

# **Determinants of Digital Transformation of Elderly Care: Preliminary Insights from Polish and Swedish Technology Providers**

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## **Abstract**

The current elderly care models are challenged by an ageing population and require digital transformation involving many stakeholders, among which technology providers appear under researched. To bridge this research gap, the current study examined the perceptions of technology providers regarding barriers and enablers in two contrasting socioeconomic contexts: Poland and Sweden. The analysis employed the five-dimensional SIM model as an analytical framework and allowed us to achieve a more nuanced understanding of the technology providers' viewpoint on determinants of technology adoption for the digital transformation of elderly care. Our preliminary findings suggest that technology providers acknowledge their role in the transformation process and are willing to deliver quality solutions; however, they also perceive a number of environmental barriers that need be addressed at the governmental level. In addition, the results imply that socioeconomic context play a role in establishing a supportive environment for technology providers.

**Keywords:** Elderly Care, Digital Transformation, Determinants, Poland, Sweden.

## **1. Introduction**

In the face of a rapidly ageing global population and increasingly constrained resources, the elderly care sector faces an urgent need for transformation [7], [32]. Conventional care models are under pressure and digital technology with a potential to improve the efficiency of care services, without compromising on quality, is increasingly recognized as a key to sustainable care models and a driver for digital transformation of care systems [3, 4]. Technology-supported care models are being adapted to different degrees in European countries, depending on technology-related and socioeconomic considerations as well as the national health and care system condition [4].

However, despite the potential of technology to enhance and transform care, many initiatives fail narrowly focusing on technological aspects and immediate economic outcomes such as process automation and cost reduction, rather than broader capabilities such as business model innovation and radical improvement of the entire care ecosystem [21], [25]. The current adoption of digital technologies in care models can be seen as digitalization in the narrow sense rather than a comprehensive digital transformation [1], [8], [10]. Digital transformation aims not just at technology adoption but at achieving broader objectives such as integration and collaboration, care quality, seniors' well-being, along with the shift of the entire ecosystem [8], [10].

Prior literature highlights the importance of recognizing the roles, needs, and

preferences of key stakeholders for successful digital transformation of care, such as seniors, care providers, policymakers, and technology providers [12], [15], [17], [22]. While there has been considerable research on factors influencing seniors' adoption of digital technologies (e.g. [15], [28], [31]), the scrutiny of technology providers' role has been insufficient. Most existing studies that consider the perspective of technology providers focus primarily on their views regarding technology's potential to support seniors. However, they often overlook the enablers and barriers these providers encounter when developing and supplying technology to seniors and care institutions. This oversight is problematic, considering their crucial role in providing reliable technical solutions tailored to the complex requirements of seniors and care organizations, as well as their influence on seniors' adoption of digital technologies [22]. Against this backdrop, the current study seeks to answer **RQ**: How technology providers in Poland and Sweden perceive determinants (enablers and barriers) of technology adoption for digital transformation of elderly care?

In the current study we use the concept welfare technology (WT), defined as products and services that have an information and communication technology (ICT) component and are of direct value for seniors, their families and care providers to enhance their health, wellbeing and independence [7]. The current study is conducted in Poland and Sweden as these two countries demonstrate significant differences with respect to various technology-related and socioeconomic considerations, such as social and healthcare system [26], [19, 20] as well as level of WT adoption [4].

## 2. Background

By demographic projections, all European Union (EU) macro-regions will age in terms of the share of population aged 65+, but at different speeds. These expected changes will affect Eastern Europe with more severe consequences due to migration processes [24]. This is especially visible in the case of Poland as compared to Sweden. In 2050, in Poland, the share of people aged 65+ will constitute about 29% of the total population, while in Sweden only 23,4%. Substantial differences between Poland and Sweden are also visible in the level of digital transformation measured by the Digital Economy and Society Index (DESI) [5], which for Sweden was higher than the average level for EU countries, while for Poland its level was below average in 2022.

