

Why Do Seniors Accept or Reject New Technologies? Towards Developing a Seniors Oriented Technology Acceptance Model

Cosmina Paul¹, Alexandru Sterea¹, Mircea Mârzan¹, Aliko Economidou², Iztok Žilavec³, Luiza Spiru¹,
Adrian Gârleanu¹

¹Ana Aslan International Foundation
Bucharest, Romania
office@anaaslanacademy.ro

²Cyprus Neuroscience & Technology Institute
Nicosia, Cipru
aliki@cni.org.cy

³Razvojni Center Informacijsko
Ljubljana, Slovenia
Iztok.Zilavec@24alife.com

Abstract— On the background of literature review and field-research, this article proposes a new conceptual model for understanding why seniors accept or reject new technologies and gerontechnologies. This framework bears a special focus on the relation between TV and seniors because it has been developed in the context of a new gerontechnological TV device, Senior-TV. The already existent technology acceptance models are focusing on youth and people on the job, and little research has been carried out in the area of elderly people. Hence, we inquire into the seniors' behavioral intention towards the use of new technologies, aiming to develop a multiple-perspective conceptual model: 1) by employing a gerontographics approach, which gives a more complex data disaggregation in order to better understand the needs of the seniors; 2) by overcoming the classic TAM and UTAUT models and refining the existent models of technology acceptance tailored to seniors' market, and to incorporate other potential relevant explanatory variables; 3) by a more in-depth understanding of the relevance of technology attributed by seniors in their life; 4) by diversifying the key informers in order to have a multifaceted perspective, such as formal and informal caregivers and to better understand how do they relate to the relation between seniors and technology. The data for the analysis came from purpose sample of 148 seniors, a survey conducted over 2017-18 in Slovenia, Romania and Cyprus and a follow-up survey conducted from February to April 2019 in the same countries, with a sample of 105 seniors, which informs on the new framework proposed here. Our research show that based on a gerontographics segmentation, scholars and practitioners alike may understand, on the one hand, the influences of seniors' technology experimentation and acceptance, and, on the other hand, seniors' openness towards specific types of technologies. In order to account for the seniors' perspective on the relevance of technologies in their life, based on the gerontographics segmentation, we mapped their interests and predisposition towards the attributes of technologies. The degree to which developers meet these interest and predispositions of the seniors, give the ascendance of the new product or service of the seniors' market.

Keywords- *technology adoption; gerontechnology; gerontographics; technology acceptance model.*

I. BENEFITS OF NEW TECHNOLOGIES AND GERONTECHNOLOGIES

The population is ageing. It is widely believed that the development of new technologies and gerontechnologies can tremendously help societies in facing the challenges posed by the ageing population. The increasing number of seniors in our societies build a demand for entertainment, communication, education and health and open new markets for the new technology developers [1]-[3]. Though little is known of the seniors' behavioral intention and preferences toward new technologies. Technology is of special focus due to the widespread and unchallenged societal acceptance that technology may improve the quality of elderly people not only in terms of their healthiness [4], but also in psychological and social terms, such as reducing loneliness, anxiety, social isolation [5], and lowering self-esteem, which impacts dramatically on the poor cognitive functioning [6]-[8], mortality [9][10], impaired sleep [11], impaired mental health and Alzheimer's disease [12]. The benefits brought by ICT for seniors are also discussed in the literature [13]-[15] and some research show that seniors benefit from ICT through perceiving the life stress much lower, due to the fact that via ICT the seniors improve their connection to outside world and so their life quality increases [16]-[18]. If technology advancement improves the ways of communication, information and entertainment while staying at home, this potential is highly appreciated for the beneficial improvements technology has made for the people aged over 65.

II. CURRENT BARRIERS IN TECHNOLOGY ADOPTION BY SENIORS

There are two types of recurrent barriers which occur when developing new technologies for seniors. The first refers to assuming a relative homogeneous market of people aged over 65 and, the second refers to overlooking the social influences of formal and informal carers and of the relevance and meaning attributed to new technologies and gerontechnologies by the seniors.

Delello and McWhorter [19] emphasize that the obstacles

for the adoption of technology by elderly include: costs [20], inappropriate design, experience, awareness [21], attitude [22], self-efficacy [23], and a general lack of interest [24]. Demiris et al [25] address the psychological barriers identified as the privacy violations from the cameras, the replacement of human assistance by technology, the user-friendliness of technology. The specific needs of the older persons are not taking into consideration when developing technology and, moreover, those who design and develop technology are young, who hold different needs and abilities [26]. Therefore, elderly people adopts with difficulty new technologies because of the age-related impairments, vision, hearing and memory loss, and loss of mobility, which lead to less of confidence and difficulties. Hence, Boulton-Lewis et al add embarrassment with lack of abilities, reduced dexterity and visual acuity and memory loss.

