Ageing and Technology Decision-making: A Framework for Assessing Uncertainty

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1. Introduction

We are living in an innovation age challenged with increasing complexity of decisions in all aspects of society. Such ICT innovations, advancing at an unprecedented rate, demand a sophisticated policy response to assess the impact of the rapid technological advances on society. We are keen to investigate the different types of uncertainty facing policy makers in the context of ICT innovation and the Ageing Society. This study provides a wide-ranging analysis of European policy relating to telecare and telemedicine. The purpose of our study is to explore policy measures related to telecare and home-based telemedicine in the European countries represented by a consortium of 14 European countries.[1] This case is of interest as European countries are challenged with an ageing population. Specifically, between 2000 and 2050, the proportion of the world's population over 60 years will double from about 11% to 22%. The absolute number of people aged 60 years and over is expected to increase from 605 million to 2 billion over the same period. The world will have more people who live to see their 80s or 90s than ever before. The number of people aged 80 years or older will have almost quadrupled to 395 million between 2000 and 2050. Indeed the probability of needing care increases with age. Less than 1% of those younger than 65 years need long-term care, while 30%

1 | PACITA is a four-year EU financed project under FP7 aimed at increasing the capacity and enhancing the institutional foundation for knowledge-based policy-making on issues involving science, technology and innovation, mainly based upon the diversity of practices in Parliamentary Technology Assessment (PTA).http://www.pacitaproject.eu/

of the women aged 80 years or over use long-term care services, on average across the OECD (OECD 2011). In light of these trends, recent innovative developments in technology have produced ICT devices to address the many challenges in supporting elderly people.

Information and communication technology (ICT)-based care technologies include real-time audio and visual contacts between patients and caregivers; embedded technologies such as smart homes, clothes and furniture to monitor patients inside and even outside their homes; electronic tagging of dementia patients and more biotechnological innovations, such as implants and devices for chronic disease monitoring. These technologies cover a wide range of innovations, from those already functioning to those that are prospective and theoretical. They provide health care and enable elderly people to maintain their autonomy and allow them to live independently for a longer period of time. These technologies are subsumed under the term telecare. However as well as the positive benefits, theorists are speculating on the social and legal risks of telecare, specifically regarding the issue of technology failure and the onus of responsibility, be it the users or the providers of the technology (Percival/Hanson 2006). It is worth noting the intention of this chapter is not to determine the ethics of telecare. Rather, this chapter supports the call by Yanga/Zhiyong Lan (2010) for the need for further study to facilitate our understanding of efficient policy making for how technology can address the challenges of the Ageing Society.

Given that telecare technologies is a ripe area of innovation which will have positive and potentially challenging societal implications, our research objective is to explore the different types of uncertainties for policy makers addressing how technology can address the challenges of the Ageing Society. We situate this study against the backdrop of 'responsible innovation', a growing scholarly appreciation that the advancements in ICT should be positioned within a societal context focused on the future consciousness of social well-being. Responsible Innovation is recognised to be a dynamic concept enacted at multiple levels and is forecasted to feature on the political agenda in the coming years. The term Responsible Innovation is defined as "taking care of the future through collective stewardship of science and innovation in the present" (Stilgoe/Owen/Macnaghten 2013: 3).

Our study contributes to this paradigm as it explores policy makers' response to telecare innovation and explores to what extent policy is considering the opportunities and challenges of telecare within the context of the aging society wellbeing. Within this agenda of 'Responsible Innovation', our chapter

will outline how decision support can facilitate better technology assessment processes, which are needed to manage innovations in ICT to address the Ageing Society. The rest of the chapter is organised as follows. The next section presents the literature review focusing on how technology can address the challenges of the Ageing Society and decision support. Following this, we outline the methodology, then the findings, followed by a discussion of the findings before concluding with outlining implications for policy makers.

2. Literature Review

ICT Policy Making

ICT policy making is a much studied area for scholars, as countries grapple with new innovative technologies and question their impact. Governments are challenged to scientifically assess societal, ethical, legal and economic aspects of technology. However, Delvenne et al. (2011) argues uncertainty is no longer contained within modern structures of policy making. Specifically, they argue the current challenge for policy makers is to accommodate the uncertainty and dynamics of patterns to offer the decision- making process "a context-determined and temporally limited orientation for action that makes learning through experience possible" (Delvenne et al. 2011: 18). Furthermore, no discussion on such complex decision making is meaningful without a discussion of the limitations which apply to human decision making, as described by Simon under the term of bounded rationality (March/Simon 1958).