Swedish and Polish social and healthcare systems are organized differently. The Swedish system is built on the state responsibility model with a strong emphasis on redistribution, social inclusion and universality of public services. This model promotes also a high level of regular employment in the care sector in order to meet the care needs of dependent people [20]. The system of care for the elderly in Poland can be described as a hybrid system in which some social needs are met by the state and other needs are met by private service providers. Due to the low level of public financing, the Polish health care system experiences shortages of the workforce and problems with access to health services, particularly long-term care provision relies heavily on informal caregivers [19]. In the context of digitization, Poland has seen an unprecedented increase in the number of teleconsultations during the pandemic, which currently remains one of the highest in the EU [19]. In Sweden, the use of teleconsultations has increased since digital health providers were able to offer these services nationwide in 2015. After the pandemic, new regulations legislation was passed to integrate teleconsultations better into local healthcare systems [20].

Although the role of technology providers in the adoption of WT by seniors and care service staff is sometimes acknowledged [22], their perspectives and experiences with the drivers and barriers for digital transformation of care systems are seldom considered. Three of the few identified papers studied technology providers' view on the benefits and challenges in WT adoption. In an early study, Nordgren [18] revealed that providers emphasized the role of WT in enhancing care efficiency and improving the quality of life for seniors. Nikou et al. [17] interviewed various stakeholders in Netherlands, including 17 technology providers, who emphasized tailoring online services to seniors' needs and

expressed a preference for engaging directly with end-users rather than with other providers. Zhao et al. [33] investigated the barriers and facilitators of deploying technologies in care institutions during the COVID-19 pandemic in Australia. Providers emphasized WT's benefits for enhancing social interaction between residents and their families, but also highlighted challenges such as limitations of video technology, staff tiredness, the lack of support of volunteers, and the adequacy of infrastructural resources.

Two recent studies discuss the barriers and facilitators for collaboration between technology providers when using healthcare and care platforms. Khalil [12] review existing literature and identified several barriers such as care fragmentation, poor coordination among various care providers and specialists, and the lack of socio-technical integration across the entire care ecosystem. In another study, Mugurusi et al. [16] investigate how privately owned technology can create more personalized elderly care services and the organizational transformations that occur when such technology is integrated into existing care models. After studying WT deployment in a municipality in Norway, they found that incorporating technology into traditional care models affects service quality, costs, and the resource allocation in public organization business models. Therefore, there is a need for a holistic approach to digital transformation to fully use the potential of innovative technologies and improve quality and efficiency in care.

Summing up, previous research on WT adoption from the WT providers' perspective highlights the need for a comprehensive approach to the digital transformation of care that includes social and technical aspects [23]. In general, there is a lack of models for analyzing factors driving digital transformation from WT providers' perspectives. We believe that digital transformation could be seen as responsible or mission-oriented innovation, i.e. innovation that supports social change for the public good [13], [27], [29]. The adoption of WT can be seen as a solution to these social and economic challenges. The literature on responsible innovation emphasizes system-wide change, considering various social and technical dimensions [9], [11], [14]. The Swedish Governmental innovation center Vinnova [9], [30] proposed a five-dimensional SIM model for analyzing large-scale systematic change, which is suitable for studying WT providers' perceptions of WT adoption for digital transformation of the care system.

### 3. Method

In order to get an exploratory insight into the opinions of WT providers as regards enablers and barriers related to digital transformation of elderly care, we conducted semi structured interviews with representatives of six companies operating in Poland and in Sweden, three in each country. In total, we interviewed eight respondents, four in Poland and four in Sweden. The interviews were being conducted over an extended period of time and were concluded in March 2024. The interviewees represented six WT providers, of which five were SMEs and one was a large company. The respondents played mostly managerial roles in their companies: four held the position of company president, two served as vice-presidents, while two respondents were involved as project managers. We believe that such a representation of respondents allowed us to gather insightful data about the determinants of digital transformation of elderly care. It should also be emphasized that in order to better understand the perspective of WT providers, all interviewers previously participated in conferences related to social and health care issues, where many practitioners were represented, including WT providers. The respondents were selected based on convenience and availability. However, we tried to ensure diversity by including technology providers from different regions in each country, both larger and smaller companies, and ensuring a similar number of respondents in Poland and Sweden to facilitate comparison. We have neither the ambition nor the possibility to generalize findings from this qualitative and exploratory study to the entire population. The intention of the current study was to delve into the unexplored perspectives of technology providers and better understand the enablers and barriers they encounter when developing and supplying technology to seniors and care institutions to identify interesting paths for future investigation.

