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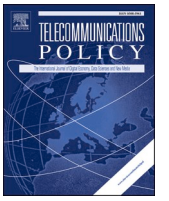

Toward the adoption of digital assistive technology: Factors affecting older people's initial trust formation

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ABSTRACT

In recent decades, Europe has experienced a major societal challenge—the aging of the human population. The Finnish government has responded to this challenge by focusing on individually tailored services that enable older adults to live independently and comfortably at home for longer with the help of digital assistive technology. This paper presents the findings of an empirical study on how initial trust is formed with regard technology adoption by older people. Four bases of trust (personality, cognitive, calculative, and institutional) underpin the theoretical framework of the study. A qualitative research approach was adopted, utilizing individual and focus group interviews with older people living independently in urban and rural areas of South Finland. The findings derived from thematic analysis offer new insights into the complex and multidimensional process of older people's initial trust formation, which is affected by an interplay of 12 identified factors shaping the four bases of trust and four supplementary factors. These findings lead to propositions for future research.

1. Introduction

Over the last few decades, Europe has seen the rise of a major societal challenge—the aging of the human population. It is estimated that by 2060, one in three Europeans will be above the age of 60 (European Commission, 2019). Population aging is a global trend that is expected to have far-reaching consequences for social, economic, and political development. In particular, it puts pressure on public budgets and healthcare systems, increasing the demand for equal and higher-quality care services and technologies (United Nations, 2015a). In many countries, the aging workforce is causing a severe shortage of healthcare workers, resulting in replacement challenges (World Health Organization (WHO), 2014). In Finland, ongoing reform aims to restructure public healthcare and social welfare systems to safeguard equal and quality services throughout the country by 2023 (Finnish Government, 2020). This reform focuses on delivering individually tailored services that enable older people to continue living independently and comfortably at home for longer with the help of digital assistive technology, which implies the use of information and communication technologies (ICTs).

Over the last two decades, there has been rapidly growing interest in providing elderly care and well-being through the exploitation of new digital assistive technologies, particularly for delivering remote care and health monitoring services and transforming existing hidden-care routines among family members into care work (Ho, 2020; Vines et al., 2013, pp. 607–616). A wide range of digital assistive technology solutions have been developed and introduced into the market to augment traditional assistive technologies. In this study, digital assistive technology refers to assistive ICT-based products, related services, and systems. The following technology

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solutions are the focus of the study: monitoring health and diagnosing illnesses, medication management, and reminders (e.g., Dawadi et al., 2013; Siek et al., 2011; Tang et al., 2011); monitoring physical activity (e.g., Austin et al., 2016; Gaugler et al., 2019; Lussier et al., 2019; Pigini et al., 2017); environmental monitoring and facilitating a sense of safety and independence (e.g., Bock et al., 2016; Pigini et al., 2017); fall detection (e.g., Igual et al., 2013; Stone & Skubic, 2015); enabling social communication and preventing loneliness (e.g., Austin et al., 2016; Jekel et al., 2016); and improving the quality of daily activities (e.g., Alberdi et al., 2018; Blasco et al., 2014; Lussier et al., 2019; Suryadevara and Mukhopadhyay, 2012).

It is crucial that older people accept, adopt, and use rapidly developing digital assistive technology, especially given findings suggesting a positive relationship between the new technology solutions and improvements in older people's quality of life (Baraković et al., 2020; Leung & Chen, 2019; Siegel & Dorner, 2017) and in the provision of more proactive, responsive, and accessible care services. These technologies enable older people to take a more active role in managing their own health and well-being, thereby advancing the cost-effectiveness of elderly care (Czaja, 2015; Free et al., 2013; Varshney, 2014). Recent research has indicated that a number of factors may act as specific adoption accelerators or barriers that can vary according to the technology and should be considered when designing innovative solutions (Keränen et al., 2017; Weck et al., 2022, pp. 1–14). However, more understanding of the factors that influence the adoption and use of new technology solutions by older people is required (Klimova & Poulova, 2018, pp. 85–94).

Trust is considered to be an important determinant of users' acceptance and adoption of digital services (e.g., Mou et al., 2017; Pavlou, 2003), a predictor of intended use (Dahlberg et al., 2003; Gao & Waechter, 2017; Gefen et al., 2003), a risk reducer among inexperienced users, a reducer of social uncertainty (e.g., Gefen, 2000; Jarvenpaa et al., 1999; Jarvenpaa et al., 2000), and overall, a primary construct for understanding users' perceptions of technology (e.g., Li et al., 2008). Therefore, the formation of initial trust (including the bases of this trust) needs to be better understood, particularly in the case of new technology, where perceptions of risk and uncertainty must be overcome before the technology is used (Lankton et al., 2015; McKnight et al., 2002a; Wang & Benbasat, 2005). Existing academic literature has paid little attention to factors affecting the formation of older users' initial trust in new technologies. Filling this gap can maximize the potential of technology in elderly care and provide developers and service organizations with an opportunity to build older users' trust before they interact with the technology and then strengthen this trust (De Regge et al., 2020).

Thus, this study aims to better understand initial trust as a determinant of technology adoption by focusing on the factors affecting its formation in the context of digital assistive technology for older people living independently. Initial trust here refers to trust in an unfamiliar technology product and related services or systems tailored to the specific needs of older people. Accordingly, the research questions are as follows:

- How is older people's initial trust formed with regard to technology adoption?
- What factors affect the formation of older people's initial trust in digital assistive technology?

To address these questions, a qualitative research approach was adopted, using individual and focus group interviews with adults aged 55 years and over who lived independently in facilities called "senior houses"—privately owned condominiums or rental apartments for adults of this age group (Desrosiers et al., 2004; Tyvimaa & Kemp, 2011)—in South Finland. The interviews were specifically designed to gain a better understanding of older people's attitudes, perceptions, and beliefs affecting their initial trust in the aforementioned solutions of digital assistive technology.

The paper is structured as follows. In the next section, we present the theoretical framework to provide a well-supported rationale for the empirical investigation. We then turn to the research methodology, elaborating on the research design, data collection, and data analysis methods. The empirical findings are presented and discussed before the conclusions, propositions, limitations, and avenues for future research are outlined.

2. Theoretical framework

In this section, we discuss the literature that provides a background understanding of technology adoption by older people and the role trust plays in this process. Trust in technology, especially the development of initial trust, is recognized as having a significant role in the adoption of technology. Subsequently, we outline the theoretical framework of this initial trust formation, which guides the empirical investigation. Finally, we consider the importance of socio-demographic characteristics for the chosen category of population—older people—who are under-represented in technology adoption research.

2.1. Technology adoption models and trust

Technology adoption is understood as a process that starts with the potential user becoming aware of the technology and finishes with "the user embracing the technology and making full use of it" (Renaud & Van Biljon, 2008, p. 210). Ultimately, an individual decision to use or reject the technology is made (Nijssen & Frambach, 2000). Faced with the prospect of the availability of new technology, various factors can influence people's attitudes, intention toward use, and actual usage (Childers et al., 2001; Ngai et al., 2007). Researchers have long been preoccupied with attempts to effectively explain the adoption of technology innovations, conceptualizing acceptance and adoption via several models, including the TAM (Technology Acceptance Model) (Davis, 1989; Venkatesh & Davis, 2000), UTAUT (Unified Theory of Acceptance and Use of Technology) (Venkatesh et al., 2003), TAM 3 (Venkatesh & Bala, 2008), and UTAUT 2 (Venkatesh et al., 2012) models. In addition to the perceived usefulness and perceived ease of use

developed in TAM, in Venkatesh et al.'s (2003) UTAUT model, they propose the following four main factors influencing the intention and usage of information technology: performance expectancy, effort expectancy, facilitating conditions, and social influence. Venkatesh et al. (2003) also added key moderating factors such as gender, age, experience, and voluntariness of use.

