

The Implementation of Welfare Technology in Municipal Care: A Qualitative Study of Procurement Practices in Sweden

Sanna Kuoppamäki (✉ sannaku@kth.se)

Royal Institute of Technology

Research Article

Keywords: Welfare technology, implementation, procurement, municipalities, competence

Posted Date: June 1st, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-558504/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: Welfare technology has been launched as a concept to accelerate digital transformation in care services, but the implementation of these technologies is still hindered by organisational resistance, lack of infrastructure, and juridical and ethical issues. This paper investigates the decision-making among municipal actors in the implementation of welfare technology in a specific task that is procurement. The study explores the perceptions and negotiations in purchasing welfare technology in each stage of the procurement model revealing the impact of technical, economic, juridical and ethical competence on the mapping and planning, procurement, implementation and management of welfare technology.

Methods: The study presents empirical findings from a qualitative interview study for municipal actors in Sweden. Semi-structured interviews were gathered among procurement managers, IT managers, and managers in social administrators in three different municipalities in 2020 (N=8). Inductive content analysis and systematic categorisation were employed resulting to 17 sub-categories, 9 generic categories and 3 main categories of procurement practices.

Results: Challenges in the procurement practices occur in all stages of the procurement model. In mapping and planning, municipal actors outline barriers the need analysis, requirement specification and market analysis. In procurement stage, economic resources, standardisation and interoperability hinder the procurement process. Implementation and management is complicated by supplier assessment, legislation, cross-organisational collaboration and political strategy. Building on these findings, the study defines the procurement competence to consist of technical, economic, juridical and ethical expertise to assess and evaluate welfare technology. Technical and ethical competence is needed in early stages of the procurement, whereas juridical and economic competence relates to later stages of the model.

Conclusions: Procurement competence is associated with the implementation of welfare technology in 1) assessment of the end-users needs, 2) estimation of the costs and benefits of welfare technology, and 3) management of the juridical and legislation issues in data management. Economic and juridical decisions to purchase welfare technology are not value-neutral, but rather associated with socially shared understandings of technological possibilities in care provision. Optimisation of procurement process requires a combination of capabilities to implement welfare technology that meet the demands and needs of end-users.

Introduction

Digital transformation and the uptake of welfare technology in care services is expected to improve the quality and cost-effectiveness of care provision. The implementation of these technologies in municipal care is still hindered by many factors, ranging from lack of infrastructure and insufficient resources to juridical and ethical issues [10, 17, 20, 37]. Welfare technologies, providing assistance in practical tasks, health monitoring, remote treatment and rehabilitation for older adults or persons in a risk of disability,

are launched as a solution to optimise the provision of care work, such as support care delivery and performance of care related tasks [17, 18, 21]. These health systems, embodied in variety forms of technologies ranging from safety alarms, night monitoring, digital surveillance and sensor and movement detectors to assistive robots and exercise apps, aim increase the safety, autonomy and independence for older adults, resulting to patient empowerment and improved professional practices in health and social care [28].

Research has acknowledged several reasons for the low uptake of welfare technology in municipal care. Welfare technology gathers a heterogeneous group of technologies that introduce technologies in new areas, such as home care services in private homes. These technologies adopted and used by a diverse group of end-users, from older adults to informal and formal care providers [27] and patients with dementia or intellectual disabilities or cognitive impairments [37]. The implementation of these technologies raises ethical debates on surveillance, quality of life and assessment of the benefits of welfare technology to different stakeholders [9, 10, 27]. The implementation entails adjustments at the individual and organisational level, often resulting to several forms of resistance [32, 37, 41]. Adopting and using welfare technologies in care practices contests new ways of working, changes in professional roles and identities, requiring new types of skills and competences among the health care professionals [24]. Participatory design methods have been applied to augment the implementation of welfare technology in care settings [25, 43].

Municipalities are responsible for purchasing welfare technology to care services that often follows a standardised structure of public procurement in Sweden [6, 20]. The procurement, defined as a process in which authorities and other public actors purchase goods, services and public works, can significantly delay or complicate the implementation of welfare technology. Procurement of welfare technology gathers different actors, procurement administrators, health care professional and suppliers in the complex task of requirement specification, where technological identities of medical devices are socially constructed and negotiated between different actors [2]. Diffusion and innovation of new medical devices is governed by socio-technical processes, and negotiated logics between health care professionals and administrators in their conversations of diffusion of innovations [47, 48, 49]. Purchasing welfare technology also requires a set of managerial and technical skills, ranging from communication, problem-solving, teamwork, cost analysis and persuasion [30].

Against this background, this paper investigates the complexities of decision-making among municipal actors in the task of purchasing welfare technology for digital transformation in care services. Based on qualitative interviews for municipal actors in Sweden, the study analyses how municipal actors negotiate and interpret barriers and enablers of procurement practices in relation to their skills and competences of purchasing welfare technology. Building on these findings, the study conceptualises the procurement competence to address the different layers of knowledge and expertise required during implementation of welfare technology. As a conclusion, the study discusses how purchasing welfare technology entails socio-technical understandings of the need assessment, cost-benefit analysis and juridical and legislation issues that often are interpreted and negotiated in a specific cultural context.

The paper begins with introducing welfare technology and procurement practices in municipal care. This is followed by a presentation of qualitative approach to procurement practices, based on semi-structured interviews for procurement managers in municipal care. The result section presents the complexities in the decision-making in each stage of the procurement model, resulting to definition of procurement competence as economic, technical, juridical and ethical skills to assess, evaluate and conduct procurement of welfare technology.

