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Cover Page Footnote

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Competing Concerns on Emerging Welfare Technologies

A review of eight prevailing debates in current literature

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Abstract. Welfare technologies (WT) such as telecare, service robots, and other digital innovations for public sector service delivery are expected to improve and even radically transform health- and eldercare. However, despite political awareness and financial investments, many studies report promising inventions that fail to become implemented on a larger scale. Current research draws a fragmented and heterogeneous picture of this problem, with divergent implications for practice. This article reviews and discusses the extant literature to identify eight competing concerns central to how WT can become implemented on a large scale. By highlighting and contrasting practical and theoretical positions in this emerging and interdisciplinary research topic, the review contributes to understanding the complexities that managers and policy-makers must address to diffuse and sustain WT innovations from small to large scale.

Key words: Digital innovation, diffusion, adoption, welfare technology, and systematic literature review.

1 Introduction

A new era of digital innovation has paved the way for novel technologies such as smart devices, Internet of Things, Big Data, and robots. Technologies that enable radical changes on how we live, how organizations operate, and even the nature of entire industries (Fichman, Dos Santos, and Zheng 2014). Information systems (IS) research

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provides valuable insights and theoretical grounding for studying the transformative impact of digital innovation on service and value creation (Barrett, Davidson, Prabhu, and Vargo 2015) and how organizations can engage in and sustain digital innovation at scale (Benbya et al. 2020; Nambisan et al. 2017; Vial 2019; Yoo et al. 2012).

Within the public sector, digital innovation has fostered the so-called "welfare technologies (WT) such as telecare, service robots, virtual home care, and tracking technologies. Expected to support citizens in their daily lives, reduce costs, and offer a better work environment for service providers, WTs are increasingly introduced in health- and eldercare organizations—especially in Scandinavia (Hofmann 2013; Lo et al. 2019; Nielsen et al. 2014; Søndergård 2017;). The promises of these technologies are manifested in political strategies and in growing markets influenced by demand-pull (aging population and lack of care workers) as well as technology-push mechanisms (emerging technologies) (Aaen et al. 2018; Frennert 2019). However, it is extremely difficult to realize and sustain the expected benefits of digital WT innovations on a larger scale—and—even when inventions demonstrate viability in initial testing, it is far from given that they will be implemented on a larger scale (Greenhalgh et al. 2004; Christensen and Nielsen 2017; Karlsen et al. 2019). Although policymakers and public sector managers call for WTs to be implemented rapidly and at scale, it has proved notoriously challenging to go beyond small-scale pilot projects when facing the multiple complexities in health and care (Greenhalgh et al. 2017; Segato and Masella 2017; Wade et al. 2016).

This problem of diffusion represents a significant challenge for digital innovation in health- and eldercare services. However, as illustrated in this systematic literature review, current research is fragmented and highlights different and often competing concerns for sustaining and scaling WT innovation. This fragmentation creates insufficient theoretical understandings of the complexities of WT innovation and results in difficult-to-grasp and contradicting recommendations for practice.

To remedy these shortcomings and promote WT innovation as an important research agenda for the IS community, this paper aims to synthesize, contrast, and discuss literature with relevance to WT innovation—and in particular in relation to adoption and diffusion processes. IS has a long tradition for contributing to theorization on adoption and diffusion of emerging technologies while acknowledging both technical, managerial, organizational, and institutional complexities in the innovation process (e.g., Abrahamson 1991; Barrett et al. 2013; Berente et al 2019; Davis 1989; Karahanna et al. 1999). For this reason, IS research perspectives has a lot to offer for scholars and practitioners engaging in WT innovation. In return, embracing the empirical domain

of WT opens up new research avenues for the IS community and provides unique possibilities for theorizing about digital innovation in public sector contexts.

By organizing and contrasting prevailing debates on the diffusion of digital WT innovations in the extant literature, this paper responds to the scholarly call for focusing on complexities and tensions faced by organizations when scaling up, diffusing, and sustaining emerging WTs (Søndergård 2017; Greenhalgh et al. 2017; Karlsen et al. 2019). Based on a systematic literature review designed to organize and contrast diverse positions on the adoption and diffusion of WT innovations, the paper addresses the following research question: What are the competing concerns in managing the transition from small-scale welfare technology inventions to large-scale implementation?

In continuation of answering the research question, I discuss broader implications of the results and how competing concerns can be embraced by managers to further and sustain digital innovations (Müller et al. 2019; Svahn et al. 2017;). I propose that thinking in terms of competing concerns can facilitate inter-stakeholder communication by providing heuristic cues for understanding complexities and generate ideas for possible interventions in the innovation process.

The paper contributes by conceptualizing eight competing concerns central to sustaining and diffusing digital WT innovations. While it is valuable to synthesize what we already know, it is equally important to stimulate new conversations. By highlighting and contrasting the research positions in this emerging and interdisciplinary topic, the review pinpoints new research directions of particular relevance for IS and identifies different factors of importance to WT innovation.

The remainder of the paper is structured as follows: In the next section, I describe the methods I used to search, select, analyze, and synthesize the extant literature. The analysis in Section 3 begins with a quantitative and descriptive overview of the selected articles, followed by an in-depth thematic analysis structured around eight competing concerns. In Section 4, I discuss the study's implications for theory and practice as well as limitations before concluding in Section 5.

2 Methods

Literature reviews are critical for producing a synthesized overview in order to enable identification of research gaps in emerging interdisciplinary topics and advancing research and theory (Webster and Watson 2002). This review focuses on synthesizing a fragmented stream of literature while at the same time analytically contrasting dominant positions into abstracted competing concerns. This review method consists of

systematic search, screening and selection processes, and in-depth analysis, as Tranfield et al. (2003) suggested.

2.1 Review scope: welfare technology

Throughout the paper, I use welfare technologies (WT) as an umbrella term for a wide range of *citizen-facing innovations* in health- and eldercare. Overall, these innovations aim for improved service delivery, and they are often developed and implemented in collaborations that involve citizens (end-users), care workers, service organizations, and technology companies (Aaen et al. 2018). Examples of WT include telecare services for independent living (Cook et al. 2018), GPS tracking devices for people with cognitive impairments (Procter et al. 2018), smartphone applications to plan daily activities or monitor symptoms (Kettlewell et al. 2018), and sensor systems for digital night surveillance in nursing homes (Nilsen et al. 2016). Outside of Scandinavia, these types of technologies are often referred to as assisted and active living technologies (Florez-Revuelta and Chaaraoui 2016), ambient assisted living (Maan and Gunawardana 2018), or simply "assisted technologies" (Smith et al. 2018)[1].

2.2 Search and selection strategy

I aimed to collect a wide range of papers with relevance to welfare technologies (=welfare tech*), assistive technologies (=assist* tech*), or assisted living technologies (=assist* living* tech*).

There is no universally accepted terminology for or definition of describing the transition from small-scale invention to large-scale implementation. To delimit the subject area and ensure a flexible approach with different perspectives on this interdisciplinary subject, I followed Tranfield et al. (2003)'s advice of a scoping study involving an iterative and comprehensive process leading to a broad selection of different and partially overlapping terminologies. The initial search contained the terms 'diffusion' (e.g., Oderanti and Li 2016), 'upscaling' or 'scale-up' (e.g., MacLachlan et al. 2018; Proctor et al. 2018), and 'adoption' (e.g., Kamesawa et al. 2018). Based on these searches I encountered other relevant terminologies such as 'technology transfer' (e.g., Smith et al. 2018), 'roll-out' (e.g., Peek et al. 2016), and 'uptake' (Shaw et al. 2017) which were then added in new search iterations. The final search string included 'upscaling/scale-up', 'adoption', 'diffusion', 'spread', 'roll-out', 'technology transfer', 'implementation process', 'acceptance', and 'uptake' (see Figure 1).

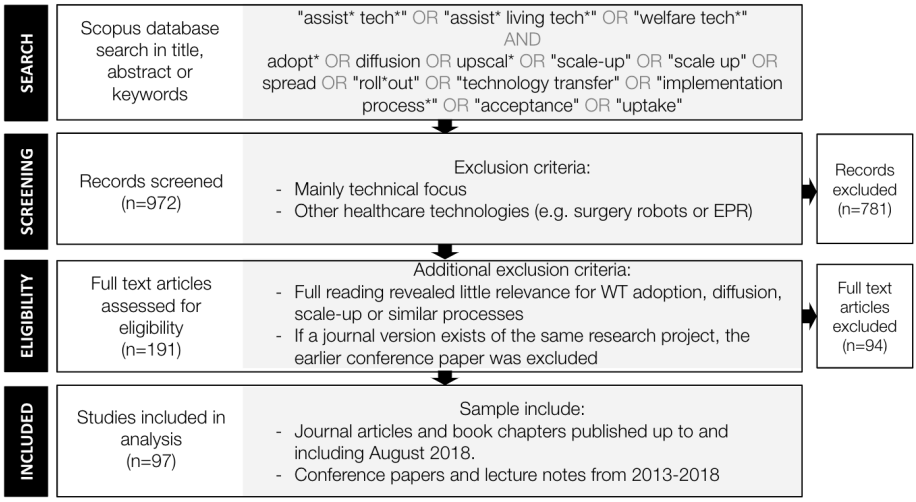

Figure 1. Article search and selection process

I searched the Scopus database for research articles, conference papers, and book chapters published up to and including August 2018, with the earliest selected article dating back to 1997. Assuming that past quality conference papers would have reached a journal outlet, only conference papers from 2013 and later were included. Correspondingly, if a journal version of the same research project existed, I excluded the earlier conference paper version.

The search resulted in a total of 972 potential candidates, 97 of which I selected for inclusion in the final dataset (see Appendix 1 for a complete list of included articles and papers). I included studies if they focused explicitly on welfare technologies and had diffusion, scale-up, adoption, or similar perspectives as their focal concepts. I excluded studies on the use of other types of healthcare technologies (e.g., Electronic Patient Record-systems or surgery robots) or the development of WT from a purely technical perspective. Figure 1 visualizes the article search and selection process.

2.3 Analysis and synthesis

Following Tranfield et al.'s (2003) recommendation, I synthesized the literature in two steps: a brief descriptive analysis quantifying the type of research, publication outlet, type of WT, empirical setting, and frequency of the keywords followed by a thorough qualitative thematic analysis.