For the specific context of households and private environments, Brown and Venkatesh (2005) proposed and tested another model of adoption of technology in the household (MATH) to explain the adoption of technology, including personal computers (PCs) in their earlier studies. Before then, the Diffusion of Innovations Model (Rogers, 1995) was used to describe the patterns in which an innovation is adopted by individuals, as well as the overall user population. The model identifies five significant characteristics—relative advantage, compatibility, complexity, trialability, and observability—as the factors that influence adoption decisions. Other studies have also supported the significance of individual differences, such as age, education, income, cultural background, technology self-efficacy, and life stage, in affecting adoption decisions (Golvin & Anderson, 2009; Porter & Donthu, 2006; Sarker & Wells, 2003). The importance of incorporating socio-demographic variables into a combined model based on UTAUT and MATH (both are used to explain IT adoption in private, non-mandatory settings) prompted Niehaves and Plattfaut (2014) to synthesize what they call a Fourth model, which includes variables like education, gender, income, and age.

Technology acceptance and adoption models have also been developed specifically in relation to older users. Renaud and Van Biljon (2008), in their Senior Technology Acceptance and Adoption Model (STAM), propose to account for individual difference factors in older people's decision to use a given technology. Whereas, in Chen and Chan's (2014) version of STAM (senior technology acceptance model), they extend previous technology acceptance models and theories by adding age-related health and ability characteristics of older people. The widely known technology acceptance models discussed above, including the above-mentioned STAM models, do not include the construct of trust. However, given the acceleration of the development of e-commerce and the use of digital technology in recent decades, the significant role of trust in the adoption of such technology has been increasingly recognized.

Thus, in their seminal work, Gefen et al. (2003) integrated TAM with the trust construct in the context of online commerce by using the following trust factors: calculative-based trust, institutional-based structural assurance, institution-based situational normality, and knowledge-based familiarity. Building on this, Pavlou (2003) developed a model integrating traditional TAM variables with trust and perceived risk to identify key drivers of e-commerce acceptance. Trust has also been identified as a key factor determining behavioral intention with regard to the use of mobile payments and mobile commerce (Chandra et al., 2010; Slade et al., 2015).

2.2. Formation of initial trust in technology

In many disciplines, trust is primarily considered to be an inter-personal phenomenon (e.g., Blau, 1964; Rotter, 1967), and therefore, trust research has become significant and advanced in the context of relationships between humans. However, there is empirical evidence that people do not perceive trust-related concepts differently across different types of relationships—for example, relationships between humans and between humans and technological artifacts (Jian et al., 2000), or digital assistive technology, as in this study. This means that results from studies on the development of human–human trust (Rempel et al., 1985) may apply to situations of trust development between humans and digital systems (Jian et al., 2000). Furthermore, Muir (1988, pp. 71–83) has claimed human trust in technological artifacts can be influenced by the same factors affecting trust among humans. According to Mayer et al. (1995), trust refers to "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (p. 712). It is this willingness to be vulnerable irrespective of the ability to monitor or control the other party that is relevant in the context of assistive technologies for older people (Schwaninger et al., 2021). The willingness to depend on a technology across situations and technologies is considered especially relevant to trust in technology (McKnight et al., 2011). In relation to this study, trust in digital assistive technology combines trust in humans operating technologies and systems, whereby trust is connected to another party's competence, benevolence, and integrity (Mayer et al., 1995), and trust in the technology in general or in a specific technology, with a focus on attributes like functionality, helpfulness, and reliability (McKnight et al., 2011).

According to McKnight et al. (2011), trust in a specific technology reflects trusting beliefs that in a given situation with possible negative outcomes, this technology has the attributes necessary to perform as expected, such as with appropriate capability and functionality, adequate helpfulness, and consistent reliability. With regard to initial trust, trust in specific technology is not based on a trustor's prior experience with or first-hand knowledge of the technology (McKnight et al., 1998).

Extensive trust research in different disciplines has recognized several distinctive bases that are relevant to initial trust formation, such as personality, knowledge, cognitive, calculative, and institutional bases (Kramer, 1999; Lewis & Weigert, 1985; Mayer et al., 1995; McKnight et al., 1998; Rousseau et al., 1998; Williamson, 1993). The initial trust model proposed by Li et al. (2008) was built on these bases of trust. Additionally, it follows McKnight et al.'s (1998) selection of four of "the most commonly used trusting beliefs in the literature" (p. 477), excluding the knowledge base of trust since in an initial trust formation context, there is no direct knowledge of or experiential interaction with an unfamiliar trustee.

To build a theoretical framework in this study, we utilized Li et al.'s (2008) empirically tested model, which comprises trusting bases that are considered to be the determinants of trusting beliefs affecting trusting attitudes and trusting intentions in an information system context. With a focus on digital technology, the study adopts four trusting bases such as personality, cognitive, calculative, and institutional, for the discussion of the bases of trust in the following sections.

2.2.1. Personality base of trust

The personality base of trust is underpinned by one's propensity (Mayer et al., 1995) and disposition to trust (McKnight et al., 2002b). Faith in humanity and a trusting stance have been identified as the subcomponents of the personality base of trust (Brown

et al., 2004; McKnight et al., 1998). Faith in humanity captures the notion of people's beliefs about general human nature (McKnight et al., 1998), and having strong faith in humanity is linked to a general tendency to trust others (Rotter, 1971). Initial trusting beliefs are based on people's basic beliefs in human nature, especially under conditions of limited information (Mullins & Cummings, 1999; Rotter, 1971). The primary dimensions of the individual difference construct as part of the personality base of trust are benevolence, competence, and integrity, along with trusting beliefs (McKnight et al., 2002b). A trusting stance, on the other hand, is the initial trust placed in another party with the expectation of a positive result (Cummings & Bromiley, 1996; Deutsch, 1958). Both trusting beliefs and the trusting stance can also be extended to a non-human object such as assistive digital technology.

2.2.2. Cognitive base of trust

Cognitive familiarity is an important aspect of trust formation, as developed in the social psychology research tradition. Initial trusting beliefs are based on cognitive familiarity—more specifically, second-hand knowledge, impressions, cognitive cues, and cognitive processes (Gefen, 2000). These aspects thus form the cognitive base of trust. An unfamiliar trustee will be classified as trustworthy or untrustworthy based on the reputation of the trustee; moreover, a trustee with a good reputation will be believed to be trustworthy (McKnight et al., 1998). Importantly, when there is a lack of information or no experiential information, the trustee's reputation may affect people's beliefs about the trustee's competence, benevolence, or integrity (Barber, 1983; Dasgupta, 1988; Powell, 1996, pp. 1–67).

