



Acceleration Factors for the Actualization of Behavioural Intentions among Elder Users of Assistive Technologies

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ABSTRACT:

This study aims to identify factors that accelerate the actualization of technology usage behaviour once the behavioural intention is established in the minds of elders. Assistive technologies are the highlights of this study specifically those which are fitted on transportation vehicles that function to bring the elders to various locations from their base homes. This study closely referenced the Technology Acceptance Model (TAM), which emphasizes the two variables Perceived Ease of Use and Perceived Usefulness of technologies which form the key determinants of TAM, and undertakes a Qualitative approach. This study gives evidence to the discovery that there are in existence various factors which accelerate the actualization of behavioural intention of the elders in using Assistive Technologies. Secondly the study also reveals that having mere intentions in the mind need not necessarily result in the actualization of usage of the Assistive Technologies. The findings of the study suggest a plethora of opportunities for subsequent studies both in the academia and on commercial ventures. Opportunities for further studies may lie in the scope of policy development and regulations for Assistive Technology provision and user participation, and similarly in the commercialization of specific Assistive Technologies for a wider and more economical adoption by the elders. The study further suggests that there are also opportunities in exploring the potential to bridge inter-party roles of the government and the private sector in germinating Assistive Technology products and services to address any known gaps in their usage by the elders.

1. Introduction

The world is getting older due to the demography of its population. UN DESA (2020) reported that whilst there were 727 million persons aged 65 and above globally in 2020 it is expected that the same group will grow more than double or reaching 1.5 Billion in 2050. This statistically shows a potential growth from 9.3% in 2020 to 16% in 2050.

Yunus et. al (2017) highlighted that the elders in Malaysia were approximately 9.13% or 2.38 million of the country's population in 2015 and is expected to reach 15% by 2030, which qualifies the nation to be an 'Ageing Nation'. Malaysians are deemed to live a longer life as the life expectancy increases from 54.3 years in 1957 to 74.75 years in 2016.

Health remains a key issue for the elders as they begin to experience changes to and limitations of bodily functions. Noor et. al (2019) highlighted a few medical issues related to ageing including neurological

disorder, respiratory issues, hypertension and dementia, which exemplify the needs for care facilities and more focused attention. Evidences on related health issues and situations beleaguering the elder community in the country call for comprehensive and specialized attentions. Guerin and others (2015) conveyed a number of challenges with regards to the delivery of healthcare services including heavy workloads, inadequate number of facilities, slow process turnaround and long waiting time. Yunus et. al (2017) stressed that although there are available health services for the elderly in Malaysia, they continue to be inadequate in scope and breadth and further alarmed by the growing ageing population in Malaysia. Yunus et. al (2017) subsequently recommended the establishment of proactive community-based healthcare for the elderly citing the example in Japan whilst stressing that current policies and programmes are inclined towards specifically the dependent or disabled or the elderly poor. Kon, Lam and Chan



(2017) highlighted the recent reports of the World Health Organization (WHO) which underscored the shortage of caregivers where the number of caregivers across the world is at a mere 7.2 million and is disproportionate to the huge scale of elderly population increase.

These situations are further aggravated by the rising cost in hospital care and the inadequate number of geriatric-trained personnel. The Malaysia Society of Geriatric Medicine (MSGM) in its 2019 reports highlighted that Malaysia has a ratio of 0.19 percent per 10,000 population geriatrician ratio which is well below the ratios of 0.5 and 0.85 for Canada and the UK respectively. With the limitations of care provided by hospitals, rapidly expanding population size of elders and similarly longer expectation in life, the need for institutionalization or care at home for the elders is only expectedly to rise

Such situation portrays that the scarcity of Geriatricians has turned the trade to be highly sought after. Geriatrics patients would go to extreme ends to secure appointments and be cared by these limited number of specialist doctors. Additionally, as the care for elders is being extensively administered at institutions or at home, the elders would have to commute from where they are to where the Geriatricians are located. Similarly, the elders would also need to commute to various other places frequently to seek complementary treatment and to conduct other activities to maintain an active lifestyle. Assistive Technology has been viewed as a potential and practical option in addressing the gaps in elderly care, in institutions, care homes or even self-care, and from several viewpoints including the imbalanced ratio of healthcare professionals and the older population, and the continuous need to improve living independence for those who face challenges as a result of bodily changes due to aging.

Vichitvanichphonng et. al (2018) explained that Assistive Technologies for aged care are possibly categorized as *Supportive* or *Empowering* in nature. A Supportive Technology is defined as a product that aids the elders to perform activities that they are not able to do whilst an Empowering Technology means to acquire physical or educational training that helps the elders to maintain their capabilities to conduct their daily activities thereby to live independently. In the same regard, this study contextually would provide a focus on Assistive Technology as a *Supportive* element where the Assistive Technology selected would function in aiding the elders in their usage of transportation vehicles.

De Witte et. al (2018) stressed that although that there is no one homogenous Assistive Technology for the elders, Assistive Technologies be they simple low-tech or complex expensive in form, can benefit people of all ages and with all kinds of impairments including locomotor, visual, hearing, speech or cognition. Whilst the study would not attempt to emphasize the effects of a particular Assistive Technology on the non-homogenous nature of the elders, the Assistive Technology cited in the study exemplifies its significance in aiding the movement of the elders in and out of motor vehicles despite its simple and low-tech make up.