The interviews have been conducted by the team of authors, the meetings have been

recorded and transcribed. In the subsequent data analysis, we adopted two approaches: inductive and deductive [6]. In the first approach, we applied a bottom-up strategy and conducted a thematic analysis in order to discover major categories of concepts emerging from our respondents' opinions. In so doing, we performed a number of iterations within the team of three authors in order to achieve a coherent set of categories and adopt investigator triangulation [2]. In consequence of data gathering and analysis, we collected 118 statements from Polish respondents and 130 opinions from Swedish representatives, which were then categorized into 43 concepts.

In the second, deductive perspective, we decided to map the discovered concepts onto the SIM framework, which, as previously noted, is a promising framework within the responsible innovation field. The SIM framework includes five categories of social and technical nature: **Culture and values (C)** – related to behavior patterns, culture, and values; **Regulatory framework (R)** – related to adaption to and development of existing rules and regulations and legal interoperability between actors; **Business models (B)** – related to understanding how investments, business models and procurement processes contribute to sustainable solutions; **Infrastructure and production systems (I)** – related to development or use of digital infrastructures that creates prerequisites for data collection, data analysis, and making data available in a secure and efficient way; and **Technologies, products and processes (T)** – related to functionality, applications, and technical solutions, including socio-technical processes, to generate, process, analyze, make available, and present data.

#### 4. Results

The table includes the most important barriers and enablers mentioned by respondents. The elements summarized in the table have been described in more detail in the following.

**Table 1.** The most important barriers and enablers.

SIM	Poland	Sweden
Culture and values (C)	<b>Enablers:</b> <ul style="list-style-type: none"> <li>• WT addresses existing (real) needs and have potential to improve care quality</li> <li>• Providers' positive perception of Polish seniors' digital literacy based on experience with WT</li> <li>• Providers' understanding that to succeed it is necessary to look at the problem from the point of view of the senior's needs</li> <li>• Coping with technology by seniors</li> </ul> <b>Barriers:</b> <ul style="list-style-type: none"> <li>• Lack of a general government policy supporting WT</li> <li>• Criticism of WT by some seniors</li> <li>• Fear for stigmatization</li> <li>• Seniors' problems in adapting to changes in solutions</li> <li>• Resistance of care professionals to changes</li> <li>• Lack of competences among decision-makers regarding use of WT in care</li> </ul>	<b>Enablers:</b> <ul style="list-style-type: none"> <li>• WT addresses existing (real) needs and have potential to improve care quality</li> <li>• Positive attitude to digitalization in the society (engagement of Swedish government and media, seniors' and relatives' positive attitudes and engagement)</li> <li>• Providers willingness to address existing needs</li> </ul> <b>Barriers:</b> <ul style="list-style-type: none"> <li>• Lack of skills and competences (decision-makers, care professionals, seniors)</li> <li>• Unwillingness and fear for increased care/work burden (care professionals, relatives, IT departments at municipality)</li> <li>• Fear for stigmatization</li> <li>• Unrealistic expectations of seniors</li> </ul>
Regulatory framework (R)	<b>Enablers:</b> <i>Not identified</i> <b>Barriers:</b> <ul style="list-style-type: none"> <li>• Lack of financial regulations for the development of the product market</li> <li>• Lack of standards ensuring the quality of WT</li> <li>• Excessive requirements for public procurement</li> <li>• Lack of regulation of the product market to eliminate unfair competitors</li> <li>• Unclear how to interpret the law in the new context</li> </ul>	<b>Enablers:</b> <i>Not identified</i> <b>Barriers:</b> <ul style="list-style-type: none"> <li>• Regulation of public procurement</li> <li>• Unclear how to interpret the law in the new context generally but especially regarding security and privacy</li> <li>• Lack of standards and quality assurance for WT</li> <li>• Informed consent – cognitive impairments</li> </ul>