Mitzner et al [27] found that the openness towards adopting new technology is related to the support offered by technology to everyday tasks, convenience and useful characteristics, while the reluctance is related to the inconveniences created, unhelpful characteristics, and security and reliability concerns. Oestlund [28] points out to the perception of a limited future, the increased feeling of fatigue and circumspection, which all significantly reduce the appetite for new technology.

Bringing together older adults and technology, gerontechnology is a fast growing interdisciplinary domain [19]. The differentiation between the adoption of gerontechnology and of the new technology by seniors is also of crucial importance. Gerontechnology refers to inquiring into human-computer interaction for seniors and it requires an interdisciplinary journey into nursing, gerontology and social work, while new technologies adoption by seniors does not employ the nursing perspective. However, the gerontologists draw attention to the phenomenon of the too fast growing technology while the implications can be understood in time.

III. TOWARDS A NOVEL MODEL OF TECHNOLOGY ACCEPTANCE BY SENIORS

The first two pilot cycles employed by our research were aimed to adapt and test the most frequent used theoretical models on technology acceptance. The first field research cycle was based on Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) models, but they proved insufficiently explanatory when applied to the seniors due to the fact that these frameworks are constructed and tailored on students and people on the job. Therefore, most of the items were irrelevant for the older people and they failed to offer a conceptual understanding of how technology can be integrating with aging [29].

In the last years, new research started to be developed to overcome TAM model and for developing a more in-depth understanding of gerontechnology. Technology Acceptance Model (TAM) was proposed by Davis [30] and it was at the

center of an overwhelmingly high number of researches regarding technology adoption but, among all, just a few studies focused on senior citizens [3]. Afterwards, Davis proposed TAM2, adding subjective norms into the model. Because the research on seniors is quite rare, more research is needed for conclusive results for this specific target group. TAM model proves to be easy replicable and consistent across technologies [31] but, along Legris et al [32], researchers advice for a more systematic study of external variables. After about 20 years since the TAM model was proposed, Venkatesh et al. [33] discuss the fu

ture of this model for research and emphasize that the model has been widely replicated because of its simplicity and easiness of generalizability, though its relevance is limited. Substantial changes have been introduced in The Unified Theory of Acceptance and the Use of Technology Model, UTAUT1 and UTAUT 2 models. Legris et al [32] suggest to integrate the model into broader frameworks which include human and social factors and the adoption of innovation model.

For the third pilot cycle, we included the lessons learned from the first two cycles and tested two conceptual models in order to assess their explanatory power: the Senior Technology Acceptance Model (STAM), which was proposed by Renaud and Biljon [34] and the Gerontechnology Acceptance Model proposed by Chen and Chan [35]. The first stays as the earliest effort for conceptual theorization of predicting technology acceptance and adoption by seniors and it was designed to predict older adults' mobile phone adoption. The model proposed by Chen and Chan [35] is built on the inquiry into gerontechnology acceptance by elderly from Hong Kong. Both models are based on TAM and UTAUT classic models. We complemented the findings with a qualitative inquiry into the contextual factors that shape technology adoption. Hence, we build up a conceptual framework to integrate both various models tested in quantitative studies and the qualitative research related to our topic.

A. Methodology

There are two field-research stages employed in our analysis which had been carried out under the Active and Assistive Living (AAL) Program with funding by the European Union. The data for the first analysis came from purpose sample of 148 seniors, two surveys conducted over 2017-18 in Slovenia, Romania and Cyprus and the second analysis consists of a follow-up survey conducted from February to April 2019 in the same countries and having a sample of 105 senior respondents. The primary goal of the overall research was to explore the levels of adoption by senior consumers of a new emerging technology, Senior-TV. In order to recruit participants, the project coordinator of each country contacted the administrators of nursing homes, daily centers, hospitals and retirement houses, and independent seniors at home and asked for their permission to test the Senior TV product. To assure protection of human subjects,

the research did not employed any identifying details (including e-mails, phone numbers, addresses, etc.). It was not mandatory to answer all the questions, and if any question caused the participants even the mildest inconvenience, they could choose not to answer it. They were free to withdraw from the study at any time and for any reason. We have included the “Verbal Fluency Test” (VFT) which is an instrument for cognitive assessment and it has been also used in the previous two pilots and the short version of the Health Survey SF12, a scale which has been included to indicate the physical and psychological state of the respondents.