For the thematic analysis, I organized the existing knowledge and differences in the literature using an inductive and interpretive approach (Leidner 2018; Tranfield et al. 2003). This approach can be particularly well suited to reviewing a reasonably new phenomenon, such as WT innovation (Leidner 2018). Thus, initial coding was open and resulted in numerous observations on findings and practical implications for adoption and diffusion of WT innovation. As the review progressed, patterns and themes of different theoretical and practical implications for WT innovation began to emerge. Finally, I analytically abstracted these themes into eight aggregated and competing concerns structured in four analytical levels; that is user level, organizational level, market level, and policy level. By user level, I refer to studies analyzing factors determining the end-users' decision to adopt WT. On this level of analysis, I found competing concerns on whether low user acceptance was rooted in intrinsic or contextual factors of WT and whether the primary decision-maker for user acceptance was the care recipient or the caregiver. By organizational level, I refer to studies analyzing how adopting organizations can organize large-scale implementation. On this level of analysis, I found competing concerns on whether WT implementation should be artifact-driven or system-driven and whether implementation should be centrally managed or unfold in decentralized processes. By market level, I refer to studies analyzing different business strategies to distribute WTs at scale. On this level, I found competing concerns on whether WT should be tailored for specific niche markets or target mainstream consumer markets. I also found competing concerns on whether low market uptake was a consequence of lacking viable business models or of neglected marketing. Finally, by policy level, I refer to studies analyzing how policy strategies can support the uptake of WT. On this level, I found competing concerns on the extent of governmental interventions and whether policy strategies should focus on technology-push or demand-pull mechanisms.

Figure 2 provides examples of the thematic analysis process from the results in selected articles to themes in implications for managing WT innovation and ending in the aggregated level of competing concerns. Appendix 2 contains a concept matrix (Webster and Watson 2002), providing an overview of identified concerns in each selected study.

3 Analysis

The analysis is structured into six subsections, starting with a quantitative and descriptive overview of the selected articles, followed by an in-depth thematic analysis of competing concerns on user level, organizational level, market level, and policy level, ending with a summary of results.

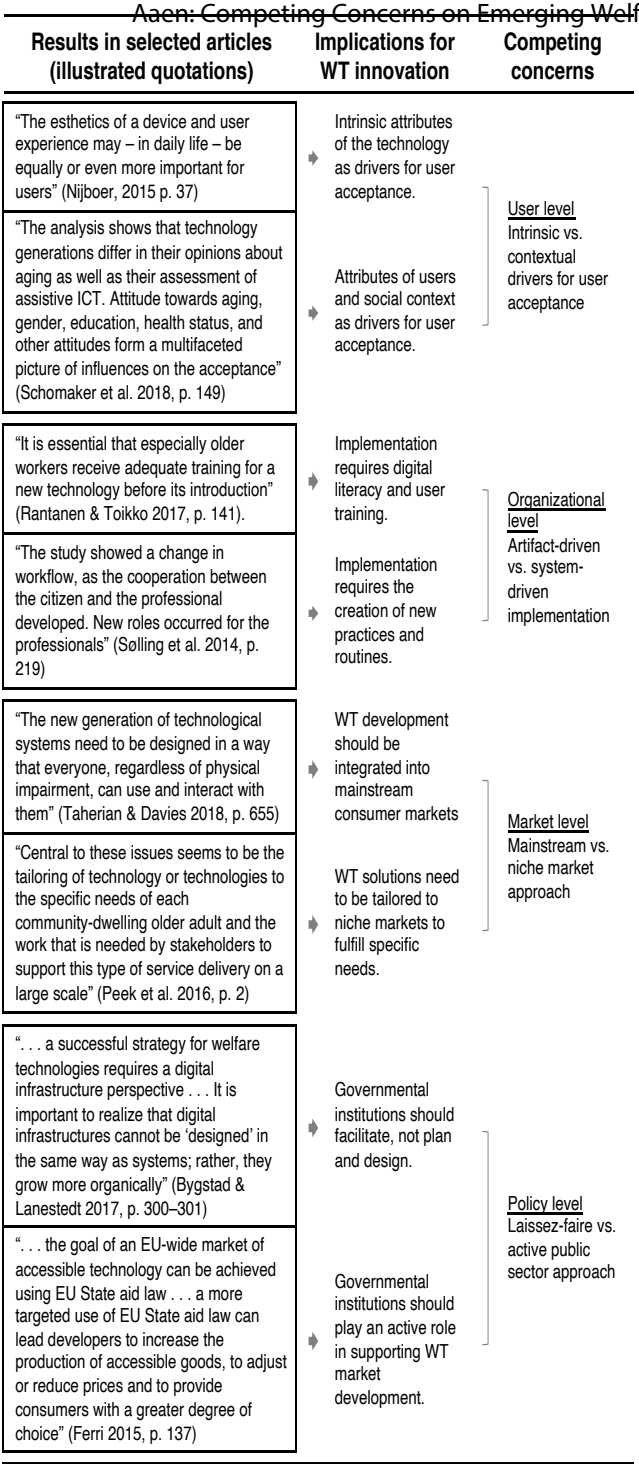

Figure 2. Example of the coding process from initial analysis to competing concerns

3.1 Quantitative and descriptive overview of the identified articles

The selected articles display fragmented and emerging bodies of literature, with 55 of the 97 articles being published since 2015 and coming from a total of 58 different sources. As of now, the discussions primarily persist in health informatics journals (including high-ranking outlets such as *Implementation Science*, *Journal of Medical Internet Research*, and *Journal of the American Medical Informatics Association*), with limited entries in information systems management and e-government journals (exceptions include papers in *Transforming Government: People, Process and Policy* and *Hawaii International Conference on System Sciences*). The journals with the greatest number of records include *Disability and Rehabilitation: Assistive Technology* (10), *Technology and Disability* (8), *International Journal of Healthcare Technology and Management* (4), *Journal of Assistive Technologies* (4), and *Studies in Health Technology and Informatics* (4).

As shown in Figure 3, almost half the included papers are qualitative case studies. Generally, the quantitative surveys have rather small sample sizes (n) and are published in conference proceedings or lecture notes (e.g., n = 64 in Heek and Ziefle 2018; n = 166 in Schomakers et al. 2018). Four mixed-method studies explore different stakeholders' views and barriers to WT uptake through interviews (Pal et al. 2017), focus

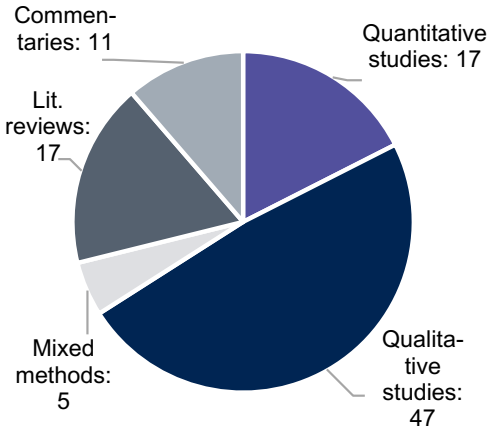

Figure 3. Type of research

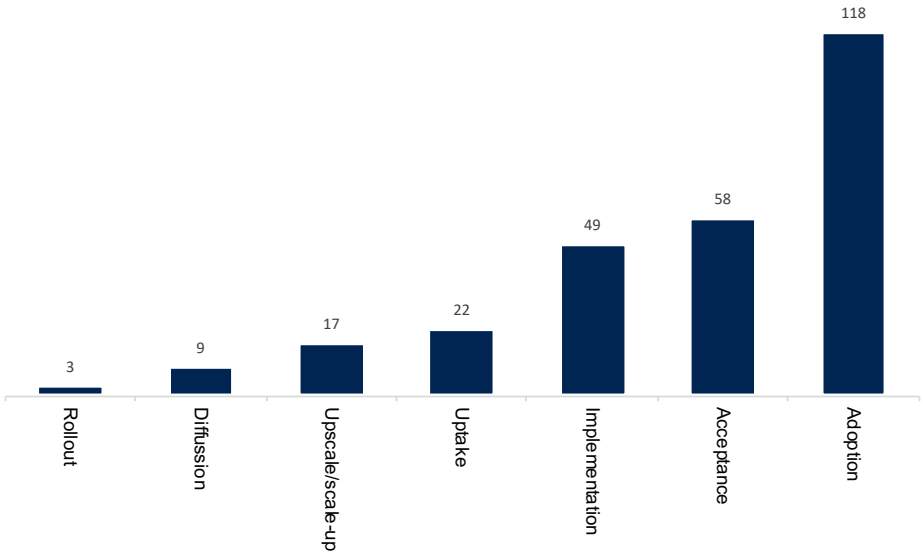

Figure 4. Total keyword frequency in abstracts (incl. spelling variations)

groups (van den Heuvel et al. 2012; Ward et al. 2017), or workshops (Glende et al. 2016) in combination with surveys. I also included 17 literature reviews that consolidate partial insights on descriptive overviews of WT design (e.g., Ienca et al. 2018), WT acceptance among certain user groups (e.g., Yusif et al. 2016), or various business models for WT (Oderanti and Li 2016). Finally, I included 11 research commentaries on different empirical, theoretical, or normative positions for WT uptake and diffusion (e.g., MacLachlan and Scherer 2018; MacLachlan et al. 2018; Smith et al. 2018).

Despite being a fragmented research field, most of the identified papers begin in a similar way: by pointing to the gap between the high expectations for WT and a seemingly low use and market uptake in practice. In general, the papers acknowledge multiple barriers for scaling up WT, such as lack of awareness among potential users, general concerns toward technology and fear of losing human contact, poor technical usability, lack of digital literacy among users, and the cost of acquisition, implementation, and operation (e.g., Cook et al. 2018; Maan and Gunawardana 2018; Taherian and Davies

2018; Wisniewski et al. 2019). However, while I was establishing the search string, I identified a number of different perspectives and terminologies that researchers used to describe and analyze the transition from small-scale WT inventions to large-scale implementation. As shown in Figure 4, the most frequently used terms are 'adoption', 'acceptance', and 'implementation.' These differences are somewhat reflected in the studies' scopes and analytical levels, with 'acceptance' mainly being applied on the user level, 'implementation' and 'rollout' on the organizational level, and 'uptake' on the market level. Yet despite diversity in terminologies and levels of analysis, the included studies address the same real-world problem of WT innovation, but with very different and often opposing practical and theoretical implications. I structured these insights into eight competing concerns that form central challenges and perspectives for WT innovation.