Background

Welfare technology in municipal care

Welfare technology has been launched as a concept to describe the digital transformation and health system changes in the Nordic countries [5, 6, 9, 10, 17-20]. Welfare technologies are assistive technologies providing physical, social and cognitive assistance for older adults and persons in a risk of disability, with a purpose of increasing safety, participation and independence, together with improving care delivery and working environment of health care professionals [20, 39]. These technologies include various forms of digital devices from care robots [4, 35], telecare and alarms [29, 49], monitoring systems [3, 26], digital reminders [8] and mobile health applications [12, 34]. Welfare technologies embody devices such surveillance cameras, key-free locks, GPS alarms, virtual doctors, security bracelets and mobile access to patient documentation and digital signing of medication [20], aiming to offer care at a distance, and new divisions of labour and responsibility [28].

The implementation of new technical solutions to care practices is not linear process, and many factors hinder the adoption, use and implementation of welfare technology in municipal care [51]. The implementation of new technological innovations entails changes in health care professionals' work, tasks, roles identities and relationships, which requires management and technological leadership in organisations. Adopting and using care robots, for instance, influences work atmosphere, meaningfulness of work and professional development of care professionals, such as need for orientation, problems with time usage and overall attitudes towards renewing of care service [35]. Confrontations that older adults and their care providers need to phase may include technical incompatibilities, professional identities and roles, lack of orientation and fears [40]. For this reason, technology implementation is increasingly becoming co-produced, and the testing and deployment is often conducted in collaboration between technology developers and customers. Implementing new technologies encounters different types of organisational, cultural, technological and ethical resistance. This may include, for instance, resistance to change established routines, resistance due to language differences, clash of professional cultures, resistance due to patient safety, concerns on quality of care, patient privacy, dignity and justice [37].

In the Nordic countries, municipalities carry the responsibility to organise, manage, procure and implement welfare technologies [6, 18]. The implementation of welfare technology in municipal care is

influenced by a variety of structural factors such as procurement legislation, political directives, available resources and competence [17]. According to Socialstyrelsen [44], in 2018 the majority (78 %) of the Swedish municipalities had implemented safety alarms for older people living at home; in 2019 the number had risen to 86 %. Other welfare technologies, such as medication reminders, were implemented by one third (35 %) of the municipalities in 2019, also showing a rising trend from previous years. Especially GPS-alarms and night monitoring systems are still less implemented. In practice, municipalities show a great variance in the implementation and procurement of welfare technology: some municipalities are innovative, testing state-of-the-art innovations, and other municipalities have implemented only the most common welfare technology such as safety alarms [44]. Even though the utilisation of welfare technology is increasing, most of welfare technologies have still remained as test and pilot services [11].

Procurement of welfare technology

Public procurement has been recognised as an important instrument of innovation policy [23, 33, 48]. Procurement is a process where authorities and other public actors purchase goods, services, and public works for the purpose of innovation and diffusion of new technologies. This has the potential to push innovation based on both supply and demand of new technologies [13]. The procurement process is defined in Swedish Public Procurement Act to ensure that public procurement is based on equality, non-discrimination, openness, mutual recognition and proportionality [31]. Additionally, a number of policy documents and recommendations guide the procurement process at the European level [15].

Procurement is a stage that often delays and hinders the implementation of welfare technology [5, 6, 17]. Nordic countries have developed guidelines and recommendations for the procurement of welfare technology [6, 38]. One of these guidelines is the procurement model created by the National Agency for Public Procurement. The model consists of three chronological steps. The preparation phase (1) includes planning, mapping and analysing the need and the market for the technology to be procured. The municipal actors need to identify and recognise the need for the welfare technology, and map out relevant suppliers in the field. This is followed by the procurement phase (2). Municipalities choose either direct procurement or the public procurement, based on the value of the procured welfare technology, resulting to an agreement between supplier and the municipality. The realisation phase (3) includes implementing and managing the procurement of welfare technology by reviewing the delivery.

Procurement process involves many actors from different organisational levels, which make it a resource-demanding practice that complicates the implementation of welfare technology [20]. Barriers and challenges that prevent a well-functioning procurement process are derived from the organisational structures, mechanisms and processes [2, 45]. An important factor is the interaction between procurers and suppliers. Suppliers often lack feedback from procurement managers on previous bids, and therefore they have limited possibilities for improving their capability. Procurement managers show a low interest

in suppliers' experience as a private sector deliverer, and suppliers often have difficulties in initiating a dialogue with the procurer in the procedures and conditions [48].

Purchasing welfare technology requires a set of managerial and technical skills, ranging from communication, cost analysis, teamwork, problem-solving, negotiation and persuasion [30]. Research has acknowledged that procurement managers often have low competence and limited expertise in conducting complex purchases [22]. This lack of competence hinders the innovation diffusion [14, 22, 23, 36, 48]. The lack of skills and expertise can result to insufficient communication between potential suppliers and procurement actors. Procurement process compiles a variety of actors who are influenced by social processes, such as negotiations, values and ideals of welfare technology [2, 18, 47]. To date, research has shown a connection between the procurement results and the competence within those performing the procurement, but no studies have defined or covered the characteristics of procurement competence of welfare technology in detail. Based on this research gap, the study investigates different dimensions of procurement competence and aims to evaluate its impact and connection on the implementation of welfare technology in municipalities.

Methods

Data and participants

The study reports findings from a qualitative interview study conducted among municipal actors in three municipalities in Sweden. Data consists of qualitative interviews for 8 municipal actors, including procurement managers, IT development managers and managers in social administration (Table 1). The municipalities were selected based on their recent experience in procuring welfare technology: all participants had recently been involved in the procurement of welfare technology. Participants were recruited by sending an e-mail invitation to municipal actors. Interviews were conducted as face-to-face interviews or phone interviews during spring 2020 [11].