2.2.3. Calculative base of trust

Considering the cost and benefit of acting opportunistically or in an untrustworthy way is the main focus of the transaction cost approach (Williamson, 1989, pp. 135–182). Based on this theoretical underpinning is the cost–benefit calculation regarding whether it is worthwhile for a trustee to act opportunistically, forming an essential part of the calculative base of trust (Shapiro et al., 1992). In relation to calculative trust in an initial interpersonal trust context, Paul and McDaniel (2004) have stressed the vulnerability of the trustor in relation to the non-performance of the trustee. According to Li et al. (2008), users' initial trusting beliefs toward the system will be affected by their calculation of the potential costs and benefits for the misuse/abuse of said system. In relation to digital technology, the calculation of the potential costs and benefits for misuse/abuse of the technology/system will affect initial trusting beliefs toward the system.

2.2.4. Institutional base of trust

The institutional base of trust refers to an individual's belief in the existence of the necessary institutional environment, including the structures, mechanisms, and regulations that enable the individual to feel a sense of security about a situation and to act in anticipation of a successful future endeavor (McKnight et al., 1998; Shapiro, 1987; Zucker, 1986, pp. 55–111). Accordingly, institutions cannot be sufficient bases for trust if these institutions are not trusted themselves (Child & Möllering, 2003). The institutional base of trust comprises two components—namely, structural assurance and situational normality (Lewis & Weigert, 1985; McKnight et al., 1998). Structural assurance implies structural safeguards, which consist of regulations, guarantees, and legal resources (Shapiro, 1987). Prior studies in technology settings suggest imperative safeguards such as third-party certifications (Luo, 2002) and feedback mechanisms (Pavlou & Gefen, 2004). Situational normality means that a given situation is normal; moreover, in typical circumstances, when people believe that a situation is normal, they are typically comfortable enough to trust others in such a setting (Baier, 1986; Lewis & Weigert, 1985; McKnight et al., 1998). McKnight et al. (1998) have also noted that the trustor, having no knowledge about the trustee, will rely on their feelings about the situational setting so as to build trusting beliefs. Benevolence, competence, and integrity have been established as dimensions of beliefs relating to situational normality (McKnight et al., 2002b).

2.3. Older People's initial trust in and adoption of technology

Prior to our discussion of the initial trust in and adoption of technology by older people, it is imperative to formulate a definition of older people due to the fact that the literature does not yet offer a universal view of the concept. For example, many studies focusing on "older people" include those aged 60 to 65, which is threshold of retirement age (Opalinski, 2001). Alternatively, Hawthorn (2000) considered an "older adult" as a person over age 45, claiming that the effects of aging start to become visible as we reach our mid-40s. In their study, Desrosiers et al. (2004) defined older adults to be those aged 55 and over, using the following "four age groups: 55–64, 65–74, 75–84 and 85+" (p. 407). Similarly, for the purpose of this study, the term "older people" refers to persons aged 55 years and over and is used interchangeably with "older adults."

Researchers have emphasized that initial trust in technology is credited as essential for technology adoption (Li et al., 2008; Parasuraman & Riley, 1997), and trust in technology can result in the appropriate use, disuse, misuse, or abuse of the technology (Parasuraman & Riley, 1997). More recently, Octavius and Antonio (2021) specifically focused on initial trust. Choosing the Diffusion of Innovation model, UTAUT2, and the internet customer trust model, they propose that initial trust in mobile health (mHealth) providers, including doctors and platforms, is essential for users to make the decision to adopt mHealth services. These authors cite previous research (Gao & Waechter, 2017; Zhou et al., 2016) that has examined initial trust mechanisms to reduce uncertainty in technology acceptance and in the context of use. It is evident that much of the technology is unknown; hence, initial trust plays an essential role in eliminating the risks and uncertainties in the related interactions (Gao & Waechter, 2017). Empirical studies have also verified a significant positive relationship between initial trust and use intention (Cao et al., 2020; Gao & Waechter, 2017; Kaabachi et al., 2019).

Regarding older adults, Lee and Coughlin (2015) have presented technology adoption factors specifically relevant to this

population group. The aim of collating these factors is "to provide a better understanding for making decisions, strategies, and design specifications as a technology is planned, designed, developed, produced, and distributed to older adults" (Lee & Coughlin, 2015, p. 749). The ten factors are presented in Table 1. While trust does not explicitly figure in their list, Lee and Coughlin (2015) assert (based on The SCAN Foundation, 2010) that older adults are more likely to express a lower level of familiarity and trust in relation to new technology compared to younger people. In addition, Offermann-van Heek et al. (2019) include missing trust in technology as one of the perceived barriers to older peoples' adoption of Ambient Assisted Living (AAL) technologies.

2.4. Older People's socio-demographic characteristics and adoption of technology

It is also important to acknowledge that older people are a heterogeneous group and vary regarding their socio-demographic characteristics in terms of gender, age, educational background, digital literacy levels, and prior technological experience. These factors may lead to significant differences in older people's needs and attitudes toward technology (Rosenlund & Kinnunen, 2018). In addition, other research has demonstrated that the interconnected nature of socio-demographic characteristics like age, gender, education, and technological experience has a deep impact on the level of technology adoption and trust in technology in general by older adults (Czaja et al., 2006; Flandorfer, 2012; Sun & Zhang, 2006). However, the inability, fear, or unwillingness to use technological devices on the part of older adults has also been acknowledged (Flandorfer, 2012). Particularly those who are older, less educated, less affluent, or have disabilities, irrespective of gender differences, use such devices to a lesser extent (Czaja et al., 2006; Friemel, 2016; Keränen et al., 2017; Smith, 2014).

Attention has also been devoted to gender differences in this context. For example, studies have found that men are more likely to be highly task-oriented and have a higher perception of the usefulness of technological devices (Minton & Schneider, 1980; Sun & Zhang, 2006)—in particular, placing more value on communication and entertainment devices (Halmdienst et al., 2019). In contrast, women's perceptions of the benefits of using technological devices are estimated to be lower (Venkatesh & Morris, 2000), although devices that include specific health or support value have been perceived with a more positive attitude by women (Halmdienst et al., 2019).

3. Methodology

A qualitative methodological approach was adopted in this research, owing to the primary aims of exploring, interpreting, and describing the research phenomenon—the formation of older people's initial trust in digital assistive technology. Due to the complexity and multidimensionality of the phenomenon, pre-existing theoretical knowledge and concepts underpinning initial trust formation were utilized. Interviewing was chosen as the primary method of obtaining sufficiently detailed first-hand data. It is the most commonly used method of data collection in qualitative research (King & Horrocks, 2010) and is widely acknowledged as the most powerful method for uncovering and understanding the beliefs, values, and behaviors of individuals (Rubin & Rubin, 2005).

The empirical part of the research consisted of two stages—first, the pilot study, and second, the main study. To facilitate data collection in the main study, the pilot study aimed to build an initial understanding of the research phenomenon and to design the appropriate interview guide for the main study. In both studies, the target groups were older adults over the age of 55 who lived independently in their own homes. Four age groups were differentiated to reveal the major differences between the "younger" (and larger) age groups (the 55–64-year-olds and the 65–74-year-olds) and the "older" groups (75–84-year-olds and those aged 85 years and over) in formation of their initial trust in technology.