3.2 User level

From a user-level perspective, the issue of how WT can be implemented on a large scale is first and foremost a matter of users accepting or rejecting the technology. In this regard, I identified two competing concerns.

Intrinsic vs. contextual drivers for user acceptance

The first set of competing concerns centers on whether the primary drivers for user acceptance of WT are found in the intrinsic characteristics of the technology (e.g., technological readiness) or in the context/environment (e.g., societal readiness).

Acceptance studies of WT typically take an invention-centric focus on users' perceptions of the technology artifact, claiming that WTs fail or succeed based on their usability and fit for their users (Pal et al. 2017). For instance, Ward et al. (2017) found that the top three reported enabling factors for consumers to buy a WT were 1) believing that a product would really make a difference, 2) a feeling that costs were affordable and worth it, or 3) a belief that the product would make life safer at home. Thus, what makes WT successful is its user appeal (Nijboer 2015) both in terms of appearance (Robinson et al. 2014) and in terms of functionality, usability, safety, and cost (Glende et al. 2016). These decisions are often formulated as a tradeoff between perceived functionality or added value and users' concerns regarding technology, such as privacy implications and costs (Yusif et al. 2016).

However, dealing with low user acceptance goes beyond product design to encompass users' cognitive cost-benefit tradeoffs when considering the gains and pains of

the use of technology and the available alternatives (Peek et al. 2014). Studies such as Vichitvanichphong et al.'s (2014), Weegh and Kampel's (2015), and Schomakers et al.'s (2018) claimed that the acceptability and successfulness of WT adoption depended on multifaceted contextual factors such as the receptivity of the possible users, socio-cultural aspects, and attitudes toward aging and health conditions. For instance, a small-scale survey (n = 64) by Van Heek et al. (2018) suggested that attitudes toward care in general were relevant for the acceptance of WT, while Hartley et al. (2010) found views on aging was a main barrier for adoption and use of hearing aids. Similarly, Wu et al. (2016) found that although potential users reported difficulties in managing some of their daily activities and acknowledging the potential usefulness of an assistive robot, they prefeerred using their own alternative coping strategies to maintain independence and a certain desired self-image.

The importance of contextual factors for user acceptance has also been demonstrated for caregivers' intention to introduce new WTs. For instance, Rantanen and Toikko (2017) found that care workers acceptance toward WT's depended on factors such as professional background/education, general attitude toward technologies, perceived capacity to learn to use the applications, and perceived opinions from their colleagues. Additionally, Sølling et al. (2014) found that professionals' perception of what was 'good' care could be a critical barrier to the acceptance and adoption of WT. Thus, this perspective suggests a focus on user and contextual attributes rather than the technological attributes of the WT artifact itself. Finally, these contextual factors are not static but develop and evolve with personal experience and/or expected challenges related to independent living (Peek et al. 2017). For instance, previous positive experiences of using WT can make it easier to introduce new technologies (Rantanen and Toikko 2017). Wisniewski et al. (2019) found a curvilinear relationship between informal caregivers' perceived need for WTs and the patient's condition, as WTs were not perceived as needed in the early stages of the patient's disease but were at the same time seen as less useful in advanced stages that required constant supervision and managed care. Therefore, Peek et al. (2014) recommended keeping track of potential users' perceived needs for technology in order for potential users to coordinate the introduction of new WT accordingly.

Care recipients vs. caregivers as primary decision-makers for user acceptance

A frequently reported key characteristic of WT is that its use typically involves multiple stakeholders—either directly or implicitly—such as professional care workers and/or

family and informal caregivers in addition to the recipient of the care (e.g., Kamesawa et al. 2018; Peek et al. 2014). Furthermore, WT can serve multiple purposes, such as improving the independence and wellbeing of the care recipient while at the same time supporting and reducing the caregiver's workload (Cook et al. 2018). In order to introduce WT on a large scale, it is therefore critical to understand the social dynamics for user acceptance and to identify whom to target. Thus, the second set of competing concerns relates to whether the primary decision-makers for user acceptance are the care recipients or the caregivers.

Van Heek et al. (2018) argued that professional caregivers played a decisive role in the acceptance of WT in professional care settings, whereas in informal settings, Cook et al. (2018) found that family caregivers felt responsibility for the decision to use the WT even without the client being aware of the referral. Bouwhuis (2016) presented similar observations, where technologies were rejected even without involving the recipient of care. This reveals that in some cases, the primary client is treated as an accidental stakeholder somewhere at the end of the implementation process. From this perspective, it is less critical to what degree the recipient of care accepts the technology, but instead it is important to examine how other stakeholders accept the WT.

Yet most technology acceptance model (TAM) studies on WT consider the recipient as the primary user and sole agent making the choice to adopt the technology (e.g., Chaurasia et al. 2016; Pal et al. 2018). Opposing scholars criticize these studies for neglecting the concept that WT implementation involves many stakeholders who have their own interests at heart; they argue that this may separately or collectively block adoption and usage irrespective of end-users' acceptance (Bouwhuis 2016; Kamesawa et al. 2018; Peek et al. 2014). For instance, as Kamesawa et al. (2018) pointed out, if the use of a WT increased the workload of care workers, it might create problems with acceptance among the care workers—and likewise, even if the care workers accepted a WT, its practical use could be problematic if it was incompatible with the physical or mental attributes of the care recipient. From this perspective, user acceptance of WT unfolds in social settings with family, friends, professional caregivers, and peers, all of whom have an influence (Peek et al. 2014; Garg et al. 2014).

3.3 Organizational level

Adoption and implementation of WT often involve multiple stakeholders and creation of new practices. This results in two additional competing concerns in terms of how to organize WT implementation.

Artifact-driven vs. system-driven implementation

The third set of competing concerns involves the extent to which WT implementation should be centered around the technological artifact focusing on user training and technology support, and to what extent WT implementation should be managed in a system perspective in which several interacting factors need reorganizing.

Introducing new WT artifacts involves a change to existing practices to at least some degree. To authors such as Rantanen and Toikko (2017) and Taherian and Davies (2018), this means that service organizations should ensure that users (professionals and/or care recipients) obtain sufficient skill levels to operate a new technology before introduction. In fact, inadequate user training has been reported as a key barrier to WT implementation in several studies (e.g., Hall et al. 2017; Karlsson et al. 2017). Other artifact-driven barriers to implementation include the costs of acquisition and maintenance (e.g., Ward et al. 2017) and technical support (Gilham et al. 2017). From this perspective, the implementation and spread of WT is limited by the amount of resources that are needed to buy, learn to operate, and maintain the technology.

However, as potential users are often not only reluctant to adopt new WT but are also likely to abandon it after the initial introduction, other authors argue that the sustainable implementation and routinization of WT is a complex organizational challenge that begins rather than ends with initial adoption (Procter et al. 2018; Sugarhood et al. 2014; Sølling et al. 2014). Accordingly, MacLachlan and Sherer (2018) proposed a systems thinking approach in which several interacting strategic and situational factors need to be taken into account, often in a network of different organizations. From this perspective, WT is not merely "a product that you can buy, install, and enjoy, but instead a system consisting of many components of widely differing kinds, not controllable by the user" (Bouwhuis 2016, p. 47). Therefore, implementing WT on a large scale involves extensive reorganizing with new workflows, responsibilities, and roles for the professionals and citizens involved (Sugarhood et al. 2014). Equally important to training and infrastructure is to consider informal procedures and tacit knowledge, such as invisible work practices, when addressing WT's scalability and sustainability (Procter et al. 2018).

Centralized vs. decentralized approaches to large-scale implementation

The next set of competing concerns revolves around whether WT implementation should be managed through a centralized effort or unfold as a decentralized process in a network of autonomous agents.

Some studies identify a lack of centralized goal-setting and strategic planning as an important barrier to large-scale implementation of WT and call for more vertical decision-making to manage implementation efforts (Rantanen and Toikko 2017; Sølling et al. 2014). This also means that organizations need to plan appropriately for managing the respective needs and expectations for different user groups when introducing new WT (Batt-Rawden et al. 2017; Smith et al. 2018; Vishwanath et al. 2009). Following this position, it is necessary to find new ways to limit the number of stakeholders involved in paying for, installing, and using WT in order to reduce complexity and make implementation feasible (Bouwhuis 2016). In contrast, according to Draffan et al. (2015), what might at first seem to be conflicting interests and competing logics among different stakeholders and professional silos might instead point to a need for a unifying terminology in relation to WT implementation (e.g., patient, client, consumer, and user) that can be remedied through cooperation and knowledge-sharing.

Other studies emphasize a more decentralized approach, noting that WT implementation depends on contextual factors and the involvement of all stakeholders in discussions and decision-making to mitigate concerns and realize the full range of potential benefits (Devlin et al. 2016; Hall et al. 2017). While Devlin et al. (2016) saw robust management and continual communication as essential for the large, multi-agency implementation of WT, Peek et al. (2016) noted that managers within home care or social work organizations expressed a need to collaborate outside of their own organization such as patient or housing associations to ensure successful implementation. The underlying assumption in this decentralized implementation approach is that "a technology that 'works' for one individual in a particular set of circumstances is unlikely to work in the same way for another in a different set of circumstances" (Shaw et al. 2017, p. 2). For instance, seeing WT as embedded in a socio-technical infrastructure, Cozza (2018) argued that in order to scale up WT, it would be necessary to create technical, social, and organizational interoperability and convergence between multiple and heterogeneous stakeholders. However, this task becomes more difficult to manage as scaling unfolds and the actors needed to be involved increases and diversify. Therefore, Cozza called for ongoing and decentralized participatory processes to facilitate cooperation and commitment between different stakeholders. A similar notion is found in Procter et al.'s (2018) work, where they labeled co-production as essential for WT's scalability and sustainability. Further, Shaw et al. (2017) called for co-design principles to enable the creation of new situated (i.e., locally contingent) knowledge and routines needed to successfully introduce WTs in new contexts. This, however, also reveals an inherent tension between aiming to personalize technology implementations and aiming to deploy

WT at scale (Peek et al. 2016). Ultimately, this also implies that caregivers and service providers should be able to opt out of adopting a certain WT (Wisniewski et al. 2019).

3.4 Market level

On the market level, two competing concerns revolve around business strategies and economic models for WT rollout.

