

Perceived Threat of Cyber Attacks and its Role in the Adoption of Tablet Computers by Older Adults

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Abstract. *This study explores factors affecting tablet adoption among older adults in Slovenia. Findings highlight significant differences across three adoption groups: those without a tablet, with an unused tablet, and active users. Perceived usefulness and existing knowledge greatly influence adoption intention, while cybersecurity concerns and anxiety contribute to usage fear and potential benefits' rejection. As these concerns are universal across all adoption stages, strategies addressing cybersecurity, including clear cyber safety information, online safety training, and accessible cybersecurity infrastructure, are essential for promoting tablet use among older adults.*

Keywords. Technology adoption, older adults, tablets, tablet computers, cybersecurity, fear of cyber attacks

1 Introduction

The demographic transition towards an aging population represents a significant shift and an urgent societal concern in the current era. Individuals aged 65 and above constitute a substantial proportion of the population in Europe, a trend projected to escalate to a quarter of the population in the European Union and North America in the upcoming decades (United Nations, 2022; WHO, 2022). This rising trend spawns a multitude of challenges that demand immediate and creative solutions.

Addressing the issues associated with an aging population is pivotal for the successful realization of the United Nations' 2030 Agenda for Sustainable Development, considering its overlap with Sustainable Development Goals (SDGs) such as poverty eradication, health and wellbeing, gender equality, economic growth, decent work, reduced inequalities, and sustainable cities. In order to foster genuinely transformative, inclusive, and sustainable development outcomes, it is imperative to perceive older persons not solely as a vulnerable group but as active participants contributing to societal progress (United Nations Development Programme, 2017).

The proliferation of digital technologies, which have become increasingly intertwined with everyday life, presents unique solutions for issues associated with an aging population. Since 2019, the digital age has seen a marked surge in internet and information and communication technology (ICT) usage, notably involving mobile and smart devices. This growth was particularly pronounced during the pandemic (Deloitte, 2021; ITU, 2021).

However, a significant digital divide persists between younger and older generations, with the older adults demonstrating a lesser inclination to embrace technology compared to the broader population (Anderson & Perrin, 2017). Despite this, smart devices hold the potential to enrich the quality of life for all age demographics. Owing to their accessibility and user-friendly interfaces, these devices have led some individuals to forgo traditional computers, opting instead for mobile devices, particularly tablets (Chan et al., 2016).

The aim of this preliminary study is to investigate the adoption of tablets among older adults in Slovenia, i.e., individuals aged 65 and above, and to gauge their perceived threat level from cyber-attacks. The study seeks to understand the influence of various factors, such as technology adoption habits, behavioral tendencies, and security considerations, on this population's tablet usage. The survey also aims to analyze participant's experiences with using tablets, and to measure constructs like perceived usefulness, ease of use, and others, with the ultimate goal of understanding how these elements contribute to the adoption or rejection of tablets among older adults.

2 Theoretical Background

The penetration rate of tablet PCs, akin to other frequently employed ICT, has witnessed significant fluctuations over time. In 2012, the penetration rate in selected European countries varied from 14.9% to 22.3%. However, by 2020, this rate had seen a substantial upswing, ranging from 61% to 73.5%. The Netherlands registered the highest penetration rate of

tablet PCs in the European Union (66%), whereas Ukraine reported the lowest rate (14%) (Statista, 2023b, 2023a). In 2021, approximately 30% of individuals across 27 European Union countries utilized tablets for internet access, with 20% of individuals aged between 65 and 74 partaking in this practice (Eurostat, 2023a). Parallel studies conducted in the United States revealed that roughly one-third of seniors aged 65 and older owned tablet computers in 2016. Tablet ownership was more prevalent among seniors with advanced educational attainment and those residing in higher-income households (Anderson & Perrin, 2017).

While older adults may not exhibit the same level of proficiency with emerging technologies as younger generations, who grew up in the computer age, the utilization of smart devices, such as tablets, can proffer a multitude of benefits and flexible solutions for this demographic group (Vaportzis et al., 2017). Tablets can serve as a conduit for maintaining social connections, assist in medication management, facilitate setting reminders, and provide cognitive-stimulating games.

