Over 60 and ICT: Exploring Factors that Affect Older Adults' ICTs Usage

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Abstract. This study aimed to describe the use of information and communication technologies (ICTs) by Hong Kong older adults (over 60 years of age), and to explore the factors affecting their intention to use ICT innovations in future. A questionnaire survey was conducted with 109 older adults in Hong Kong. Exploratory factor analysis was used to extract important factors. Hierarchical regression was used to assess the associations between factors and intention to use ICT innovations in the future. The results showed that the older adults mainly used ICTs for entertainment and social communication. Education, perceived benefits, and security and privacy were applications and issues that were significantly and positively associated with the intention that older adult had towards use of ICT innovations in the future.

Keywords: Older adults · ICT · Usage · Factors

1 Introduction

The Population Division of United Nations recently reported that in 2015 there were 901 million people in the world above 60 years of age. This number is projected to grow to 1.4 billion by 2030, and to 2.1 billion by 2050 [1]. The rapid growth of the aging population is a global phenomenon: virtually every country in the world will experience a substantial increase in the size of the population aged 60 years or over between 2015 and 2030. The growth of the older population is expected to be especially rapid in Asia, with increases of more than 60 % between 2015 and 2030 [1]. In Hong Kong, population ageing is expected to be very marked with the proportion of elderly aged 65 and over projected to increase from 15 % in 2014 to 23 % in 2024 and 30 % in 2034, and further rise to 36 % in 2064 [2]. Globally, 40 % of older persons aged 60 years or over live independently i.e. alone or with only their spouse. As countries develop and their populations continue to age, living alone or with a spouse only will become more common among older people in the future [3]. However, older people may face various difficulties when trying to live independently and safely as a result of age-related decline in physiological and psychological functions that affect physical, sensory and cognitive abilities [4]. The United Nations ageing report [1]

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addressed the importance of improving access for older people to public services in both urban and rural settings, including ensuring that infrastructure and services are accessible to persons with limited mobility, vision, hearing or other impairments which tend to increase with age. The proliferation of technologies, such as mobile devices, offer a variety of new channels to reach older people, for example, by delivering messages related to health, security or environmental hazards via SMS (Short Messaging Service). The digital divide is the gulf between those who have ready access to information and communication technologies (ICT) and those who do not. It is vital to bridge the digital divide for older people by addressing differences in educational background and ICT skills through technology training courses, programmes and learning hubs tailored to their needs [1].

Fortunately, with the rise of the silver market, there are various innovative products and services to help to support older people to live conveniently and independently and to enable them to lead healthy and active lives. There are products such as tailored mobile phones and apps for older adults. However, previous research shows that relative to younger people, older people lag behind in adoption of technology due to factors such as perceived usefulness and ease of use of technology, age-related characteristics in health and cognitive ability, and difficulties in finding technical support to solve interface operation problems [5]. In the case of information and communication technologies such as computers and the Internet, there are many human computer interaction factors that influence decisions for older adults to adopt such technologies [6]. The problem of adoption by older people is exacerbated by the fast rate of introduction of technological innovations such as, the multi-touch user interface used in iPhones and other devices, or most recently, motion-activated user interfaces. These innovations obviously changed the way people interact with technology and have improved the quality of life and work efficiency, for example, simple hand motions on touch panels are easier and quicker than a traditional mouse which need accurate moves and clicks. However, it is not necessarily the case that older people will be ready to learn or to be able to use and adopt innovations with ease. Various age-related factors which are regarded as essential determinants in the process of design and operation should be taken into consideration when trying to enhance the penetration of information and communication technologies among older adults. When studying the acceptance of information and communication technology, the factors related to human-computer interaction are suggested to include perceived usefulness, perceived ease of use, Internet dependence, self-efficacy towards technologies, technology anxiety or technophobia, intrinsic motivations, information reliability and some others [2, 3].

Older adults, especially 'younger' seniors, may now understand the necessity of using ICT products and services in their life [7], and that they are now expected to use some common ICT products and services such as computer, smartphone, and the internet more frequently than before in order to manage daily activities. Thus, it is timely and important to explore what needs to be done now to ensure effective implementation and adoption of ICTs among older adults in the future. The success of innovative technologies and services for older people is based on a comprehensive understanding of their current usage and future needs.