3.1. Pilot study

The first stage of the research was an explorative small-scale pilot study, which involved conducting face-to-face interviews with ten older adults living in three Finnish municipalities (Tampere, Hämeenlinna, and Parainen) in May 2018. The interviews were held with representatives of all four predefined age groups and directed with the help of an interview guide. At least one male (M) and one female (F) were selected from each age group with different geographical locations of residence (i.e., rural and urban areas) and either

Table 1
Summary of descriptions of the factors of older adults' adoption of technology.

Factor	Description
Value	Perception of usefulness and potential benefit
Usability	Perception of user-friendliness and ease of learning
Affordability	Perception of potential cost savings
Accessibility	Knowledge of existence and availability in the market
Technical support	Availability and quality of professional assistance throughout use
Social support	Support from family, peers, and community
Emotion	Perception of emotional and psychological benefits
Independence	Perception of social visibility or how a technology makes them look to others
Experience	Relevance with their prior experiences and interactions
Confidence	Empowerment without anxiety or intimidation

Source: Lee & Coughlin, 2015, p. 750.

an academic or non-academic background. Factors pertaining to academic background were not only considered to be related to the participants' academic degrees but also to the types of jobs, skills developed, vocational qualifications, and work experience they had in their career paths. An invitation to interview was made over the phone or face to face, utilizing researchers' networks exclusively to reach those who met the predefined criteria for participation. This invitation was accepted by all invited interviewees after the research purpose of data collection was explained to them and after they were assured of their confidentiality and anonymity.

The inductive approach of the pilot study offered an initial understanding of the major differences and similarities between the predefined groups of older people regarding their use of digital technology in daily activities, as well as their challenges and needs considering socio-demographic (age, gender, educational background, and geographic location) and functional capacity (physical, psychological, cognitive, and social functions) characteristics and digital literacy. Digital literacy, which is closely related to educational background and supports the use of digital assistive technology, was a specific focus of this study and refers to the accessibility and/or ownership, frequency of use, and personal experience with ICT devices, such as smartphones, personal computers, and/or tablets. In this sense, older people with a higher level of digital literacy were considered to be digitally active.

The findings showed that digitally active ICT users (i.e., those with a higher level of digital literacy) represented mostly those in the younger age groups, irrespective of gender, and those with an academic background and better functional capacity living in an urban area. The findings also revealed the significant variety existing among older people in relation to their digital literacy, geographic location, and needs for elderly care services due to decreased functional capacity. Therefore, age, digital literacy, and geographic location were regarded as the most important dimensions for the next research stage.

It was then possible to distinguish the following two persona groups on the grounds of key socio-demographic characteristics:

(1) Digitally active older person living in an urban area in close proximity to a variety of elderly care services
(2) Digitally inactive older person with disabilities living in a rural area far from services.

Thus, the pilot study provided important insights for a more in-depth investigation of the two defined persona groups in the second research stage—the main study.

3.2. Main study

The selection of the informants for the main study was done considering the main socio-demographic characteristics of both persona groups with special emphasis on independent living. Thus, all selected informants were independently living Finns over the age of 55. However, a greater focus was put on the first persona group considering the fact that the aging population is growing faster in urban areas than in rural ones (United Nations, 2015b). Furthermore, older people from rural areas usually do not live independently due to having close family members around them. Many of those who live independently often move to the cities at some point due to the increased need for care and being closer to assisted-living facilities and recreational areas. Additionally, older adults living in rural areas largely do not possess an educational background in and/or experience working with digital technologies, which may result in a higher level of the digital literacy critical for the use of new digital assistive technology (Eshet-Alkalai, 2004; Ng, 2012).

However, while dividing interviews according to the two persona groups identified in the pilot study, the differentiation in key characteristics such as "digitally active living in a rural area" and "digitally inactive living in an urban area" were considered in the data collection strategy and analysis. Accordingly, the diversity of informants within both groups was sought with respect to their age, gender, and educational background, as well as the degree of digital technology use in their daily activities. Selecting three different urban areas of residence—the cities of Kerava (located in the Greater Helsinki region), Hämeenlinna, and Tampere, which represent a "growth corridor" zone in the area of South Finland—supported diversity specifically in the first persona group.

3.2.1. Interviews with the first persona group

To interview the selected representatives of the first persona group, the focus group methodology was applied. This group interview method capitalizes on communication among all research participants and group interaction to generate data (Kitzinger, 1995). This method was particularly useful for interviewing older adults about conditions affecting the formation of their initial trust in digital assistive technology. The method also allowed the researchers to pose probing questions during interviews, which added more depth to the obtained data through elaboration and clarification (King & Horrocks, 2010). This method encouraged smooth discussions in a highly open manner among participants, as there was no need to strictly follow the interview guide. It also facilitated the asking the same question of multiple participants and allowed data saturation to be reached (Guest et al., 2006).

Between November 2018 and February 2019, two focus group interviews were conducted both in Tampere and Kerava, and three were conducted in Hämeenlinna. A total of 41 older adults, of which 26 were women and 15 were men, participated in seven focus groups, ranging in size from four to eight participants in each group. In all three cities, the groups were made up of older adults living independently in facilities called "senior houses," which are "privately owned condominiums or rental apartments for those 55 years or older" (Tyvimaa & Kemp, 2011, p. 51). Senior houses provide a safe and comfortable living environment built specifically to enhance the quality of life for older adults. These houses include indoor facilities for joint activities, such as meeting rooms, gyms, swimming pools, or saunas, as well as safety equipment, and are usually in closer proximity to public services and recreational areas. In this type of senior house, rent could be supported by the municipality for low-income tenants (Tyvimaa & Kemp, 2011).

The reason for selecting senior houses was the ease of recruiting a sufficient number of older adults who met the predefined criteria for participation and to arrange focus group interviews in their meeting rooms through the representatives of companies providing private services in the residences. Invitations with a brief explanation of the interview purpose were placed on bulletin boards in the

lobbies and meeting rooms of the buildings three weeks prior to the interviews. Following Barrett and Kirk (2000), researchers paid specific attention to the age of focus group participants. The purpose of the research and definitions and examples of new digital assistive technology (listed in the Introduction section) were explained to all groups before the interviews took place using a PowerPoint presentation. Each focus group met once with the research team for an interview, which lasted approximately 120 min, together with the briefing of approximately 30 min. At the end of the briefing, written consent with the assurance of confidentiality was received from those who agreed to participate in the interviews. Only a couple of people left after the briefing due to their tight schedules.

Data saturation was reached after interviews were conducted in seven focus groups. Thus, in the first persona group, further interviews were not needed given that collecting new data, identifying new themes, and new coding were no longer feasible; the ability to replicate the study was thereby attained (Guest et al., 2006).

3.2.2. Interviews with the second persona group

Regarding the second persona group, individual face-to-face interviewing was chosen as the data-collection method. Participants of this group were inhabitants from various parts of the vast rural areas surrounding the city of Tampere. The same procedures of the briefing, consent, and interview guide as in the focus groups were utilized during these interviews with six women and four men who represented four predefined target age groups of independently living older adults. The participants were invited to participate in the interview over the phone or via face-to-face contact utilizing a researcher's personal network. In total, ten individual interviews were conducted at the participants' homes between July and August 2019, having analyzed the data collected from the focus group interviews.

