) How can we facilitate successful innovation and growth in digital welfare technologies?

We proceed by briefly reviewing the research on welfare technologies, and present our theoretical lens. Then, in section 3, we describe our methods for a comparative case study. In section 4, we present our findings, and discuss them in section 5.

2. LITERATURE REVIEW: WELFARE TECHNOLOGIES AND DIGITAL INFRASTRUCTURES

In this section, we briefly review extant research on welfare technologies, then offering a conceptualisation of digital welfare technologies as digital infrastructures.

2.1. Welfare technologies

The rising interest for welfare technologies should be seen in the light of changing demographics and the need for new solutions in the organisation and provision of care and welfare services. The Scandinavian countries have seen a number of initiatives and research within welfare technologies. Many governments have produced reports and white papers, and are supporting industrial and municipal innovation projects. The green paper "Innovation in the Care Services" (Ministry of Health and Care Services, 2011) forwarded five recommendations for the organisation of care for elderly:

- Civic society should play a greater role
- Welfare technology (simple solutions) should be widely adopted
- The elderly should be encouraged to continue to live at home, and be supported with services
- Innovation and research should be strengthened, particularly associated to municipalities
- A market for services catering for the elderly should be developed

All these issues are interrelated, and have spurred a broad research effort. In the field of welfare technology, the extant Scandinavian research addresses such topics as:

- *Field assessment.* For example, SINTEF assessed the possibilities and challenges involved with the implementation of welfare technology associated with housing solutions (Aspnes et al., 2012). Molka-Danielsen et al. (2013) assessed the Scandinavian situation, and linked it to the European Union initiatives.
- *Case studies of single projects*. For example Løfquist et al (2013).
- *Technology assessment.* This includes assistive technologies (Molka-Danielsen and Moe, 2013), and robotics (Hansen et al., 2013).
- *Standardization.* For example, the *Continua Health Alliance* has established a system of interoperable personal health care devices and solutions.
- *Economics.* For example, one study showed that Denmark in 2012 and 2013 saved 500 mill DKR (65 mill Euro) due to the use of welfare technology in care services (KL's Økonomiske Sekretariat, 2013).

The overall picture is that the field is rich in new technologies and promising concepts, while the practical applications, with a few exceptions, are pilot projects.

In Japan, is it harder to assess current welfare technology research, because only a small part is published in English (this excludes pure technology research, such as robotics, where much more is available). We will briefly point to two contributions from our project partners in Japan. Wakamatsu and Takahashi (2010) and Wakamatsu (2011) at Tokyo Medical and Dental University has published the results from a number of telemedicine and case studies, pointing out that humane and simple technologies rather than high-tech solutions, are required in this field. Tohru Ifikube and his colleagues at the University of Tokyo have developed assistive technologies for elderly and disabled over a period of 30 years, based on neuroscience (Ifikube, 2010). The same research group was heavily engaged in the Health Innovation Programme (HIP), described in section 4. It is notable that the aims of the Japanese welfare technology research (see for example the national programme "The Creation of Sciences, Technologies and Systems to Enrich the Lives of the Aged in Japanese Society" (2011-2019), are rather similar to the Scandinavian, in focusing on improving the quality of life for the elderly, rather than technology development.

2.2 The dynamics of digital infrastructures

In understanding the innovation and evolution of digital welfare technologies, we make two assumptions. First, in order to succeed, welfare technologies cannot be treated successfully as local, stand-alone solutions, but should be understood as emerging *digital infrastructures* (Hanseth and Lyytinen, 2010). Such structures are interconnected systems of technical, social and human elements that together create value. This is consistent with the overall need for innovation within welfare and care services, not only in technology (Ministry of Health and Care Services, 2011). Well-known examples of digital infrastructures are e-business solutions, e-government systems and social media.

Second, the evolution of digital infrastructures is characterized by a certain dynamics that is different from stand-alone IT systems. In particular, the growth of these structures is hard to plan in detail, because they include a diversity of actors and technology that, in order to succeed must be adaptable to changing needs and environments over time. In understanding these dynamics, we build on the contribution of Henfridsson and Bygstad (2013) that describe the evolution of digital infrastructures as the interplay between three self-reinforcing mechanisms:

- *Innovation:* The creative combination of social and technical elements in order to create new services (see Figure 1).
- *Adoption:* The recruitment of users, through easy-to-use solutions that solve short-term problems.
- *Scaling:* The expansion of the network to include more partners to provide more services.