Scholars argue under conditions of bounded-rationality, decision makers seemingly "do what they can" or in some cases, "make-do". To further complicate matters, when contemplating boundaries in ICT policy decision making, traditional boundaries are not imposed, but constructed, bargained, negotiated and appropriated by stakeholders (Delvenne et al. 2011). We speculate such boundary-less domains can result in ambiguity of decision making within a fluid environment. Policy makers need to urgently respond to demands of citizens to engage more pro-actively in policy decisions that heavily concern particular stakeholder groups and citizens (Wimmer et al. 2012). We question if policy makers as decision makers in such fluid environments are indeed 'muddling through' according to Lindblom (1959). If so, we propose a decision support lens which can make a potentially powerful contribution and will provide recommendations of real pragmatic value

for policy makers. Our study will address the need for more clearly defined and systematic theoretical and empirical studies to facilitate our understanding of efficient policy decisions (Yanga/Zhiyong Lan 2010)

Decision Support

We propose a decision support lens will help improve the quality of decision making for policy makers addressing telecare technology. Decision support systems can be effective in multiple environments for a range of uncertainties. Following Alter, one should explore how decision support can be provided when considering the feasibility of Decision Support Systems (DSS). Alter (1992, 2004) has repeatedly pointed out that the development of DSS was secondary to the objective of improving the quality of decision making, calling for a focus on decision support rather than decision support systems. To provide decision support, one should concentrate on developing an overall system of decision making which is based on evidence and supported by expert advice. The use of DSS in a political context can be problematic as studies found that the inherent rationality of the DSS was in conflict with how participants usually make decisions as well as with the political process (Andersson/Gronlund/Astrom 2012). For an in depth analysis of DSS and a framework for the classification of DSS usage across organizations see Adam et al (1998). We are keen to further explore the feasibility of DSS in a policy making context for how technology can address the challenges of the Ageing Society. We argue policy decision making for how technology can address the challenges of the Ageing Society addresses a number of categories of uncertainty (Earl/Hopwood 1980). Specifically policy making for ICT innovation considers the following:

- Uncertainty about the mechanics of technologies – the what question
- Uncertainty about their impact – the who and how questions
- Uncertainty about societal preferences – the why questions

Earl and Hopwood (1980) have theorised on the nature of uncertainty and, leveraging Thompson and Tuden (1959), they have distinguished uncertainty about the cause and effect relationship versus uncertainty which relates to the preferences of the stakeholders. Silver (1991) also proposes a reflection on the difference between guidance underpinned by information and guidance aimed at prescribing choices, which he respectively labels informative

decisional guidance and suggestive decisional guidance. In general, DSS applications must rely on the existence of clear modelling and reasoning to underpin the optimisation algorithms that are being applied. DSS are applicable to all types of stakeholders, both managerial and non managerial and are used to support fully structured problems where it is possible to specify algorithms or decision rules that allow the problem to be found, alternative solutions to be designed and the best solution to be selected (Adam et al. 1998). The key issue is therefore whether societal decisions in the area of ICT lend themselves to the development of what Earl and Hopwood (1980) term answer machines and what happens when the level of uncertainty and ambiguity involved means that the provision of the answer machine can potentially compromise the ability of policy makers to make the right choices. Earl and Hopwood (1980) have warned against trying to hide the true complexity of societal problems (focusing on developing DSS), rather than embracing it (focusing on improving the quality of decisions). Where assumptions are made about the future, or where consensus has not yet arisen in an organisation or society, decision support should not provide artificially complete ready-made answers and should, instead, promote judgment and dialogue amongst stakeholders. Although the concept of decisional guidance may appear intangible, Earl and Hopwood's (1980) recommendations provide tangible avenues for analysing decisional guidance in terms of its fit with the problems facing policy makers. We propose therefore that certain societal problems with a given technology can lead to suggestive guidance, whereas others cannot and should not, given the state of development of policy-makers' understanding or the absence of a clear societal consensus. This has clear implications for the type of dialogue which must take place in society in relation to different types of innovations. This chapter explores policy making in the area of telecare technology as an example of ICT innovation and considers how DSS can support policy making, be it as suggestive guidance or otherwise.