Consecutively conducting focus group and individual interviews over different time periods enabled us to make comparisons between the interviews, having done them one after another with time intervals for review. We were then able to draw out common themes from participants' views and determine when data saturation was reached. These interviews were digitally recorded with the permission of the respondents. The recordings were transcribed verbatim into text in Finnish and then translated into English, thereby protecting the participants' confidentiality. To analyze the transcribed data collected during the interviews with representatives of both persona groups, thematic analysis was chosen as the analysis method. According to Braun and Clarke (2006), thematic analysis is "a method for identifying, analyzing, and reporting patterns (themes) within data" (p. 6), which organizes and describes the data set in rich detail.

This method allowed for the incorporation of theoretical knowledge and certain predetermined concepts from existing theories, as well as the application of the data-driven inductive approach and the ability to remain open to additional emerging categories and themes (Miles & Huberman, 1994; Snape & Spencer, 2003, pp. 1–23). The data analysis process consisted of the following four major stages: first, the data collected during focus group interviews was coded; second, the data collected during individual interviews was coded; third, the general themes were induced from the collected qualitative data; and fourth, a set of identified themes were introduced and discussed in relation to the relevant literature.

4. Findings and discussion

The initial trust model proposed by Li et al. (2008) was utilized in the theoretical framework of the main study, encompassing four

Table 2
Factors affecting the formation of initial trust.

Factors Shaping Bases of Trust
1. Personality Base of Trust
1. Positive trusting beliefs in human nature
2. Functionality of technology products, related services, and systems
3. Technological advances and helpfulness
2. Cognitive Base of Trust
4. Cognitive familiarity
5. Reputation of technology
6. Reliability of technology and service providers
7. Human roles and structures
3. Calculative Base of Trust
8. Risk of exposure to opportunistic behavior
9. Positive beliefs in official advice
4. Institutional Base of Trust
10. Existence of "situational normality"
11. Structural assurance
12. Control over personal information
Supplementary Factors
13. ICT self-efficacy
14. Support of social networks
15. Cultural adaptation
16. Existence of the "digital divide"

bases of trust with the aim of understanding the formation of older people's initial trust in digital assistive technology. This was done through the lens of socio-demographic characteristics, such as age, digital literacy, and geographic location (i.e., rural or urban living area), which were selected as a result of the pilot study. The findings from the thematic analysis of the qualitative data, highlighting 16 themes or factors affecting the formation of initial trust, are presented in Table 2, and discussed in the following sections.

4.1. Personality base of trust

4.1.1. Positive trusting beliefs in human nature

All interviews began with a discussion about the respondents' general trust in others. During these discussions, the majority of interview participants were able to explicitly describe their "positive trusting beliefs in human nature" in terms of underlying assumptions about people in general, such as their benevolence, competence, and integrity (McKnight et al., 1998, 2002b). Having these positive trusting beliefs, respondents are more likely to trust others when novel situations arise (Li et al., 2008). The following interview extracts illustrate these findings: "Yes, I usually trust people" and "Yeah, I trust [people] quite a lot." There were no significant differences in the positive beliefs of respondents with respect to the socio-demographic characteristics, such as age, digital literacy, or geographic location (i.e., rural or urban living area) selected for the study.

It is interesting to note that the following related extract also highlights the importance of close interpersonal and cultural aspects: "However, at least those closest to me. Yeah, I trust them. […] I trust other Finns." This is consistent with the existing literature on the positive correlation between close interpersonal relationships and cultural similarity and trust (e.g., Cook, 2001; Earle & Cvetkovich, 1995; Gulati, 1995; Rempel et al., 1985; Yuki et al., 2005).

4.1.2. Functionality of technology products and related services and systems

The focal theme of "positive trusting beliefs in human nature" addressed by participants was extended to non-human objects (e.g., Gefen et al., 2003; Li et al., 2008; Vance et al., 2008), such as digital assistive technology. In all age groups, general trusting beliefs in the functionality of the technology products, related services, and technology-enabling systems were seen as a crucial factor affecting initial trust. The following opinion was predominantly shared among those in the "younger" (and larger) age groups (55–64-year-olds and 65–74-year-olds) of respondents who were digitally active (i.e., with a higher level of digital literacy), from urban areas, and who extended their trusting beliefs from familiar to unfamiliar technology: "I trust the functionality of the new systems and technology because I have a lot of experience in using ICT devices as my profession necessitated it."

According to McKnight, 2005, users consider whether the technology fulfills the terms of the functionality required to complete a task. The identified theme corresponds to the trusting belief that a specific technology has the functions, capabilities, or attributes that enable one to do what one needs to do (McKnight et al., 2011). Furthermore, the above interview extract implies that the respondent relies on knowledge-based trust (Dong et al., 2015) related to familiar ICT devices, enabling the transfer of trusting beliefs in functionality to unfamiliar or new technologies.

4.1.3. Technological advances and helpfulness

Participants representing the younger age groups, who were digitally active and mainly from urban areas, expressed positive attitudes toward technological progress in general. They were also confident in the helpfulness of the rapidly expanding advances in technologies, reflecting their unquestioning trusting beliefs in new technologies.

> These [technologies] have become more common nowadays. We are going forward every day. Changes are so much faster. This is evolution. The pace is huge … not only for an old man but also for younger ones. However, these [technologies] are so much more advanced and helpful, and everything nowadays is more trustworthy.

McKnight et al. (2011) defined trusting beliefs in technological helpfulness as beliefs that technology provides adequate, effective, and responsive help for users. In the case of digital assistive technology, technological advances and helpfulness refer to the functions that enable older adults to perform the necessary tasks. Since technology-related trust reflects beliefs about a technology's characteristics (McKnight et al., 2011), the evaluation of such identified factors as technological advances and helpfulness is important and may have a positive impact on the formation of initial trust in assistive digital technologies.

4.2. Cognitive base of trust

4.2.1. Cognitive familiarity

The findings revealed a positive relationship between cognitive familiarity with technology and initial trust. Familiarity is an awareness or understanding of technology, "often based on previous interactions, experiences, and learning of what, why, where and when others do what they do" (Gefen, 2000, p. 727). In the context of initial trust formation, when prior direct interaction with or experience using technology is nonexistent, cognitive familiarity with the technology can be based on other users' experiences and acquired through learning and utilizing multiple information sources. The general point made by the majority of respondents was that any source of information on new digital assistive technologies is important for their initial trust.

> Everyone will, of course, think about how it works, whether to trust it or not? And it makes you question things a little, or if it's the kind of information you have that doesn't need much thinking.

Two sources of information were specifically acknowledged as the most commonly used: online forums and offline "word-of-

mouth" referrals. In particular, representatives of the "older" (and smaller) age groups (75–84-year-olds and those aged 85 years and over), who were digitally inactive, irrespective of whether they were from urban or rural areas, tended to rely heavily on their friends' and relatives' referrals: "It really makes a difference, how much it [technology] is used by my friends; it makes it possible to ask them about their experiences."; "Well, I guess if my children say that this [technology] is good and safe, then it must be."

Representatives of younger age groups from urban areas who were digitally active were not likely to rely exclusively on the experience of their friends and relatives, but also on practical issues like technical compatibility.