The user-friendly nature and adaptability of these devices are particularly advantageous for users with visual impairments, aiding in reading and accessing critical data. Different features enabling automated texting amplify the communicative potential for those with hearing and mobility limitations (Kim et al., 2022; Tsai et al., 2015; Vasconcelos et al., 2012). As a result, tablets can exert a positive influence on the cognitive abilities, health, and overall well-being of the older adults, particularly in alleviating feelings of isolation and depression often concomitant with decreased mobility (Chan et al., 2016; Vaportzis et al., 2018).

While tablets can be highly beneficial for older adults, their utilization is not without its limitations and barriers. These barriers can be classified into several categories, including a lack of instructions and guidance, limited knowledge and confidence, health-related issues, prohibitive costs, insufficient accommodation for sensory and motor impairments, and limited input from clinicians and researchers (Kim et al., 2022; Vaportzis et al., 2017; Wilson et al., 2022).

Moreover, the susceptibility to cyber threats and the risk of falling victim to cybercrime has become a significant concern for older adults operating smart devices and tablets. This demographic is particularly vulnerable to cyber-attacks due to their limited digital proficiency, restricted experiences, and a lack of knowledge in this arena (Blackwood-Brown et al., 2021; FBI, 2022; Virtanen, 2017). Furthermore, mild cognitive impairment can undermine their ability to discern scams, adhere to recommended security protocols, and evaluate the risks associated with their online behaviors (Mentis et al., 2019).

The latest Special Eurobarometer on Europeans' attitude towards cybersecurity revealed that up to a third of older users have personally experienced or been victims of cybercrime, with frauds, scams, and

malicious software constituting the most prevalent types of crimes. Older users are also less likely to undertake security-related measures and feel less informed about cybercrime, thereby exacerbating their vulnerability. This digital divide is particularly acute among older, less affluent individuals with lower educational attainment, which underscores the need for enhanced support and assistance in using tablets and addressing their limitations and barriers (European Commission, 2020).

These findings from the Eurobarometer align closely with the data provided by Eurostat (2023b) emphasizing the pressing issue of internet security among the older adult population within the European Union (EU). In 2019, it was reported that approximately 19% of this demographic encountered issues related to online safety. The most prevalent issue was phishing scams or fraudulent emails. Pharming scams were the next most common concern, followed by the loss of documents, images, or other data due to computer infections, such as viruses, worms, or Trojan horses.

Therefore, the population of older adults requires additional support and guidance in the safe and secure usage of tablets and other digital technologies. By addressing these barriers and providing appropriate training and resources, we can help bridge the digital divide and enable senior citizens to harness the numerous benefits that tablets and technology can offer.

Thus far, an extensive body of research has been dedicated to investigating the engagement of the elderly population with smart devices. This collection of scholarly work focused on tablet usage can generally be compartmentalized into several distinct thematic categories.

Firstly, a prominent area of investigation has centered on the prevalence, adoption rates, and familiarity of tablets amongst the older adults, with a particular emphasis in the context of the COVID-19 pandemic (Kim et al., 2022; Vaportzis et al., 2018). These studies suggest that tablets have become an integral part of daily routines for many older users, concurrently advocating for enhancements in future training initiatives. Secondly, research examining the benefits and challenges associated with tablet use among the older adults has revealed several obstacles including a lack of technological familiarity, diminished confidence, and inadequate training. Conversely, tablets offer numerous advantages to this demographic, such as entertainment, social connectivity, and a platform for seeking information (Vaportzis et al., 2017; Wilson et al., 2022). Nonetheless, a note of caution has been raised regarding techno-optimism (Cid et al., 2020), with some studies suggesting that tablet use among elderly residents in long-term care facilities may not significantly ameliorate cognitive decline, loneliness, or self-esteem. A third area of research focuses on tablet design and interaction techniques (Petrie &

Darzentas, 2017; Sciarretta et al., 2015), emphasizing the potential of appropriate design methodologies in augmenting the value of tablet applications for older users. Lastly, emerging research topics include the investigation of adoption and motivation to use tablets among the older adults. Studies have found that perceived ease of use and usefulness, as well as positive perceptions toward the devices, serve as significant factors influencing adoption (Chee et al., 2022; Tsai et al., 2015).