Taking into consideration the nature of the selected Assistive Technologies being fittings on transportation vehicles which are utilized to ferry the elders, and the physical condition of the elders who are limited in physical movement capability and who require the aid of Assistive Technologies, this study was carried out to identify whether there are external factors that influence the actualization of Assistive Technology usage by the elders by accelerating the actual usage once the intention to use is formed in the minds of the elders. This study which identifies the accelerating external factors has also been carried out in reaction to the Technology Acceptance Model (TAM) theory and its evolutions in TAM2 and TAM3, which suggest that technology usage takes place directly after a behavioural intention is formed.

2. Literature Review

In gaining deeper understanding on previous researches and related works conducted within the scope of the study, a literature review was carried out on several topics including Assistive Technologies, Elders, Care Homes and Adoption of Assistive Technologies. Additionally, the key theories on technology adoption and acceptance were also reviewed upon, which eventually contributed to the Conceptual Framework of this study.

2.1 Understanding Assistive Technologies

The World Health Organization (WHO, 2023) described Assistive Technologies as an overarching term encompassing systems and services in relation to the delivery of assistive products and services, which are capable to maintain or improve an individual's functioning and independence. Assistive Technologies include a variety of products and services from differing levels of complexity including Hearing aids, wheelchairs, communication aids, spectacles, prostheses, and pill organizers, to list a few. Additionally, Assistive Technologies come in various forms and cannot be classified as one of the same for



all types. There are available Assistive Technologies that can be perceived as physical aids as in the examples of wheel chair, trolleys as there are orthopaedic mattress, toilet hoist, non-slip mat to special cutleries and utensils, and special door handles. There exist Assistive Technologies which are furniture fittings in nature including ramps, door alerts, handrails to mechanized stair lift, door opening system and timer to alert on completion of tasks. With the advent of information and communications technologies (ICT), Assistive Technologies too have been developed utilizing ICT and are connected to the telecommunications network via Internet Protocol (IP) including Alarm Systems – smoke, fire, general emergency, remote video monitoring capability, health monitor which can identify changes in pulse, temperature and movement, fall detector and prediction sensors, ambient lights for elders who wake up at night to i.e. go to toilet, and controls for i.e. cooker gas supply (Miskelly 2001).

WHO continued to emphasize that there are more than 2.5 Billion people globally who are in need of one or more Assistive Technologies and by 2050 the figure will reach 3.5 Billion as a result of an enlarging ageing population and the increase of non-communicable ailments.

For many years the potential and benefits of Assistive Technologies have been discovered and highlighted. The various benefits of Assistive technology include to enable the society to have healthy, productive, independent, and dignified living and similarly reducing the need for formal health and support services, long-term care and the work of caregivers.

N Thakur and C Y Han (2020) stated that the specific needs of the elderly are due to physical disabilities, cognitive issues, weakened memory, disorganized behaviour and increasing age but the extent of limitations differs according to specific factors including age, gender, background, experience, skills, and knowledge. Additionally, the shortage of caregivers results in the need for technology-based services for elderly people to assist them in their independent and active aging.

Hoey, Monk and Mihailidis (2012) recommended three factors to be considered in ensuring optimal impact of technology in elderly care, and they include Customizability of Technology for People, Generalization on purposes for Sensors and Adaptability of Technology on changing needs of People. Additionally, The Ambient Assisted Living Association (AAL, 2013) recommended three main stages in designing products fitting the need of the elderly and they include *Understanding*, *Conceptualizing*, and *Testing*. *Understanding* would

refer to the gathering of information on the behaviour and needs of an elderly person *Conceptualizing* sees to the generation of ideas and development of concepts to satisfy the needs and *Testing* is where new concepts and products are tested for feedback to improve the final product.

2.2 The Elderly Population

There exists a few definitions and references to the elderly group of populations. The United Nations, referred to those of the age 65 and above as the older group in its World Population Ageing Highlights 2020. The World Health Organization made reference to the age group of 60 in its Ageing and Health Report in 2022. Unal and Oyzdemir (2019) cited that the WHO classified old age according to three distinct categories including 65-75 years (Young-Old Age) describing the transition into retirement, 75-85 years (Advanced Old Age) where functional losses are noticeable and, 85 years and above (Advanced Old Age) where there are requirements for special care.

The Young-Old Age is also referred to as the 'Sandwich Generation' where instead of being cared for as elders, will also play a role as caregivers for the 'Advanced Old Age' or some may term as the 'Oldest Old' group. Both the Sandwich Generation and Advanced Old Age or the Oldest Old do live together and when combined they can be referred to as the 'Boomerang Generation', a term which denotes the situation where children and parents which are both in the elderly age group age are together (Brown 2017).

2.3 Assistive Technologies adoption by the Elders in Malaysia

Reports on the adoption of technology for elder care in Malaysia are not extensive. Much of the focus on relevant studies within Malaysian context is on elder caregiving in general, government policy, health issues and, problems and challenges. F. Isa et.al (2020) highlighted that the demand for more technologically assisted care facilities for the elders in Malaysia is increasing due to the increasing ageing population and the various challenges the children are facing in taking care of their elderly parents. It will therefore be worthwhile to explore and discover the breadth and depth of Assistive Technologies adoption especially from the viewpoints of the elders themselves, which otherwise could have been overlooked or not prioritized by elderly care stakeholders in general.