> The whole family, your immediate relatives and those relatives who live a bit further away, the communication that you need with them is vital. So, for example, compatibility of ICT devices among, like, your inner circle is a pretty essential criterion.

The findings also showed that most respondents, irrespective of their age groups, especially those with relatively good digital literacy and living in urban areas who were very active internet users, searched for information regarding new technologies, and were willing to rely on information acquired from reviews and recommendations in online forums.

> We go to look for information there [the internet], we google and see what kinds of reviews there are for the device, and based on that, we then choose something that's average or good.

> Information is available over there [on the internet] … private individuals give their own critiques about some specific devices … maybe scarce user experience but based on facts. So, we do kind of check a bit of everything … on the net forums.

The active use of information sources, such as television and radio advertisements, as well as local community newspapers and bulletins, by older adults who were heavily dependent on low-tech sources could be explained by the limited number of sources that market new digital assistive technologies to a mass audience and the relatively few users who can act as word-of-mouth sources (Delello & McWhorter, 2015; Golant, 2017; Lee & Coughlin, 2015).

4.2.2. Reputation of technology

In general, reputation or "second-hand knowledge," which is a result of indirect learning (McKnight et al., 1998) based on other users' experiences, was widely recognized by the interview respondents. When prior experience with technology is nonexistent, reputation is the only knowledge that may unveil whether technology satisfies users' needs and expectations. This knowledge created a foundation for initial trust in technology for the majority of respondents, who highlighted three dimensions of reputation that could improve their satisfaction levels. Thus, representatives of the younger age groups who were digitally active, irrespective of whether they were from urban or rural areas, emphasized that their attitudes toward new digital assistive technology would be strongly influenced by the reputation of a technology's brand. Viewing the "well-known and trusted brand" as a promise of future performance, quality, and required capacity to respond to their needs may lead to the overall satisfaction that generates trust (Anderson & Sullivan, 1993; Deighton, 1992; Selnes, 1998): "My attitude toward technology is also influenced by reputation, and I always try to choose a well-known and trusted brand when we buy a new device."

Among the respondents from the older age groups, a retailer's good reputation was highly valued and seen as improving their satisfaction. They evaluated a given retailer's reputation based on the retailer's ability to satisfy their needs for easy access to maintenance services and their preference for using their native language during communication.

> The fact that it [technology retailer] has some representative, in this case, in Finland, where you can handle matters so that the service isn't entirely abroad, what language you can use in communication, and that the manufacturer is accessible. So, these pretty much dictate what you get.

In addition, the reputation of the organization providing technical support services was considered by some respondents from the older age groups to be essential for their initial trust. The findings indicated that a given technology's good reputation was one of the most prevalent and powerful sources of the respondents' initial trust and intention to adopt a technology.

4.2.3. Reliability of technology and service providers

The reliability of the technology, the service provider, and the organization providing the technical support services was seen by most participants as very important for their initial trust, irrespective of socio-demographic characteristics (i.e., age groups, digital literacy, and geographical location of residence).

> Reliability is most important … particularly, who provides the service, what that organization is. Already someone you can trust and someone that is safe, that you can then buy that kind of service. That is already a lot.

This finding correlates with previous literature on trustees, who must be relied upon to behave in a predictable manner (Giffin, 1967; McKnight, 2005, pp. 329–331; McKnight et al., 2011). With technology, reliability refers to the belief that a specific technology will function consistently and correctly, thus shaping users' perceptions of reliability (McKnight et al., 2011).

4.2.4. Human roles and structures

The importance of the human role was highlighted by many respondents, irrespective of socio-demographic characteristics: "Well, people are an essential part of the system, after all." The following comment elaborates on this view:

> I would say the most important part of the system is still people, no matter how much technology is involved. The person is still the system manager there, or the supervisor makes the necessary changes there and reacts. There is a person working behind the scenes there. It's not the system itself; it's crazy to trust just the system.

Respondents' trusting beliefs conformed to the human-bound view of the concept of trust in technology: "People trust people, not technology" (Friedman et al., 2000, p. 36). Digital assistive technology is usually delivered as a service solution by professionals who evaluate quality of life and health status, provide advice, and support older people during the process of technology selection and use in daily life. The role of these professionals is critical in ensuring fair and meaningful access to technology and the necessary conditions for its operation, making them a vital part of the technology-enabling system; therefore, their competence and integrity are important. In this particular context, the nature of initial trust should not be considered narrowly, and the vulnerability that both people and technology may or may not complete a task or function in a satisfactory manner must be considered.

4.3. Calculative base of trust

4.3.1. Risk of exposure to opportunistic behavior

Older respondents from both urban and rural areas, irrespective of whether they were digitally active or inactive, perceived the potential of opportunistic behavior on the part of technology providers as less important, since digital assistive technology was meant to be useful and beneficial to them: "You have to trust; even when you think that nothing works. Things will not go forward if you don't have trust."

This finding mirrors Gefen et al.'s (2003) conclusions regarding the antecedents of trust in an online environment—the belief that the vendor (the assistive digital technology provider in this study) has nothing to gain by cheating, being incompetent, not caring, or being dishonest. At the same time, younger participants, those from urban areas, and those with better digital literacy expressed more concerns about the security of personal health information in the future and considered the risk of exposure to opportunistic behavior related to the storage of this information as a real threat: "In whose hands it [personal health information] is, who can manipulate it, who can exploit it, how it is secured, these are big questions."; "However, the risks are increasing all the time, and this kind of [health] information, if any is available, is possible to sell." This corresponds with internet privacy and confidentiality concerns, such as threats to personal information submitted over the internet or stored in a virtual space (Dinev & Hart, 2006; Malhotra et al., 2004).

4.3.2. Positive beliefs in official advice

With regard to the question of how official advice and guidance given by the public elderly care providers for the use of new digital assistive technology services or devices would affect an older adult's initial trust and attitude toward these technology solutions, all respondents expressed strong positive beliefs that providers had nothing to gain from being untrustworthy or giving self-interested advice. Their common view can be exemplified by the following quotes: "Yes, elderly care providers' advice affects trust in it [technology]. Yes, having advice would help with choosing [technology]. It will not necessarily be the basis for making a final decision, but it will help, it has to."; "Apparently, what they recommend is not just pulled out of thin air. They have information."

These quotes signify the belief in care professionals' benevolence, as well as the belief that these professionals are competent and act in the interests of older people, supporting the formation of their initial trust in technology products, related services, and systems. This finding is comparable to Peek et al.'s (2017) study, in which one of the triggers for older people to begin using a technological device was advice given by health professionals, as well as initial information on available assistive devices offered by home care providers for older people.

4.4. Institutional base of trust

4.4.1. Structural assurance

The interview participants, irrespective of socio-demographic characteristics, expressed their confidence in the existing institutional system. In particular, they noted that they generally felt safe and protected by the health authorities' regulations, guarantees, and legal safeguards, such as quality control systems: "Yes, I believe that at least in Finland [we are protected]. We should be. To be in this country is to feel safe."; "So long as we have not heard of misdeeds, we will trust. Isn't that the Finnish principle?"