Notwithstanding, recent studies have detected a degree of skepticism towards tablets and technology in general among senior citizens, which can pose substantial barriers to adoption and effective usage (Vaportzis et al., 2017). Furthermore, privacy and cybersecurity concerns have been linked to the usage of tablet applications among older adults (Moyle et al., 2020). Drawing upon previous research, it can be deduced that despite the generally positive reception of tablets, a number of obstacles obstruct greater or more rapid adoption rates within the elderly demographic.

While a considerable number of studies have explored smart devices and tablet adoption among the older adults, it is imperative to acknowledge the myriad factors influencing this process, intrinsically tied to their experiences and perceptions. Yet, existing research has rarely adopted a comprehensive approach to examine the diverse factors influencing tablet adoption among the older adults, including cybercrime fears. Therefore, the primary objective of this research is to delve into tablet adoption among older individuals, particularly focusing on discerning differences between adoption groups and correlated factors. Moreover, this study aims to scrutinize the role of perceived threat in relation to prospective adoption factors, with the ultimate objective of gaining a more profound understanding of the dynamics that influence tablet adoption among the older adults. The premise underpinning this research is that understanding the barriers and facilitators to tablet adoption among the older adults is crucial for the design of effective interventions. Addressing these factors could promote technology adoption, thereby enhancing the quality of life for this burgeoning demographic.

3 Method

To examine the adoption of tablet use among older adults and how much they feel threatened by cyberattacks, we conducted a survey among older adults in Slovenia, explicitly targeting individuals aged 65 years and above. This survey was conducted in February and March 2023. The recruitment of participants for the study was carried out by students, who were given clear instructions to reach out to a diverse group of individuals in their immediate and extended circles. This included their grandparents, neighbors, acquaintances, and randomly selected individuals from their respective hometowns.

These students were trained to provide necessary assistance to the participants, with a key focus on ensuring that the participants had a full understanding of the survey's context and objectives. This involved clarifying the survey details outlined on the introduction page and explaining central concepts integral to the survey, such as the concepts of tablets and cyberattacks. Furthermore, the students provided support to participants who experienced difficulty in choosing a response, such as when expressing agreement or disagreement with a statement on a 5-point Likert scale. The goal was to ensure that participants felt confident in their responses and that their answers genuinely reflected their perceptions and experiences.

It's important to note that the students were strictly directed to assist in clarifying the content and in explaining how to provide responses. They were explicitly told not to sway the respondents' answers in any manner.

The survey questionnaire was structured to assess a range of factors related to technology adoption, behavioral tendencies, and security. These factors were categorized into several constructs, including perceived usefulness, ease of use, subjective norm, facilitating conditions, hedonic motivation, anxiety, fear, perceived threat, attitude towards use, intention to use, and rejection of benefits. We employed a mix of four items and three items to measure subjective norm, ease of use, and the other constructs, respectively. The questionnaire also incorporated questions specifically designed to understand participants' experiences with using tablets and their demographic characteristics.

The study was conducted in ethical compliance, as demonstrated by the approval of the Faculty of Criminal Justice and Security Research Ethics Committee at the University of Maribor.

The survey was successfully completed by 119 older adults. Of these, 54.6% were female, and 45.4% were male. The age distribution among the respondents was broad, with ages ranging from 65 to 93 years, and the median age being 70 years. Furthermore, the participants were almost equally distributed between urban (44.5%) and rural (55.5%) environments, offering a balanced perspective from both types of settings.

The reliability of the survey instrument was assessed using Cronbach's alpha (CA), resulting in values ranging from 0.850 to 0.979, which were comfortably above the standard threshold of 0.800 for all constructs. An exception was noted for the construct of facilitating conditions, with a CA of 0.357. Being a formative construct, it is composed of diverse dimensions. The lower reliability for this construct suggests that these dimensions may not be as interconnected as in other contexts, such as organizational settings, where the reliability for this construct is typically adequate. To analyze the data, we computed the mean for all constructs, except for facilitating conditions.