Research around ICT acceptance and usage among older adults is currently receiving an increasing amount of attention, not only in the developed countries but also in developing countries. A variety of factors have been explored by earlier researchers in different contexts. In a review study by some of the current authors [6], these factors were qualitatively categorized into: Perceived usefulness (perceived impact on life, needs satisfaction, perceived convenience and perceived benefits and usefulness); Subjective norms (children/family influence, caregiver influence, social influence); Perceived behavior control (self-efficacy, anxiety, facilitating condition, support availability); Perceived usability (perceived ease of use, age-centered interface, system reliability); Affections, and Socio-demographic mediators (gender, age, education, income, health and past experience). However, the classification and definition of factors were based on qualitative analysis rather than on empirical studies. When considering geographical factors and technological domains, all the potential factors need to be further validated for their effects on the usage of ICTs for older adults in Hong Kong.

The aim of this study was to understand the usage and adoption of ICT products and services by older adults in Hong Kong. This study also explored human computer interaction (HCI) related factors that influence the intentions of older adults to use ICT innovations in the future.

2 Methodology

This cross-sectional study of Hong Kong adults over 60 years of age was conducted through a questionnaire survey, consisting of three major parts: (1) demographic characteristics; (2) usage behavior concerning ICT products and activities; (3) attitudes and perceptions towards ICT. The language of the questionnaire was traditional Chinese. Considering education background variety, the questionnaire was administered through face-to-face interview instead of being self-administered. The interviewer presented the questions and repeated the responses back to the interviewees to confirm that their answers were accurately documented.

2.1 Participants

A total of 109 Hong Kong Chinese adults aged over 60 (47 males and 62 females) from six local elderly service centers participated this study. Background information including gender, age, education, marital status, living arrangement, work status, year income, and means of living was collected.

2.2 Measurements of Usage Behavior: Products and Activities

Based on our previous study [6], a total of three categories of ICT products, services and systems were included in the questionnaire, namely (1) Internet explorer; (2) Phones (telephone/feature phone/smart phone/geriatric cellular phone); (3) Computers (desktop/laptop/tablet). The measurement scale for usage experience towards the three categories

of IT products was from one to three (1 = have never heard of the technology or services, 2 = have heard of but not used, 3 = have been using or used) [8]. Six categories containing a total of 21 items of activities using ICT products were listed in this section accordance with the previous review [6]. The six categories were (1) Remote monitoring; (2) E-Health care activities; (3) Social communication; (4) Online services; (5) Entertainment; (6) Daily routine activities. A four-point scale was used to measure usage frequency (4 = Frequent, 3 = Often, 2 = Rare, 1 = Never).

2.3 Acceptance Constructs

The acceptance constructs used in the questionnaire were selected by three experts in this field based on the available sources of previous studies. First, measurement constructs in previous studies which were focused on the adoption of the Internet, computers, mobile phones and related activities by older adults were included; second, constructs related to human-computer interaction (HCI) were included, such as perceived usefulness, perceived ease of use, Internet dependence, self-efficacy towards technologies, technology anxiety or technophobia, intrinsic motivations, and information reliability; then, in order to maintain a higher reliability and validity, the constructs with relatively lower factor loadings (< 0.7) in previous studies were dropped; as a result, 24 acceptance items were retained in the questionnaire (Table 1).

Table 1. Potential acceptance constructs and sources

No.	Potential constructs	Sources
1	Perceived impact on life	[9]
2	Perceived usefulness	[7, 10] [11–13]
3	Needs satisfaction	[14, 15]
4	Perceived benefits	[16]
5	Perceived convenience	[16]
6	Children's/families' influence	[17, 18]
7	Social influence	[18–21]
8	Subjective norm	[7, 11]
9	Self-efficacy	[22, 23]
10	Facilitating condition	[22–24]
11	Anxiety	[9, 22, 25]
12	Support availability	[14, 26]
13	Perceived ease of use	[7, 11, 27]
14	Age-centered interface	[21, 28, 29]
15	Relevance of living style	[15, 17]
16	Technology compatibility	[21]
17	Cost & Economics compatibility	[30, 31]
18	Perceived usability	[14]

(*Continued*)

Table 1. (*Continued*)

No.	Potential constructs	Sources
19	System reliability	[9, 16]
20	Quality of visual presentation	[32]
21	Data protection	[10]
22	Personal privacy	[33]
23	Security and safety	[10]
24	Uncertainty risk	[9, 16, 20]

2.4 Method of Analysis

An exploratory factor analysis (EFA) was conducted to extract the most relevant affecting factors based on the 24 potential acceptance constructs. One of the greatest advantages of EFA is that all the factors extracted through this method are not assumed ahead by the authors. Hierarchical regression analysis was performed to examine the relationships between the independent factors extracted through EFA and the intentions that older adults had towards further usage of IT products. The hierarchical regression method allows researchers to diagnose and control confounding variables which may also influence the dependent factors in the first stage model, such as the demographic characteristics of the older adults.

