



# Personal and other factors affecting acceptance of smartphone technology by older Chinese adults



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## ARTICLE INFO

### Article history:

Received 22 January 2015

Received in revised form

12 November 2015

Accepted 29 November 2015

Available online xxx

### Keywords:

Chinese older adults

Smartphone

Technology acceptance

Mobile apps

Personal factors

## ABSTRACT

It has been well documented that in the 21st century, there will be relatively more older people around the world than in the past. Also, it seems that technology will expand in this era at an unprecedented rate. Therefore, it is of critical importance to understand the factors that influence the acceptance of technology by older people. The positive impact that the use of mobile applications can have for older people was confirmed by a previous study (Plaza et al., 2011). The study reported here aimed to explore and confirm, for older adults in China, the key influential factors of smartphone acceptance, and to describe the personal circumstances of Chinese older adults who use smartphone. A structured questionnaire and face to face individual interviews were used with 120 Chinese older adults (over 55). Structural Equation Modeling was used to confirm a proposed smartphone acceptance model based on Technology Acceptance Model (TAM), and the Unified Theory of Acceptance and Use of Technology (UTAUT). The results showed that those who were younger, with higher education, non-widowed, with better economic condition related to salary or family support were more likely to use smartphone. Also, cost was found to be a critical factor influencing behavior intention. Self-satisfaction and facilitating conditions were proved to be important factors influencing perceived usefulness and perceived ease of use.

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## 1. Introduction

In the 21st century, network usage is increasing very rapidly and new interfaces, search engines, and features are becoming available at an unprecedented rate. The expanding power of computers and the recent growth of information technologies such as smartphones have made it possible for large numbers of people to have direct access to an increasingly wide array of information sources and services. Coupled with this explosive growth in technology is the ageing of the population. Both age-related cognitive and physiological impairments render the difficulty of daily activities (Pinto et al., 2000) and are highly relevant when interactive technology is being used (Sonderegger et al., 2016). We are now confronted with the convergence of these two major worldwide trends. In China, since 2000, the speed of population ageing has surpassed the rate of population ageing for the rest of the world.

Currently, China has a larger number of older people than any other countries in the world. The number of Chinese people aged over 60 exceeded 194 million in 2010, accounting for 14.3 percent of the total population (Wu and Dang, 2013). Given that older people represent an increasingly large proportion of the population and will benefit from being active users of technology, issues surrounding aging and information technology are of critical importance (Czaja and Lee, 2009). Meeting ageing-related demands such as social security systems, health care and community services with a relatively low level of economic development is a tough challenge for China. Thus, if older adults in China are able to use technology, the economic and social burdens of families, communities and the country may be lowered significantly (Chen and Chan, 2013).

ICT (Information and Communications Technology) is regarded as an effective tool to help create a successful intergenerational society (Chen and Chan, 2011). Among the various kinds of ICT products, the mobile phone is the one most generally used by older adults in daily life. In society at large, the mobile phone has become an essential component for work, education, communication, and entertainment, and it is being increasingly used within the

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### List of abbreviations

AT	Attitude towards using
BI	Behavioral Intention
CT	Cost Tolerance
FC	Facilitating Conditions
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
SAMCOP	Smartphone Acceptance Model for Chinese Older People
SS	Self-Satisfaction
STAM	Senior Technology Acceptance Model
TAM	Technology Acceptance Model
TAM2	Technology Acceptance Model 2
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology

healthcare area. Previous studies have shown that older people are aware of and willing to use various types of technology, especially mobile phones, which have the potential to improve the quality of life for older people (Plaza et al., 2011).

According to the 32nd Statistical Report on Internet Development in 2013 released by CNNIC (China Internet Network Information Center, 2014), the growth of netizens has entered into a steady state, and mobile phones have become the primary source of new netizens. The popularity of 3G, the development of improved wireless networks and innovation of mobile phone applications has greatly facilitated the rapid growth of mobile phone netizens. The CNNIC investigation showed that in 2013, 89.2% of the population was using mobile phones in China. Furthermore, among the age group 45–64, 51% of the population were using smartphones, which suggested that many adults who are at the early stage of ageing are now using smartphones.