Mainstream consumer products vs. professional niche products

The fifth set of competing concerns is centered around the question of whether WT is a niche market in which products should be tailored for specific contexts, or if developers instead should integrate assistive aspects into mainstream technologies through universal design principles.

Many researchers argue that the best way to scale up these technologies is through universal design principles so that everyone, regardless of disability or illness, can use and interact with them (Björk 2009). For instance, MacLachlan et al. (2018) pointed to leading tech companies, such as Apple's voice assistant Siri and Microsoft's eyegaze technology, as examples of mainstream technologies with assistive elements that could contribute to everybody's productivity and quality of life. From this point of view, integrating assistive technologies into consumer markets is seen as a win-win strategy that creates affordable products with functional solutions for larger populations as well as potential economic gains with larger manufacturing runs that decrease production costs per unit and make products more reliable (e.g., Björk 2009; Blackman 2013; Bouwhuis 2016). Furthermore, integrating assistive aspects into mainstream consumer products rather than developing WT products for a specific niche market segment could decrease stigmatization and increase acceptance of the technologies (Taherian and Davies 2018). For instance, Wu et al. (2015) claimed that the notion of gerontechnology, targeted specifically to older adults, contained stigmatizing symbolism that might prevent their adoption. Finally, from a usability perspective, Consel et al. (2015) argued that having a plethora of different design silos made the products difficult to learn how to use. Therefore, establishing unifying design standards would reduce user's cognitive cost for adopting new WT and ultimately help scale up WT products (ibid.).

However, other researchers dispute whether the widespread adoption of such universal plug-and-play WT solutions is possible, as people (with disabilities or illness) have a highly individual set of needs that might vary over time. Instead of a universal design approach targeting mainstream consumer markets, WT solutions should be spe-

cifically designed with regard to contextual factors in collaborations with users and their professional and informal networks of caregivers (e.g., Blackburna and Cudd 2012; Peek et al. 2016; Procter et al. 2018; Sugarhood et al. 2014).

Lack of viable business models vs. lack of marketing efforts

The sixth set of competing concerns centers on whether the low market uptake of WT is a consequence of a lack of economically viable business models or is due to neglected marketing efforts resulting in potential users and gatekeepers being unaware of possible products and how to acquire them.

Like any products, WT developers must address the question of who will pay for its adoption early on. Studies have shown a limited ability and willingness to pay for WT products among end-users, making it a key task to demonstrate business value for third-party economic buyers such as government programs; it reveals that these technologies are more cost-effective than alternative solutions (Schulz et al. 2014). Thus, WT will only achieve large-scale application when the business models are economically viable and provide benefits for all of the involved stakeholders (Maclachlan et al. 2018; Oderanti and Li 2017). However, for many WT products, establishing a suitable business model remains an unresolved issue (Bouwhuis 2016). In this regard, Smith et al. (2018) argued that WT business models should incorporate replacement and loaner plans to emphasize trialability for involved stakeholders before deciding on their appropriateness for a specific user and to enable the replacement of products to respond to changes in user needs (e.g., as a disability or illness progresses or if a child grows out of using a device). Thus, when establishing a WT distribution system, "a parallel system based on expected product reliability and obsolescence must accompany the rollout" (Smith et al. 2018, p. 477).

However, other researchers claim that the main issue with current business strategies for scaling up WT is a neglected focus on marketing efforts, pointing to a need for more accessible and better information for potential users of what, where, and how to acquire suitable WT products (e.g., Glende et al. 2016; van den Heuvel et al. 2012). To remedy this, Ward et al. (2017) proposed a broker/independent advisor model in which an independent consultant (care professional) would identify the user's needs and then select and bundle products or services into a whole solution. Such a business strategy would require new partnerships between WT suppliers, caregivers, and care recipients and a focus on tailoring a system of service solutions rather than single-product development.

3.5 Policy level

Zooming out to the policy level, I identified two competing concerns on policy strategies for realizing the expected benefits of the welfare technologies.

Laissez-faire policy strategy vs. an active public sector approach

The seventh set of competing concerns is whether the lack of WT scaling is a market failure that should be addressed through governmental interventions, and if so, to what extent?

Ferri (2015) argued that the primary obstacle for WT was the so-called valley of death in terms of financing the transitioning from research and development phase to commercialization of the final product. Therefore, Ferri claims, are strategic use of governmental programs and state aid be necessary to provide access to capital to finance this transition. However, following Mazzucato's notion of the entrepreneurial state, Ferri (2015) further argued that the WT market needed more sophisticated governmental interventions beyond simply funding basic research and setting regulations. Similarly, Lane (2012) notes that despite substantial public investment in research and development, WT innovations continuously fail to meet expectations. Thus, governments and public sector organizations need to shift existing policies from merely financial aspects to actively engaging in open innovation partnerships. Moreover, Sølling et al. (2014) suggested another active public sector intervention by stressing the importance of ensuring sufficient technical infrastructure (i.e., high-speed connections to the internet all over the country) for large-scale implementation of digital WT solutions. Calling for further policy interventions, Maclachlan et al. (2018) proposed a holistic and person-centered policy approach in which policy initiatives took into account that WT involved multiple sectors rather than "seeking to silo it" (p. 456).

In contrast, Peek et al. (2016) point to a more laissez-faire governmental approach arguing that WTs are frequently abandoned when the governmental funding stops and that subsidizing WT development may obscure the possibility of identifying the actual need in the market. Similar skepticism on centralized governmental funding initiatives is found in Smith et al. (2018), who argued that end-users and care professionals were more committed to using WT "if they 'invest in' and pay [for] a portion of the cost of the device" (p. 480).

Bygstad and Lanestedt (2017) advocate, from a policy perspective, seeing welfare technologies as emerging digital infrastructures instead of as isolated technical artifacts. However, based on a comparative study of WT policies in Norway and Japan, the authors argued that such digital infrastructure "cannot be 'designed' in the same way as

systems; rather, they grow more organically, through innovation, adoption and scaling" (p. 300-301). Thus, rather than active participation in WT innovation, Bygstad and Lanestedt argues that the role of governments and public agencies should be to facilitate, not plan and design.

Technology push vs. demand pull innovation strategy for WT

The eighth and final set of competing concerns relates to technology push and demand pull mechanisms for WT innovation and market shaping. For instance, studying technology-intrinsic drivers for WT adoption (e.g., product safety and privacy), Koimizu et al. (2018) recommended that policy-makers, together with other stakeholders, establish ethical guidelines to support WT development (the supply side). In contrast, focusing on contextual drivers for WT adoption, Wisniewski et al. (2019) recommended using market-shaping policies in terms of patient and caregiver education in the use of WT (the demand side). Similarly, Lane (2015) advocates for more extensive use of demand-driven policies, claiming that "governments consistently and inappropriately support an exploratory grant approach led by academia which generates knowledge in conceptual and prototype states, and instead should shift to a procurement contract approach led by industry which designs, tests and deploys commercial products and services" (p. 78).

While Ferri (2015) and Smith et al. (2018) argued for the necessity of policies engaging in both supply-side mechanisms as well as stimulating demand, the discussions on push vs. pull strategies for WT rollout are heavily under-researched, leaving researchers to speculate under which circumstances and to what extent either or both strategies may be suitable for the development and widespread distribution of WT: "Depending on a given context, Push, Pull or Push/Pull may be the best strategy. Various combinations are needed and will vary based on the human, societal, environmental and regulatory conditions. The importance of understanding these methods is to be aware of the approach to be used and that whatever used is deliberate and assessed, so a product development process can shift or adapt in approach if necessary" (Smith et al. 2018, p. 478).

3.6 Summary of the competing concerns

Table 1 contains a summary of the competing concerns in the critical transition from small-scale WT invention to large-scale implementation.

1. Drivers for user acceptance	User acceptance depends primarily on intrinsic attributes of the technology (11, 12, 13, 14, 19, 25, 28, 29, 30, 31, 56, 69, 89, 95)	User acceptance depends primarily on attributes of users and social context (2, 9, 16, 20, 22, 23, 26, 32, 34, 35, 37, 38, 57, 60, 61, 62, 64, 65, 67, 71, 78, 82, 84, 86, 87, 90, 93)
2. Primary decision-maker for user acceptance	Care recipients as the primary decision-makers for the acceptance of WT (9, 11, 25, 28, 29, 39, 54, 60, 61, 69, 71, 75)	Caregivers as primary decision-makers for the acceptance of WT (2, 10, 15, 17, 38, 39, 52, 55, 58, 79, 86, 92, 96)
3. Approaches to implementation	WT implementation should be centered around the technology artifact to secure adequate infrastructure and training (3, 10, 12, 17, 30, 33, 40, 55, 67, 83)	WT implementation should be seen in a system in which several interacting factors need re-organizing (1, 7, 18, 21, 42, 49, 51, 52, 66, 73, 81, 82, 91)
4. Decision making structure	WT upscaling depends on centralized organizational efforts (2, 21, 77, 82, 88)	WT upscaling unfolds as a decentralized process in a network of autonomous agents (3, 12, 18, 24, 33, 45, 57, 63, 66, 68, 73, 91, 92)
5. Product type	Universal design / assistive elements should be incorporated into mainstream consumer products (1, 4, 6, 7, 14, 45, 61, 75, 80, 83, 94)	WTs should be developed as niche products specifically tailored to users' needs (5, 63, 66, 81, 92)
6. Business focus	Lack of viable business models limit WT upscaling (7, 50, 52, 59, 72, 74, 77)	Lack of marketing efforts limit WT upscaling (31, 46, 48, 79, 85, 89, 91, 97)
7. Extent of governmental participation	The WT market needs participative and entrepreneurial governments (8, 52, 63, 77)	Governments and agencies should only facilitate, not plan and design WT innovation (27, 36, 44, 46, 47, 50, 53, 82)
8. Policy focus	Policymakers should establish ethical guidelines to support WT development (7, 14, 36, 41, 50, 52, 53, 70, 74, 76)	Policymakers should enact market-shaping policies to stimulate WT demand (1, 43, 79, 92)

Table 1. Summary of eight competing concerns on WT innovation in extant literature (see Appendix 1 for overview of included studies)

4 Discussion

Emerging from an inductive coding protocol, this review contributes to the emerging literature on WT innovation by providing a framework of eight competing concerns central to diffusing and sustaining WT innovation from small to large scale. Below I will discuss how this framework contributes to our understanding of the complexities surrounding WT innovation and informs practice.