The limited number of studies conducted on Assistive Technologies vis-à-vis elderly care in Malaysia amidst the expected higher level technology exposure amongst Malaysian elders spell great opportunities for new researches to be conducted. Mohd Tobi and others



(2017) stated that due to the projection that the elderly population in Malaysia will double by 2028, the public needs to be made more aware on the demography change and similarly, facilitating infrastructure in the country needs to reassessed and addressed to be made adequate to support the growth. These translate into required continuous and focused research.

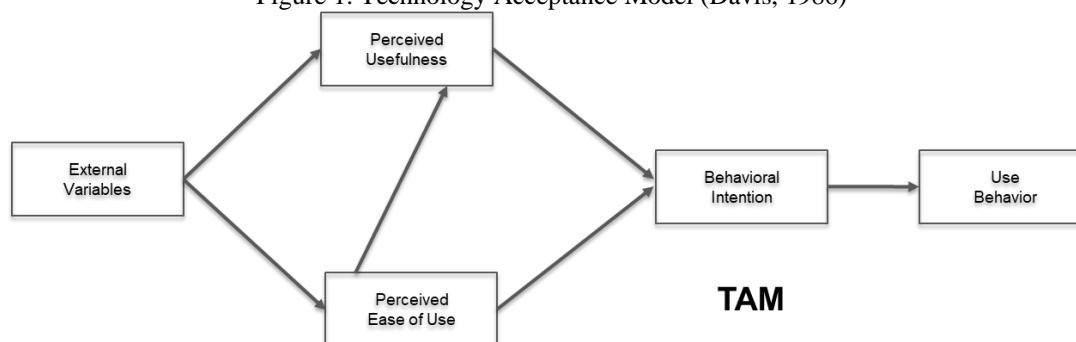
In studying technology adoption by the elders Burgess & Burgess (2006) recommended the use of multiple research methods including qualitative studies, where physiological and psychological needs of elders are identified and addressed, and was quick to add that listening to elders is vital, in gathering the elders' actual feedback. Forlizzi, DiSalvo and Gemperle (2004) emphasized the importance of not getting overzealous with innovation in technologies and to take cognizance of the view that whilst Assistive Technologies provide clear mechanistic physical aid, they do not necessarily meet psychological needs of elders in fulfilling the expectation of higher Quality of Life. Seltzer, J. and Yahirun, J. J. (2014) underscored that the key challenges in technology-based solutions provision to the elders lie in the effectiveness of technology to address the elderly population diversity. Elders vary according to age group, gender and background, which result is differing habits and user interaction. Joshi and Bratteteig (2016) on the other hand reminded on the need for simple interaction mechanisms which are tailored for the elders where the mechanisms are easy to learn and use and where the designs for the mechanisms could also be what the elders regard as intuitive and easy.

2.4 Theories and Models on Technology Adoption and Acceptance

The development of theories on technology adoption helped to answer several questions including in the identification of reasons or issues that influence the use of technology. The answers that are obtained from such inquiries have contributed to the design and development of technologies and even predict the users' responses to the use of any technology (Taherdoost 2017). Thus, the acceptance of any particular technology is crucial to the fate of the technology in question.

In 1985 Fred Davis conceptualized the Technology Acceptance Model (TAM) as a part of his doctoral thesis. Davis equated the use of a technology or system as a behaviour and referenced the Theory of Reasonable Action (TRA) (Fishbein and Ajzen 1975) in his concept. Davis proposed that User Motivation could be used to predict or explain the actual system use, and the motivation is directly influenced by external stimulus comprising the system's features and capabilities. Davis developed the initial TAM in 1986 as per Figure 1, where he identified three factors which were used to explain User Motivation, including Perceived Ease of Use, Perceived Usefulness and Attitude towards Using the System. Notably, Davis (1986) excluded Subjective Norm which was a component in TRA as an antecedent in predicting behaviour as he only relied on two distinct Beliefs including Perceived Ease of Use and Perceived Usefulness as the predictor of Attitudes towards system use.

Figure 1. Technology Acceptance Model (Davis, 1986)



It is important to understand the definitions of the determinants as recommended by Davis (1985):

a. Perceived Usefulness – “The degree to which an individual believes that using a particular system would enhance his job performance Davis (1989) emphasized the word ‘Usefulness’ which refers to the *capability of being used advantageously*.