Data collection was carried out in accordance with guidelines and regulations from Swedish Ethical Review Authority. All participants gave an informed consent for the participation in the study. The study did not collect any personal or sensitive information from the participants, nor involved any physical intervention, and therefore an ethical approval from the Swedish Ethical Review Board was not needed [46]. To protect participants' privacy, all data is anonymised, and all identifiers have been removed from the data.

Table 1
Data characteristics

Municipality	Participant (N = 8)	Type of interview
Municipality 1	Procurement manager (2)	Pair interview (face-to-face)
	IT manager (1)	In-person interview (face-to-face)
Municipality 2	Project manager (2)	Pair interview (face-to-face)
Municipality 3	Manager in social administration (2)	In-person interview (phone)
	IT manager (1)	In-person interview (phone)

The interview process followed the principles of qualitative semi-structured interviews. A set of interview questions were designed based on findings from previous literature regarding procurement process and welfare technology. Additional questions were asked whenever the interviewers felt that more detailed information could be extracted. The purpose of the interviews was to create an environment where municipal actors felt comfortable in sharing their perceptions of the challenges and problems in the procurement process. Each interview lasted approximately 60 minutes. All interviews were recorded and transcribed. A saturation method was used in each interviews: when the interviewers perceived that all relevant information was extracted, the interview session ended [42].

Data analysis

Transcriptions were analysed with a qualitative content method used for written or visual information with the goal of producing valid inferences from the collected data [7]. Inductive content analysis with a systematic categorisation was employed as specific analytical tool to draw categories, sub-categories and main categories from the collected data. The interpretation of data was performed with regard to research questions 1) what are the challenges of procurement of welfare technology outlined by municipal actors, and 2) to what extent these challenges can be associated with procurement competence in each stage of the procurement model.

In the first phase of the analysis, all transcriptions were read through. The relevant data extractions providing answers to research questions were coded with meaning units in each transcript. A list of all codes in connection with the meaning units were created to minimise the risk of perceptual change of the meaning units. In accordance with the inductive approach, the list was formed throughout the analysis. In the second phase, after the final meaning units were identified, the texts were read once again to check that all data has been accurately included. In the third phase, meaning units were condensed to sub-categories (N = 17), generic categories (N = 9) and main categories (N = 3). The final phase consisted of the summarising the extracted data in a way that was presentable for the reader. Appropriate meaning units were presented as quotations in the text, and a summary of all the main categories and sub-categories were presented in the Table 2.

Results

This section gathers the findings on how municipal actors perceive the barriers and challenges of the procurement in different stages of the procurement model. Planning and mapping consists of the decision-making in the need and market analysis and requirement specification. Procurement stage gathers economic resources, need for standardisation and interoperability. Implementation and management refers to supplier assessment, cross-organisational collaboration and political strategy. Building on these findings, a framework for procurement competence is presented, consisting of technical, economic, juridical and ethical competence.

Table 2
Challenges of the procurement practices in different procurement stages

<i>Procurement stage</i>	<i>Generic category</i>	<i>Sub-category (data extraction)</i>
Planning and mapping	Need analysis	Difficult to meet the end-users needs Ethical issues on privacy Acquisition is not demand-centered Need analysis is not done systematically
	Requirement specification	Difficult to set functional requirements for design Specifying requirements requires skills
	Market analysis	Difficult to select a right product and supplier Procurement is not governed by end-users needs
Procurement	Economic resources	Lack of financial resources
	Standardisation	Lack of national strategy to implement welfare technology Lack of standardisation Lack of integration of welfare technology products Health care responsibilities differ between municipalities
	Interoperability	Requirement for interoperability restricts the amount of suppliers
Implementation and management	Supplier assessment	Difficult to find a suitable supplier
	Cross-organisational collaboration	Need to hire external technical competence
	Political strategy	Lack of political strategy

Planning and mapping

Need analysis

Procurement process is regulated in the procurement legislation, but each individual municipal actor performs each procurement decision based on individual consideration. This individual decision-making is practiced particularly in the early stages of the procurement process. The individual decision-making in the *need analysis* was pronounced as difficulties to meet end-users demands and to specify the requirements. Requirements of ethical aspects for technology design are particularly difficult to fulfill, as patients set more demands than they are able to deliver technically:

You make more and more demands as a patient, than we are able to deliver technically to them. The procurement does not say so, but it comes more as a demand from the end users, or those we are trying to help.

Ethical aspects were perceived important when welfare technology was procured for dementia patients or patients with cognitive disabilities. The storage of data was considered problematic in the cases of GPS alarm and sensor cameras that gather and collect patients' personal data. Ethical requirements were also sometimes contradicting with functional requirements. Even though welfare technology can fulfill the functional requirements, it can contradict with the patient's autonomy. In most cases, ethical decisions in the procurement are left for procurement managers to solve:

There are a lot of ethical problems. (–) We have this with consent. It is very difficult to get consent from people with dementia. The night camera. Shall we look at them while they are lying there sleeping? The safety requirements are also raised when changing with new technology.

Most participants recognised the importance of need analysis in the procurement process, but they still lacked the routine of doing it in a systematic manner. Need analysis was either based on informal inquiries for health care professionals or their managers, or asking their informal opinions on technological solutions in particular occasions. In each case, municipal actors had little or no guidelines to when and how they should analyse the needs of end-users of welfare technology. Usually need analysis was based on occasional questions of the importance of technology, current practices and role at work, and what kind of needs have been raised in their current situations. Particularly home care professionals were considered a user group that municipal actors had little or no access to:

Yes we do (the need analysis), but maybe not as systematically as we should. (–) Either I ask them (health care professionals) to raise the issue further with their managers to come back, that I send with which issues I want them to listen to the employees and ask.