These findings are aligned with the view that the existence of effective institutional mechanisms provides assurance of safe and secure transaction conduct (Gefen et al., 2003; McKnight et al., 1998; Shapiro, 1987; Zucker, 1986, pp. 55–111). Furthermore, in line with McKnight et al. (1998), the structural assurance components acknowledged by the respondents shaped their trusting beliefs in digital assistive technology in the Finnish context.

4.4.2. Existence of "situational normality"

Most of the respondents, irrespective of the selected socio-demographic characteristics, expressed a belief in the existence of "situational normality" in relation to digital assistive technology. They believed that elderly care professionals operated according to ethical principles and in a competent manner, which led to their trusting beliefs in digital assistive technology. "Yeah, I don't have any experience of anything bad, either. Of course, the press always writes about sorts of things, but at the moment, everything has gone well so far."; "When I think about health clinics and medical services, then I do assume that they have picked the sort of people who have the required training."

They also perceived that personal health information databases were managed in a secure way under regulations set out by health

authorities and used according to ethical standards.

> If, and when, it goes with the same formula; for example, at the moment, all services that are in use in "My Kanta Pages" [personal health database] and other places, these are the things that are defined by the health authorities and require strong identification. If the minimum level is that, then why not trust?

Technology users' positive feelings about the situational setting (McKnight et al., 1998) were based on their familiarity and previous experiences (Gefen et al., 2003; McKnight et al., 2002b). Users were more willing to trust technology when they believed that the technology was being used with integrity, benevolence, and competence (McKnight et al., 2002b).

4.4.3. Personal information protection

Younger respondents who were digitally active and from urban areas placed much emphasis on the protection of personal information through the control of health authorities over technology providers' health databases. This control was perceived as an assurance of the privacy and security of personal information and a factor positively affecting their initial trust formation in digital assistive technology.

> It is mainly about the management of access rights to the database ….If the [technology] producer is the administrator of its database, the management of the database must be under the control of the health authority.

This finding confirms the widely acknowledged concern with information security in relation to e-health and digitized health-related information in general, as well as an increased focus on responsibility, regulation, and compliance involving health authorities (Georgiou & Prgomet, 2019). Moreover, the importance of a trusting relationship with a healthcare provider has been recognized as essential for minimizing perceived risk related to potential concerns with privacy and security (Park et al., 2020).

4.5. Supplementary factors

4.5.1. ICT self-efficacy

Knowledge and skills acquired from the prior use of ICT were acknowledged as important for initial trust in digital assistive technology by many younger informants, those who were digitally active, and those from urban areas. These respondents were confident in their abilities to use ICT devices due to experience anchored mainly in their past working lives.

> If we now talk about some [ICT] device, if it has a long lifespan behind it, and you've got experience, then you trust it ….But something new, then it might be something that takes a while before you can trust it.

Their perceptions of higher ICT self-efficacy also enabled them to believe in their abilities to use digital assistive technologies. The rest of the interview participants, representing mainly the older age groups, perceived their ICT self-efficacy as very low, since their experience using these devices was almost nonexistent or rather recent. Additionally, many of them had challenges due to health-related impairments that reduced their functional abilities to use ICT devices. This is reflected in the following interview quote:

> For this old man, learning to use one of these computer things has been a rocky road. I didn't need a computer in my workplace, and three or four years ago, I got a computer from my grandchildren … I started from scratch with it … it has been hard with these fingers.

This finding is consistent with previous research positing that age differences in technology adoption and use are partially mediated by ICT anxiety and ICT self-efficacy (Czaja et al., 2006). Studies have also shown that in cases of low self-efficacy among older people, the main issue is the fear of a steep learning curve and the need for assistance (Peek et al., 2016). It could also be proposed that initial trust, as an important determinant of technology adoption, is likely to be affected by levels of both ICT anxiety and ICT self-efficacy.

4.5.2. Support of social networks

Among the older respondents from both urban and rural areas who were digitally inactive, the availability of support in the choice and use of digital assistive technology from their close relatives and friends (i.e., social networks) was acknowledged as important for their initial trust in such technology. These respondents expressed confidence in the trustworthiness of the members of their social networks and the belief that they would take the respondents' interests into account when choosing the relevant assistive technology for them, especially when the need was both acute and urgent.

Most of these interviewees accentuated the indispensable role their relatives played in teaching them how to use digital devices at home: "It is difficult to learn how to use all kinds of new devices. Children give me advice, yes."; "My son taught me and my daughter, when it was so awkward." Earlier research has recognized the importance of social networks, including participants' partners, children, other relatives, and peers, in providing practical, financial, and emotional advice and support in the choice and daily use of technologies enabling aging in place (Peek et al., 2017, 2019). This finding also indicates a positive attitude and willingness to learn technologies, supporting the results of previous empirical studies that contradict stereotypes about older people being afraid and unwilling to learn, use, and adopt technologies (e.g., Mitzner et al., 2010).

4.5.3. Cultural adaptation

The issue of cultural adaptation in assistive technology solutions was raised as important by some younger respondents from urban areas, irrespective of whether they were digitally active or inactive.

For the developers, it's a problem, which market they [technology solutions] are made for. I just read a book where it said that Germans trust different things than Finns. And then Russians apparently trust different things than Americans. So when one such product comes, then you have to know how to target it toward that clientele in different ways.

By drawing attention to the importance of cultural adaptation for the formation of initial trust, this finding is a call for developers to consider cultural factors and adapt their digital assistive technology solutions to meet the needs and expectations of older users from different cultures. To ensure that technology adequately matches potential users' needs and expectations, it is necessary to consider their perceptions of a technology from an early stage in its development to its use in real-life settings (Davis et al., 2014; Simblett et al., 2018). These perceptions vary from culture to culture and are related to differences in gender, age, educational background, digital literacy levels, and prior technological experience (Czaja et al., 2006; Flandorfer, 2012; Sun & Zhang, 2006; Venkatesh & Morris, 2000). For example, a new set of skills is required for the effective use of every advanced technology (Wertsch, 1995, pp. 56–74); therefore, it must be adapted to the educational background and levels of digital literacy and skills of people of the target culture. Practically, this may require adding or modifying some functionalities and auxiliary features or even substituting technology components that could positively affect trust in and intention to adopt technology.

4.5.4. Existence of the "digital divide"

Older participants from both urban and rural areas, irrespective of digital literacy, raised cost and equality issues in relation to initial trust formation. Their strong concerns about the cost and equal availability of digital assistive technology took precedence over their consideration of trust in this technology. These issues call attention to the existence of the "digital divide," which refers to the gap between older and younger people in access to and consequent use of digital technology. The respondents were particularly concerned about the technology and related services' costs, which could be a threshold question for less affluent older people: "Certainly it [cost] might be for someone a deal-breaker."; "If the costs rise to obscene levels, then yeah, it will probably lead to inequality."

Furthermore, the respondents advocated equal availability of and access to digital assistive technology for everyone through the system of public health and social services. This would also mean reducing the digital divide and increasing the digital inclusion of older people (Ciesielska et al., 2022): "The public voucher system should, well, you know, enable it [equal availability]. That is how, you know, you make it [technology] equally available for use." Similar to prior research, concerns about continued support for assistive technologies from municipalities and other agencies were an important part of cost considerations (Peek et al., 2016). This finding also complements previous studies on the digital divide among older people, seen to be rooted in the resources available to them (Levy et al., 2015; Pirhonen et al., 2020).