3. Methodology

The methodology utilized in this study is an in-depth case study approach of European response to telecare policy. The case-study method has been widely recommended for study areas that are not yet well understood and lack formal theories (Yin 2009). It is particularly relevant for our study as there are

very few studies on the actual use of DSS in a political context (Andersson/Gronlund/Astrom 2012). It has also gained particular popularity in the public policy literature because of 'the depth and richness' the result can provide for enlightened public policies (Silverman 2013). Since ICT innovation and decision support is a comparatively new and underexplored policy issue, a case study approach can provide rich context-dependent knowledge to assist policy-making. The fourteen countries in the study were Austria, Belgium, Bulgaria, The Czech Republic, Denmark, Germany, Hungary, Ireland, Lithuania, Norway, The Netherlands, Portugal, Spain and Switzerland. The selection of countries signifies the participating partners in a FP7 funded project called PACITA and represents Europe as our case study. The categories used to capture consistent data on each country, were as follows: Definitions, National Demographic Trends, National policies, Policy Enablers, Policy Enactors, Actor Involvement Incentives, Service Providers, Technologies in use, and a Risk Analysis. The choice of categories for inclusion were grounded in relation to its practical purposes following recommendations by studies analyzing and comparing how technology can address the challenges of the Ageing Society (Ishmatova/Thi Thanh Hai 2013).

Specifically, we explored the definitions used in policy documents in the 14 European countries in the study. Then, we assessed demographic conditions. Next, we examined specific national policies. Following this, we investigated the key actors involved. We categorized them as policy enablers and policy enactors. On consultation with national experts, there appears to be many risks, but these are not recognised in policy discussions thus far. Extensive desk research was conducted for each country. To complement this, policy experts were contacted for additional information that was not easily accessible via secondary sources. The richness of information differed from each country; however, this is not problematic as it reflects their differing levels of policy sophistication in the area of telecare. Therefore, there are some apparent nuances in the approaches but this adds to the complexity of the findings. For the purpose of this study, relevant legal and policy documents, government publications and scholarly literature were examined, documenting developments up until September 2013. Documentary search and analysis were complemented by a series of semi-structured in-depth interviews. Finally, we held a workshop with key experts to validate our results, which led to further relevant analysis as outlined in the following section.

It is worth noting that the purpose of the chapter is not to compare and contrast national approaches to telecare but indeed to explore how the chal-

lenge of ICT and the ageing society can be addressed using DSS. Therefore, we present the findings at an aggregate level rather than individual and offer examples to best represent the nuances in the richness of the data. We will present the findings in the form of the key questions following Earl and Hopwood (1980) framework that can be addressed using a DSS.

4. Case Study

The primary function of telecare technology is to address the challenge of an ageing population. Our study revealed there are a number of common societal challenges that emerged from our analysis. Specifically, the countries in our study are challenged with a significant increase in life expectancy, an increase in senior citizens suffering from dementia and other age related illnesses, rising cost of care of senior citizens and an increased demand for independent living solutions. In light of such challenges, policy makers are exploring emerging technological advances in telecare and telemedicine to offer solutions. However, the technologies are not an exclusive panacea for the aforementioned challenges and indeed pose responsibilities for policy makers with regard to uncertainty over cause and effect of the innovative technology. The findings provide a basis for commentary and serve to promote awareness of the policy status in telecare in Europe, as represented by the European countries in our study. We present the findings following the categories of uncertainty, presented in the literature review. Specifically, we discuss uncertainty about the mechanics of technology, uncertainty about their impact and uncertainty about societal preferences.

Uncertainty about the Mechanics of Technologies – the What Question

Our findings reveal common interpretations of telecare and telemedicine are used in national documents; however, they are used interchangeably in many contexts. There are a number of interrelated concepts such as Ambient Assisted Living, eHealth, Assistive Technology, ICT in Health, Welfare Technology and Telehealth. Such level of uncertainty is not conducive to effective policy making. European policy makers need to determine a definitive understanding of what telecare technology is. Furthermore, there are differing levels of sophistication regarding the formulation and implementation of telecare policy. Firstly, there is difference in timeline in the adoption of

telecare policy. For example, 1993 was the earliest policy initiative in Austria whereby a tax funded long-term care system that is independent from income was introduced. Since then, all countries in our study have documents referencing telecare, or equivalent but to varying levels of comprehensiveness. For example, the policies are at various levels of a continuum concerning frameworks for security and strategies for encouraging adoption. We argue some countries are proactive in seeking opportunities for encouraging the development of telecare, whilst others are reactive and seek only to fulfil the minimum requirements of regulation. The following are areas of uncertainty about the mechanics of technologies that arose from our analysis.