3 Results

3.1 Demographics

The majority of older adults in the sample were aged 70−74 (54.1 %), with primary education (47.7 %) and secondary education (41.3 %), married (96.3 %), living with household member (64.2 %), retired (61.5 %), living with support of relatives (59.6 %) and with annual income less than $30,000 HKD (93.6 %). Detailed characteristics of the sample are shown in Table 2.

3.2 Usage Behavior: Products and Services

Usage experience towards ICT products was measured by asking the older adults whether they had heard of or personally used the products. The results are shown in Table 3. 100 % of them have been using or had used a phone (smart and non-smart phone, telephone), especially, 42 out of 109 older adults have been using or had used a smartphone. Also, every older adult participating in this survey had heard about computers. However, only 38.5 % of them have been using or had used computers. Regarding Internet explorer, 13.9 % had never heard about it, and 32.9 % have been using or had used it. The usage rates for the Internet and computers were quite similar.

3.3 Usage Behavior: Activities

Experiences of activities were measured by asking the usage frequency for different activities involving the use of ICT products, services and systems over the last 12 months. The results are shown in Table 4. In total, six categories of ICT related activities were summarized as follows; remote monitoring, health care, social communication, online services, entertainment, and routine activities. As shown in Fig. 1, among the six categories, more than half of the older adults had never used ICTs for health care (67.27 %), remote monitoring (81.33 %) or online services (85.55 %). Correspondingly, they often use ICTs for entertainment (23.57 %), social communication (15.54 %), and for routine activities (14.40 %) such as, for example, calendar and alarm clock.

Table 2. Demographic profile (N = 109)

	Frequency	Percentage (%)
Gender		
Male	47.0	43.1
Female	62.0	56.9
Age		
60−64	8.0	7.3
65−69	36.0	33.0
70−74	59.0	54.1
Over75	6.0	5.5
Education		
Pre-primary	12.0	11.0
Primary	52.0	47.7
Secondary	45.0	41.3
Post-Secondary	0.0	0.0
Marital status		
Married	105.0	96.3
Divorced/Separated	2.0	1.8
Widowed	2.0	1.8
Living arrangement		
With household member	70.0	64.2
Living alone	24.0	22.0
In nursing home	15.0	13.8
Work status		
Full-time work	10.0	9.2
Part-time work	32.0	29.4
Retired	67.0	61.5
Never worked	0.0	0.0
Year income (HKD)		

(*Continued*)

Table 2. (*Continued*)

	Frequency	Percentage (%)
<$30,000	102.0	93.6
$30,000–$49,999	1.0	0.9
$50,000–$74,999	3.0	2.8
>$75,000	3.0	2.8
Primary means of living		
Salary	1.0	0.9
Retirement wages	2.0	1.8
Relatives support	41.0	59.6
Community subsidy	65.0	37.6

Table 3. IT products

	Never heard of (%)	Heard of but never used (%)	Have been using or used (%)
1. Internet Explorer	13.9	53.2	32.9
2. Phones	0.0	0.0	100.0
3. Computers	0.0	61.5	38.5

Table 4. Activities of using ICT over 12 months

Category	Never (%)	Rare (%)	Often (%)	Frequent (%)
1. Remote monitoring	81.33	15.57	2.73	0.30
2. Health care	67.27	18.97	13.77	0.00
3. Social communication	53.02	26.04	15.54	5.32
4. Online services	85.55	12.15	2.08	0.23
5. Entertainment	32.73	37.60	23.57	6.13
6. Routine activities	48.03	35.17	14.40	2.43

3.4 Factor Analysis

Principal factor analysis was used as the extraction method in this study. Kaiser-Meyer-Olkin measure of sampling adequacy was 0.619 ($p < 0.001$) which indicated that factor analysis was an appropriate method here. All constructs were rotated using Varimax with Kaiser Normalization, and the constructs with factor loading over 0.5 were supposed to belong to a certain factor [34].