Requirement specification

During the need and market analysis, municipal actors conduct a *requirement specification* that is defining the technical framework and other requirements for the procured product. This demands a good level of knowledge in technical and ethical requirements, but also in design and usability of welfare technology. Welfare technology needs to be attractive and easy to use for the end-users, but definitions of

good design vary. Requirement specification itself was considered difficult, and demand both economic, technical, juridical and ethical competence:

But if we make a requirement, then this supplier will not be able to deliver. There had been two different providers, one has a cloud service and the other could put it on servers locally. If we want it to be installed locally", and put it as a must-requirement, but that solution may be a million more expensive. Then we must know that we need to make this a should-have requirement.

Market analysis

The competence to set the requirements is derived from the technical knowledge and understanding different functions of welfare technology. Technical competence is particularly relevant in the *market analysis* that refers to knowledge on the relevant suppliers. Knowing which supplier can deliver solutions that fulfill the technical demands is a central aspect of the competence on market analysis. Another aspect is the *cost-benefit analysis*, where financial costs of welfare technology need to be carefully considered and optimised in relation to existing benefits. Municipal actors need to have the knowledge on technical requirements to be able define how much it is reasonable to pay for different technological functions, and whether or not it is feasible to invest additional financial resources for specific technical solutions. This evaluation indicates the optimisation of solutions between market and needs, so that requirements can be set in an optimal way. Requirement specification thus combines aspects of both technical and economic competence, where these requirements need to be evaluated from the perspective of end-users and relevant suppliers. The market for welfare technologies are considered broad, which sets a high demand of market knowledge for the procurement managers: *'We know roughly what we want. But I cannot say that I know what the market can offer because we do not actually do it (the market analysis) in this case.'*

In some cases, the shortages in the need and market analysis resulted to procuring welfare technology that is not based on end-users needs. Municipalities may procure welfare technology based on interests and opportunities, even if these technologies do not necessarily fit the end users' needs. Particularly those municipalities that had good financial resources were driven by an interest to explore new technological solutions. As a result, the evaluation of end-user needs is receiving less attention in the decision-making:

Yes, some of us are very aware of that (procurement is governed by technical possibilities rather than real needs). With the help of technology, we can measure the heart rate of the person lying down and sleeping and see that it really is alive. (–) But do we need it?

Procurement stage

Economic resources

Many municipal actors stated the lack of economic resources as a main reason for not procuring welfare technology: *'There may be great systems but they are too expensive, so it is almost impossible to use them from an economic perspective even if you see that this has good potential'*. The question of

economic resources was seen as a political question. In Sweden, politicians of each municipality guide the decisions on resource allocation, which can significantly influence on the economic resources that are available for elderly care. Economic resources influenced financial capabilities to procure certain technology, but also opportunities to develop *procurement competence* of welfare technology:

It is about competence because when we may have too many handling errors, it can also contribute to why the technology does not work, so it has absolute competence as well. And it's about financial resources again, because it costs money to develop the skills of staff.

Standardisation

Procurement competence was primarily associated with technical competence: understanding technical requirements and possibilities of welfare technology. Participants discussed the need to develop a national strategy to standardise and systematise the procurement process. Current national strategies focus on the procurement process from the legislation perspective, but often lack guidelines to implementation of welfare technology. While the welfare technology is expected to improve the working environment of health care professionals and increase the independence and autonomy of end-users, the concrete strategy on how to make use of welfare technology in elderly care was perceived as insufficient:

When the municipalities procure services in elderly care, it feels as if there is no national or strategic thought about how we should go from where we are today to where people talk about wanting to be. Therefore, the procurement competence involves the skills, knowledge and understanding of the utilisation of welfare technology in an optimal way. This requires understanding care practices and demands for person-centered care among health care professionals. Understanding technical requirements for welfare technology is crucial for being able to select the right type of technology, but in the implementation phase, the understanding of health care practices is needed to utilise the possibilities of welfare technology. For instance, with certain technological functions, welfare technology can be used for monitoring the patient, but to optimise the potential of welfare technology, it should be used to improve the overall well-being of the patient in a more individual and patient-centered way:

Municipalities must learn to work with the information that different products on the market provide, rather than just the function. Instead of taking a person's weight every second to see when a person dies, you can use that information to study the person's movement patterns to see if any other medicine is needed.

From the organisational perspective, many challenges of the procurement of welfare technology can be associated with governmental aspects, including the juridical, legislation and political issues of organising and providing elderly care. The municipalities, guided by politicians in municipalities, obtain different level of responsibility to organise health and medical care responsibility for home care. Some municipalities are responsible for providing health services as a part of home care, and this directly influences on the procurement decisions: *'There are products, e.g. medical reminders where studies show that user organisations save SEK 40,000 per older adult in a year. But there is no interest in municipalities that do not have the health care responsibility to procure such welfare technology.'*

Interoperability

Juridical issues and legislation complicate the process of procurement due to data management issues and General Data Protection Regulation (GDPR) regulations. Difficult situations can occur when public procurement procedures need to be followed even though only one supplier can deliver a solution, which makes the process time-consuming and inefficient. A specific juridical problem was the *requirement for interoperability* that refers to compatibility between old and new technical systems and their ability to interact. The new technical system needs to fit with other technical systems, which can limit the suppliers:

Requirements for interoperability limit the number of suppliers. (-) A limited number of suppliers means that the entire legal part of the procurement, where suppliers must submit tenders and the best price must win, becomes an unnecessary and time-consuming process. It is often only one supplier who will be able to deliver the required solution in the end.