	All (N = 119)	Do not have (N ₁ = 73)	Do not use (N ₂ = 14)	Use (N ₃ = 32)	F
Perceived usefulness	3.15	2.69	3.24	4.16	24.9831***a,b
Ease of use	2.82	2.43	2.39	3.91	17.4007***a,b
Subjective norm	3.43	3.08	3.70	4.11	14.9530***b
Hedonic motivation	3.50	3.09	3.43	4.46	15.8834***a,b
FC1: Financial status	3.35	2.95	4.00	4.00	9.2069***b,c
FC2: Knowledge	2.50	1.89	2.36	3.97	37.9726***a,b
FC3: Support	4.03	3.86	4.36	4.25	1.6026
Attitude towards use	3.46	2.98	3.50	4.52	25.1797***a,b
Perceived threat	3.00	3.18	3.19	2.52	2.9304
Anxiety	2.24	2.65	2.17	1.33	15.0772***b
Fear of use	1.90	2.28	1.69	1.13	12.0826***b
Rejection of benefits	2.57	2.76	2.71	2.06	6.5233***b
Intention to use	3.09	2.33	3.38	4.70	68.6113***a,b,c

FC - facilitating conditions; *** $p < .001$, ** $p < .01$, * $p < .05$; ^a difference between groups »use« and »do not use«, ^b difference between groups »use« and »do not have«, ^c difference between groups »do not use« and »do not have«

Table 1: Differences among adoption groups (pre-adoption, non-adoption, post-adoption).

4 Results

This section reports the results of our study, focusing primarily on two distinct areas: technology adoption and perceived cyberattack threat. We present a detailed examination of these aspects and their significant findings, providing insights into the behavior and perceptions of older adults regarding tablet use.

4.1 Technology Adoption Aspect

First, we focused on examining the differences between three distinct adoption groups: those who do not possess a tablet (pre-adoption), those who own but do not use a tablet (non-adoption), and those who actively use a tablet (post-adoption). This detailed investigation was facilitated by conducting an Analysis of Variance (ANOVA) for all the constructs that were measured during the survey. The ANOVA aimed to identify any substantial differences among the adoption groups. To further refine our analysis, we employed Bonferroni post-hoc tests. These tests were crucial in establishing whether there were significant differences between each individual adoption group. Our findings from these tests, which offer valuable insights into the three groups' behavioral tendencies and technology adoption habits, are presented comprehensively in Table 1.

The analysis of our survey results revealed statistically significant differences across adoption groups for all the constructs we measured (perceived usefulness, ease of use, subjective norm, facilitating conditions, hedonic motivation, anxiety, fear, perceived threat, attitude towards use, intention to use, and rejection of benefits) with the exception of perceived threat and support, a component of facilitating conditions. This finding suggests that

feelings of threat from cyberattacks are universally experienced across all adoption groups, irrespective of their tablet usage status. In other words, the level of perceived threat from cyber incidents remains consistent whether respondents are pre-adoption, non-adoption, or post-adoption group members. Furthermore, our results show that all participants potentially have access to some form of support, likely due to the sampling strategy we used. This is illustrated by the high average score of 4.03 for item FC3, which was the highest mean score across all the items in the survey.

In addition to the analysis mentioned earlier, we also conducted a linear regression to delve deeper into the factors associated with the 'intention to use' (the dependent variable in our model). We included in our regression model all the factors outlined in Table 1, along with 'age' as a control variable, considering these as independent variables. The model explained over 70 percent of the variance, as indicated by an adjusted R-squared ($R^2 = 0.715$).

However, we found that only two factors – perceived usefulness ($\beta = 0.438$; $p < 0.001$) and knowledge (a dimension of 'facilitating conditions', $\beta = 0.418$; $p < 0.001$) – showed statistical significance. This suggests that the respondents may be more inclined to use tablets if they perceive them as being useful and if they already possess the necessary knowledge to operate them. The findings underscore the critical role that the perceived utility of tablets and the existing knowledge of potential users play in the decision-making process related to tablet use.