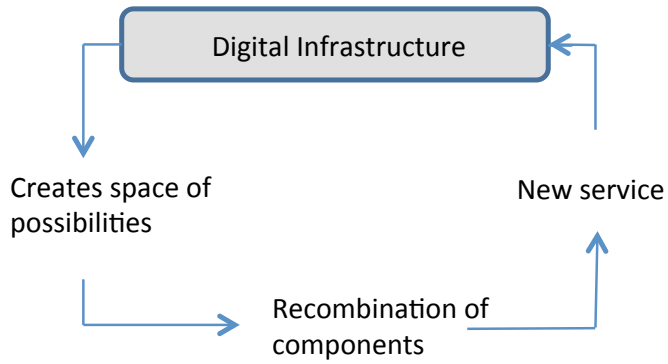

Figure 1. The self-reinforcing innovation mechanism (Henfridsson & Bygstad, 2013)

The mechanism in Figure 1 is self-reinforcing: the infrastructure creates a space of possibility, which can be used to recombine components into new services. These services increase the space of possibilities, and so on. The three mechanisms may also reinforce each other: Adoption lead to more resources that can be used for more innovation, while scaling provides more partners with more services, which leads to more adoption. It is documented over a broad range of different types of

digital infrastructures that the interaction of the three mechanisms explains successful cases (Henfridsson and Bygstad, 2013). We will build our analysis on this framework.

3. METHOD

Our general research approach was a multilevel case study (George and Bennett, 2005), where we wanted to investigate the innovation system of welfare technology, i.e. the interplay of key actors in order to innovate and adopt new IT-based solutions for welfare support.

The four groups of actors (Figure 2) were selected from analysing the Norwegian green paper (Ministry of Health and Care Services, 2011), and the white paper (Ministry of Health and Care Services (2013), which offered a broad and comprehensive picture of the status and challenges in welfare technologies.

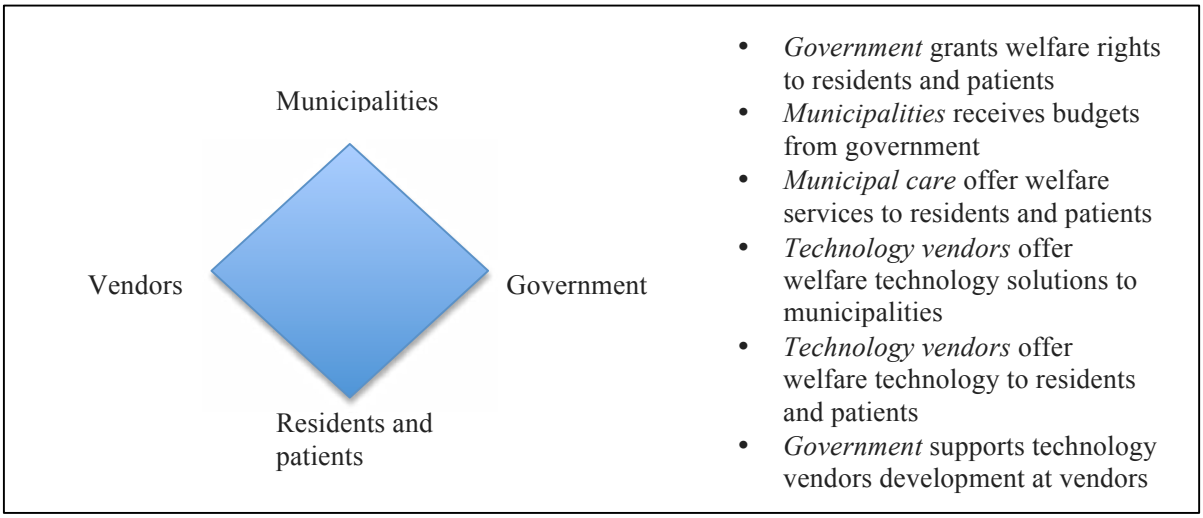

Figure 2: *Key actors*

We chose to conduct a comparative study between Norway and Japan, for several reasons. First, the authorities of the two countries have the same concerns regarding ageing populations. Both countries are resourceful and well-run societies. Further, both countries have a history of early technology adoption. In both cases, there are large expectations to the potential role of technology in the care sector.

Data Collection

In our problem definition phase, we discussed our approach with our sponsor, the Norwegian Ministry of Health and Care Services. Further, in adapting our research approach to a Japanese context, we also discussed our approach with welfare technology researchers at University of Tokyo and Tokyo Medical and Dental University. Innovation Norway's Tokyo office facilitated our visit to Japan.

In Norway, our sampling approach was to uncover an actor-network (Walsham, 1997), as a cross-section of the welfare technology area. We started by choosing two interesting welfare initiatives in the Oslo area. While observing the practical use of welfare technology, we identified municipal authorities, technology vendors and involved government actors. We then approached these for interviews, and asked all informants not only about their aims and activities, but also on their relationships to the other actors. In Japan, this strategy was unfeasible, but we tried to replicate the study as far as possible. The list of informants in the two countries is shown in Table 1.