In a 'niche' market like welfare technology, the bureaucratic procurement legislation makes it time-consuming to procure an already established welfare technology. The procurement process is based on the assumption that municipal actors go to the market, specify the needs and requirements for welfare technology, and choose the best supplier that can deliver a product based on specific needs. However, in many cases there is only one supplier that can deliver the required technical solution, but the procurement process needs to be followed according to certain legislation. More flexibility is thus needed to meet the needs of municipal elderly care, and avoid unnecessary delay:

We know that only this supplier will be able to deliver the product we demand. (-) But we still need to do a public procurement to follow the rules, and then this whole procurement procedure becomes more of a bureaucratic chimera, and this becomes a hinder and a frustration in a way.

Implementation and management

Supplier assessment

Procurement practices of welfare technology were also influenced by cross-organisational mechanisms, which refers to the collaboration between municipalities and suppliers. The most important collaboration typically occurs between the municipality and the supplier, but the collaboration between different municipalities is also significant in terms of sharing knowledge, best practices and new opportunities for welfare technology. In the collaboration between the municipality and the supplier, municipal actors articulated the difficulties to find a suitable supplier due to the 'niche' market of welfare technology. In many cases, the municipalities need to choose the most suitable supplier from four or five options, sometimes settling for the 'least worst' supplier: *'There is no flawless supplier. It's a lot (about) – to make sure the supplier does what you want them to do. There is no perfect supplier who knows everything, but it is important to try to find the ones that are the least worst'*.

The procurement competence involves good skills and knowledge of the market analysis, and communication with the relevant suppliers. When municipalities research for the suppliers, they often

have to deal with a diversity of companies who offer a different set of technical systems and products. Municipal actors perceive it as challenging that start-up companies do not have the knowledge of municipal needs, which makes the communication with suppliers difficult. Municipalities need to set specific requirements for the procured technology, which also limits the amount of suppliers: *'We demand a system that is very good to integrate with our business system, and considering that we have it as the basic requirement, it will only be the same supplier who has our business system'*. Once the municipal actors have established a contact with the supplier, the communication and with the suppliers works fluently. Establishing contacts with certain suppliers optimises the procurement process.

Cross-organisational collaboration

Collaboration between different municipalities and outsourcing activities such as market analysis can help to optimise the procurement process in terms of knowledge sharing on market analysis and technical competence. Municipalities can reach out to other municipalities to consult in the market analysis and requirement specification, and to strengthen the procurement competence within one municipality. The knowledge of the relevant suppliers and technical requirements is changing fast and it needs to be updated, and effective communication between municipalities can help with knowledge transformation:

We wanted this consultant to bring in a competence that was good in understanding what requirements could be set. And you can not have such competence in a municipality. It becomes obsolete again, after a few years.

Political strategy

The collaboration between municipalities can nevertheless be hindered by the lack of existing political strategies to cross-organisational collaboration. The standardisation of procurement practices is needed for the companies and suppliers to offer certain products for the market: *'Standard, so there must be national standards. These companies we work with would be very happy and say "Yes but it is this standard that should be run, and this applies for 20 years'*. Political strategies to improve standardisation would also help municipal actors to solve some of the juridical and ethical issues regarding data management and GDPR; storage of personal information that many welfare technologies such as sensors or cameras gather. Standardisation is derived from the political strategy to implement welfare technology in each municipality. Political decisions in each municipality affect the investment budget, but they also affect ambitions and priorities in municipalities to organise care activities. Municipal actors mentioned the Scandinavian model in Norway and Denmark as a good alternative, where the implementation of welfare technology is more standardised, and each municipality has less political influence on strategies of welfare technology.

Procurement competence of welfare technology

This section presents four different dimensions of the procurement competence based on challenges and barriers of the procurement process in each stage of the procurement model. The dimensions of

procurement competence were formed based on the analysis of procurement challenges with regard to the type of skills, knowledge and capabilities pronounced by municipal actors. The capability approach to procurement process has identified higher and lower level procurement capabilities [16] and a set of purchasing skills [30]. Lower level functional capabilities include tasks such as distribution, logistics, and marketing conducted at the individual level, while higher-level dynamic capabilities enable the change, renewal and transformation of existing capabilities to create new products and services at the organisational level [36]. Welfare technology, procured at the municipal sector, has its own requirements for competence that here is defined as technical, economic, juridical and ethical competence.

Technical competence refers to the understanding of the technical requirements of welfare technology in the planning and mapping stage of the procurement model. Data analysis has shown the difficulties in requirement specification regarding welfare technology. This technical competence can be defined as a knowledge of the usability, design and functional requirements of welfare technology. *Economic* competence involves knowledge of conducting the market analysis, recognising relevant suppliers and conducting financial decisions. Economic competence is needed particularly in the procurement stage where financial decisions need to be made based on cost-benefit analysis with a limited amount of financial resources available. *Juridical* competence refers to knowledge on legislation and juridical issues to conduct the procurement of welfare technology in a systematic and standardised way that take into consideration the requirement for interoperability and data management. *Ethical* competence relates to need analysis such as recognising and understanding the needs of end-users in early stages of the procurement model, and evaluating the benefits of these technologies for the end-users.

Discussion

The study has investigated the implementation of welfare technology in municipal care with regard to procurement practices of welfare technology. The study has explored individual decision-making in each stage of the procurement model with a focus on planning and mapping, procurement and implementation and management stages of the procurement process. The study complements previous studies on implementation of welfare technology by focusing on the procurement task of welfare technology, which has received little attention in previous research [10, 19, 20, 24, 28, 37]. Additionally, the study adds to literature on procurement practices by describing and defining skills and competences needed in the procurement of welfare technology [2, 23, 30, 45, 48, 49]. To conclude these findings, the study presents the following implications on the procurement of welfare technology to highlight the association between procurement competence and its outcomes.