4.2 Perceived Cyberattack Threat Aspect

To understand the role of 'perceived threats,' we explored various associations that could yield

meaningful insights. Specifically, we designed a linear regression model to predict the 'fear of use' (our dependent variable). In this model, we considered 'perceived threat,' 'anxiety,' and 'age' as independent variables. This model was successful in explaining more than 35% of the variance (adjusted $R^2 = 0.374$). Within these independent variables, 'perceived threat' ($\beta = 0.163$; $p < 0.05$) and 'anxiety' ($\beta = 0.489$; $p < 0.001$) emerged as significant, while 'age' did not. These findings offer valuable insights into the factors contributing to older adults' fear of using tablets. It appears that this fear could be partially rooted in anxiety related to tablet usage and partially driven by their perception of vulnerability when using a tablet. We believe that future research could benefit from further exploring these relationships to establish causal links.

Although seemingly pertinent for a considerable portion of older adults, the concept of 'rejection' has been less explored in previous studies. We, therefore, constructed a linear regression model to predict 'rejection of benefits' (our dependent variable) using the same independent variables as before. This model explained more than 25% of the variance (adjusted $R^2 = 0.258$). Consistent with the previous model, 'perceived threat' ($\beta = 0.309$; $p < 0.001$) and 'anxiety' ($\beta = 0.292$; $p < 0.01$) were found to be significant. Our findings suggest that the more threatened older adults feel by cyber-attacks or, the more anxious they are about tablets, the more likely they are to reject the potential benefits of tablets.

5 Discussion

Following the example in the results section, this section, explores two primary aspects: the technology adoption aspect and the perceived cyberattack threat aspect. We examine their relationship with the adoption and usage of tablets among older adults, and discuss how these factors can shape their behavior, attitudes, and decisions related to technology.

5.1 Technology Adoption Aspect

In our study, the classification of participants into three distinct groups - those who do not possess a tablet (pre-adoption), those who own but do not use a tablet (non-adoption), and those who actively use a tablet (post-adoption) - enabled us to examine the nuanced differences in behaviors, attitudes, and perspectives within each category.

The analysis revealed substantial differences among these groups across most of the constructs we investigated. This signifies that the technology adoption process among older adults is complex and layered, influenced by a broad array of attitudes, perceptions, and experiences related to technology. Interestingly, one of the standout findings of our study was the consistency of perceived threats from

cyberattacks across all adoption groups. Regardless of whether the respondents already owned and used a tablet, had a tablet but did not use it, or did not possess a tablet at all, the fear of cyberattacks was universally present. This underlines the pervasiveness and influence of cybersecurity concerns in shaping technology adoption decisions among older adults. It underscores the necessity for adequate education and reassurance about safety measures when promoting tablet use among this demographic.

In addition, our results indicated that all respondents potentially had access to some form of support, with a high average score for the item FC3. Given that our sample comprises individuals from diverse backgrounds and locations, it is promising to see evidence of a support network. It is well-documented that having a support system can facilitate technology adoption, especially among older adults who might need assistance navigating new devices or features. Therefore, such a finding is an encouraging sign and suggests that our participants might not be as isolated from assistance as one might expect.

The linear regression model designed to examine the factors associated with the 'intention to use' tablets explained over 70% of the variance and highlighted perceived usefulness and existing knowledge about tablets as significant predictors of adoption. This finding suggests that the decision to use tablets among older adults is not a random or impulsive but a calculated decision influenced by their perception of the tablet's usefulness and their confidence in their ability to operate it. In essence, older adults are more likely to adopt tablets if they see a practical value in them, such as staying connected with family or accessing services, and if they feel they have the requisite knowledge to use them effectively. This highlights the critical need for both - promoting the benefits of tablet usage in a way that resonates with older adults and providing comprehensive and accessible education and training initiatives to equip them with the necessary skills and knowledge to use tablets.