- What is telecare technology?
- What are the best policies to encourage the development of telecare?
- What are the regulatory requirements?

Uncertainty about their Impact – the Who and How Questions

Our findings reveal evidence of fragmented, uncoordinated decision-making and implementation in the telecare domain with no central responsibility for policy making in all countries in our study. Specifically we addressed Policy Enablers, a categorization of actors responsible for the formulation of telecare policy and Policy Enactors, a categorization of actors responsible for the implementation of telecare policy.

In the category of Policy Enablers, our findings highlighted a surge in the number of government departments getting involved in the telecare domain. For example, the Ministry of Health, the Ministry of Social Affairs, and the Ministry of Industry and Employment were all recognised to play a role in some aspect of telecare, in various countries. Due to the various groups involved, we can deem telecare policy to be a complex policy making subject. To add to the complexity, there is also an additional dimension of regional versus national policy, for example in the case of Belgium. We argue there is no single group taking responsibility for the formulation of telecare policy and this can be deemed a weakness.

In the category of Policy Enactors, our findings reveal there is a mix of non-profit, voluntary, and non-governmental agencies involved. For example, there are age action groups, charitable organisations, age support groups. Their roles are varied and include raising awareness, and dissemination of research. Similarly, we argue there is a sense of unaligned discourse in the

implementation of policies relating to telecare. When researching telecare service providers, we found private firms to be dominant in both service and product offerings. It is also a space that lends itself to innovation for new companies. There are a growing number of startups in the telecare field and it is particularly common area found among spinouts from universities. We propose this may be due to the large funding programmes such as FP7. An example of such a university spin out is Technology in Healthcare, spun out from Bangor University in 1998 in Wales, which was responsible for TED, The Electronic Doctor, and a number of other smart sensor products.

Another, particularly interesting case is the Hagen Committee in Norway. This is a national program for municipal innovation in care where 1% of care services budget is allocated to Innovation in the form of a Private public partnership. The implication of such an initiative encourages dedicated innovation in a particular phenomenon and has a largely positive contribution to the innovative capabilities of SMEs and start-ups seeking to develop their technology for the ageing society.

However, other countries have yet to formalize initiatives to encourage innovation between private and public institutions. This is an area that could be further explored. The following are areas of uncertainty about the impact that arose from our analysis.

- Who should be responsible for the formulation of telecare policy?
- Who should be responsible for the implementation of telecare policy?
- How can public- private partnerships encourage advancement of telecare technology?

Uncertainty about Societal Preferences – the Why Questions

Surprisingly, the societal preferences of telecare were largely absent in national telecare policy documentation. At the workshop with experts we were engaged in an interesting discussion on the risks associated with telecare. Here, several types of risks were identified, including Privacy Risk, Social Risk, Technology Risk, Legal Risk and Financial Risks. The most common privacy risks were concerned with legal rights and ethical considerations not being fully addressed by policy makers. The social risk of isolation was considered and the question of forced or voluntary participation was raised. Such an issue has serious implications on the societal fabric of a country and should be considered at a national level.

The technology risk of how to secure data storage and transmission of sensitive health data were identified. Such an issue is not exclusive to telecare as indeed Big Data is a term today that impacts all areas of technology and society including social media data, location data generated by smart phones and other roaming devices, public information available online and data from sensors embedded in cars, buildings and other objects.

Also the polarized dilemma of technology driven innovation versus user need innovation was questioned and the ramifications of this debate for policy making. Whether technology should be driven by societal need or technological capability is an issue policy makers need to address.

Legal risks were also articulated; specifically the medical responsibility was questioned in the technology versus practitioner onus of responsibility debate in the time of malpractice. The legal risk of the lack of legislation and regulation in this space was also recognised. Finally, the financial risk was discussed as to the question of who is responsible for the costs of the telecare technology. The following are areas of uncertainty about the societal preferences which arose from our analysis.

- Why telecare risks are not being discussed at policy level?