B. Research Findings

By developing a novel seniors’ oriented technology acceptance model, we aim to support the advancing research on technology adoption by seniors. Our research shows relevant aspects which need to be considered when discussing the relation between seniors and new technology.

a) Gerontographics segmentation

Seniors are internally a very diverse group in terms of age, culture, emotional state of health, cognitive abilities, social needs and preferences. Seniors’ heterogeneity and their attitudes towards engagement with new technologies and gerontechnologies shall be assessed through gerontographics approach [36]. The classic differences of young and old seniors is insufficient in tackling on the specificities of the seniors target groups. Our findings demonstrate that age, physical state of health and cognitive abilities do not have a direct and unmediated impact on the seniors’ performance with technology and on their behavioral intention to utilize technologies, validating the recommendations of going beyond the trite understanding of the concepts of biological and cognitive age [37]. Gerontographics segmentation is a useful tool in analyzing and targeting adult market [38]-[40] and it is based on the assumption that elderly manifest similar behavior as long as they had encountered similar circumstances, experiences and past events. Four segments of the elderly are considered: healthy indulgers, ailing outgoers, healthy hermits and frail recluses. Healthy indulgers experience good psychological physical and social aging; ailing outgoers in spite of a decline in the physical well-being manifest high level of psychological being and stay socially integrated; healthy hermits keep a good physical being but a low psychological well-being and stay isolated from society; the frail recluses have chronic health conditions and low psychological well-being.

Chen and Chan [35] show that external variables, such as health and ability characteristics, have a direct and unmediated influence on usage behavior. Henceforth, the gerontographics segmentation, which are the lens through which we chose to look to our data, are in line with Chen and Chan [35] research findings and with the first model which refers to the ‘user context’.

The fact that the framework proposed by Chen and Chan [35] emphasizes the relevance of contextual factors rather than of the product experience, is also confirmed by our field-

research: seniors habits, activities, interests and curiosities are a results of their life long experiences and, therefore, their adoption on new technologies depend on contextual factors and not on new technology products’ attributes. Moreover, the data from the first field-research cycle show that technologies cannot actively engage seniors per se, but the attitudes of the seniors towards the new technologies determine seniors’ engagement with new technologies and gerontechnologies. This attitude of the seniors is determined by the state of health of the respondents and by their current life style, which may be assessed through a gerontographics approach.

b) Social influences versus ‘perceived usefulness’

Social influences or its lacking foster seniors’ acceptance or rejection of gerontechnologies and new technologies. In the case of dependent seniors, which are integrated into the category of frail recluses, the social influences of the nursing professionals and informal carers are key in the processes of experimentation and acceptance of new technologies or gerontechnologies. Social influence replace the variable of ‘perceived usefulness’ for the categories of frail recluses and healthy hermits, the categories which have a certain degree of dependency and are isolated and/or self-isolated from society. A top-down approach is present in developing and promoting gerontechnologies by not considering seniors’ habits, values and desires and the same top-down approach is advanced when designing new technologies products or services and expect seniors to engage with them.

‘Perceived usefulness’ is relevant for the two categories of healthy indulgers and ailing outgoers, which confirms the results presented by Selwin et al. [41] who show that independent seniors avoid ICT because of the perceived irrelevance in their lives. Therefore, instead of opting for gerontechnologies and any technology services which age-stigmatize and are focused on health improvements, if the case, they prefer to opt for universal technologies. Our findings are also consistent with those of Boulton-Lewis et al. [26] who present the importance of promoting technological models within ethical frameworks, which see users as independent decision-makers, only as long as we target the healthy indulgers and ailing outgoers.

The technologies tailored for senior users tend to focus on health improvements and supportive services, while independent seniors do not perceive themselves as dependent and in-need of health technologies. Moreover, those seniors opened towards the adoption of new technologies perceive themselves younger than their biological age. Therefore, our findings go in line with the research which shows that the main reason expressed by an overwhelming majority for the non-use of ICT is actually the perceived irrelevance of ICT in their lives [41].

c) Seniors’ predispositions and interests

Our research findings show that watching TV does not have many symbolic associations for the healthy indulgers and ailing outgoers, while there are plenty of mentally

associations attributed to TV watching by healthy hermits and frail recluses. Healthy indulgers look for information (62.5%) and social integration (42.9%) and ailing outgoers look for information (66.7%), enjoyment (66.7%) and social integration (50%) when experimenting new technologies. In conclusion, gerontechnologies and other age-stigmatizing services such as those designed for health utility, fail to meet the needs of the socially integrated seniors. By contrast, the healthy hermits and frail recluses, who are not socially integrated, associate TV watching with decreasing loneliness and companionship to a high degree. 83.6% of the healthy hermits associate TV watching with decreasing loneliness, 80.3% with information and 61.5% declares that it sets their daily rhythm. Frail recluses prove to be the most dependent group of gerontechnology and new technologies. 89.5% of frail recluses associate TV watching with enjoyment, 76.5% with decreasing loneliness and 75% with companionship. Nevertheless, TV watching is largely associated with social integration, which matters for all four categories, though for a higher degree for the last two, as being one of a very few vehicles for their sense of belonging to society (60.6% for frail recluses, 57.7% for healthy hermits, 50% for ailing outgoers, and 42.9% for healthy indulgers).