Mobile phones enable older adults to keep in touch with others all the time and at different locations so that they do not need to stay at home waiting for news or communications with friends and family. This can encourage them to lead a more active social life as they can potentially go out at will and still be in touch with family and friends. In addition, mobile phones can provide a sense of safety and security for older people when they are at home alone or when they go out alone (Kurniawan, 2008). Mobile phones, especially smartphones, increasingly play an important role in the homecare of older adults. Current research of mobile phone usage among older adults is covering an increasing variety of clinical domains (Joe and Demiris, 2013). There exists a golden opportunity to utilize smartphone technologies to help manage the health of older adults and to improve their quality of life and well-being.

Venkatesh concluded that, like anyone else, older adults accept and adopt technology when it meets their needs and expectations (Venkatesh et al. 2003; Conci et al. 2009). However, Verdegem and De Marez (2011) reported that technology innovations often fail to be fully utilized because of not enough attention is given to user acceptance. Wilkowska and Ziefle (2011) showed that the more carefully and sensitively the cognitions and mindsets of users are addressed and included in the concepts and designs of communication and information equipment and systems, the higher the chance of broad user acceptance and the adoption of new technologies. It is very much the issue of user acceptance that determines usage behavior and wider use of technologies. In order to ensure that older adults are able to adapt to new information environments, the factors that influence their acceptance of

technologies such as the smartphone, and the difficulties that they experience when using smartphones and mobile apps need to be explored.

Technology products and services, especially the use of the Internet and mobile phones, that older people have reported using were primarily in the home and related to domestic matters (Mitzner et al., 2010; Ziefle and Röcker, 2010). Mobile phone technology acceptance by older adults has recently receiving considerable attention and models have been proposed to predict factors that influence acceptance and adoption from different perspectives. Renaud and van Biljon (2008) used structured interviews to qualitatively confirm the factors affecting the acceptance and adoption of technology by older users. Their interviews employed usage scenarios as well as a mobile phone design activity. Conci et al. (2009) showed that intrinsic motivations play an important role albeit always mediated by utilitarian motives. Verkasolo et al. (2010) generally found that perceived enjoyment and usefulness can explain intention to use smartphone applications for both users and non-users. With regard to usability problems, Ehmen et al. (2012) pointed out that it was essential to consider abilities and deficiencies of the older population as part of the development process for technological devices. Also, Teh et al. (2014) offered fresh insights for mobile device manufacturers and application developers to focus their design efforts around the three aspects of intuitiveness, convenience and usefulness, as needed in different ways by users from different age groups. In China, research on this topic is just beginning, Deng et al. (2014) investigated the adoption of mobile health services by middle-aged and older people, and the results revealed that perceived value, attitude, perceived behavior control, technology anxiety, and self-actualization need positively affected the behavior intention of the older users. Zhou and Rau (2014), using explorative analysis, studied the acceptance of new functions on smartphones, with particular focus on the mobile phone functions, and concluded with ten important functional requirements reported by participants. Overall, the research concerning smartphone technology acceptance has just started in China and, as yet, is insufficient, such that, there is a lack of research that explores and confirms the determinants of behavior intention for smartphone usage from a structured perspective among older Chinese people.

The present study aimed to investigate the critical factors which may have significant impacts on smartphone technology acceptance and behavioral intention among older adults in China using confirmatory factor analysis. It explored both the intrinsic and extrinsic factors that influence the acceptance of older adults of smartphones and mobile apps. Considering the relatively low per capita income level, education status and traditional cultural background that exists in China, this study aimed to develop a Smartphone Acceptance Model for Chinese Older People (SAMCOP) based on the theory and constructs of the technology acceptance model (TAM) (Davis, 1986) and incorporating the following three additional hypothesized factors: “Facilitating Conditions (FC)”, “Self-satisfaction (SS)” and “Cost Tolerance (CT)”. Through the study, the basic personal circumstances of Chinese older adults who are smartphone users will also be described.

## 2. Technology acceptance constructs and hypotheses

The factors influencing usage of technology have been studied extensively. Several models have been proposed to explain technology acceptance behavior, including the theory of reasoned action (TRA) (Fishbein and Ajzen, 1975), the technology acceptance model (TAM) (Davis, 1986), the technology acceptance model 2 (TAM2) (Venkatesh and Davis, 2000), and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003).

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