Older People and Technology Acceptance

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Abstract. Currently, the number of people at the age of 65+ is rising at frenetic pace. For instance, in developed countries, the number of older adults forms 24% and this number should rise to 33% by 2050. Therefore, there is a need to prolong an active life of older people, who want to lead active, fulfilling and quality life in a sense of their inclusion, socialization and independence. This can be achieved not only by continuous support from their family members, but current trends show an important role of information and communication technologies (ICT) in this process. The purpose of this study is to explore technology acceptance models, as well as the factors influencing the acceptance of technologies by older people, such as the key demographic characteristics (i.e., age or education), which can accelerate or slow down their acceptance of ICT devices. The methods used in this study include a method of literature review of available sources exploring the acceptance of ICT devices by older people, a method of comparison and evaluation of the findings from the selected studies on this topic. The findings of the reviewed research studies indicate that the presented four theoretical models provide sound theoretical bases for potential empirical studies exploring the acceptance and use of technologies by older people. However, more attention should be paid to their support in the form of training, as well as meeting their unique personal needs. Future research should focus on the acceptance and use of mobile devices and their effectiveness on the improvement of quality of life of older generation groups.

Keywords: Older people · Technological devices · Acceptance · Models · Factors
Benefits · Limitations

1 Introduction

Ageing is becoming a big social issue nowadays. In 2000, the number of people at the age of 65+ in the world reached 12.4% and this number is expected to grow to 19% by 2030 [1]. In developed countries, this number of older adults forms 24% and it should rise to 33% by 2050 [2]. In Europe the population group aged 65+ represents 18% of the 503 million Europeans, which should almost double by 2060 [3]. Therefore, there is a need to prolong an active life of older people, who want to lead active, fulfilling and quality life in a sense of their inclusion, socialization and independence. This can be achieved not only by continuous support from their family members, but current trends show an important role of information and communication technologies (ICT) in this process. These ICT devices can promote autonomy of older people by facilitating the

execution of many routine activities, such as shopping or communication. Their use also offers cognitively and intellectually challenging activities that can empower older people. Thus, the use of ICT devices can maintain them independent, active and socially inclusive. In fact, there are certain prerequisites, which can trigger their use and acceptance by older people. These include a steady rise in the number of older people worldwide, ICT as a tool for providing older people with the promise of greater independence, and the fact that the generation of baby boomers approaching retirement is relatively comfortable using ICT [4].

As research shows, older people are nowadays more digitally literate, especially those parents of baby boomers, and 80% of them have access to the Internet [4–6]. Furthermore, there is an increasing number of those older individuals who own and use mobile devices, such as a mobile phone. For instance, 78% of older people at the age of 65+ own a mobile phone in the USA, as well as in the UK [7, 8]. In the Czech Republic, it is 91% [9]. In fact, currently mobile devices seems to be more exploited than the desktop computers [10].

The purpose of this study is to explore technology acceptance models, as well as the factors influencing the acceptance of technologies by older people, such as the key demographic characteristics (i.e., age or education), which can accelerate or slow down their acceptance of ICT devices. In addition, the authors aim at emphasizing the main benefits and limitations of technology acceptance by this group of people.

2   Methods

The methods used in this study include a method of literature review of available sources exploring the acceptance of ICT devices by older people, a method of comparison and evaluation of the findings from the selected studies on this topic, as well as the discussion of the findings from the authors' own empirical studies on this research topic. The literature search was conducted in the acknowledged databases Web of Science, Scopus, and ScienceDirect. Altogether over 36,000 articles were generated from all three databases where the key words *older people* AND *technology acceptance* were inserted. Nevertheless, only few related to the research topic.