As shown in Table 5, 17 out of 24 potential constructs were retained (factor loading > 0.5).

Based on the descriptions of those retained constructs, they were classified into 5 factors. According to retained constructs 13, 14, 18, and 20, the first factor was taken to reflect the ease of physical and cognitive use of technology, thus it was named

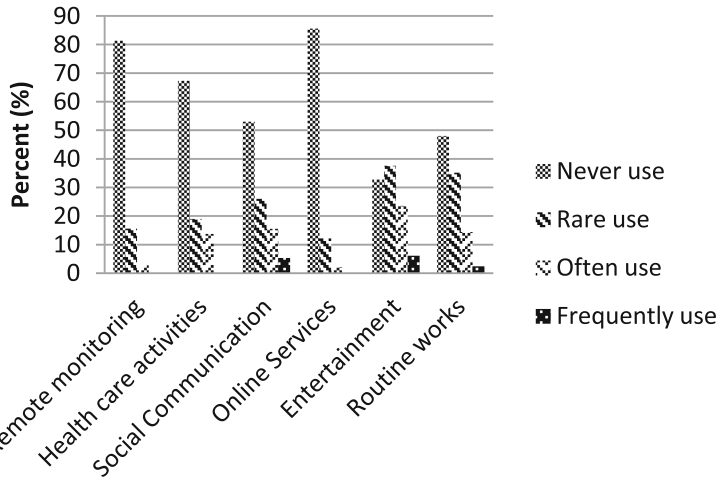

Fig. 1. Usage experiences of different activities using information technology products/systems

Table 5. Principal factor analysis results: factor loading and reliability (N = 109)

No. of constructs	Factor name	Cronbach's alpha	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
13	Perceived Affordances	.511	**.611**	−.022	.322	−.095	.051
14			**.682**	.150	.130	.276	.083
18			**.527**	.173	−.093	−.036	.119
20			**.591**	−.065	.064	.254	.385
2	Perceived Benefits	.558	.075	**.799**	.077	−.026	−.023
4			.038	**.744**	.058	.112	-.063
5			.077	**.591**	.048	.202	.298
19	Security and Privacy	.541	.212	−.067	**.498**	.251	−.201
22			−.115	−.220	**.609**	.357	.182
23			.006	−.054	**.633**	.078	.175
24			−.018	.305	**.513**	−.209	−.027
7	External Support	.506	−.262	.070	−.049	**.602**	.069
10			−.077	.186	.018	**.540**	.179
12			.169	.117	.108	**.630**	.097
15	Compatibility	.512	−.038	.164	.040	.077	**.568**
16			.051	−.154	.089	.062	**.555**
17			.147	.048	−.049	.084	**.614**

Perceived Affordances (PA); the second factor was named Perceived Benefits (PB) in accordance with constructs 2, 4, and 5, which reflected perceived usefulness and outcome expectancy for ICTs; the third factor was named Security and Privacy (SP) because constructs 19 and 22−24 were focused on the protection of personal

security and safety; in accordance with constructs 7, 10, and 12, the fourth factor was named External Support (ES) which emphasized the importance of external facilitations and help; the last factor was named Compatibility according to constructs 15−17, which included living style compatibility, technology compatibility, and economic compatibility.

Cronbach's alpha of more than 0.5 indicated a good reliability [35]. The overall Cronbach's alpha in this study was 0.562 (> 0.5) and the Cronbach's alpha for all five factors were over 0.5 which indicated a good reliability for the measurements.

3.5 Hierarchical Regression

Hierarchical regression method was used to evaluate the relationships between factors and further usage intention. The results are shown in Table 6. Tolerance values and variance inflation factor (VIF) values were calculated to assess collinearity. Tolerance values of all independent variables were greater than 0.01, which together with VIFs less than 5, indicated that collinearity was not a problem [34].

Table 6. Hierarchical regression results for usage intention (N = 109)

Model		Model summary	Standardized coefficients	t	Sig.	Collinearity statistics	
						Tolerance	VIF
1	(Constant)	Adjusted R square = 0.043 R square change = 0.052*		17.638	.000		
	education		.228*	2.420	.017	1.000	1.000
2	(Constant)	Adjusted R square = 0.674 R square change = 0.641***		1.836	.069		
	education		.027	.465	.643	.868	1.152
	PA		−.081	−1.330	.187	.818	1.222
	PB		.119*	2.105	.038	.940	1.064
	SP		.823***	14.117	.000	.888	1.127
	ES		−.085	−1.429	.156	.850	1.177
	PC		.028	.478	.634	.899	1.112

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

As suggested by prior studies, demographics should be considered when the relationships between acceptance factors and usage intention are evaluated. Demographic variables such as age [36, 37], education [22], health status [23, 28] were entered in the first stage regression model. However, only education was significantly associated with usage intention and was therefore was retained in the first stage model. The result indicated that older adults with higher education levels were more likely to use ICT innovations.