4.1 Competing concerns as heuristic cues in digital innovation complexity

Systematic reviews provide practitioners a means for research-based evidence to inform their decisions (Tranfield et al. 2003). The debates identified in current literature provide an overview of central concerns for project managers and policymakers engaging in WT innovation. However, instead of synthesizing fragmented bodies of literature into a set of conclusive guidelines for best practice, this review has contrasted diverging positions into competing concerns. By highlighting conflicting viewpoints and recommendations, we can embrace the complexities of WT innovation and understand central factors, drivers, and barriers for sustaining and scaling such innovations.

As reflected in this review, diffusing and sustaining emerging innovations is a heavily contested process in which decisionmakers need to consider not only technical feasibility and economic viability but also socio-structural permissibility (Dobson and Nicholson 2017). Thus, the gap between the enthusiasm of policymakers and managers seeking to promote emerging WTs and the limited uptake in practice may be—at least partially explained—by unresolved competing concerns between the multiple stakeholders involved such as public sector organizations (service providers), private companies (technology developers), citizens (end-users), and policy makers (Aaen et al. 2018; Greenhalgh et al. 2012). Consequently, digital innovation is shaped by how competing concerns are managed within and across the network of involved actors (Cho et al. 2007; Svahn et al. 2017). Accordingly, if WTs are to be diffused and sustained at scale, more effective inter-stakeholder communication must occur to better manage competing concerns and facilitate socio-cognitive sensemaking across a heterogeneity of innovation actors (Greenhalgh et al. 2012; Jay 2013; Nambisan et al. 2017). The framework of competing concerns developed in this review can help facilitate this process in two ways:

Firstly, while each of the included studies in this review provides useful insights on WT innovation on their own, they only address parts of a multifaceted reality. Organizing and contrasting these insights may lead to a more holistic understanding

of the challenges in sustaining and scaling WT innovation. Given the dynamic and complex nature of WT innovation, it would be naïve to assume that balancing these concerns can be made with full comprehension of the advantages and disadvantages of each possible configuration or lead to consensus among the stakeholders involved (Greenhalgh et al. 2012). Instead, managing the competing concerns will unfold as a series of interrelated decisions and priorities throughout the innovation process from early small-scale invention to large-scale implementation (Cho et al. 2007; Svahn et al. 2017). To help decide what information is relevant and make sense of complex events, people extract heuristic *cues* from the environment (Weick 1995). These cues provide points of reference as simple, familiar structures that tie elements together cognitively. In this regard, the abstracted positions presented as competing concerns in this review can provide practitioners with cues for making sense of the complexity surrounding WT innovation. The positions are deliberately simplified viewpoints to be used as reference points to link, discuss, and make sense of factors, drivers, and barriers for diffusing and sustaining WT innovation. As such, the competing concerns found in this review might serve as a point of departure for facilitating inter-stakeholder communication to establish a more coherent understanding of the innovation complexities and to organize action across a heterogeneity of innovation actors (Jay 2013; Nambisan et al. 2017).

Secondly, linking these various factors, drivers, and barriers together in competing concerns, allows decisionmakers to think of combined interventions and strategies through shifts in vantage point when deadlocks are encountered. For instance, if project managers found low user acceptance towards a new WT even if the new technology outperforms existing practices, it would be prudent to shift vantage point towards addressing more social and contextual factors concerning user acceptance. An example of such shifts can be seen in a recent case study of the emergence of a drug-dispenser robot for independent residents (Aaen 2019): Initial technological breakdowns hampered the trust of potential users in the robot, and although the developers systematically addressed all problems and eventually arrived at a very reliable solution, there were still issues with user acceptance. When project management adapted their strategy on how to enroll users, uptake of the robot increased. As such, whereas the problem of low user acceptance initially was rooted in technology-intrinsic factors, the solution involved reconfigurations in socio-contextual factors.

Therefore, I propose that the competing concerns provide a framework for making sense of the various factors, barriers, and drivers to stimulate ideas for potential solutions as the innovation process unfolds. As further discussed in the limitations below, these eight competing concerns do not constitute a complete and universally applicable checklist of all relevant aspects in WT innovation—nor would they be equally relevant

for any given WT project. However, by thinking of the competing concerns as heuristic cues, I argue that they can help identify and discuss critical aspects in the WT innovation process across a heterogeneity of innovation actors.

4.2 Limitations and future research

This research has a number of limitations. Most notably, the search is limited to only include English keywords in one database (Scopus), and the review likely misses otherwise eligible studies written e.g., in Danish, Swedish, or Norwegian. Furthermore, the technology-centric focus on WT might have left out useful and complementary insights from studies on other types of innovation in health- and eldercare. Consequently, I do not claim to be exhaustive in this review, and I call for empirical studies that focus on exploring and expanding on the competing concerns surrounding emerging WTs.

Digital innovation fundamentally transforms the organization of service delivery (Barret et al. 2015), and challenges current theories on innovation management (Nambisan et al. 2017). WT innovation promises a rich and potentially highly rewarding domain for theorizing on the complexities of digital innovation. As mentioned in the introduction, IS researchers are uniquely positioned to contribute to this emerging interdisciplinary research stream. Given the identified dominance of exploratory and often a-theoretical studies in the current research, future studies should emphasize concept and theory development through longitudinal and comparative case studies of WT innovation processes. IS research can provide useful lenses to theorize how to manage conflicting demands, opposing perspectives, and organizational ambiguity in digital innovation (Benbya et al. 2020; Nambisan et al. 2017; Singh et al 2009; Svahn et al. 2017). By highlighting eight competing concerns central to emerging WTs, this article paves the way for new research avenues for understanding the complexities of diffusing and sustaining digital innovation in delivery of health- and eldercare services.

5 Conclusion

The challenges of scaling, diffusing, and sustaining emerging WTs pose a significant threat to the digital transformation of welfare service delivery in health- and eldercare. Existing literature is fragmented and characterized by many unresolved debates and competing implications for practice. This systematic review article makes three contributions. Firstly, it organizes and contrasts current literature into eight sets of competing concerns central to scaling and diffusing WT innovations. Secondly, as proposed in the discussion, thinking in terms of competing concerns can support inter-stakeholder

communication by providing heuristic cues to make sense of innovation complexity and generate ideas for possible interventions as the innovation process unfolds. Finally, the identified competing concerns pinpoint new research directions for exploring and expanding our understanding of the challenges surrounding emerging WT innovations.

Notes

1. While Welfare Technology seems to be the preferred term for initiatives in Scandinavia and the Nordic region (see www.nordicwelfare.org), Assisted Living Technologies is more commonly used within the European Union (see www.aal-europe.eu). Finally, the broader term Assistive Technology is used for initiatives within the World Health Organization (see www.who.int/health-topics/assistive-technology). I included all three terminologies in the search string to ensure that the search was not confined to one geographic region (Webster and Watson 2002).

References

Aaen, J., Nielsen, J., and Elmholdt, K. T., (2018). 10 år med velfærdsteknologi: Strategi og praksis. *Samfundslederskab i Skandinavien*, (33:3): 236-259.

Aaen, J., (2019). Organizing for Emerging Welfare Technology: Launching a Drug-Dispensing Robot for Independent Living. *Selected Papers of the IRIS*, (10): Article 1.

Abrahamson, E., (1991). Managerial fads and fashions: The diffusion and rejection of innovations. *Academy of Management Review*, (16:3): 586-612.

Barrett, M., Heracleous, L., and Walsham, G., (2013). A Rhetorical Approach to IT Diffusion: Reconceptualizing the Ideology-Framing Relationship in Computerization Movements. *Management Information Systems Quarterly*, (37:1): 201-220.

Barrett, M., Davidson, E., Prabhu, J., and Vargo, S., (2015). Service Innovation in the Digital Age: Key Contribution and Future Directions. *Management Information Systems Quarterly*, (39:1): 135-154.

Benbya, H., Nan, N., Tanriverdi, H., and Yoo, Y., (2020). Complexity and Information Systems Research in the Emerging Digital World. *Management Information Systems Quarterly*, (44:1): 1-17.

Berente, N., Lyytinen, K., Yoo, Y., and Maurer, C., (2019). Institutional Logics and Pluralistic Responses to Enterprise System Implementation: A Qualitative Meta-Analysis. *Management Information Systems Quarterly*, (43:3): 873-902.

Christensen, J. K. B., and Nielsen, J. A., (2017). Interorganisatorisk innovation i sundhedssektoren: Opskalering af et telemedicinsk pilotforsøg. *Økonomistyring og Informatik*, (32:4): 327-347.

Cho, S., Mathiassen, L., and Robey, D., (2007). Dialectics of resilience: A multi-level analysis of a telehealth innovation. *Journal of Information Technology*, (22): 24-35.

Davis, F., (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *Management Information Systems Quarterly*, (13:3): 319-340.

Dobson, J.A.. and Nicholson, B., (2017). Exploring the Dialectics Underlying Institutionalization of IT Artifacts. Journal of the Association for Information Systems, (18:12): Article 4.

Dougherty, D., and Hardy, C., (1996). Sustained product innovation in large, mature organizations: Overcoming innovation-to-organization problems. *Academy of Management Journal*, (39:5): 1120-1153.

Fichman, R., Dos Santos, B., and Zheng, Z., (2014). Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum. *Management Information Systems Quarterly*, (38:2): 329-353.

Frennert, S., (2019). Lost in digitalization? Municipality employment of welfare technologies. *Disability and Rehabilitation: Assistive Technology*, (14:6): 635-642

Garud, R., Gehman, J., and Kumaraswamy, A., (2011). Complexity Arrangements for Sustained Innovation: Lessons from 3M Corporation. *Organization Studies*, (32:6): 737-767.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., and Kyriakidou, O., (2004). Diffusion of innovations in service organizations: Systematic review and recommendations, *Milbank Quarterly*, (82:4): 581-629.

Greenhalgh, T., Procter, R., Wherton, J., Sugarhood, P., and Shaw, S., (2012). The organising vision for telehealth and telecare: discourse analysis. *BMJ Open*, (2:4): 001574. doi:10.1136/bmjopen-2012-001574

Greenhalgh, T., Wherton, J., Papoutsi, C., Lynch, J., Hughes, G., A'Court, C., Hinder, S., Fahy, N., Procter, R., and Shaw S., (2017). Beyond Adoption: A New Framework for Theorizing and Evaluating Nonadoption, Abandonment, and Challenges to the Scale-Up, Spread, and Sustainability of Health and Care Technologies. *Journal of medical Internet Research*, (19:11): e367. doi:10.2196/jmir.8775

Hofmann, B., (2013). Ethical Challenges with Welfare Technology: A Review of the Literature. *Science and Engineering Ethics*, 19 (2), 389-406

Jay, J., (2013). Navigating Paradox As A Mechanism Of Change And Innovation In Hybrid Organizations. The *Academy of Management Journal*, (56:1): 137-159.