5.2 Perceived Cyberattack Threat Aspect

The perception of threats from cyberattacks was consistent across all adoption groups, signifying its universal presence in the technology adoption equation among older adults. A particularly noteworthy is its role in shaping two specific constructs - the fear of use and the rejection of benefits - which have significant implications for tablet adoption. The linear regression model, which aimed to predict fear of use, revealed that both perceived threat and anxiety were significant contributors, explaining more than 35% of the variance. This suggests that the fear of using tablets among older adults is not solely a product of their unfamiliarity with the technology but is significantly influenced by their cybersecurity concerns and overall anxiety related to tablet usage.

The significant association between perceived threat and fear of use brings to the forefront the importance of cybersecurity concerns among older adults. It indicates that even when older adults are willing to adopt new technology, the fear of potential cyber threats can act as a formidable barrier, possibly causing them to avoid using tablets. This fear might be exacerbated by media reports on cyberattacks and data breaches, which could further fuel their doubts about the safety of using technology. Moreover, our study also found a significant association between perceived threats and anxiety, suggesting that heightened perception of cyber threats can contribute to increased anxiety about using tablets. This underscores the psychological toll cybersecurity concerns can have on older adults, possibly making them more hesitant about embracing and accepting digital technology.

The second regression model, predicting the rejection of benefits, also highlighted the role of perceived threats and anxiety. These two factors were significant predictors, accounting for more than 25% of the variance. This indicates that the more threatened older adults feel by cyberattacks, or the more anxious they are about tablets, the more likely they are to reject the potential benefits of tablets. This finding suggests that cybersecurity concerns might deter older adults from using tablets and lead them to dismiss the potential advantages these devices offer. This could include staying connected with family and friends, accessing information, online shopping, or using health services.

Our study suggests that the perceived threat of cyberattacks can have a pervasive and multifaceted impact on tablet adoption among older adults, influencing not only their usage habits but also their attitudes toward the benefits of technology. It highlights the need for targeted strategies to address these concerns, such as providing clear and comprehensible information on cyber safety measures, offering training on safe online practices, and establishing robust cybersecurity infrastructure and protocols that are understandable and accessible to older adults.

6 Limitations

Before drawing conclusions, we must acknowledge several limitations within our study. First, our findings are preliminary, forming part of an ongoing larger-scale study. As more data are gathered and more responses accumulate, we can conduct further and more in-depth analyses. For instance, examining each adoption group separately and more thoroughly will be possible.

Second, the adoption groups in our study were not uniformly distributed. This uneven distribution could potentially impact the reliability of our findings and interpretations. Future research might need to consider more balanced data collection strategies to ensure a

more even distribution among the adoption groups. Such strategies would help derive more robust and reliable insights into older adults' adoption behaviors and attitudes toward tablet computers.

Third, despite our efforts to form survey items with the older demographic in mind, respondents could still find them challenging to comprehend. Future research should consider further simplifying the survey questionnaire to ensure our targeted older demographic easily understands it. An easier-to-understand questionnaire would not only enhance the validity of the responses collected but would also open up possibilities for different sampling strategies. These strategies could reach respondents who do not have any support while completing the survey, thereby broadening the participant base and enhancing the generalizability of the findings.

7 Conclusion

In conclusion, our research sheds light on the factors influencing tablet adoption among older adults in Slovenia. The results highlight the importance of perceived usefulness and existing knowledge in determining an individual's intention to use technology. The study also indicates that perceived threats and anxiety significantly influence the fear of using tablets and the tendency to reject their benefits. These findings provide a deeper understanding of the complex dynamics of technology adoption among older adults, further highlighting the need to address these challenges to facilitate their digital inclusion.

Future research should focus on conducting a more in-depth study of each adoption group, striving for a more balanced representation of participants across different adoption stages, and further simplifying the questionnaire for better comprehension. Future research should also employ alternative sampling strategies to reach older adults who may not have support while completing the survey. Additionally, future research should delve into the role of different forms of support, such as family, friends, or community resources, in the technology adoption process among older adults. Lastly, future research should investigate other factors that might influence technology adoption among older adults, including health status, previous technology experience, attitudes toward change, and the perceived relevance of technology in their day-to-day lives.

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