4.6. Summary

The main study uses a qualitative methodological approach to identify, explore and interpret the factors that affect the formation of initial trust in digital assistive technology among older people, and that also may encourage potential adoption of this technology. This was done by looking at the factors through a socio-demographic lens. The findings represent the attitudes to, perceptions of, and trusting beliefs in digital assistive technology products, services, and systems exhibited by older people living independently in Finland. These findings illustrate the 12 specific factors that shape the personality, cognitive, calculative, and institutional bases of trust, as well as four supplementary factors that are not directly involved in shaping the bases of trust but have been identified as important for initial trust formation and potential technology adoption. Furthermore, the 16 identified factors were not found to be fully dependent on the selected socio-demographic characteristics.

4.6.1. Factors shaping the four bases of trust

Shaping the personality base of trust, positive trusting beliefs in human nature were manifested in the prevailing beliefs among all respondents regarding the benevolence, competence, and integrity of humans in general. Having these positive beliefs supports the formation of trusting beliefs in non-human objects, such as digital assistive technology. While trusting beliefs in the functionality of the technology were predominantly shared by younger respondents, those who were digitally active, and those who lived in urban areas, this was mainly based on their work-related experience in the use of ICT devices. These younger respondents were also more open to new technologies, being confident in the helpfulness of rapidly expanding technological advances, which could be seen as factors positively affecting their initial trust in digital assistive technology.

In relation to the cognitive base of trust, the respondents' cognitive familiarity with digital assistive technology was primarily considered a significant factor based on other users' experiences and was acquired through learning and utilizing multiple information sources. Digitally active respondents from the younger age groups who lived in urban areas relied mostly on the technical characteristics of technology, gleaned in particular from sources such as online forums and word-of-mouth referrals, unlike their older counterparts, who tended to rely exclusively on the experiences and referrals of their friends and relatives. These findings demonstrate that one of the most prevalent and powerful sources of respondents' initial trust and intention to adopt a technology was the good reputation of the technology and the knowledge of prior use by someone else. The reputation of the technology's brand was mainly emphasized by digitally active representatives of the younger age groups, whereas the reputations of the retailer and the organization providing technical support services were mostly seen as valuable for the older groups. The majority of interview participants also indicated that the reliability of both a given technology and service providers was an indispensable part of the initial trust placed in digital assistive technology. There was also a common view that technology-related services and systems are operated by humans, and for these systems to work well, the competence and integrity of the human operators are of utmost importance.

In terms of the calculative base of trust, concerns about the potential for opportunistic behavior on the part of technology providers

were deemed less important by older participants, who considered digital assistive technology to be useful and beneficial to them. Digitally active representatives of the younger age groups, predominantly from urban areas, were more concerned about the security of personal health information. Respondents' commonly shared beliefs in the integrity, benevolence, and competence of healthcare service providers shaped the calculative base of their initial trust in technology products, related services, and systems endorsed by public elderly care providers.

With regard to the institutional base of trust, the majority of interview participants were confident about the existing institutional system. They felt safe and protected by the health authorities' regulations, guarantees, and legal safeguards, such as quality control systems that form "structural assurance." Most of the respondents expressed the belief that elderly care professionals operate according to ethical principles and in a competent manner that implies "situational normality." Younger participants living in urban areas paid much attention to the control of health authorities over the technology providers' health databases, considering it to be an assurance of the privacy and security of personal information. Thus, confidence in the institutional system and the positive perception of the situational setting, as well as what makes it normal, positively affected their initial trust formation in digital assistive technology.

4.6.2. Supplementary factors

The perceptions of higher ICT self-efficacy among participants of the younger age groups, mostly from urban areas, signified their beliefs in their ability to use digital assistive technologies and thus positively affected their initial trust in the technology. Low ICT self-efficacy was described mostly by older participants. This was explained by their nonexistent experience in the use of ICT devices, as well as by their health-related impairments that reduced their functional abilities and prevented them from starting to use technology. As a result, low ICT self-efficacy negatively affected the respondents' initial trust in digital assistive technology. The availability of support from social networks in the choice and use of digital assistive technology was perceived as a crucial factor affecting the initial trust of respondents from older age groups.

Perceptions of technology can vary from culture to culture, and the necessity of considering cultural differences and cultural adaptation of digital assistive technology solutions was stressed by those in the younger age groups from urban areas. Specifically, cultural adaptation was seen as requiring technology to be adapted to the educational background and digital literacy and skills of people in the target culture.

For those representing the older age groups from both urban and rural areas, irrespective of whether they were digitally active or inactive, the issue of the digital divide was raised through their strong concern about the cost and equal availability of digital assistive technology. Notably, cost and equality issues took precedence over considerations of trust in this technology.

5. Conclusions and implications

With this paper, we seek to contribute to the academic literature on technology adoption by examining factors affecting the formation of initial trust in digital assistive technology among older people living independently in Finland. Having identified a lack of empirical research in this area, we conducted a qualitative study to discover the attitudes, perceptions, and beliefs affecting older people's initial trust in digital assistive technology and to expand our understanding of the moderating role of socio-demographic characteristics in the formation of initial trust. Thus, our research was guided by two questions: (1) How is older people's initial trust formed with regard to technology adoption; (2) What factors affect the formation of older people's initial trust in digital assistive technology?

A thematic analysis of the results led to original findings expressed through the 16 themes or factors affecting the formation of initial trust and comprising 12 specific factors shaping the four bases of trust and four supplementary factors (see Table 2 in Section 4).

The value of this qualitative research lies in its having opened up possibilities for us to theorize the findings and to suggest the following propositions:

- By considering the identified factors affecting the formation of initial trust in digital assistive technology, older people's adoption of technology can be markedly improved.
- Having a moderating role in the formation of initial trust, socio-demographic characteristics may affect the process of technology adoption by older people.

This study also makes an important contribution to current practice, offering essential insights that designers, developers, and public and private care service providers can use to direct the R&D of new digital assistive technology solutions and their uptake in a way that can gain older people's initial trust and advance the process of technology adoption. It is also important to highlight that while older people have relationships with many stakeholders in their assistive care system, such as members of extended families, caregivers, and technology providers, it is mostly how they work together that affects their initial trust formation in technology and its adoption.

Although the purpose of our qualitative research was directed toward providing in-depth explanations and meanings rather than generalizing the findings, the identified factors affecting initial trust formation provide a basis for contributing to practical implications in other country settings beyond Finland. However, there are some limitations that should be noted. First, this study was conducted in a highly specific context that focused exclusively on independently living older people rather than accounting for the opinions of those who help them in their daily lives, such as relatives, friends, neighbors, and caregivers. Second, the factors affecting initial trust formation were identified in relation to the set of selected types of digital assistive technology presented in the introduction rather than focusing on each type of technology separately.

Thus, future research will benefit from the inclusion of views from all stakeholders involved in the assistive care systems of older people to yield findings that are more comprehensive. The findings could also be tested further through large-scale survey research, differentiating between factors affecting trust formation with regard to distinct types of digital assistive products or services as well as in different countries and cultural contexts. Finally, the issue of technology's cultural adaptation emerged during the data analysis, which merits further empirical investigation within a culturally diverse context.

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