Karahanna, E., Straub, D., and Chervany, N., (1999). Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs. *Management Information Systems Quarterly*, (23:2): 183-213.

Karlsen, C., Haraldstad, K., Moe, C. E., and Thygesen, E., (2019). Challenges of Mainstreaming Telecare. Exploring Actualization of Telecare Affordances in Home Care Services. *Scandinavian Journal of Information Systems*, (31:1): Article 2.

Lewis, M., (2000). Exploring Paradox: Toward a More Comprehensive Guide. *The Academy of Management Review*, (25:4): 760-776.

Lo, C., Waldahl, R. H., and Antonsen, Y., (2019). Tverrfaglig, sammenkoblet og allestedsnærværende—om implementering av velferdsteknologi i kommunale helse- og omsorgstjenester. *Nordisk Välfärdsforskning*, (4:1): 9-19.

Müller, S., Obwegeser, N., Glud, J., and Johildarson, G., (2019). Digital Innovation and Organizational Culture: The Case of a Danish Media Company. *Scandinavian Journal of Information Systems*, (31:2): 3-34.

Nambisan, S., Lyytinen, K., Majchrzak, A., and Song, M. 2017. Digital Innovation Management: Reinventing Innovation Management Research in a Digital World. *Management Information Systems Quarterly*, (41:1): 223-238

Nielsen, J. A, Mathiassen, L., and Newell, S., (2014). Theorization and Translation in IT Institutionalization: Evidence from Danish Home Care. *Management Information Systems Quarterly*, (38:1): 165-186.

Vial, G., (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, (28:2): 118-144

Segato, F. and Masella, C., (2017). Telemedicine services: How to make them last over time. *Health Policy and Technology*, (6:3): 268—278

Singh, R., Mathiassen, L., and Mishra, A., (2009). A Theory of Rural Telehealth Innovation—A Paradoxical Approach. *ICIS 2009 Proceedings*: Article 126.

Svahn, F., Mathiassen, L., and Lindgren, R., (2017). Embracing Digital Innovation in Incumbent Firms: How Volvo Cars Managed Competing Concerns. *Management Information Systems Quarterly*, (41:1): 239-253.

Søndergård, D., (2017). *Welfare technology: Tool box*. Nordens Välfärdscenter, Stockholm.

Tranfield, D., Denyer, D., and Smart, P., (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, (14): 207-222.

Wade, V. A., Taylor, A. D., Kidd, M. R., and Carati, C., (2016). Transitioning a home telehealth project into a sustainable, large-scale service: a qualitative study. BMC Health Services Research, (16): Article 183.

Webster, J., and Watson, R., (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, (26:2): Xiii-Xxiii.

Weick, K., (1995). *Sensemaking in Organisations*. London: Sage.

Yoo, Y., Boland, R., Lyytinen, K., and Majchrzak, A., (2012). Organizing for Innovation in the Digitized World. *Organization Science*, (23:5): 1398-1408.

Appendix 1: List of included studies

#1	Barlow, J., and T. Venables (2004). Will technological innovation create the true lifetime home?. *Housing Studies,* (19:5): 795-810.
#2	Batt-Rawden, K.B., Björk E., and Waaler D., (2017). Human factors in the implementation and adoption of innovations in health care services. A longitudinal case study on the introduction of new technology. *Innovation Journal,* (22:3): 2-25.
#3	Bauer, S., Elsaesser L.-J., Scherer M., Sax C., and Arthanat S., (2014). Promoting a standard for assistive technology service delivery. *Technology and Disability,* (26:1): 39-48.
#4	Björk, E., (2009). Many become losers when the Universal Design perspective is neglected: Exploring the true cost of ignoring Universal Design principles. *Technology and Disability,* (21:4): 117-125
#5	Blackburn, S.J., and Cudd P.A., (2012). A discussion of systematic user requirements gathering from a population who require assistive technology. *Technology and Disability,* (24:3): 193-204.
#6	Blackman, T., (2013). Care robots for the supermarket shelf: A product gap in assistive technologies. *Ageing and Society,* (33:5): 763-781.
#7	Bouwhuis, D.G., (2016). A framework for the acceptance of gerontechnology in relation to smart living. In: *Handbook of Smart Homes, Health Care and Well-Being*. Ed. by Van Hoof, J., Demiris, G., Wouters, E., p. 33-52.
#8	Bygstad, B. and Lanestedt, G., (2017). Expectations and realities in welfare technologies: A comparative study of Japan and Norway. *Transforming Government: People, Process and Policy,* (11:2): 286-303.
#9	Chaurasia, P., McClean, S.I., Nugent, C.D., et al (2016). Modelling assistive technology adoption for people with dementia. *Journal of Biomedical Informatics,* (63): 235-248.
#10	Churchill, J., and Hoogerwerf, E.-J., (2013). Promoting assistive technology competence among care staff in Europe. *Assistive Technology Research Series,* (33): 458—463.
#11	Cimperman, M., Brenčič, M.M., Trkman, P., and Stanonik, M.D.L., (2013). Older Adults' perceptions of home telehealth services. *Telemedicine and e-Health,* (19:10): 786-790.
#12	Clark., J., and McGee-Lennon, M., (2011). A stakeholder-centred exploration of the current barriers to the uptake of home care technology in the UK. *Journal of Assistive Technologies,* (5:1):12-25.

#13	Connelly, K., Laghari, R.K., Mokhtari, M., and Falk, T.H., (2014). Approaches to understanding the impact of technologies for aging in place: A mini-review. *Gerontology,* (60:3): 282-288.
#14	Consel, C., Dupuy, L., and Sauzéon, H., (2015). A unifying notification system to scale up assistive services. *ASSETS—The 17th International ACM SIGACCESS Conference on Computers and Accessibility, Oct 2015, Lisbon, Portugal. Proceedings of the 17th International ACM SIGACCESS Conference on Computers & Accessibility*, p. 77-87
#15	Cook, E.J., Randhawa, G., Guppy A., et al (2018). Exploring factors that impact the decision to use assistive telecare: Perspectives of family care-givers of older people in the United Kingdom. *Ageing and Society,* (38:9): 1912-1932.
#16	Cook, E.J., Randhawa, G., Sharp C., et al (2016). Exploring the factors that influence the decision to adopt and engage with an integrated assistive telehealth and telecare service in Cambridgeshire, UK: A nested qualitative study of patient 'users' and 'non-users'. *BMC Health Services Research,* (16): Article 137.
#17	Copley, J. and Ziviani, J., (2004). Barriers to the use of assistive technology for children with multiple disabilities. *Occupational Therapy International,* (11:4): 229-243.
#18	Cozza, M., (2018). Interoperability and convergence for welfare technology. In: *Lecture Notes in Computer Science*, Volume 10927 LNCS, Springer, 2018, p. 13-24.
#19	Damodaran, L. and Olphert, W., (2010). User responses to assisted living technologies (Alts)—a review of the literature. *Journal of Integrated Care,* (18:2): 25-32.
#20	Deibel, K., (2013). A convenient heuristic model for understanding assistive technology adoption. *Proceedings of the 15th International ACM SIGACCESS Conference on Computers and Accessibility, ASSETS 2013*, Article No. 32.
#21	Devlin, A.M., McGee-Lennon, M., O'Donnell, C.A., et al (2016). Delivering digital health and well-being at scale: Lessons learned during the implementation of the dallas program in the United Kingdom. *Journal of the American Medical Informatics Association,* (23:1): 48-59.
#22	Doughty, K., and. Williams, G., (2016). New models of assessment and prescription of smart assisted living technologies for personalised support of older and disabled people. *Journal of Assistive Technologies,* (10:1): 39-50.
#23	Dorsten, A.-M., Sifford, S.K., Bharucha, A., Mecca, L.P., and Wactlar, H., (2009). Ethical perspectives on emerging assistive technologies: Insights from focus groups with stakeholders in long-term care facilities. *Journal of Empirical Research on Human Research Ethics,* (4:1): 25-36.

#24	Draffan, E.A., James, A., Cudd, P., and Bentley, C., (2015). Barriers and Facilitators to Uptake of Assistive Technologies: Summary of a Literature Exploration. *Studies in Health Technology and Informatics*, (217): 350-356.
#25	Feldwieser, F., Marchollek, M., Meis, M., Gietzelt, M., and Steinhagen-Thiessen, E., (2016). Acceptance of seniors towards automatic in home fall detection devices. *Journal of Assistive Technologies,* (10:4): 178-186.
#26	Fernando, S., Money, A., Elliman, T., and Lines, L., (2010). Older adults and diffusion of assistive web-base technologies. *Journal of Information Technology Research,* (3:1): 1-12.
#27	Ferri, D., (2015). Does accessible technology need an 'entrepreneurial state'? The creation of an EU market of universally designed and assistive technology through state aid. *International Review of Law, Computers and Technology,* (29:2-3): 137-161.
#28	Fischer, S.H., David, D., Crotty, B.H., Dierks, M. and Safran, C., (2014). Acceptance and use of health information technology by community-dwelling elders. *International Journal of Medical Informatics,* (83:9): 624-635.
#29	Garg, V., Camp, L.J., Lorenzen-Huber, L., Shankar, K., and Connelly. K., (2014). Privacy concerns in assisted living technologies. *Annales des Telecommunications/Annals of Telecommunications,* (69:1-2): 75-88.
#30	Gillham, M., Pepper, M., Kelly, S., and Howells, G., (2017). Stakeholder views addressing the development and uptake of powered wheelchair assistive technology. *Disability and Rehabilitation: Assistive Technology*, (14:2):146-160
#31	Glende, S., Conrad, I., Krezdorn, L., et al (2016). Increasing the Acceptance of Assistive Robots for Older People Through Marketing Strategies Based on Stakeholder Needs. *International Journal of Social Robotics,* (8:3): 355-369.
#32	Godwin, B., (2012). The ethical evaluation of assistive technology for practitioners: A checklist arising from a participatory study with people with dementia, family and professionals. *Journal of Assistive Technologies,* (6:2): 123-135.
#33	Hall A., Wilson C.B., Stanmore E., and Todd C., (2017). Implementing monitoring technologies in care homes for people with dementia: A qualitative exploration using Normalization Process Theory. *International Journal of Nursing Studies,* (72): 60-70.
#34	Hartley D., Rochtchina E., Newall P., Golding M., and Mitchell P., (2010). Use of hearing aids and assistive listening devices in an older australian population. *Journal of the American Academy of Audiology,* (21:10): 642-53.