Advantageous is indeed an important aspect which is present in the determinant *Perceived Usefulness*. In many instances, acquiring an advantage may mean being rewarded, which similarly denotes the act of instilling positive enforcement to oneself. In a typical

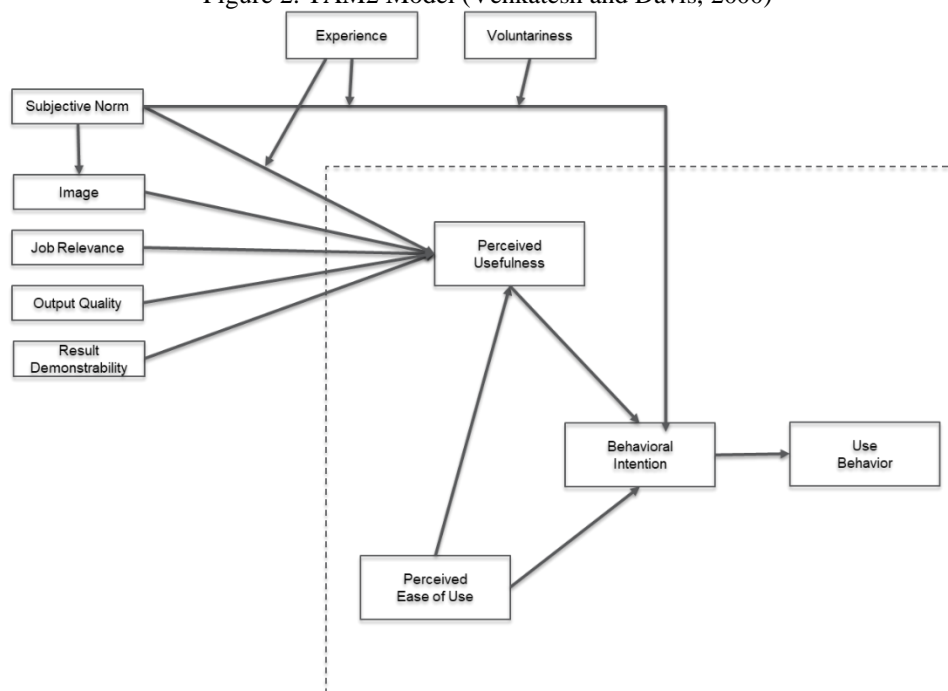


organizational set-up, the examples of being rewarded may include getting promoted, receiving a pay raise or bonus on salary, all of which are capable of driving an individual to use technology as a means to achieve the rewards. Contextually, in situations where elders face difficulty in moving about, being rewarded may mean easing the elders' ability to move around or increasing the safety of the elders whilst being in motion, which are achieved with the application of assistive technologies.

b. Perceived Ease of Use – “The degree to which an individual believes that using a particular system would be free of physical and mental effort”

In explaining the determinant, Davis (1989) underscored the word *Ease*, which accentuates the freedom from the need to experience difficulty or exert effort in acquiring the ability to use a particular technology. It is nevertheless understandable that technologies which require the least amount of effort to use will obtain high levels of usage. This situation is thought to be more apparent in cases of elders who experience difficulty in movement, where the elders are expected to be more at ease with Assistive Technologies that exhibit the least challenge to use.

Figure 2. TAM2 Model (Venkatesh and Davis, 2000)



TAM 2

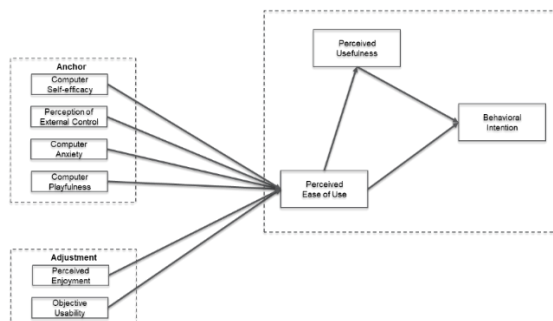
TAM underwent a series of evolution upon newer discoveries on the model. Most studies on TAM although acknowledging it as an important model to predict behaviour on system usage, were nevertheless limited in measuring the reasons of the variables Perceived Usefulness and Perceived Ease of Use. In addressing these limitations Venkatesh and Davis (2000) came out with extensions on TAM thereafter remodelled as TAM 2 as depicted in Figure 2. New additional antecedents were incorporated to the Perceived Usefulness construct, derived from two significant groups including Social Influence and Cognitive Processes (Bradley 2009) thus providing more explanations and details on the reasons why a

system is deemed useful by users. However, P. Legris, J Ingham and P. Collette (2003) viewed that TAM2 did not specify how expectancies are influencing on behaviour and was not able to predict user behaviour within specific cultures. Marikyan D and Papagiannidis S (2023) highlighted that the limitations with TAM have been an interest of discussion for years as its simplicity and lack of understanding on both the Perceived Ease of Use and Perceived Usefulness antecedents have resulted in criticisms. Similarly, TAM-based models were also challenged on its self-reporting measurement of use intention thus the possibility of common method biasness. On the other hand, Lai (2017) conveyed that TAM 2 was able to



successfully reflect technology adoption in either mandatory or voluntary environment.