For example, in the Web of Science 167 articles were found. The first one appeared already in 1996. However, most of the articles on the research issue started to be published after 2010 as Fig. 1 below illustrates. The topic of the majority of studies relates to health monitoring and assisted living technologies. This is not surprising since older people are mainly concerned at this age in maintaining their health conditions. The number of articles on the pure exploration of older people and their acceptance of technologies was relatively scarce.
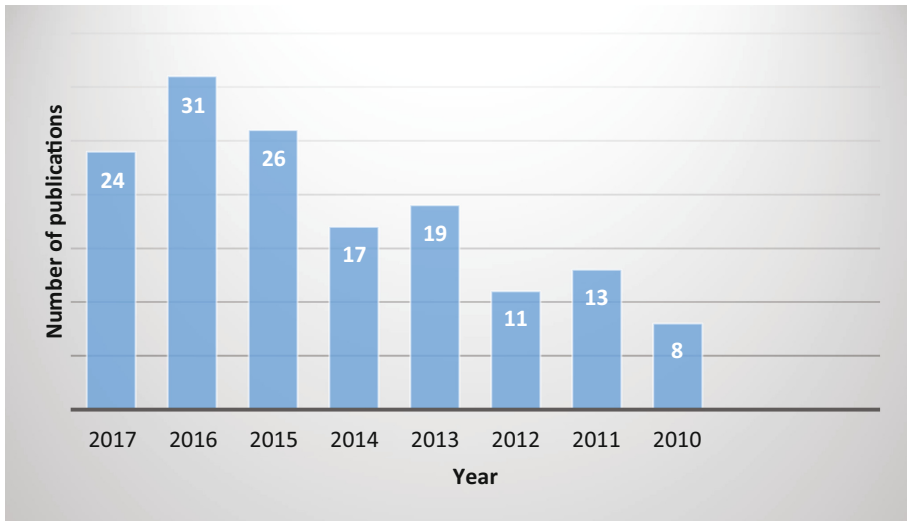
Fig. 1. An overview of the number of publications on the research topic in the Web of Science, authors' own processing based on the data from the Web of Science [11].

3   Findings and Discussion

The research on the acceptance of technologies by older people firstly concerns the exploration of the existing models describing successful acceptance of technological devices by older individuals. Overall, there are four models. The first, original one is the Technology Acceptance Model (TAM) developed by Davis in 1989 [12]. This model is based on two basic constructs: perceived usefulness (i.e., the level to which an individual reckons that exploiting a particular system would improve his or her job performance) and perceived ease of use (i.e., the level to which an individual reckons that exploiting a particular system would cause smaller effort). Thus, if the individual believes that the technological devices is useful and s/he can use it independently, s/he will develop a positive attitude and his/her behavior will lead to the adoption of such a technological device. On the contrary, if his/her personal needs are not satisfied, s/he will reject it.

The second model, which is based on TAM, is the so-called Unified Theory of Acceptance and Use of Technology (UTAUT) model, developed in 2003 by Venkantesh et al. [13]. This model consists of four basic constructs determining person's behavioral intention to exploit the system and his/her usage behavior (Fig. 2 below).

Fig. 2. Unified Theory of Acceptance and Use of Technology (UTAUT) model (authors' own processing).

The extent to which each key construct influences the user's intention to use the technological device is influenced by four factors, which are as follows: gender, age, experience, and voluntariness of use [14]. The functionality of this model in practice has been recently evidenced by Macedo [15], who applied this model with 278 Portuguese older adults. Especially behavioral intention appeared to be significantly effective on determining the actual use of technological devices.

The third model, based on TAM and UTAUT, is the Senior Technology Acceptance Model (STAM), aimed particularly at older generation groups [16, 17]. This model was developed by Renaud and Van Biljon in 2008 [16]. It consists of three stages: objectification (i.e., the intention to exploit the technological device, to see whether it is useful and easy to use or not); incorporation (i.e., further exploration and experimentation with the technological device); and conversion (i.e., either accept or reject the technology on the basis of real life experience).

The fourth model, developed by Kim et al. [14] in 2016, includes the key elements of all three prior models, but incorporates another four new components; one more stage - intention to learn, including three new factors: self-efficacy (i.e., the level to which a person thinks s/he is able to do the task), conversion readiness (i.e., ability to accept a new