Actors	*Norway*	*Japan*	*Topics*
Government	Ministry of Health and Care Services. Norwegian Directorate of Health. The Research Council of Norway	Ministry of Internal Affairs and Communications. Ministry of Health, Labour and Welfare.	Policies, plans and incentives
Municipalities	Bærum, Oslo (St. Hanshaugen district)	Kashiwa City. Kita-ku district in Tokyo City	Organisation of services, use of technology
Institutions and home based residents	Dønski centre for the elderly in Bærum. St. Hanshaugen in Oslo	Kashiwa City Kita-ku (resident)	Welfare technology in use
Vendors	Dignio Imatis	Hitachi SECOM HIP Project	Available technology and solutions, vendor strategies

Table 1. Informants

Data Analysis

Data analysis was conducted in three steps.

First, the observations and data from the interviews made at each "corner" of our informants' diamond were summarized and assessed. The result of this analysis is documented in Table 2, in the Findings section. Then we analysed the dynamics between the Norwegian actors, and later the Japanese actors. For example, the interplay between municipalities and vendors was analysed in terms of pilot projects, practical experiences with the involved technologies, and assumed challenges in future development. We also assessed the relationship between municipalities and residents, in such topics as understanding needs, usability issues and technical support arrangements.

Finally, we analysed the dynamics of this interplay in three mechanisms or aspects of welfare technology evolution; innovation, adoption, and scaling. This analysis was conducted comparatively in several iterations, in order to uncover the active mechanisms in our cases in the two countries. The result of this analysis is shown in Table 3 in the Findings section.

4. FINDINGS

Japan has over 125 million people on an area that is about as large as Norway, which has 5 million people. Japan has around 2000 municipalities and city districts, while Norway has 428 municipalities, which means that the Japanese units have much larger populations. Tokyo, the world's largest city with its 23 million inhabitants, is divided into townships (or "Ku's"), each of which (as an average) has more inhabitants than the city of Oslo. Both countries have a predominantly publicly financed health care (around 80 %). Health spending as a share of GDP is also about the same (Norway 9.3 % and Japan 9.6 %) (OECD, 2013).

Norway and Japan share a number of characteristics on the welfare challenges. In Norway, the proportion of the population over 65 years will increase from the current 15 % (2010) to 23 % by 2050. In Japan - which is the country in the world with the oldest population – this share will raise from 23 % to 39 % within the same period. In both countries the welfare policies are focused on self-empowerment; the most important resource is the care-needing and elderly themselves: most care will be home-based. Therefore, governments aim to enable the municipalities to provide services, and stimulate innovation and use of technology that helps elderly to be able to live in their own homes as long as possible.

4.1. Characteristics of the involved actors

Our four groups of actors and some key characteristics are shown in Table 2.

Actor group	*Norway*	*Japan*
1. Government	Large ambitions Initiatives for national architecture	Large ambitions. Rely highly on large vendors for architecture
2. Municipalities	Simple use of welfare technology: Safety alarms Service provided by municipality	Simple use of welfare technology: Safety alarms Services provided by private actors
3. Residents, family	Diversity Higher level of ICT use in general	Diversity
4. Vendors	Mostly small Niche products	Some very large, many small ones Service provision

Table 2. Key characteristics of our four actors

Government

The ministries of both countries give a relatively similar description of the current situation, characterized by an ageing population with an increasing need for health and care services, and a lack of financial and human resources to provide this. Both the Japanese Ministry of Internal Affairs and Communications (MIC), and Ministry of Health, Labour and Welfare (MHLW) – and the Norwegian Ministry of Health and Care Services – have a holistic view of the issues, stressing that the solution and necessary policies includes a broad set of measures. Further, they all have large expectations to the potential role of digital welfare technologies, and they have published extensive reports and visions.

The Japanese Ministry of Internal Affairs and Communications (which is in charge of the use of ICT in the public sector) has produced a plan (MIC, 2013) that calls for increased deployment of ICT in the medical and care field, in order to adapt the economy to the ageing population. As Section Chief Yokomori and his team in MIC explained to us, the government has established the concept of *Super Platinum Society* that includes three visions:

- Live independently and enjoy a long and healthy life.
- Work with motivation in life and participate in society.
- Create new industries and international cooperation (creating a 180 bn. Euro market by 2020).