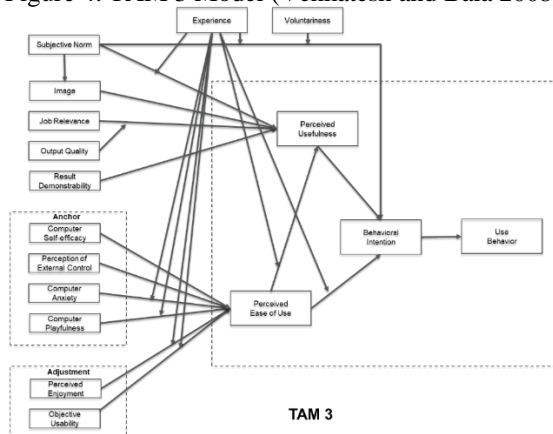
Figure 3. Antecedents added to Variable Perceived of Use in TAM2 (Venkatesh, 2000)



Venkatesh (2000) subsequently added 2 new groups of antecedents; Anchors and Adjustments to the variable Perceived Ease of Use as another extension to TAM 2 as shown in Figure 3. Anchors refer to the general belief on the use of systems whereas Adjustments refer to beliefs moulded by the users' direct experience with the system or technology in question.

Finally in 2008, TAM 3 as indicated in Figure 4 was conceived by Venkatesh and Bala by incorporating TAM 2 and the new antecedents to Perceived Ease of Use. TAM 3 consists of antecedents from 4 major groups including Individual Differences, Systems Characteristics, Social Influence and Facilitating Conditions, and was experimented in actual Information Technology (IT) settings (Lai 2017). Such tests were crucial to the establishment of TAM3 as the earlier TAM models were criticized for being tested in more mandatory conditions like amongst students thus did not test on actual usage but relied on the responses which indicated usage (Lee et. al 2003)

Figure 4. TAM 3 Model (Venkatesh and Bala 2008)



TAM has been identified as a highly referred and overemphasized model for studies and researches on technology use and adoption despite the existence of many other models (Lee et.al 2003). Described as a powerful model, TAM was the subject of over 698 journal citations as early as in 2003 (Lee et.al 2003) and encompassed a wide variety of technologies usage studies including the use of technology in office, home, and specialized systems. Bradley (2009) highlighted at least 23 TAM variables extracted from study findings and suggested TAM as a model being widely used and validated thus making it a reliable model for reference. TAM as a model is capable to provide the basis to identify external influences on internal perceptions, made possible by the external variables that directly impact its two key determinants (Sharma, Ganpati and Kumar 2013). Marikyan D and Papagiannidis S (2023) further added that in spite of the criticisms against TAM on methodology and theoretical application limitations, the model is apparently resilient and have had strong predictive power to assess behavioural intentions for the past three decades.

It is noted that due to its many references in an extensive number of studies, TAM model has been over extended with external variables, which may go against the Principal of Parsimony in a theory or model.

It is apparent that all the external variables proposed throughout the evolution of TAM to TAM 3 have given effect to the key constructs Perceived Ease of Use and Perceived Usefulness. Arguably also, the many studies referencing TAM models tested on these external variables and their influences on the two key constructs, as precursors to the Behavioural Intention of the subjects tested. From there, all TAM models seem to suggest that Behavioural Intention will eventually result in Use Behaviour without needing of or being influenced by any variable, be it internal or external.

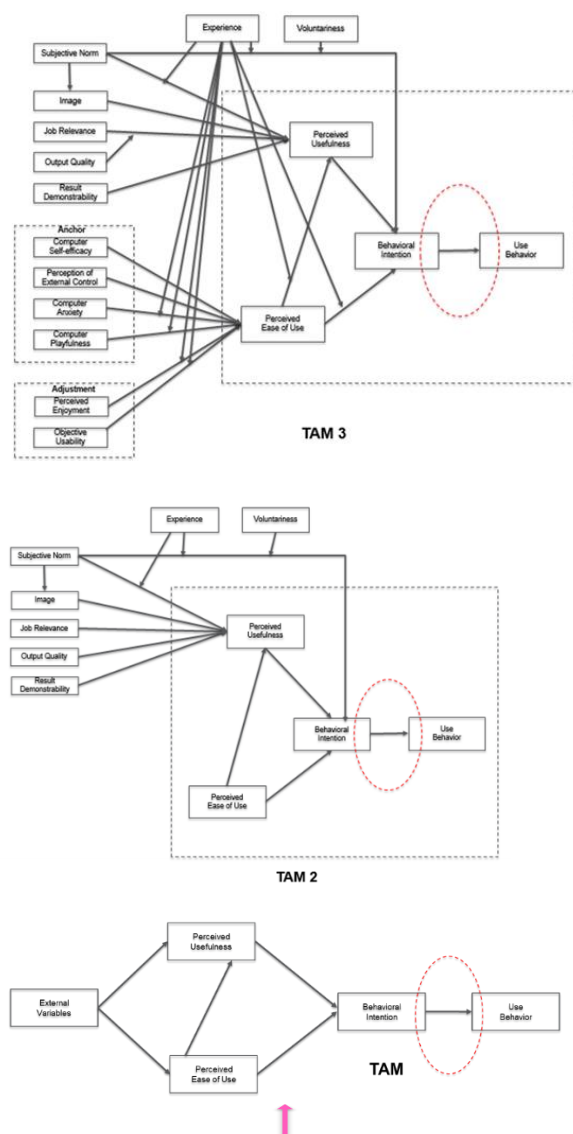
The observations on all TAM models suggest that there exists a chasm of influencing factors in between Behavioural Intention and Use Behaviour which needs to be investigated further. The chasm in question which does not seem to be a key interest of many researchers, has a promising potential to unravel new understanding on factors that influence the actualization of behavioural intention into Use Behaviour.