IV. CONCLUSIONS AND FUTURE WORK

This analysis proposes a framework for analyzing the seniors’ relation with new technologies and gerontechnologies and it aims to increase the understanding about the factors affecting seniors’ acceptance or rejection of newly developed technologies. It was found that

gerontographics segmentation can tremendously inform on the openness of the seniors towards certain products or services. Seniors who are independent and socially active, namely the categories of healthy indulgers and ailing outgoers, are open only towards new technologies and avoid age stigmatized gerontechnologies and health oriented products and services, while the categories of frail recluses and healthy hermits, who are more self-isolated and dependent, are more open towards new technologies and gerontechnologies alike.

Frail recluses and healthy hermits, or in other words, seniors who are not socially integrated and feel psychologically ill, adopt technologies under the influences of their formal or informal caregivers. Hence, ‘perceived usefulness’ and ‘perceived ease of use’ of the technologies, factors which play a key role in the classic technology acceptance models, are replaced with social influences factors. These findings are consistent with the senior technology adoption framework developed by Chen and Chan [35]. Moreover, we found that a major key factor in the acceptance of technology by seniors is played by their predisposition in choosing technologies which carry out a specific role for them. Seniors who are socially isolated adopt technologies for decreasing loneliness and setting up a rhythm of the day, while those socially integrated accept technologies only for information and enjoyment. More research is needed in order to test the model proposed here on a wider range of technologies and in different cultural settings.

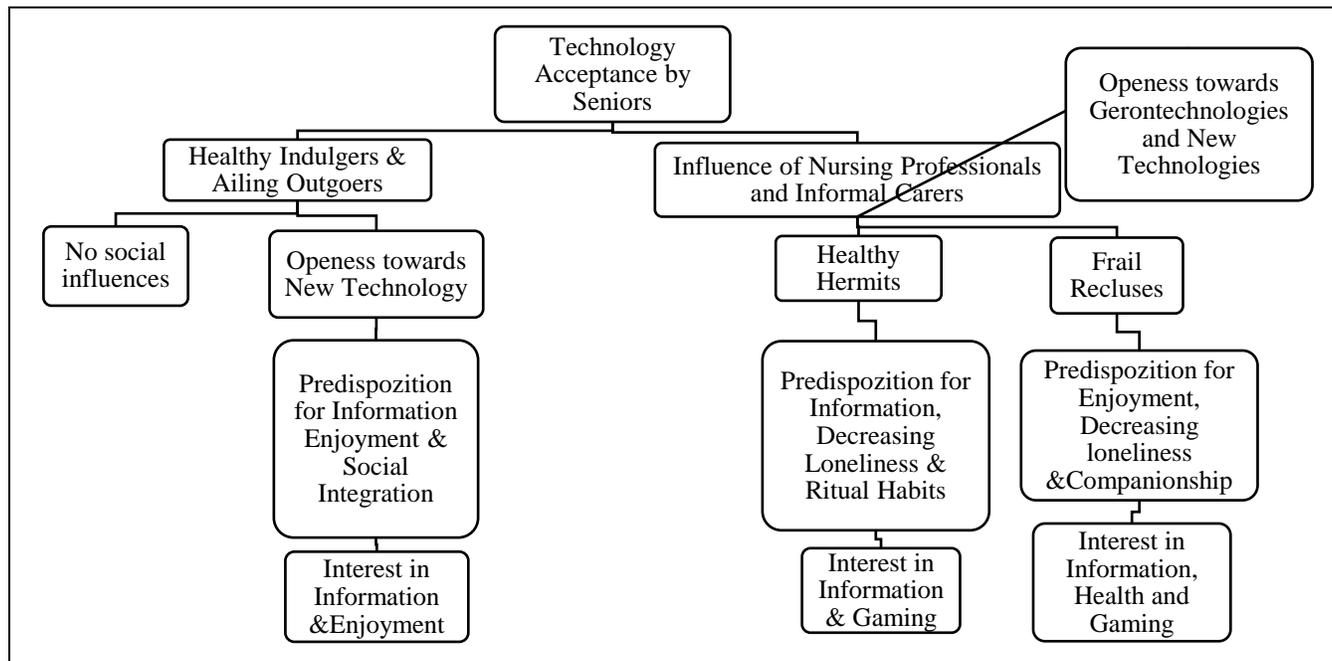


Fig. 1 A novel framework for understanding seniors’ technology acceptance

ACKNOWLEDGMENT

This work was performed in the frame of the EU project Senior-TV (AAL/Call2014/171, with implementation period Nov 2015 – April 2019), funded by the AAL Programme, co-funded by the European Commission and the National Funding Authorities of Cyprus, Spain, Slovenia and Romania.

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