The Norwegian government has built on the recommendations form the so-called "Hagen Report" (Ministry of Health and Care Services, 2011), and produced the white paper *Future Care* (Ministry of Health and Care Services, 2013). This has also led to the operational plan named *Welfare Technology,* from the Norwegian Directorate of Health (2012), supported by The Association of Local and Regional Authorities. The plan includes a financing and knowledge-sharing scheme for the implementation of welfare technology in the municipalities. The purpose of this scheme is a controlled experimentation with technologies, organization, service models and models for co-operation between municipalities, vendors and service providers, before concluding and consolidating on some well-integrated and standardized concepts.

Similarly, the Japanese Ministry of Health, Labour and Welfare (MHLW) runs a financing scheme for municipalities and vendors, piloting solutions for "community based care services", aiming at stimulating the local authorities to experiment with welfare technology. MHLW also runs a programme supporting the development of robotics, ranging from simple to high-tech services (MHLW, 2013). One example is the "feeding robot" (from SECOM), which allows a disabled patient to operate a robot arm with a spoon, using her/his chin, to pick food from a section of a plate, and to steer the spoon to the mouth. The product is available also in Europe but production has stopped because of poor sales (Figure 3).

Figure 3. The Secom manufactured My Spoon feeding robot

Residents and patients

This group is characterised by diversity; many elderly are both healthy and technology savvy, using PCs or tablets to surf the net, pay their bills and communicate on Facebook with their grandchildren (while Internet is widely available in both countries, the use of smart phones is significantly higher in Norway than in Japan). Some elderly are healthy, but not technology savvy; they may only use the telephone. Some elderly are of course sick and dependent on continuous care. We found residents' own technology in both countries to be simple and standardized Internet solutions to communicate with their family, i.e. smart phones and tablets with applications such as Facebook and YouTube, and some simple safety alarm solutions. This resonates well with Wakamatsu's (2011) findings of the need for simple and humane technology.

Thus, from the user perspective, there is no common solution when it comes to welfare technology, but each person is a special case. In both countries, a large majority of elderly lives at home, and the authorities strongly support this by providing services and technology. In Japan, a person over 65 is assessed once a year by a Care Manager, who will assign the person to one of seven categories of care need (applying to the mandatory insurance system), depending on health and social situation. In Norway, the assigned GP and the municipal office will act as a counsellor. In Japan, families have traditionally played a key role in caring for the elderly, but this is changing.

Municipalities

In Japan, the municipalities have small administrations, and private actors do all the delivery of care. The national government has instituted the "Integrated community care system" which is a framework for assisting and organising care services: According to the insurance classification (7 categories), the elderly are assigned a set of services. The full spectre of services delivered at municipal level in Tokyo city, is presented in an extensive publication from Tokyo Metropolitan Government (2013). Anyhow, the role of the municipality is to orchestrate these services, not to deliver them. This is in contrast to Norway, where the municipality is delivering most services.

The welfare technology in most use in homes of both countries is safety alarms; including simple, small devices, that the elderly carries at all times. In Japan, released alarms are received by private call-centres; in Norway, usually the municipality receives them, in different arrangements. The municipalities in both countries have ambitions for much more use of technology in welfare services, but it is generally acknowledged that it will take time, both because of economic constraints and because of the immaturity of technical solutions. Partly as a result of the before mentioned financing scheme from the Norwegian Directorate for Health, several Norwegian municipalities since 2013 run small-scale user-oriented development and pilot projects with welfare technology. A manager in the Directorate commented:

"The municipalities will need some years to experiment with different concepts and service delivery models, before they are able to agree on service designs and sets of standards, consolidate, and scale up their use of welfare technology. And the government needs to assess properly the need for revised regulatory frameworks".

Vendors

Generally, the welfare technologies are immature and at early stages of development. The vendor situation differs between the two countries. Some very large corporations and an under-growth of smaller niche players dominate the supply side in Japan. We visited Hitachi, a giant corporation with 300.000 employees, and a turnover of 9 trillion yen. Competitors are, among others, Fujitsu and Toshiba. The large corporations have a history of building large-scale infrastructures in Japan, for example in safety and security, telecom and health care. Hitachi's strategy for growth in the welfare technology market is to capitalize on their existing customer base. We also visited SECOM, a company with almost 15.000 employees and a turnover of 66 billion yen. SECOM is combining innovation (robots, software, drones) with large-volume service provision – making their customer's life "more secure, convenient and comfortable", as the company presentation express it (Figure 4).

Figure 4. Director T. Komatsuzaki at Secom Co. Ltd., pointing at the alarm control panel

In Norway the welfare technology field is characterized by many relatively small niche vendors, for example in the areas of sensors (Dignio) and touch-screen solutions for work-flow (Imatis). The small companies typically run pilot projects in co-operation with municipalities, supported financially by the Norwegian Research Council or other governmental institutions and schemes.