In the second stage model (model 2), education level was controlled and the five extracted factors were entered. The explanation power of the regression model was

obviously much enhanced (R2 = 0.674). Among the factors, perceived benefits and security and privacy were significantly associated with usage intention and had standardized coefficients equal to 0.119 ($p < 0.05$) and 0.823 ($p < 0.001$) respectively. This result suggested that older adults with higher score on perceived benefits and stronger trust on security and privacy towards ICTs will be more willing to further adopt ICT innovations.

4 Discussions

4.1 Usage Behaviors

In the present study, it was found that ICTs were mainly used by older adults for communication, entertainment, and some routine activities. The most commonly used product was the phone, including smart and non-smartphone, and telephone. However, for computers and the Internet, more than half of the older adults indicated that they had heard of but never used these technologies. For older adults particularly, computers are more complex than mobile phones both physically and cognitively. Also, older adults may not intend to use internet explorer because it always requires typing which is difficult for them.

The results also showed that older adults rarely used ICTs to do remote monitoring, healthcare, or online services activities. Older adults are not familiar with these relatively complex or innovative activities using ICTs. Social communication and entertainment are the two most frequent activities that older adults in Hong Kong use ICTs for. The findings here are consistent with Mitzner et al. [16] who found that older adults mainly use technology for the basic purposes of communication and entertainment. It seems that adoption of technology may be affected by the level of technological innovativeness and complexity.

4.2 Perceived Benefits

This study validated the idea that perceived benefits positively affect the intention of older adults to make further use of ICT innovations. It has been found that most older adults acknowledged the positive impact of ICTs on their quality of life, and the benefits that ICTs could provide [9]. Older adults have also been found to recognize the benefits of technological devices as well as the importance and usefulness of these for everyday life [38]. Perceived usefulness has also been found to be a significant predictor of Internet use intention [11]. Positive attitudes were most frequently related to how the technology supported activities, enhanced convenience, and contained useful features. Consistent with prior studies, older people in this study incorporated ICT in their daily lives according to its usefulness, they use technology with specific aims in mind for each device but it has been shown that they do not make extensive use of these tools [26].

4.3 Security and Privacy

This study also validated the significant effects of perceived security and privacy on use of ICTs by older adults. It is necessary to consider the concerns of older adults towards the security and privacy aspect of ICTs because it plays an important role in the acceptance and usage of technologies [39]. Older adults have the idea that the aggregation of all the personal data collected by ICT devices and systems may challenge personal information safety, especially when concerning health-related data. Privacy may be considered to be composed of the right to seclusion, autonomy, control of property (including personal data), spatial boundaries, and the ability to see, verify, and correct personal data. It seems that concerns over privacy are contextual, individualized, and influenced by the psychosocial motivations of later life [10]. Older adults generally lack practical and relevant knowledge concerning online privacy and data protection.

5 Conclusions

This study investigated the use of ICT products, services, and systems by older adults in Hong Kong. It also explored and validated two HCI related factors that may affect intention of older adults to further adopt and use ICT. This study collected data from 109 adults over 60 years of age in Hong Kong using a survey questionnaire administered through face-to-face interviews.

It was found that older adults in Hong Kong mainly used ICTs for communication and entertainment. It was also found that education, perceived benefits, and security and privacy were significant factors influencing the intention older people had towards making use of ICT innovations in the future. Older adults with higher education were found to be more likely to adopt ICT innovation in the future. Consistent with the findings of previous studies, older adults in this study were very interested in the benefits that they can gain through the use of ICT products and services. They also reported anxiety about individual privacy protection when using ICT products and services. Previous studies have suggested that attending training programmes can help elderly people to build confidence in using technology, thereby gaining positive attitudes toward and increasing their intention to use ICT [40]. It is important to eliminate the anxiety that older adults feel towards ICTs and to enhance their knowledge about the benefits of ICTs.

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