<b>Infrastructure and production systems (I)</b>	<p><b>Enablers:</b></p> <ul style="list-style-type: none"> <li>• Availability of various architectural solutions of the system (e.g. on-premise, cloud-based)</li> <li>• Availability of resources for collecting and analyzing data in real time</li> </ul> <p><b>Barriers:</b></p> <ul style="list-style-type: none"> <li>• Ensuring safe data storage</li> <li>• Limited capacity of the solution (e.g. related to the risk of blocking the line during a call)</li> </ul>	<p><b>Enablers:</b> <i>Not identified</i></p> <p><b>Barriers:</b></p> <ul style="list-style-type: none"> <li>• Lack of common municipality technical platform to connect diverse WT solutions to</li> <li>• Outdated technical infrastructure in the municipality which prevents connection and use of modern and advanced WT solutions</li> <li>• Unclear responsibility for providing and paying for Wi-Fi in elderly care institutions</li> </ul>
<b>Business models (B)</b>	<p><b>Enablers:</b></p> <ul style="list-style-type: none"> <li>• Possibility to participate in projects providing finance and cooperation with various institutions and companies</li> <li>• Using targeted promotion to acquire customers e.g. through media for seniors and through promotional campaigns and pilot programs for decision-makers</li> </ul> <p><b>Barriers:</b></p> <ul style="list-style-type: none"> <li>• Lack of financing of solutions by the National Health Fund (NFZ)</li> <li>• Limited public funds for WT development</li> <li>• The need to obtain funds from projects and the problem of financing after their completion</li> <li>• Market dominated by public procurement with limited financing</li> <li>• Prevailing models focusing on price before quality – limited public funds and thus costs incurred by private individuals (no refunds)</li> <li>• Limited demand for expensive solutions (e.g. monitoring)</li> <li>• Unfair competition in tenders (lowering prices)</li> </ul>	<p><b>Enablers:</b></p> <ul style="list-style-type: none"> <li>• Potential profit from collaboration between WT providers</li> <li>• Possibility to test and develop solutions in real life settings supported by government and local municipalities</li> <li>• Provision of WT solutions by municipalities assistive technology center and municipalities</li> </ul> <p><b>Barriers:</b></p> <ul style="list-style-type: none"> <li>• Payment models for care unclear/undeveloped and not encouraging use of WT</li> <li>• Lack of structures for and willingness of collaboration between IT providers</li> <li>• Lack of integrated care models for collaboration between different stakeholders</li> <li>• Development cost for special (individual) adjustments is too high - uncertainty of return on investment</li> <li>• Public procurement market favorable for big (already established) companies</li> <li>• Immature business models at municipalities to purchase/maintain WT</li> </ul>
<b>Technologies, products and processes (T)</b>	<p><b>Enablers:</b></p> <ul style="list-style-type: none"> <li>• WT solutions' functionality addressing real and urgent needs of seniors, care organizations, and relatives</li> <li>• Possibility of creating personalized solutions, e.g. dependent on the state of health</li> <li>• Ability to create solutions using information from real-time data analyses</li> <li>• Creating solutions enabling integration with external devices/systems</li> </ul> <p><b>Barriers:</b> <i>Not identified</i></p>	<p><b>Enablers:</b></p> <ul style="list-style-type: none"> <li>• Accessibility of easy to use and relatively affordable technical components</li> <li>• WT solutions' functionality addressing real needs of seniors, care organizations, and relatives</li> <li>• Development of multifunctional integrated solutions that meet many needs at the same time</li> <li>• Development of communication aids and processes helping seniors to understand WT's usefulness and give informed consent to use</li> </ul> <p><b>Barriers:</b></p> <ul style="list-style-type: none"> <li>• Undeveloped care processes that would naturally integrate WT</li> <li>• Undefined responsibility in care processes involving various actors</li> <li>• Difficulty to adjust WT products to users with cognitive decline because they cannot express their needs</li> <li>• Lack of work processes and social structures supporting use and implementation of WT</li> </ul>