4.2. Findings from four sites

We illustrate our findings with a short description of four sites, two in Norway and two in Japan:

- Dønski, in Bærum Municipality: A large centre for the elderly
- St.Hanshaugen District, in Oslo City
- The Welfare Coordination unit in Kashiwa City
- Kasama City: A medium sized city, with a full-scale solution from Hitachi

Dønski

This is a combined care- and resident centre for the elderly, just outside Oslo, with around 200 residents. Being a pilot institution in the municipality it runs several pilot projects in co-operation with research institutions. One project is experimenting with tablets with Internet access for the residents. Another project is run with the automatic pill dispenser from Dignio, which stores one month, in 30 cells, of medicines for a patient. At a certain time each day it opens, allowing the patient to access the

daily ration of pills. If the patient is not releasing the pills, an SMS message will be sent automatically to the nurse office.

Another project is using the touch-screen solution from Imatis, which is used by the staff to support patient logistics. There is one line on the screen per patient, showing the name, room and other information. The nurse office can assign the patient to another room by drag-and-drop, and assign the nurse-of-day likewise. One nurse commented:

> *"The touch-screen solution is easy to use, and gives everybody information on our patients and residents. However, we use several other devices, and none of them are integrated: we use paper forms in the pocket when we visit patients in their rooms, there is a separate screen for alarms, and at the end of the day we enter into a PC-based electronic patient journal".*

The Imatis solution will be mirrored at the Municipal Office and the Ambulance Service Central, in order to provide an overview of available beds.

St. Hanshaugen
This is a district in the city of Oslo, with around 25.000 inhabitants. The Home-based Care Section has organised an innovative IT solution for connecting the elderly with the municipal services.

The solution provides the employee (who might for instance, be a nurse) with a tablet. The tablet may have a list of (for example) the 30 home residents who are the today's responsibility for the nurse. Each elderly is linked to the tablet, in different ways: one may suffer from dementia, and "his" line in the list will show a sign if he has forgotten to lock the door at night. Another may suffer from Chronic Obstructive Lung Disease, and will update (on her own tablet) the status of her health and activities every day, which will be read by the nurse. A third may suffer from a heart disease, and has a sensor from the hospital, which will trigger an alarm at the nurse's tablet. The solution is rather flexible, since the vendor can connect various devices (with various transmission solution and standards) to the nurse's tablet. It will be possible to relay messages to family members. As Deputy Director Sven Bue Berger enthusiastically told us:

> *"Everyone is happy: the elderly feel safer and better monitored than before - without getting the doors overran by unnecessary visits from care personnel. My staff has more control and an easier work day, and we avoid unnecessary and expensive call-outs".*

The Norwegian vendor Dignio developed the solution, in close co-operation with the Care Section, but without professional IT staff. According to Dignio it was relatively straightforward to connect different types of sensors and tablets to the solution because the equipment supports many formats and standards.

Kashiwa City
Kashiwa is a "bed-town" outside Tokyo, with 400.000 inhabitants. 90.000 of these are elderly, of which 12.000 have long-term care insurance and are assigned care services. The city co-operates with the University of Tokyo (Institute of Gerontology), who runs a programme called "Health Innovation Programme" with 29 technology and service vendors. The aims of the project are quite broad, but IT plays a key part.

The HIP programme is running a pilot project in 2013-18, for giving IT support to the "integrated community care system". The TRITRUS system (developed by Kanamic Network Co.) is a shared information and workflow solution for all actors that are involved in home based care: the municipality, the 17 hospitals, the dentists, the physiotherapist, and the stores that bring the food home. When the Care Manager sets up the portfolio of services she gives role-based access to the system, and the municipality can monitor the situation. Thus, the IT solution serves as a collaboration infrastructure, linking medical and care services. Said Midori Yoshida, Head of Department for the Community Building for Long Live Society in Kashiwa City:

> *"The sharing of information between providers increases quality, because they inform each other, more efficient follow-up, and more patient-centric services".*

The solution is currently in a pilot phase, serving 70 elderly, being used by 132 service providers to the elderly.

Kasama City (Hitachi)
The city of Kasama, north of Tokyo, has 79.000 inhabitants. Around 19.000 of these are over 65 years. In this city Hitachi, a giant corporation with 300.000 employees, has implemented their large IT solution called "Care and Medical Check-up Cloud", being operative from March 2014.

In basic, the solution is a Patient Journal System, which is adapted and extended to include welfare and care services. The system integrates information from all services to the elderly: that is information from and for authorities, health personnel, patients, relatives, ambulance services, hospitals, pharmacies, care managers, service operators, and social workers. Access to information is role based. Access is also provided to patients and residents, and they can register data. Users are already reported to be satisfied with the solution, with the exception of pharmacists.