Assessment of the end-users' needs

Procurement of welfare technology is a specific procurement practice with regard to the user group of this technology. The end-users of welfare technology are typically older adults in a risk of disability, and therefore welfare technology may be used by older adult and their informal or formal caregiver [17, 20]. In these complex care situations, the evaluation and assessment of the end-users need becomes a difficult

task, sometimes involving conflicting interests and needs between different older adults and their care providers. In mapping and planning phase of procurement of welfare technology, the evaluation of end-users' needs is often based on occasional and informal inquiries, without a clear systematisation of the standards of these end-users needs. Therefore, the technical and ethical competence of procurement of welfare technology, that relates to the understanding both the technical requirements and the ethical implications of welfare technology to care practice, can impact particularly on how the end-users needs are evaluated and whether or not they are sufficiently taken into consideration in the procurement process. Assessment of the end-users need can influence particularly on the type of welfare technology that is procured with regard to identification of end-users needs and its translation into requirement specification [23].

Estimation of the costs and benefits of welfare technology

Procurement of welfare technology involves a decision-making with often limited economic resources [45]. Technical and economic competence is required to evaluate the costs and benefits of welfare technology for a technically and economically optimised solution. Based on the research findings, technical and economic competence can influence the outcomes of procurement particularly in selecting the relevant supplier. Often the options to find a suitable supplier are nevertheless limited, and the implementation of welfare technology may be affected by supply-side of procurement and the type of welfare technologies that currently are available on the market [23]. A cost-benefit estimation that includes skills such as cost management, cost control and cost analysis [30] can nevertheless influence on the scope and breadth of procurement. Whether or not welfare technology is seen as a long-term investment for the municipal care, or a short-term pilot test is influenced by cost-benefit analysis of welfare technology, and the ability to estimate these in a trustworthy manner.

Although the estimation of costs and benefits is based on economic and financial skills and competences, this estimation is often associated with social and cultural understandings of the benefits of welfare technology and elderly care. The study addresses that the estimation of costs and benefits is not value-neutral but rather tied to the cultural understandings and negotiations of the needs of older adults or a persons in a risk of disability and the benefits that that welfare technology can provide [2, 19]. In Sweden, as well as other Nordic countries, care provision is influenced by a social norm of independency and autonomy [1]. Welfare technology fits well and advances the policy initiative of ageing in place: older adults' abilities to live independently in their homes longer [39]. At the same time, however, a social norm for autonomy could complicate the decision-making for allocating more financial resources to municipal elderly care. From the economic perspective, financial investments for elderly care may be difficult to prioritise at the political level, which could reduce the long-term uptake for welfare technology.

Management of the juridical and legislation issues

Procurement of welfare technology is a juridical process that is also guided by national and international recommendations and guidelines [15, 31, 44]. These recommendations aim to standardise the process of purchasing welfare technology; in practice, however, procurement actions vary between municipalities.

Although municipal actors perceive standardisation important, they consider it as a political strategy rather than a juridical issue. Legislation and juridical issues of welfare technology are mostly associated with data management and storage; hence they relate to management and implementation of welfare technology more broadly. The study implies that evaluation and assessment of welfare technology should include a question of data storage with respect to end-users privacy. Monitoring systems for fall prevention and detection can offer improved control, independence and safety and reduce the costs of home care services [3, 26]. Sensors that collect data from the location and movements of persons can improve the cost-effectiveness of care provision, but the implementation of these technologies should involve a personal choice and consent from the older adults [26]. For these situations a more specific standardisation and management of juridical issues is needed. The independence and autonomy that welfare technologies can provide should not result to decreased access and availability of other forms of care.

Conclusion

Welfare technology is a political concept in Nordic countries that is expected to improve the quality of care provision in municipal care [5, 6, 9, 10, 17–20]. This study has taken a specific outlook on the implementation of welfare technology that is the procurement. With a focus on negotiations, understandings and decision-making during the procurement practices, the study has shown the barriers to purchase welfare technology with regard to skills and competences outlined by municipal actors. Building on these findings, the study argues that economic and juridical decisions to purchase welfare technology are not value-neutral, nor strictly determined by technical skills, but also associated with ethical and socio-cultural understandings of the role of technology in care provision, delivery and care related tasks. Although the data only covered a limited amount of participants and municipalities, the analysis clarified the skills and competences with regard to purchasing welfare technology. Future research should take a more comprehensive outlook to the mechanisms and interactions between suppliers and municipal actors, and investigate procurement practices from the supplier perspective. Furthermore, challenges and barriers outlined in this study should be investigated from a comparative perspective that could give insights of the scope and frequency of these challenges between countries.

Declarations

Acknowledgements

The author would like to thank X.X for the provision of technical assistance in the data collection and analysis.

Funding

The study was funded by FORTE – Forskningsrådet för hälsa, arbetsliv och välfärd (project number X.X). The funding body did not have any role in the study design, data collection and analysis, interpretation of the data, in writing the paper, nor in the decision to submit the paper for publication.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

The author confirms sole responsibility for the study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Competing interests

The author declares no competing interests

Consent for publication

Not applicable

Ethics approval and consent to participate

Data collection was carried out in accordance with guidelines and regulations from Swedish Ethical Review Authority. All participants gave an informed consent for the participation in the study. The study did not collect any personal or sensitive information from the participants, and therefore ethical approval from the Swedish Ethical Review Board was not needed [46]. To protect participants' privacy, all data is anonymised, and all identifiers have been removed from the data.

References

1. Andersson K, Johansson S. Assessing individual needs in Swedish elderly home care services: care managers' argumentation in relation to the needs of migrant customers. *Nordic Social Work Research*. 2019; 25:1–13.
2. Askfors Y, Fornstedt H. The clash of managerial and professional logics in public procurement: Implications for innovation in the health-care sector. *Scandinavian Journal of Management*. 2018; 34(1):78–90.