In reviewing Figure 5 below, one may view that the absence of any variable that influences the progress from Behavioural Intention to Usage Behaviour seem to suggest as if once a Behavioural Intention is formed, Usage Behaviour will automatically take place and no factor, internal or external would act to constraint,



perform or accelerate the actualization of the Behavioural Intention.

Figure 5. Evolution of TAM models. highlights the absence of influencing factors.



The literature review conducted also exemplifies the limited number of studies and related works carried out on Assistive Technologies and its adoption in Malaysia especially with regards to the Elderly. The limitation in the number of studies and related works conducted conversely pose the many opportunities for studies to be conducted on similar scopes, which outcome will benefit the Elderly at-large. Assisted transportation for the group is a novelty in many instances and such development is both a commercial opportunity and an advancement in the provision of better Quality of Life

to those in need. The literature review also establishes the gap in TAM which should be investigated and explored further. Concisely, the literature review establishes an array of both prospective commercial and theoretical contributions.

3. Methodology

The study focuses on identifying factors that accelerate the actualization of behavioural intentions of elderly Assistive Technology users into actual Use Behaviour. Semi-structure In-depth Interview was chosen as the qualitative research method and was deployed on targeted elderly individuals. As the study is Qualitative in nature, the interviews provided in-depth feedback from the participants which encompassed personal experience of how the elders eventually used the assistive technology from initially having mere intentions. The assistive technology selected refers to those who are used in, on or brought onto transportation vehicles, which could include ramps, handrails, vertical poles, hand grips and wheel chairs to name a few. Transportation vehicles would refer to those operated by third parties and could include cars, taxis, buses or other transit services.

3.1 Interviewed Participants

Participants were chosen based on a pre-determined criteria which include:

- Male or Female of 60 years of age or beyond
- Frequents or lives in a care centre or may be referred to as an Old Folks Home either in Subang Jaya or the greater parts of Petaling Jaya
- Not living in a hospital
- Has access to and has used more than once any third party operated transportation for any travelling purposes i.e., to the hospital
- Able to communicate in either English or Bahasa Malaysia
- Faces challenges moving from one distant point to another including but not limited to physical challenges in walking
- Does not suffer from any mental illness

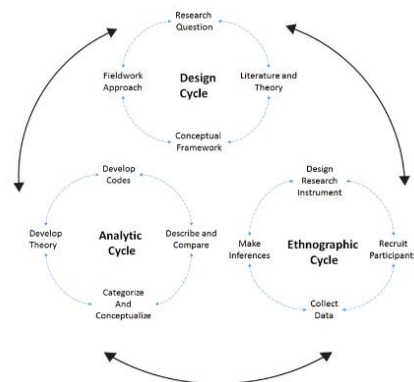
3.2 Study Design

The study referenced the Hutter-Hennink Qualitative Research Cycle (2011) in Figure 6, which proposes a three interlinked-cycle including the *Design* cycle, *Ethnographic* cycle and *Analytic* cycle. For each of the three cycles, four similarly interlinked tasks are incorporated. This research cycle emphasizes that Qualitative researches are cyclical in nature and acknowledges the roles and contribution of both *inductive* reasoning, which is a predominant feature of



a Qualitative research and *deductive* reasoning, which is more pertinent in Quantitative researches.

Figure 6. Hutter-Hennink Qualitative Research Cycle



3.3 Semi-structured In-depth Interview

Hutter, Hennink and Bailey (2011) proposed a four-step approach as a format to an Interview Guide and the format includes Introduction, Opening Questions, Key Questions and Closing Questions. It is important to emphasize that the guide for a Qualitative study interview is not similar to a Quantitative study's closed-ended questionnaire for respondents. Instead of responding to questionnaires, in the In-Depth interview participants will be facilitated to express their own perspectives to shed light on the Research Questions and affirm the Conceptual Framework. Hutter, Hennink and Bailey (2011) further recommended that the questions suitable for similar Qualitative studies need to be open, simple, short, and leading but not testing in nature. The questions too must not be formal but to use the language most comfortable and colloquial for the ease of interaction with the participants. These questions would also be supported by *probing* questions according to the topics. However, as probes, these instruments are not to be mistaken for additional questions but rather elicitation points to lure the participants to share more perspectives and experiences especially when the responses shared by the participants introduce new ideas and discoveries previously not highlighted in the Research Questions and Conceptual Framework. Similarly, this also highlights the situation where inductive reasoning takes place in the study with the unearthing of new concepts, perspectives and understanding on the same topics.

3.4 Observation

Smit, B., & Onwuegbuzie, A. J. (2018) in referencing McKechnie L. E. F. (2008) described Observation in qualitative research as being one of the oldest and fundamental method which involves collecting data

using one's senses especially systematically looking and listening. Observation additionally is fulfilled by watching and recording what others do and verbalize. Hutter, Hennink and Bailey (2011) added that the purposes of observation include to provide contextual understanding on interviews, understand or explain the interviewees' actions within the contextual setting and also to discover silent norms and values that exist in the society. For the purpose of the study, the observation method had contributed to provide complementary data to the Semi-structured In-depth interviews by adding further understanding of the responses. Mulhall (2003) shared that researchers are able to gain understanding and similarly interpret cultural behaviour by observing.