Senior engineer Seiichiro Matsumoto and his junior colleague Yuji Fujiko at the Hitachi headquarter in Tokyo explained:

> *"We want to improve the service level for residents, with seamless medical, care and prevention services based on shared information. The vision for further extension of our system includes the introduction of apps and connected sensors, and to offer statistics and BI solutions to the municipality and residents."*

According to Matsumoto and his colleagues, the system will also offer APIs for third party developers. Hitachi's plans are indeed ambitious. The plan is to implement the system in 40 % of the market in greater Tokyo within 2 years.

5. DISCUSSION

From the description of the actors and the four sites it is clear that there is a relatively large gap between the authorities' high expectations to welfare technology and the realities on the ground in the municipalities. First, we discuss the dynamics of welfare technology evolution in Norway and Japan; then we assess innovation strategies in a more policy-oriented perspective.

5.1 Dynamics of digital welfare infrastructures

Assessing our findings, it is clear that the innovation dynamics is different in the two countries. We discuss these differences using the three mechanisms of digital infrastructure evolution (Henfridsson and Bygstad, 2013) as a framework. We summarize our argument in Table 3 below.

Mechanism	***Norway***	***Japan***
Innovation: Recombining elements to solutions	Is conducted in pilot projects by municipality and vendor, both partly financed by the government.	Is mainly conducted by large vendors with large pilot projects (ex. Kasama City). Also some smaller-scale pilots involving research institutions, such as the HIP programme.
Adoption: Recruiting users	Municipalities implement solutions, as single projects or larger initiatives (such as the electricity and broadband vendor Lyse).	Vendors implement solutions, as part of contracts with municipalities (and Ku's).
Scaling: Expanding networks	- Horizontal integration (by standardization) by government, or - Vertical integration (by cable companies), expanding customer base.	Large companies expand existing infrastructure within customer base. Operations are usually outsourced to service companies.

Table 3. Dynamics of digital welfare infrastructures

Innovation
We found that the Norwegian strategy for welfare technology implementation is characterized by many relatively small projects, financed by the government, and often run with a research partner. The

projects are often quite advanced, in the sense that they use new technology in combination with a service innovation. Typically, though, the issues of adoption and scaling are postponed to later. The Japanese innovation model is different in the sense that the projects are usually larger, and often run by a large vendor in co-operation with the city municipality. The role of national government is less visible in Japan, and the corporations often take the innovation risk. The projects tend to be somewhat less ambitious in terms of innovation, and are less experiment oriented. Usually, they are also less open in their IT architecture.

Adoption

The differences between the two countries are reflected in the adoption practices. In both countries, the municipalities will choose a vendor and sign a contract. In Norway, however, the support from the government does usually not include the adoption phase, so after the pilot project, many initiatives slow down or stop completely. The municipalities often lack the infrastructure for increased use, such as a support organisation, and call-centre. In Japan, plans usually include user adoption as a part of the initiative, and therefore user adoption is happening much faster.

Scaling

Scaling is about extending networks in both user numbers and services. The Norwegian initiatives are often difficult to scale, due to their local origin and user-adapted solutions. There are some exceptions, for example Lyse, an energy and broadband supplier in the Stavanger area, who is aiming to extend their broadband services into welfare services. The Japanese corporations, in contrast, are well used to scaling. In the Hitachi case, we saw that their strategy was to build on their existing infrastructure and customer base, and to replicate the solution developed at the pilot city to many other cities. In the same vein, SECOM uses their extensive customer base to roll-out their new services. We also saw, as in the Kashiwa case, that the call-centre support is provided by a private vendor, and can easily be scaled up.

Concerning a national architecture for welfare technology, these practices lead to very different results. In Norway, the government and the municipalities are the main actors in architectural thinking, in supporting particular initiatives and in standardization. For example, the municipalities' umbrella association KS is designing an IT architecture framework and is calling for "shared municipal components". In Japan, the Ministry of Internal Affairs and Communications has designed a national IT architecture at a high level, but corporate-designed solutions will probably be much more important. These will include large-scale architectures for each corporation's network and customer base, which will in fact divide the country into a number of separate corporate infrastructures.

In summary, while the Japanese infrastructure grows by vertical integration by the corporations, the Norwegian infrastructure development is based on horizontal integration facilitated by government-designed architecture and standardization initiatives.

5.2 Innovation strategies for welfare technologies

Overall, the differences discussed in the previous section add up to somewhat different national strategies for innovation in welfare technologies and related care services. Which one will be the most effective? Can the two countries learn from each other? It is probably not easy, since the political and industrial cultures of mature economies are interwoven in many ways, and institutionalized in work practices at all levels. We still think that the involved actors in the innovation system, respectively, can learn from our comparison of Norway and Japan.