device), and peer support (i.e., people in his/her surrounding having experience with the new technology). Figure 3 below illustrates this model.
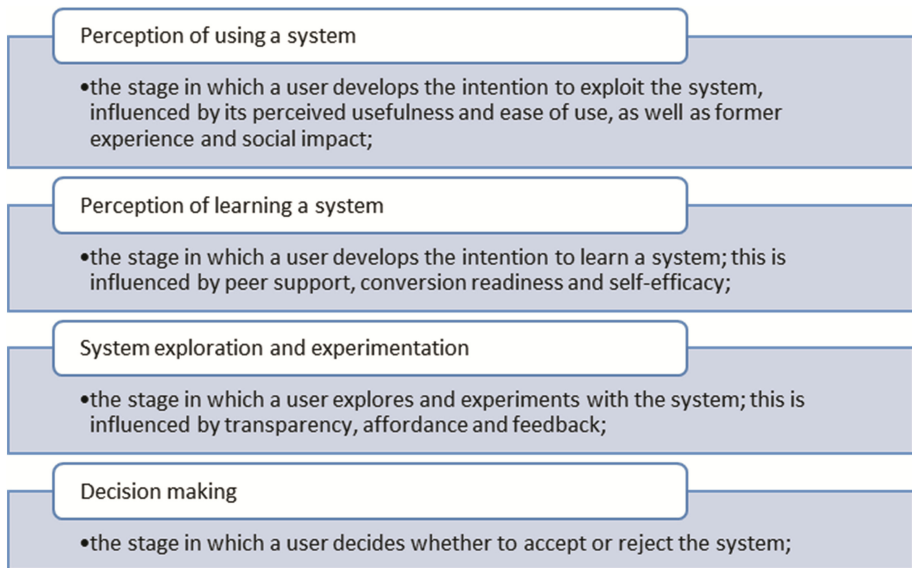
Perception of using a system
- the stage in which a user develops the intention to exploit the system, influenced by its perceived usefulness and ease of use, as well as former experience and social impact;

Perception of learning a system
- the stage in which a user develops the intention to learn a system; this is influenced by peer support, conversion readiness and self-efficacy;

System exploration and experimentation
- the stage in which a user explores and experiments with the system; this is influenced by transparency, affordance and feedback;

Decision making
- the stage in which a user decides whether to accept or reject the system;

Fig. 3. Technology acceptance model for older adults (authors' own processing).

Thus, there are altogether four stages/phases leading to the acceptance or rejection of a technological device. As it has been already pointed out, there are also several factors determining and facilitating indirectly and directly the acceptance of technologies by older people. Peek et al. [18] group them into six categories:

1. concerns regarding technology (e.g., high costs or privacy implications and usability);
2. expected benefits of technology (e.g., improved safety and perceived usefulness);
3. need for technology (e.g., healthcare reasons);
4. alternatives to technology (i.e., family members can help and substitute the technology);
5. social impact (i.e., communication with friends or family members);
6. characteristics of older adults (i.e., they wish to age in their homes, in the environment where they feel comfortable and safe).

These categories/topics are also discussed by Chen and Chan in their study on gerontechnology acceptance by elderly in Honk Kong [19].

The most decisive factor for the technology acceptance by older people seems to be the age. According to this criterion, seniors can be divided into three age groups: 55–64 years, 65–74 years, and 75+ years. Seniors aged 55–64 years are usually parents of the baby boomers. They are well-educated older individuals with desire to socialize and a love for active lifestyles. Their income is also quite favorable. Even in their retirement

they are eager to pursue education, either formally or informally [20]. The use of technological devices dramatically declines at the age of 75 years, when older people start to be affected by cognitive and physical impairments [20, 21]. This finding has been also confirmed by authors' study [9].

Another important factor is an educational status. Findings of the research studies [20, 22] indicate that older individuals with higher education are more willing to accept and adopt technological devices than those with lower education.

Nevertheless, to enhance the acceptance and use of technologies by seniors, it is important to provide support to them. This can be done by training them and making sure that the technological device suits their personal needs and age [23]. Righi et al. [24] expands that technologies designed for older individuals should be designed to meet situated and dynamic needs/interests of the communities (and not only of care) to which they belong.

As research shows, older people accept and use the technological devices in order to socialize, communicate, and monitor their health [9]. As it has been already mentioned in the part on Methods, research studies on the use of health-related technologies for older people are quite widespread. Older people are in fact the main users of health-related Internet services despite the fact that the dominant group of the Internet use is formed by young people [25]. They predominantly use technological devices, including the Internet, for searching health-related information, receiving reminders for scheduled visits, medication instructions, or consulting a doctor at a distance [26–28].