3. Baig MM, Gholamhosseini H, Connolly MJ. A comprehensive survey of wearable and wireless ECG monitoring systems for older adults. *Med Biol Eng Comput.* 2013;51(5):485–95.
4. Bajones M, Fischinger D, Weiss A, Puente PDL, Wolf D, Vincze M, et al. Results of Field Trials with a Mobile Service Robot for Older Adults in 16 Private Households. *J Hum-Robot Interact.* 2020; 9(2):1–27.
5. Baudin K, Gustafsson C, Frennert S. Views of Swedish Elder Care Personnel on Ongoing Digital Transformation: Cross-Sectional Study. *J Med Internet Res.* 2020; 22(6):e15450.
6. Baudin K, Mullersdorf M, Sundstrom A, Gustafsson C. The Policies of Provision of Assistive and Welfare Technology—A Literature Review. *Societies.* 2020; 10(1):22.
7. Bengtsson M. How to plan and perform a qualitative study using content analysis. *NursingPlus Open.* 2016; 2:8–14.
8. Chan SWT, Buddhika T, Zhang H, Nanayakkara S. ProspecFit: In Situ Evaluation of Digital Prospective Memory Training for Older Adults. *Proc ACM Interact Mob Wearable Ubiquitous Technol.* 2019; 9(3):1–20.
9. Cozza M, Crevani L, Hallin A, Schaeffer J. Future ageing: Welfare technology practices for our future older selves. *Futures.* 2019; 109:117–29.
10. Cuesta M, German Millberg L, Karlsson S, Arvidsson S. Welfare technology, ethics and well-being a qualitative study about the implementation of welfare technology within areas of social services in a Swedish municipality. *International Journal of Qualitative Studies on Health and Well-being.* 2020; 15(sup1):1835138.
11. Dahn MA. Investigation of Procurement Practices for Welfare Technologies in Municipalities in Sweden. Master's Thesis. KTH Royal Institute of Technology, School of Engineering Sciences in Chemistry, Biotechnology and Health (CBH), Biomedical Engineering and Health Systems, 2020.
12. Dietz M, Aslan I, Schiller D, Flutura S, Steinert A, Klebbe R, et al. Stress Annotations from Older Adults - Exploring the Foundations for Mobile ML-Based Health Assistance. In: *Proceedings of the 13th EAI International Conference on Pervasive Computing Technologies for Healthcare [Internet]. Trento Italy: ACM; 2019 [cited 2021 May 12]. p. 149–58. Available from: <https://dl.acm.org/doi/10.1145/3329189.3329197>*
13. Edler J, Georghiou L. Public procurement and innovation—Resurrecting the demand side. *Research Policy.* 2007; 36(7):949–63.
14. Erridge A, Greer J. Partnerships and public procurement: building social capital through supply relations. *Public Administration.* 2002; 80(3):503–22.
15. European Commission. Public procurement [Internet]. 2020. Available from: https://ec.europa.eu/growth/single-market/public-procurement_en
16. Fortune A, Mitchell W. Unpacking Firm Exit at the Firm and Industry Levels: The Adaptation and Selection of Firm Capabilities. *Strat Mgmt J.* 2012; (7):794–819.
17. Frennert S. Lost in digitalization? Municipality employment of welfare technologies. *Disability and Rehabilitation: Assistive Technology.* 2019; 14(6):635–42.

18. Frennert S. Approaches to welfare technology in municipal eldercare. *Journal of Technology in Human Services*. 2020; 38(3):226–46.
19. Frennert S. Hitting a moving target: digital transformation and welfare technology in Swedish municipal eldercare. *Disability and Rehabilitation: Assistive Technology*. 2021; 16(1):103–11.
20. Frennert S, Baudin K. The concept of welfare technology in Swedish municipal eldercare. *Disability and Rehabilitation*. 2021; 43(9):1220–7.
21. From D-M. With a little help from a... machine: Welfare Technology and Sustainable Health Promotion. *Journal of Transdisciplinary Environmental Studies*. 2015; 14(2):52–64.
22. Georghiou L, Li Y, Uyarra E, Edler J. Public Procurement for Innovation in Small European Countries. (ERA-PRISM Project Report) [Internet]. Manchester Institute of Innovation Research; Available from: https://www.research.manchester.ac.uk/portal/files/50894884/FULL_TEXT.PDF
23. Georghiou L, Edler J, Uyarra E, Yeow J. Policy instruments for public procurement of innovation: Choice, design and assessment. *Technological Forecasting and Social Change*. 2014; 86:1–12.
24. Glomsås HS, Knutsen IR, Fossum M, Halvorsen K. 'They just came with the medication dispenser'- a qualitative study of elderly service users' involvement and welfare technology in public home care services. *BMC Health Serv Res*. 2021; 21(1):245.
25. Gustafsson S, Sandsjö L. Evaluation of an interactive showroom to increase general knowledge about welfare technology and its potential in municipal care settings. *Scandinavian Journal of Occupational Therapy*. 2020; 27(8):591–600.
26. Hawley-Hague H, Boulton E, Hall A, Pfeiffer K, Todd C. Older adults' perceptions of technologies aimed at falls prevention, detection or monitoring: A systematic review. *International Journal of Medical Informatics*. 2014; 83(6):416–26.
27. Hofmann B. Ethical Challenges with Welfare Technology: A Review of the Literature. *Sci Eng Ethics*. 2013; 19(2):389–406.
28. Kamp A, Obstfelder A, Andersson K. Welfare Technologies in Care Work. *NJWLS* [Internet]. 2019 Mar 2 [cited 2021 May 12];9(S5). Available from: <https://tidsskrift.dk/njwls/article/view/112692>
29. Karlsen C, Moe CE, Haraldstad K, Thygesen E. Caring by Telecare? A Hermeneutic Study of Experiences among Older Adults and Their Family Caregivers. *J Clin Nurs*. 2018; jocn.14744.
30. Karttunen E. Purchasing and supply management skills revisited: an extensive literature review. *BIJ*. 2018; 25(9):3906–34.
31. Konkurrensverket. Swedish Public Procurement Act [Internet]. Konkurrensverket; 2017. Available from: <https://www.konkurrensverket.se/globalassets/english/publications-and-decisions/swedish-public-procurement-act.pdf>
32. Lapointe, Rivard. A Multilevel Model of Resistance to Information Technology Implementation. *MIS Quarterly*. 2005; 29(3):461.
33. Lenderink B, Halman JIM, Voordijk H. Innovation and public procurement: from fragmentation to synthesis on concepts, rationales and approaches. *Innovation: The European Journal of Social*