Central government

First, addressed mainly to the national governments of the two countries, we will point out that research has shown that "planned infrastructures", such as the Japanese, tend to be less innovative than infrastructures that grow organically (Hanseth and Lyytinen, 2010). Therefore, we expect the Norwegian strategy of more open innovation processes to produce more innovative services than the Japanese will. On the other hand, Japanese corporations do solve the adoption and scaling challenges that characterize the Norwegian approach. This may also reflect traditional differences in industrial cultures, where Norway tends to be project oriented rather than production oriented, as Japan is.

Actor group	*Norway*	*Japan*
Government	Focus more on adoption and scaling, by stimulating to larger pilot projects in municipalities.	Facilitate organic growth of infrastructures, through open, user-oriented innovation.
Municipalities	Plan and execute adoption and scaling more integrated in the innovation projects.	Avoid being locked-in with single vendors, through openness and standards in procurements.
Residents, family	Insist on simple, consumer technology, and learn how to use it.	Insist on simple, consumer technology, and learn how to use it.
Vendors	Small actors might ally to larger networks and ecologies.	Large companies might aim for more openness and user-orientation.

Table 4. Lessons learned from our comparative study, for the four actor groups

Municipalities
Addressing the municipality corner of our diamond, a reasonable assessment could be that the Norwegian municipalities, as their Japanese counterparts, should plan and execute the adoption and scaling in a more integrated way. For example, the cases of Kashiwa and Kasama show that pilot projects can be bigger and more ambitious than the small-scale initiatives usually found in Norway. On the other hand, Japanese municipalities should be aware of the danger of being locked in with their vendors, with the lack of flexibility and the substantial exit costs this entails.

Vendors
The role of a large and competent vendor that takes care of the scaling of solutions, should interest Norwegian authorities as well as all those small, innovative players who gather around the dinner plate of opportunities that the emerging care and welfare technology market represents. Probably they would have more to gain by allying with larger commercial operators, than operating alone as they usually do today. This also relates to the need for government's policies on stimulating competition and a sustainable ICT vendor market, which is often imperative in a small domestic market like the Norwegian. On the other hand, the Japanese ICT corporations could learn more from the Norwegian (or rather the Scandinavian) tradition of user-oriented development, in order to be more creative in the innovation processes.

Residents, patient and families
In the end, the overall success of welfare technology initiatives depends mostly on user acceptance. The attitudes and skills of the elderly and their families are the crucial factors here. We have the same advice to the elderly in both countries: Insist on simple, consumer technology, and learn how to use it!

6. FURTHER RESEARCH

One approach that has been a spectacular success in the IT industry is the *platform strategy*. A platform is the enabling centre of ecosystems such as Google, Amazon and Apple, and allows them to grow through the efforts of others (Iyers and Davenport, 2008). Platforms are mediating the activities of disaggregated ecosystems. Platform architectures are "modularizations of complex systems in which certain components (the platform itself) remain stable, while others (the complements) are encouraged to vary in cross-section or over time" (Baldwin and Goddard, 2008). In this sense, platforms solve the key digital infrastructure challenges; they allow for innovation (in the complements) and for adoption and scaling (by the core).

We find it interesting that both the Norwegian and Japanese actors can probably adapt their strategies for digital welfare technology to be more platform-oriented. In the Japanese case this would require the corporations to open their solutions to 3rd party companies, who would develop add-on applications in close co-operation with users. Redefining their solutions as platforms rather than complete "suites" will require a change in the typical mind-set of most large companies. In the welfare sector, this would also require a particular attention to IT security and information privacy issues, but there are many examples from other arenas (for example Internet banking) that this is well manageable.

For the Norwegian care and welfare technology scene, a platform scenario is perhaps more complicated. In the current situation we find no clear candidates for platforms, and the purchasing regulations for the public sector makes it difficult to assign platform responsibility to one vendor only. However, there are successful platforms in the banking industry (NETS) and in public administration (Altinn, and other shared components as ID-porten) that might serve as models also for the care and welfare sector.

7. CONCLUSION

Two very different countries, Norway and Japan, with rather similar challenges, namely ageing populations and diminishing work forces, were the focus of this comparative study. Both countries have large expectations to the role of welfare technology in order to address the challenges. Through a multi-level case study we found, unsurprisingly, that the expectations at policy levels are vastly higher than the results so far on the ground in municipalities. We did, however, find interesting and successful initiatives in both countries, which might indicate a way forward.

The differences in overall approaches were significant; Norway has a successful practice of user-oriented innovation, which produces excellent results, but scales poorly. Japan has an opposite problem, an innovation process dominated by corporations that is less user-oriented and innovative, but scales well. We have identified some learning point for the involved actors in both countries. Further, our recommendation to both countries is to explore a more platform-oriented IT architecture to better support innovation, adoption and scaling.