4. Data Analysis

Each of the interview response has been analysed with the aid of NVivo 12, a qualitative analysis software, to arrive at Themes, which were then positioned as factors to bridge the identified gaps in TAM models I, II and III.

4.1 Interviewed Participants

4.1.1 Participant 1

Participant 1 is a man who was 89 years old at the time of interview. Hailed from Kuala Lumpur, he had tertiary level education in technology-based studies and worked as a Technical Assistant throughout his working life. Despite being an octogenarian, Participant 1 displayed a sharp mind and was able to interact well throughout the interview session. Participant 1 had noticeable problems in walking and required assistance to move from one place to the other. As the Home where he was staying was a double storey unit, the interview was conducted at the living area on the second floor, which is the same floor where Participant 1's bedroom was located.

4.1.2 Participant 2

Participant 2 is a lady who was of 78 years of age at the point of interview. She has been living in Kuala Lumpur for the past many years and has been a patron of the Home for more than four years. Participant 2 received her education up to the Senior Cambridge level and served as a teacher throughout her working career. Despite being in her late 70's, Participant 2 was still sharp with her thoughts and provided the necessary responses without fail, although with constant prompt by the Interviewer. Participant 2 had serious walking difficulty and required the use of wheel chair most of the time when moving from one place to the other even within the vicinity of the Home.



4.1.3 Participant 3

Participant 3 is a lady in her late 70s when the interview was conducted. Participant 3 was born and raised in Kuala Lumpur and finished her high school education up until Form 3. Participant 3 had been a patron at the Home for approximately a year but was quick to inform that she would normally keep to herself most of the time. Participant 3 faced difficulty in walking and acknowledged the limitations in physical movement by the elders. She commended the availability of additional fittings on public buses including metal poles and side bars which were beneficial to those in need. She further acknowledged that such apparatus boosted the confidence level of the elders and would in some ways drive them to be more independent in the public despite their physical limitations.

4.1.4 Participant 4

Participant 4 is a lady and was at the age of 88 when the interview was conducted. Despite being an octogenarian, she displayed a very sharp mind and was able to respond well to the questions posed, albeit with casual prompts every now and then. Participant 4 funded her presence at the Home with the assistance of her daughter, a professional which was located abroad. While living at the Home, Participant 4 maintained her own house which was located nearby. Nevertheless, she was not encouraged by her daughter to continue living at the house alone due to her old age and frailty, and resorted to being accommodated at the Home which provided the intended around the clock care and support. Participant 4 did not discount the fact that she lacked the necessary confidence and feared for her safety due to her age and weak knees. This resulted in her decision to ensure the presence of others whenever she moved around for the concern that the frailty would result in an untoward incident. Participant 4 agreed that Assistive Technologies fitted to the Home van had provided the benefits to the elders with limited physical movement. She cited the use of steps to aid the elders going in and out of the van and other assistance rendered to facilitate the bringing of wheelchairs along.

4.1.5 Participant 5

Participant 5 is a lady who was 72 years old when the interview was conducted. Participant 5 showed apparent signs on walking difficulty and relayed that she would need the use of a wheelchair whenever she travelled out of the Home. Participant 5 would on the other hand acquire physical support from the Home staff for within Home boundary movement. She also conveyed that in a typical scenario, Participant 5 would obtain help from the Home staff to walk towards and

be aided to get into a vehicle. Upon arrival at the intended destination i.e. hospital, Participant 5 would request for a use of the hospital's wheelchair to move to the designated clinic. For external visits including the scheduled medical appointments, Participant 5 had resorted to the transport facilities prepared by the Home. She conveyed her difficulty in getting into the vehicles due to some limitations in her physical movement.

4.1.6 Participant 6

Participant 6 is a lady who was 80 years old during the interview. Participant 6 had only become a patron of the Home for the past quarter of the year. Her stay at the Home was fully funded by her children. Being an octogenarian with difficulty in walking, Participant 6 resorted to spending most of her time indoor at the Home unless when it was highly necessary for her to be away. This would include occasional outings and medical visits. Participant 6 conveyed that her ability to go for external visits, which is similar in the case of other elders at the Home, is limited to the Home's schedule. As the available van has passenger capacity limitation, the elders would have no choice but to take turns to go out in groups. In the case of Participant 6, her children opined that the use of the Home transportation would be the most suitable considering her overall physical and health condition.

4.1.7 Participant 7

Participant 7 is a lady who was 83 years old at the point of the interview. Participant 7 was a patient of several illnesses and similarly had extreme difficulty walking. She found it painful to stand and would require constant support to move from her bed, located in one of the rooms of the home, to any other corners of the vicinity let alone joining her Home mates for outings. Nevertheless, Participant 7 had a very sharp mind and was ever ready to provide her views on the questions posed. At the Home, Participant 7 continued to move around on a wheelchair and a staff support. By doing so she was able to continue communicating with the elder folks there and maintained a positive living condition. Participant 7 conveyed that she would still attend family functions near and far, where at most times her children and other family members would be responsible to bring her to the locations and back in their private vehicles. Where outings organized by the Home were concerned, Participant 7 would adhere to the schedule and other details prepared including making use of the Home transport vehicles.