- Science Research. 2019; 10:1–25.
34. Matthew-Maich N, Harris L, Ploeg J, Markle-Reid M, Valaitis R, Ibrahim S, et al. Designing, Implementing, and Evaluating Mobile Health Technologies for Managing Chronic Conditions in Older Adults: A Scoping Review. *JMIR mHealth uHealth*. 2016; 4(2):e29.
 35. Melkas H, Hennala L, Pekkarinen S, Kyrki V. Impacts of robot implementation on care personnel and clients in elderly-care institutions. *International Journal of Medical Informatics*. 2020; 134:104041.
 36. Mishra AN, Devaraj S, Vaidyanathan G. Capability hierarchy in electronic procurement and procurement process performance: An empirical analysis. *Journal of Operations Management*. 2013; 31(6):376–90.
 37. Nilsen ER, Dugstad J, Eide H, Gullslett MK, Eide T. Exploring resistance to implementation of welfare technology in municipal healthcare services – a longitudinal case study. *BMC Health Serv Res*. 2016; 16(1):657.
 38. Nordic Welfare Centre. Nordic thinktank for welfare technology: Making implementation easier. [Internet]. Nordic Welfare Centre; 2015. Available from: <https://nordicwelfare.org/wp-content/uploads/2017/10/THINKTANK150202.pdf>
 39. Ollevier A, Aguiar G, Palomino M, Simpelaere IS. How can technology support ageing in place in healthy older adults? A systematic review. *Public Health Rev*. 2020; 41(1):26.
 40. Pekkarinen S, Melkas H. Welfare state transition in the making: Focus on the niche-regime interaction in Finnish elderly care services. *Technological Forecasting and Social Change*. 2019; 145:240–53.
 41. Samhan B, Joshi KD. Resistance of Healthcare Information Technologies; Literature Review, Analysis, and Gaps. 48th Hawaii International Conference on System Sciences. 2015; 2992–3001.
 42. Saunders B, Sim J, Kingstone T, Baker S, Waterfield J, Bartlam B, et al. Saturation in qualitative research: exploring its conceptualization and operationalization. *Qual Quant*. 2018; 52(4):1893–907.
 43. Sjölander M, Scandurra I, Avatare Nou A, Kolkowska E. Using Care Professionals as Proxies in the Design Process of Welfare Technology – Perspectives from Municipality Care. In: Zhou J, Salvendy G, editors. *Human Aspects of IT for the Aged Population Aging, Design and User Experience* [Internet]. Cham: Springer International Publishing; 2017 [cited 2021 May 20]. p. 184–98. (Lecture Notes in Computer Science; vol. 10297). Available from: http://link.springer.com/10.1007/978-3-319-58530-7_13
 44. Socialstyrelsen. E-hälsa och välfärdsteknik i kommunerna 2018 [Internet]. Socialstyrelsen; 2018. Available from: <https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/ovrigt/2018-4-11.pdf>
 45. Sporrang J, Kadefors A. Municipal consultancy procurement: new roles and practices. *Building Research & Information*. 2014; 42(5):616–28.
 46. Swedish Ethical Review Authority. Vanliga frågor [Internet]. Etikprövningsmyndigheten 2021. Available from: <https://etikprovningmyndigheten.se/vanliga-fragor/>
 47. Ulucanlar S, Faulkner A, Peirce S, Elwyn G. Technology identity: The role of sociotechnical representations in the adoption of medical devices. *Social Science & Medicine*. 2013; 98:95–105.

48. Uyerra E, Edler J, Garcia-Estevez J, Georghiou L, Yeow J. Barriers to innovation through public procurement: A supplier perspective. *Technovation*. 2014; 34(10):631–45.
49. Uyerra E, Flanagan K, Magro E, Zabala-Iturriagagoitia JM. Anchoring the innovation impacts of public procurement to place: The role of conversations. *Environment and Planning C: Politics and Space*. 2017; 35(5):828–48.
50. Vines J, Lindsay S, Pritchard GW, Lie M, Greathead D, Olivier P, et al. Making family care work: dependence, privacy and remote home monitoring telecare systems. In: *Proceedings of the 2013 ACM international joint conference on Pervasive and ubiquitous computing [Internet]*. Zurich Switzerland: ACM; 2013 [cited 2021 May 12]. p. 607–16. Available from: <https://dl.acm.org/doi/10.1145/2493432.2493469>
51. Östlund B, Olander E, Jonsson O, Frennert S. STS-inspired design to meet the challenges of modern aging. *Welfare technology as a tool to promote user driven innovations or another way to keep older users hostage? Technological Forecasting and Social Change*. 2015; 93:82–90.