5. Implications of Research

As evident from our multiple country study, decision making regarding telecare policy is a fragmented, challenged process, with differing levels of sophistication. Our interest lies in decision support as a provision to holistic policy making in telecare to address the grand challenge of ageing. We argue policy makers, when challenged with policy making in how technology can address the challenges of the Ageing Society are suffering from a crisis of legitimacy as evident from the different types of uncertainty. As articulated by Kovisto et al. (2009: 1164), innovation processes have shifted from 'the positivist and rationalist technology-focused approaches towards the recognition of broader concerns that encompass the entire innovation system, including its economic, social and economic perspectives'.

As there are nuances among countries in their policy efforts, we argue decision support can frame the uncertainty over preferences and reduce uncertainty over cause and effect. Carter and Bélanger (2005) argue government agencies must understand the factors that influence citizen adoption of innovation. Their

findings indicate that perceived ease of use, compatibility and trustworthiness are significant predictors of citizens' intention to adopt technology.

Similarly, other studies highlight trust as the key success factor in technology acceptance of multi-criteria decision-support systems in the case of high impact decisions (Maida et al. 2013). We advance this argument and argue decision support can help promote judgment and dialogue with citizens thus providing rich material. In support of our argument, Rose and Grant (2010) argue that involvement from all stakeholders, including citizens of various ICT means and capabilities is a requisite for successful implementation.

We propose a research agenda to explore further decision support mechanisms to support how technology can address the challenges of the Ageing Society. We propose a number of implications are to be considered as evident from the findings of our case study of European telecare policy. As shown in our case study, none of the 14 countries have a dedicated policy for telecare. Whilst all recognize their national demographic trends demand a telecare response, there are a wide variety of responses in how each country in our study are engaging with telecare policy. A decision support response can frame the uncertainty and present suggestive decisional guidance following Earl and Hopwood (1980) recommendation, thus instilling trust and legitimacy in the policy making process.

Our findings recognize the challenge of applying a DSS to a decision in complicated and contested matters such as the use of technology in the aging society yet we support a DSS offering of suggestive guidance with the following two caveats. Firstly, policy- makers need to understand the clear societal consensus, and secondly, where assumptions are made about the future, or where consensus has not yet arisen in society, decision support should not provide artificially complete ready-made answers and should, instead, promote judgment and dialogue amongst stakeholders (Earl/Hopwood 1980).

Furthermore, decision support can increase integrity and honesty in policy decisions, two vital components to the success of transformation of policy making for technology innovation. Public sector values are the foundation from which the idea of genuine transformation ultimately derives (Bannister/Connolly 2014). The second implication of a decision support framework will promote a sense of action thus ensuring a sense of positivity about how technology can address the challenges of the Ageing Society policy decision making. The final implication will translate a respect for the citizen. Decision support for policy making in ICT innovation will support moving beyond a utilitarian and unidirectional approach to technology, thus fostering en-

gagement through institutionalization of citizen engagement and debate on contentious issues in ICT through increased transparency in the outcomes of decisions (Evans/Campos 2013).

6. Concluding Comments

The chapter will be of interest to Aging Society scholars, policy makers, and society in general as we explore a framework for assessing uncertainty in ageing and technology decision-making. Specifically, our study provides a picture of the uncertainty in policy making relating to how technology can address the challenges of the Ageing Society, and lends itself to further study of how decision support can frame uncertainty. We have considered 14 countries and their policy approaches to telecare. We suggest that contemplating decision support will frame uncertainty and deliver a number of implications, including legitimacy of policy, infer a sense of action and deliver a respect for the citizen. Our framework supports the feasibility and desirability of shaping and steering decision support in how policy-making can influence technology to address the challenges of the Ageing Society.

We believe that the framework we developed in this study is a significant development of previous work in the DSS area. In particular, our framework suggests that focusing on the role of DSS in ICT policy making is, potentially at least, a much richer vein for DSS research than focusing on specific types of problems or individual decision support systems.

Our study also contributes to the growing area of interest of Responsible Research and Innovation. Citizens, policy makers and funding agencies are seeking an assurance of responsibility when introducing innovation to society. DSS can offer a validity and transparency to decisions in contentious areas of innovation.

Further research should attempt to verify that, as policy makers use DSS applications to support their ICT and Ageing Society problem solving, their knowledge of these problems increase to such an extent that these problems become increasingly specifiable for the national context. Longitudinal studies of DSS usage could give a more accurate indication of the extent to which ICT and the Ageing Society challenges can be addressed from the implementation and refinement of decision support applications.

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