In the **Culture and Values** dimension, both Polish and Swedish providers emphasize the importance of WT aligning with seniors' actual needs to ensure applicability and necessity. Polish providers stress pilot projects and experiences that change their perception of seniors, boosting their positive view of seniors' digital literacy and encouraging investment in WT. Swedish providers benefit from a positive societal attitude toward digitalization, supported by government initiatives that promote digitalization through strategic documents, financial support, and real-environment testing. Both countries face barriers, such as decision-makers' lack of WT competence and understanding, with high-level management in Poland and case managers in Sweden being reluctant to endorse WT. Additionally, resistance to change among social workers is noted in both countries, stemming from fear of control in Poland and concerns over workload in Sweden. Barriers related to seniors include fear of stigmatization, difficulties with new technology, and

criticism of proposed solutions in Poland, while Swedish seniors have unrealistic expectations regarding WT.

No enablers have been identified in the **Regulatory Framework** category. A key barrier is the legal regulations on mandatory public procurement. In Sweden, these regulations prolong implementation and favor large WT providers, hindering smaller suppliers and limiting innovation. In Poland, tenders lack regulations on WT development financing and quality standards, leading to excessive requirements in state tenders and allowing dishonest producers to lower prices at the expense of quality and safety. Both countries face issues with the absence of WT standards, causing uncertainty for municipalities and providers and stifling adoption. Additionally, both countries experience ambiguity in legal interpretation regarding WT use, such as intervention in case of an alarm and responsibility for failures. In Sweden, this complexity is increased by the advanced stage of WT implementation and the integration of social and health care.

In the **Infrastructure and Production Systems** dimension, only Polish WT providers identified enabling factors, emphasizing the availability to appropriate architecture to integrate with other systems and possibility to real-time data collection and analysis. Polish providers focused on barriers related to security and capacity, such as safe data storage and performance issues like the risk of telephone line blockage due to seniors overusing alarm platforms. Swedish WT providers, however, highlighted barriers related to interoperability, such as the absence of a common technical platform across municipal care institutions and outdated infrastructure preventing the use of advanced WT solutions. Additionally, a significant barrier in Sweden is the lack of clarity regarding responsibility for providing and funding Wi-Fi in seniors' apartments, leading to ambiguity in cost-bearing and inadequate internet services, which affects WT operation and effectiveness.

In the **Business Models** category, both Polish and Swedish providers argue that the adoption of WT in elderly care benefits from interorganizational collaboration. Polish providers see as enablers participation in projects with various institutions, which opens international markets. Swedish providers stress profit potential through collaboration, encouraging innovation and best practices. Polish providers also focus on targeted promotion, while Swedish providers emphasize the role of public entities in offering WT solutions for free and supporting real-life testing and development. However, integration of WT is limited by current business models. Polish suppliers face financial limitations and lack of government reimbursement, leading to a focus on price over quality. Swedish providers encounter unclear government payment models, creating financial uncertainty and favoring cost over quality, which discourages the development of high-quality solutions. Additionally, the public procurement process favors large companies, creating barriers for smaller, innovative suppliers.

In the **Technologies, Products, and Processes** dimension, Polish and Swedish WT providers appreciate that WT solutions meet the real needs of seniors, care organizations, and loved ones by improving safety, independence, and quality of life. Both countries value user friendliness and functionality, with Polish providers emphasizing personalization and Swedish providers highlighting multi-functionality and integration to reduce complexity and costs. Regarding barriers, Polish respondents did not identify significant issues, while Swedish providers noted the underdevelopment of care processes for seamless WT integration, leading to chaotic implementations. They also emphasized a lack of clearly defined responsibilities among different actors in WT care processes, causing uncertainty and discouraging WT use.