ACKNOWLEDGEMENTS

We thank the Norwegian Ministry of Health and Care Services for sponsoring this research. We thank all informants for their time and contributions. We thank Kristin Standal in Bærum kommune and Jannike Nyiredy at Dønski. We are particularly grateful to two employees at the Innovation Norway office in Tokyo, Svend Haakon Kristensen and Hiroko Tominaga, for helping us extensively in conducting the research in Japan.

REFERENCES

Aspnes et al. (2012) “Velferdsteknologi i boliger. Muligheter og utfordringer”. *SINTEF Rapport.*

Baldwin, C. and Woodard, J. (2008). “The Architecture of Platforms: A Unified View”. Working Paper, Harvard Business School. http://www.hbs.edu/faculty/ Publication%20Files/09-034_149607b7-2b95-4316-b4b6-1df66dd34e83.pdf

Colombo, F. et al. (2011). “Help Wanted? Providing and Paying for Long-Term Care, OECD Health Policy Studies, OECD Publishing”. http://dx.doi.org/10.1787/9789264097759-en

George, A. L., and Bennett, A. (2005). *Case Studies and Theory Development in the Social Sciences*, Cambridge, MA: MIT Press.

Hansen, S. T., Andersen, H.J. and Bak, T. (2010). “Practical evaluation of robots for elderly in Denmark: an overview”. *Proceedings of HRI '10, 5th ACM/IEEE international conference on Human-robot interaction*, IEEE Press.

Hanseth, O., and Lyytinen, K. 2010. “Design theory for dynamic complexity in information infrastructures: the case of building internet.” *Journal of Information Technology*, (25:1), pp. 1-19.

Henfridsson, O. and Bygstad, B. (2013). “The Generative Mechanisms of Digital Infrastructure Evolution”. *MIS Quarterly*, 37(3), pp. 907-931.

Ifukube, T. (2010). “Sound-based assistive technology supporting "seeing", "hearing" and "speaking" for the disabled and the elderly”. *INTERSPEECH* 2010: 11-19.

Iyer, B. and T. H. Davenport (2008). Reverse Engineering. Googles Innovation Machine. *Harvard Business Review* April, pp. 59-68.

KL's Økonomiske Sekretariat (2013): *De effektive kommuner. Undersøgelse af kommunernes effektiviseringsarbejde 2012 og 2013*, København

Løfquist, C., Haak, M. and Slaug, H. (2013). "The use of assistive technology in different age-groups of old people". In (eds.) Encarnação,L. Azevedo,G.J. Gelderblom. *Assistive Technology: From Research to Practice.* IOS Press.

MHLW (Ministry of Health, Labour and Welfare) (2013). *"Support Project for the Practical Application & Long-Term Care Robots"*. Tokyo.

MIC (Ministry of Internal Affairs and Communications) (2013). "Actions for ICT Utilization in e-Health". Information Applications Promotion Office, Tokyo.

Ministry of Health and Care Services (2011) "Innovation in the Care Services". Official Norwegian Report (NOU) 2011:11.

Ministry of Health and Care Services (2013). Meld.St. 29 (2012-2013) "Future Care". Report to the Storting (White Paper).

Molka-Danielsen, J., Fensli, R. W. and Moe, C. E. (2013). "Scandinavian Approach to Assisted Living: Navigating the European Research Agenda". *Proceedings of Scandinavian Conference on Health Informatics.*

Molka-Danielsen, J. and Moe, C.E. (2013) "Designing a Survey Instrument for Assessment of Assistive ICT Initiatives". *Proceedings of Nokobit.*

Norwegian Directorate of Health (2012). "Welfare technology. Technical report on the implementation of welfare technology in the municipal health care from 2013 to 2030". Report no. IS-1990.

OECD (2013) "Health at a Glance 2013: OECD Indicators". OECD Publishing.

Tokyo Metropolitan Government (2013). Social Welfare and Public Health in Tokyo.

Wakamatsu, H. (2011). "Wellbeing based on Simple Common Technology under the Internet". Recent Researches in Sociology, Financing, Environment and Health Sciences.

Wakamatsu, H. and Takahashi, T. (2010). "Daily Life Support and Widely Applicable Living Arrangement System under the Internet Environment". *WSEAS Transactions on Information Science and Applications.*

Walsham, G. (1997) "Actor-Network Theory and IS Research: Current Status and Future Prospects". In IFIP TC8 WG 8.2 *International Conference on Information Technology and Qualitative Research* Chapman & Hall, pp. 466-480.