#35	Hirani S.P., Rixon L., Beynon M., et al (2017). Quantifying beliefs regarding telehealth: Development of the Whole Systems Demonstrator Service User Technology Acceptability Questionnaire. *Journal of Telemedicine and Telecare* (23:4): 460-469.
#36	Ienca, M., Wangmo, T., Jotterand, F., Kressig, R.W., and Elger, B., (2018). Ethical Design of Intelligent Assistive Technologies for Dementia: A Descriptive Review. *Science and Engineering Ethics,* (24:4): 1035-1055.
#37	Jamwal, R., Callaway, L., Farnworth, L., and Winkler, D., (2018). Electronic assistive technology use in Australian shared supported accommodation: rates and user characteristics. *Disability and Rehabilitation: Assistive Technology,* (13:7): 634-640.
#38	Judge, S.L., and Parette, Jr. H.P. (1998). Family-Centered Assistive Technology Decision Making. *Infant-Toddler Intervention,* (8:2): 185-206.
#39	Kamesawa A., Yoshizaki R., Hirose S., Shinozaki N., et al (2018). Acceptance and practical use of assistive technologies for frail seniors and caregivers: Interview surveys on nursing homes. *ITAP 2018: Human Aspects of IT for the Aged Population. Acceptance, Communication and Participation,* p. 70-84.
#40	Karlsson, P., Johnston, C., and Barker, K., (2017). Influences on students' assistive technology use at school: the views of classroom teachers, allied health professionals, students with cerebral palsy and their parents. *Disability and Rehabilitation: Assistive Technology,* (13:8): 763-771.
#41	Koimizu J., Kokado M., and Kato K., (2018). Ethical Perspectives of Japanese Engineers on Ambient Assisted Living Technologies: Semi-structured Interview. *Asian Bioethics Review,* (10:2): 143-155.
#42	Kötteritzsch A., and Weyers, B., (2016). Assistive Technologies for Older Adults in Urban Areas: A Literature Review. *Cognitive Computation,* (8): 299-317.
#43	Lane, J.P., (1997). Development, evaluation and marketing of assistive devices. *Technology and Disability,* (6:1-2): 105-125.
#44	Lane, J.P., (1999). Understanding Technology Transfer. *Assistive Technology,* (11:1): 5-19
#45	Lane, J.P., (2012). The "Need to Knowledge" Model: An operational framework for knowledge translation and technology transfer. *Technology and Disability,* (24): 187-192
#46	Lane J.P., (2015). "Delivering beneficial impacts in assistive technology: Improving government's approach to innovation". *Studies in Health Technology and Informatics,* (217): 78-83.
#47	Lane J.P., Leahy J.A., and Bauer S.M., (2003). Accomplishing Technology Transfer: Case-Based Lessons of What Works and What Does Not. *Assistive Technology,* (15:1): 69-88.

#48	Layton N., Murphy C., and Bell D., (2018). From individual innovation to global impact: the Global Cooperation on Assistive Technology (GATE) innovation snapshot as a method for sharing and scaling. *Disability and Rehabilitation: Assistive Technology,* (13:5): 486-491.
#49	Linskell J., and Bouamrane M.-M., (2012). Assisted-living spaces for end-users with complex needs: A proposed implementation and delivery model. *Health Informatics Journal,* (18.3): 159-170.
#50	MacLachlan M., Banes D., Bell D., et al (2018). Assistive technology policy: a position paper from the first global research, innovation, and education on assistive technology (GREAT) summit. *Disability and Rehabilitation: Assistive Technology*, (13:5): 454-466.
#51	MacLachlan, M., and Scherer, M.J., (2018). Systems thinking for assistive technology: a commentary on the GREAT summit. *Disability and Rehabilitation: Assistive Technology,* (13:5): 492-496.
#52	Magnusson L., and Hanson, E., (2012). Partnership working: The key to the AT-technology transfer process of the ACTION service (Assisting Carers using Telematics Interventions to meet Older people's Needs) in Sweden. *Technology and Disability,* (24:3): 219-232.
#53	Martinez S., Bjerkås S., Ludvigsen AE., and Fensli, R., (2016). Agder Living Lab: From Ideas to Large-Scale Deployment and Long-Term User Adoption of Inclusive Health Solutions. In: Di Bucchianico G., Kercher P., (eds) Advances in Design for Inclusion. *Advances in Intelligent Systems and Computing*, vol 500. Springer, Cham, p. 391-399
#54	Maan C., and Gunawardana, U., (2018). Barriers in acceptance of Ambient Assisted Living technologies among older Australians. *2017 IEEE Life Sciences Conference (LSC)*, Sydney, NSW, 2017, p. 222-225.
#55	Nayar, R.
#56	Nijboer, F., (2015). Technology transfer of brain-computer interfaces as assistive technology: Barriers and opportunities. *Annals of Physical and Rehabilitation Medicine,* (58:1): 35-38.
#57	Nilsen E.R., Dugstad J., Eide H., Gullslett M.K., and Eide T., (2016). Exploring resistance to implementation of welfare technology in municipal healthcare services—a longitudinal case study. *BMC Health Services Research,* (16:1): 657.
#58	O'Neill S.A., McClean S.I., Donnelly M.D., Nugent C.D., Galway L., Cleland I., Zhang S., Young T., Scotney B.W., Mason S.C., and Craig, D., (2014). Development of a technology adoption and usage prediction tool for assistive technology for people with dementia. *Interacting with Computers,* (26:2): 169-176

#59	Oderanti F.O., and F. Li (2016). A holistic review and framework for sustainable business models for assisted living technologies and services. *International Journal of Healthcare Technology and Management,* (15:4): 273-307.
#60	Offermann-van Heek J., and Ziefle M., (2018). HELP? Attitudes towards care and assistive technologies from the perspective of people with disabilities. In: Miesenberger K., Kouroupetroglou G., (eds) *Computers Helping People with Special Needs. ICCHP 2018. Lecture Notes in Computer Science, vol 10897.* Springer, pp 552-558.
#61	Pal J., Viswanathan A., Chandra P., et al (2017). Agency in assistive technology adoption: Visual impairment and smartphone use in Bangalore. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* P. 5929-5940.
#62	Peek S.T.M., Luijkx K.G., Vrijhoef H.J.M., et al (2017). Origins and consequences of technology acquirement by independent-living seniors: Towards an integrative model. *BMC Geriatrics*, (17:1): 189
#63	Peek S.T.M., Wouters E.J.M., van Hoof J., et al (2014). Factors influencing acceptance of technology for aging in place: A systematic review. *International Journal of Medical Informatics,* (83:4): 235-248.
#64	Peek S.T.M., Wouters E.J.M., Luijkx K.G., and Vrijhoef, H.J.M., (2016). What it Takes to successfully implement technology for aging in place: Focus groups with stakeholders. *Journal of Medical Internet Research,* (18:5): e98.
#65	Pressler K.A. and Ferraro, K.F., (2010). Assistive device use as a dynamic acquisition process in later life. *Gerontologist,* (50:3): 371-381.
#66	Procter, R., Wherton, J., and Greenhalgh, T., (2018). HiddenWork and the challenges of scalability and sustainability in ambulatory assisted living. *ACM Transactions on Computer-Human Interaction,* (25:2): Article 11.
#67	Rantanen T., and Toikko, T., (2017). Employees' attitudes towards welfare technology in substance abuse treatment in Finland. *Nordic Studies on Alcohol and Drugs,* (34:2): 131-144.
#68	Robillard, J.M., Cleland, I., Hoey, J., and Nugent, C., (2018). Ethical adoption: A new imperative in the development of technology for dementia. *Alzheimer's and Dementia,* (14:9): 1104-1113.
#69	Robinson H., MacDonald B., and Broadbent E., (2014). The Role of Healthcare Robots for Older People at Home: A Review. *International Journal of Social Robotics,* (6:4): 575-591.
#70	Roe P., Gill J., Allen B., Boyle B., Heck H., Shitta G., and Laouris Y., (2011). Towards a technology transfer roadmap from the Coordination Action in R&D in Accessible and Assistive ICT (CARDIAC). *Technology and Disability,* (23:3): 171-181.

#71	Schomakers E.-M., Offermann-van Heek J., and Ziefle, M., (2018). Attitudes towards aging and the acceptance of ICT for aging in place. In: Zhou J., Salvendy G., (eds) *Human Aspects of IT for the Aged Population. Acceptance, Communication and Participation*. ITAP 2018. Lecture Notes in Computer Science, vol 10926. Springer, p. 149-169.
#72	Schulz R., Beach S.R., Matthews J.T., et al (2014). Willingness to pay for quality of life technologies to enhance independent functioning among baby boomers and the elderly adults. *Gerontologist,* (54:3): 363-374.
#73	Shaw J., Shaw S., Wherton J., Hughes G., and Greenhalgh T., (2017). Studying scale-up and spread as social practice: Theoretical introduction and empirical case study. *Journal of Medical Internet Research,* (19:7): e244.
#74	Shic F., Smith D., Horsburgh B., Hollander E., Rehg J.M., and Goodwin M., (2015). Catalysts for Change: The Role of Small Business Funders in the Creation and Dissemination of Innovation. *Journal of Autism and Developmental Disorders,* (45:12): 3900-3904
#75	Sixsmith A., Woolrych R., Bierhoff I., Mueller S., and Byrne P., (2012). Ambient assisted living: From concept to implementation. *Assistive Technology Research Series,* (30): 259-286.
#76	Singleton JL, Remillard ET, Mitzner TL, and Rogers WA., (2019). Everyday technology use among older deaf adults. *Disability and Rehabilitation: Assistive Technology,* (14:4): 325-332.
#77	Smith R.O., Scherer M.J., Cooper R., et al (2018). Assistive technology products: a position paper from the first global research, innovation, and education on assistive technology (GREAT) summit. *Disability and Rehabilitation: Assistive Technology,* (13:5): 473-485.
#78	Soar J., and Su Y., (2014). Concerns of Ageing and Interest in Assistive Technologies—Convenience Sampling of Attendees at an Aged Care Technology Exhibition in China. In: Liu K., Gulliver S.R., Li W., Yu C., (eds) *Service Science and Knowledge Innovation. ICISO 2014. IFIP Advances in Information and Communication Technology*, vol 426. Springer, Berlin, Heidelberg
#79	Steel E.J., Buchanan R., Layton N., and Wilson E., (2017). Currency and competence of occupational therapists and consumers with rapidly changing technology. *Occupational Therapy International*, (2017): 5612843
#80	Stehle C., and Albrecht-Buehler C., (2008). Developing more desirable products for stroke survivors. *Topics in Stroke Rehabilitation,* (15:2): 109-17.
#81	Sugarhood P., Wherton J., Procter R., Hinder S., and Greenhalgh T., (2014). Technology as system innovation: A key informant interview study of the application of the diffusion of innovation model to telecare. *Disability and Rehabilitation: Assistive Technology,* (9:1): 79-87.