## 5. Discussion and Conclusion

The current study aimed to deepen our understanding of technology providers' perspectives on the drivers and barriers to adopting technology for the digital transformation of elderly care. Previous research is fragmented and primarily conducted in highly developed countries, with limited exploration of factors from technology providers' viewpoints. Consequently, there is a lack of comprehensive insight into how providers can meet societal expectations for developing high-quality WT solutions. To bridge this gap, our

study examined the perceptions of technology providers in two contrasting socioeconomic contexts: Poland, a transition economy, and Sweden, a highly developed economy. As explained earlier, significant differences exist between these countries in social and healthcare systems and WT adoption. Using the SIM model [9] as an analytical framework, we investigated barriers and facilitators across different dimensions, resulting in a more nuanced understanding of technology providers' views on the adoption of technology for elderly care transformation.

**Discussing key enablers**, technology providers in both countries believe that their solutions meet the concrete needs of seniors, caregivers, and care institutions, contributing to high-level objectives like enhancing care quality and promoting seniors' well-being, independence, and safety (dimensions C and T). Achieving these goals is crucial for a successful digital transformation, as noted in previous research (e.g., [12], [17-18]). Key enablers include technical advancements related to real-time data collection and analysis, multifunctional integrated solutions, diverse architectural solutions, and potential for integration with external systems (dimensions T and I in the SIM model). Modern technologies' technical capabilities and open API models are also recognized as enablers in recent literature [12].

The study revealed differences in the perceptions of Polish and Swedish WT providers regarding societal and business models (related to the SIM dimensions C and B). Swedish providers noted favorable societal attitudes towards digitalization, supported by government and media, and positive attitudes from seniors and their relatives. Polish providers did not observe similar support, likely due to less defined government strategies for active aging and digitalization. Swedish providers found testing and developing solutions in real-world settings, backed by governmental support, as enabling factors. In contrast, Polish providers found encouragement in finance-providing projects and collaborations with various institutions, many funded by the EU and other sources.

The greatest barriers in both countries relate to legislative regulation (dimension R), including regulations for WT development and use to support integrated care, and rules for cooperation and information exchange among stakeholders. Shortcomings and ambiguities in this dimension lead to further difficulties for WT providers, such as mandatory participation in governmental care, which favors large, established companies. Unclear legal frameworks and accountability structures negatively impact financing WT solutions (dimension B) and cooperation between stakeholders (dimensions B and T).

Similar barriers in regulatory frameworks and social structures are highlighted in previous literature. Khalil [12] points to the lack of socio-technical integration and unclear management of cross-institutional integrations as challenges for digital healthcare platforms. The preliminary results from Poland and Sweden, along with prior literature, indicate two parallel processes in digital transformation: developing integrated care models and adopting WT. Each process has unique challenges and lacks coordination, hindering care digital transformation. New agreements, models, and regulations are crucial for simultaneous reforms in healthcare and social care supported by WT adoption. Mugurusi et al. [16] emphasize similar challenges to legal regulations for emerging care models.

Contrary to expectations, Polish respondents identified enabling factors in dimension I, while Swedes noted only barriers, despite a more digitized society. It is conceivable that this contrast stems from differences in care systems and their transition stages. Swedish care models are long-established and not designed for current WT solutions, whereas evolving Polish care models can integrate contemporary WT opportunities. Consequently, Swedish WT providers see existing infrastructure's inadequacy as a significant obstacle. Zhao et al. [33] highlight similar problems in Australia's elderly care institutions.

**Summing up**, WT providers are eager to contribute to the digital transformation of care by offering high-quality solutions that improve care and the well-being of older adults, addressing societal challenges. Despite legal obstacles, providers leverage technological advancements to deliver WT solutions effectively within the current socioeconomic framework. The importance of a functioning WT market is recognized, with industry professionals calling for more research to support technology providers. This study provides promising insights but is based on a limited number of respondents. It aimed to

explore the perspectives of technology providers and understand the enablers and barriers they face in developing and supplying technology to seniors and care institutions. Future research should confirm these findings on a larger scale, focusing on similarities and differences between various socioeconomic contexts.

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