In addition, there is an increasing trend towards the exploitation of mobile devices by older generation [7, 29]. In fact, surveys, e.g., [9, 10] report that mobile and tablet internet usage exceeds desktop computers. Some of the seniors even use a smartphone, but the number of these people is still very low. The reasons include a number of constraints [22, 30–32]. Figure 4 below illustrates these barriers.

Therefore, the designers of technological devices aimed at older people should bear in mind the following principles:

- vision and hearing of the elderly people (e.g., suitable font size, usually bigger than 16 pixels, contrast ratios with text, or provision of subtitles when video or audio content is fundamental to the user experience);
- motor control (e.g., bigger buttons at least 9.6 mm or bigger screen device);
- device use (user-friendly);
- relationships (e.g., enable connection with a smaller, but a more important group of people such as their family members and friends);
- cognitive capacities of the elderly (e.g., provision of services such as reminders and alerts as cues for habitual actions) [33].

However, older people should be systematically made aware of the benefits of technological devices because they can provide them with a number of benefits such as reduction of travel costs (i.e., they do not inevitably have to see their doctor face-to-face if they need, for example, a prescription or some professional consultation); avoidance of social isolation (i.e., technological devices can enable them easier communication with their family members or friends and thus avoid their loneliness); decrease reduction of pressure on (family) caregivers; maintenance of their independence in executing tasks

of daily life; or enhancement of feeling of safety [34–37]. On the contrary, of course, there are certain limitations and barriers preventing older people from accepting new technological devices (cf. [38]). Table 1 below summarizes the main benefits and limitations of the acceptance and use of technological devices by older people.
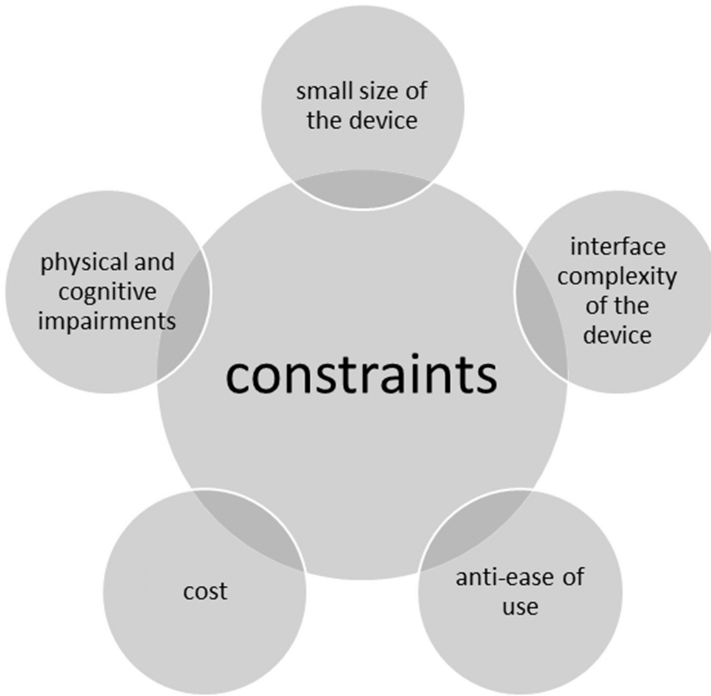

Fig. 4. Constraints of a technological device for older individuals (authors' own processing).

Table 1. Main benefits and limitations of the acceptance and use of technological devices by older people (authors' own processing).

Benefits	Limitations
• maintenance of independence and aging in place	• certain technological constraints of the devices
• reduction of economic and social burden	• physical and cognitive impairments of this group of people
• enhancement of feelings of safety	• cost of the device
• health-related services and control	• a lack of training
• reduction of social isolation	• a lack of the awareness of the benefits of the use of the device
	• stigma of using an assistive technological device
	• a lack of intention to learn
	• security and reliability concerns

4   Conclusion

The findings of the reviewed research studies indicate that the presented four theoretical models provide satisfying theoretical bases for potential empirical studies exploring the acceptance and use of technologies by older people, such as [15] or [17]. However, more attention should be paid to their support in the form of training, as well as meeting their unique personal needs.

Future research should focus on the acceptance and use of mobile devices, such as smartphones, and their effectiveness on the improvement of quality of life of these older generation groups.

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