#82	Sølling, I.K., Carøe, P., and Mathiesen, K.S., (2014). Development and implementation of IT require focus on user participation, acceptance and workflow. *Studies in Health Technology and Informatics,* (201): 219-226.
#83	Taherian S., and Davies C., (2018). Multiple stakeholder perceptions of assistive technology for individuals with cerebral palsy in New Zealand. *Disability and Rehabilitation: Assistive Technology,* (13:7): 648-657.
#84	Thielke S., Harniss M., Thompson H., Patel S., and Demiris G., and Johnson K., (2012). Maslow's Hierarchy of Human Needs and the Adoption of Health-Related Technologies for Older Adults. *Ageing International* 37(4), p. 470-488.
#85	Van Den Heuvel E., Jowitt F., and McIntyre A., (2012). Awareness, requirements and barriers to use of Assistive Technology designed to enable independence of people suffering from Dementia (ATD). *Technology and Disability,* (24:2): 139-148.
#86	Van Heek J., Ziefle M., and Himmel S., (2018). Caregivers' perspectives on ambient assisted living technologies in professional care contexts. *ICT4AWE 2018—Proceedings of the 4th International Conference on Information and Communication Technologies for Ageing Well and e-Health*
#87	Vishwanath A., Brodsky L., Shaha S., Leonard M., and Cimino M., (2009). Patterns and changes in prescriber attitudes toward PDA prescription-assistive technology. *International Journal of Medical Informatics,* (78:5): 330-339.
#88	Vichitvanichphong S., Talaei-Khoei A., Kerr D., and Ghapanchi A.H., (2014). Adoption of assistive technologies for aged care: A realist review of recent studies. *2014 47th Hawaii International Conference on System Sciences,* Waikoloa, HI, p. 2706-2715.
#89	Ward, G., Fielden S., Muir H., Holliday N., and Urwin G., (2017). Developing the assistive technology consumer market for people aged 50-70. *Ageing and Society,* (37:5): 1050-1067.
#90	Weegh, H., and M. Kampel (2015). Acceptance Criteria of Ambient Assistant Living Technologies. *Studies in Health Technology and Informatics,* (217): 857-864.
#91	Wherton J., Sugarhood P., Procter R., Hinder S., and Greenhalgh T., (2015). Co-production in practice: How people with assisted living needs can help design and evolve technologies and services. *Implementation Science,* (10): Article 75
#92	Wisniewski, P., Linton C., Chokshi A., Perlingieri B., Gurupur V., and Gabriel M., (2019). We have built it, but they have not come: Examining the adoption and use of assistive technologies for informal family caregivers. In: *Advances in Usability, User Experience and Assistive Technology*. Eds. Ahram T., Falcão C., Springer, p. 824-836.

#93	Wu, Y.-H., Cristancho-Lacroix, V., Fassert, C., Faucounau, V., De Rotrou, J., and Rigaud, A.-S., (2016). The Attitudes and Perceptions of Older Adults with Mild Cognitive Impairment Toward an Assistive Robot. *Journal of Applied Gerontology,* (35:1): 3-17.
#94	Wu, Y.-H., Damnée, S., Kerhervé, H., Ware, C., and Rigaud, A.-S., (2015). Bridging the digital divide in older adults: A study from an initiative to inform older adults about new technologies. *Clinical Interventions in Aging,* (10): 193-200.
#95	Yusif, S., Soar, J., and Hafeez-Baig, A., (2016). Older people, assistive technologies, and the barriers to adoption: A systematic review. *International Journal of Medical Informatics,* (94): 112-6.
#96	Zhang, S., McClean, S., Nugent, C., O'Neill, S., Donnelly, M., Galway, L., Scotney, B., and Cleland, I., (2014). Prediction of assistive technology adoption for people with dementia. *IEEE Journal of Biomedical and Health Informatics,* (18:1): 375-383.
#97	Zwierenberg, E., Finnema, E., Dijkstra, A., Hagendoor, M., and Sanderman, R., (2017). Diffusion of assistive technology among older people: A case of the House of the Present. *Gerontechnology,* (16:4): 227-233.

Appendix 2: Concept matrix of identified concerns in included studies

Articles		*User level*				*Organizational level*				*Market level*				*Policy level*			
		User acceptance		Primary adopters		Implementation		Decision making		Product type		Business focus		Gov. participation		Policy focus	
		Technology intrinsic drivers	Contextual drivers	Care recipients	Care givers	Artifact-driven	System-driven	Centralized	Decentralized	Mainstream products	Niche-products	Business models	Marketing	Passive / facilitating	Active / entrepreneurial	Technology push	Demand-pull
#1	Barlow and Venables (2004)						X			X							X
#2	Batt-Rawden et al. (2017)		X		X			X									
#3	Bauer et al. (2014)					X			X								
#4	Björk (2009)									X							
#5	Blackburn and Cudd (2012)										X						
#6	Blackman (2013)									X							
#7	Bouwhuis (2016)						X			X		X				X	
#8	Bygstad and Lanestedt (2017)													X			
#9	Chaurasia et al. (2016)		X	X													
#10	Churchill and Hoogerwerf (2013)				X	X											
#11	Cimperman et al. (2013)	X		X													
#12	Clark and McGee-Lennon (2011)	X				X			X								
#13	Connelly et al. (2014)	X															
#14	Consel et al. (2015)	X								X						X	

#15	Cook et al. (2018)				X												
#16	Cook et al. (2016)		X														
#17	Copley and Ziviani (2004)				X	X											
#18	Cozza (2018)						X		X								
#19	Damodaran and Olphert (2010)	X															
#20	Deibel (2013)		X														
#21	Devlin et al. (2016)						X	X									
#22	Dorsten et al. (2009)		X														
#23	Doughty and Williams (2016)		X														
#24	Draffan et al. (2015)								X								
#25	Feldwieser et al. (2016)	X		X													
#26	Fernando et al. (2010)		X														
#27	Ferri (2015)														X		
#28	Fischer et al. (2014)	X		X													
#29	Garg et al. (2014)	X		X													
#30	Gillham et al. (2017)	X				X											
#31	Glende et al. (2016)	X											X				
#32	Godwin (2012)		X														
#33	Hall et al. (2017)					X			X								
#34	Hartley et al. (2010)		X														
#35	Hirani et al. (2017)		X														
#36	Ienca et al. (2018)														X	X	
#37	Jamwal et al. (2018)		X														
#38	Judge and Parette (1998)		X		X												
#39	Kamesawa et al. (2018)			X	X												
#40	Karlsson et al. (2017)					X											

#41	Koimizu et al. (2018)															X	
#42	Kötteritzsch and Weyers (2016)						X										
#43	Lane (2015)																X
#44	Lane (2012)														X		
#45	Lane (1999)								X	X							
#46	Lane (1997)												X		X		
#47	Lane et al. (2003)														X		
#48	Layton et al. (2018)												X				
#49	Linskell and Bouamrane (2012)						X										
#50	MacLachlan et al. (2018)											X			X	X	
#51	MacLachlan and Scherer (2018)						X										
#52	Magnusson and Hanson (2012)				X		X					X		X		X	
#53	Martinez et al. (2016)														X	X	
#54	Maan and Gunawardana (2018)			X													
#55	Nayar (2017)				X	X											
#56	Nijboer (2015)	X															
#57	Nilsen et al. (2016)		X						X								
#58	O'Neill et al (2014)				X												
#59	Oderanti (2016)											X					
#60	Offermann-van Heek and Ziefle (2018)		X	X													
#61	Pal et al. (2017)		X	X						X							
#62	Peek et al. (2017)		X														
#63	Peek et al. (2016)								X		X			X			
#64	Peek et al. (2014)		X														
#65	Pressler and Ferraro (2010)		X														
#66	Procter et al. (2018)						X		X		X						
#67	Rantanen and Toikko (2017)		X			X											

#68	Robillard et al. (2018)								X								
#69	Robinson et al. (2014)	X		X													
#70	Roe (2011)															X	
#71	Schomakers et al. (2018)		X	X													
#72	Schulz et al. (2014)											X					
#73	Shaw et al. (2017)						X		X								
#74	Shic et al. (2015)											X				X	
#75	Singleton et al. (2018)			X						X							
#76	Sixsmith et al. (2012)															X	
#77	Smith et al. (2018)							X				X		X			
#78	Soar and Su (2014)		X														
#79	Steel et al. (2017)				X								X				X
#80	Stehle and Albrecht-Buehler (2008)									X							
#81	Sugarhood et al. (2014)						X				X						
#82	Sølling et al. (2014)		X				X	X							X		
#83	Taherian and Davies (2018)					X				X							
#84	Thielke et al. (2012)		X														
#85	Van Den Heuvel et al. (2012)												X				
#86	Van Heek et al. (2018)		X		X												
#87	Vichitvanichphong et al. (2014)		X														
#88	Vishwanath et al. (2009)							X									
#89	Ward et al. (2017)	X											X				
#90	Weegh and Kampel (2015)		X														
#91	Wherton et al. (2015)						X		X				X				
#92	Wisniewski et al. (2019)				X				X		X						X
#93	Wu et al. (2016)		X														

#94	Wu et al. (2015)									X							
#95	Yusif et al. (2016)	X															
#96	Zhang et al. (2014)				X												
#97	Zwierenberg et al. (2017)												X				