Participant 7 highlighted the need to have at least a simple step to help elders move in and out of vehicles and was rather apologetic to note that even with a wheelchair, she would still require the presence of



another person to assist in pushing the wheelchair around.

5. Thematic Analysis

In analysing the responses to the Research Questions, it is important to note that the Homes where the interview participants resided were equipped with facilities including motor vehicles including a van which was used to transport the elders from the identified Homes to selected destinations, for example, the hospital and shopping areas. The Homes where the elders resided did not limit the elders' external movements to using only the Homes' motor vehicles. The elders were free to join their families or friends in their respective vehicles for outings too. At the Homes there were available Assistive Technologies to assist the movement of the elders amongst others they include walking sticks, steps (to aid into motor vehicles) and wheel chairs. The Homes' staff also provide physical support to the elders the analysis was conducted using NVivo version 12 and a total of five (5) Themes were identified:

- a. Third Party participation
- b. Government Support
- c. Suitable Assistive Technologies
- d. Self-Readiness and Capacity
- e. Family Support

5.1 Third Party Participation

In elaborating their technology usage experience, the interviewed elders highlighted the crucial role of supportive circles of friends, catalytic in actualizing their intentions by facilitating and assisting in the use of Assistive Technologies. These friends were actively present when Assistive Technology usage took place.

The Homes where the elders resided were also underscored as a key factor in accelerating actual usage of technology. The Homes provided dependable care which was crucial for the elders. Firstly, the movements of the elders within the Homes and externally were not hindered by the Homes' caretakers. Similarly, the Homes provided access to a variety of Assistive Technologies including walking aids, handrails, wheel chairs and even motor vehicles which were equipped with Assistive Technologies like a portable step to assist the elders into or alighting from vehicles. Additionally, the same vehicles were able to accommodate the wheel chairs used by the elders thus an added facility for the elders who were generally physically challenged. Notably, the Homes did not limit the choice of Assistive Technologies accessible by the elders and the elders were given the flexibility to utilize whichever Assistive Technologies made

available by the Homes or other options including those provided by families or friends, if the options could provide necessary comfort for the elders. The approach by the Home would be advantageous to the elders due to the non-Homogenic nature of the elders. Several elders preferred the facilities provided by the Homes and others preferred differing options.

The Homes were managed and operated by teams of capable and resourceful staff who other than operating the Homes were also providing physical assistance to the elders including pushing the wheel chairs and guiding the elders into or out of motor vehicles.

The elders also relayed that their family members were agreeable to depend on the Homes' support and facilitation for the values brought forth by the Homes. The trust given by the families to the Homes too helped to accelerate the use intention of the elders for the Assistive Technologies into actual use behaviour.

The elders opined that the private sector played an important role in helping the actual usage of Assistive Technologies. The Homes where the elders resided were owned, managed and operated by the private sector where they value-proposed to aid the need of the elders with access to suitable Assistive Technologies to provide enhanced well-being of the elders. The elders in return obtained the advantage of the private sector's value proposition and accelerated their intention to use Assistive Technologies into actual usage. Similarly, there exist private sectors which were non-Home owners but undertook equivalent role in facilitating the use of Assistive Technologies by the elders. The elders shared that there were private operators of infrastructural facilities like shopping complexes, hospitals and transport vehicles like the public bus service which ensured that their facilities were capable to address the challenges faced by the elders including providing access to adequate number of wheelchairs and equipping the buses with low steps and hand rails.

5.2 Government Support

Government support was also identified as one of the key factors in accelerating the behavioural intention to actual usage by the elders in their usage of Assistive Technology. Government support could be both financial and non-financial in nature and may be deployed as programs or moral support.

The design of public transport vehicles reflects good government support in facilitating the needs of the elders of specific designs to ease their challenged movability. The elders highlighted that there were



available public buses which were equipped with basic Assistive Technologies and designed with consideration for those challenged where low steps and hand rails were installed. On hindsight, in Malaysia the government owns Prasarana Malaysia Berhad, an entity which drives the country's public transportation system and services. The same entity owns and operates Malaysia's stage bus services in several States, and also the nation's urban rail services.

The elders shared that more support is needed from the government to further enhance the related facilities to be more elders and people with movement challenges friendly. In other words, the government needs to consider introducing new policies and regulations to ensure that public transportation designs result in better comfort, safety and security for the use of the elders and others in need.

5.3 Suitable Assistive Technologies

Suitable Assistive Technologies was also identified as another acceleration factor. The Assistive Technology's design advantage would overcome limitations found in any technology of choice. For example, a specific Assistive Technology would not be able to serve all elders as the elders are non-homogeneous. Therefore, specific Assistive Technology designs would be able to address some of the inherent limitations. In reflection of the viewpoints of the elders, a car that has been identified to bring the elders from one place to the other may still have been designed with a small entry point and low ceiling height, which would still pose challenges to the elders thus the availability of an aptly designed step as an Assistive Technology could ease movement of the elders into and out of the car. Similarly, a car may be designed with wide seats for better comfort but an elder using the car would require a device to slide from one side of the seat to the other, as conveyed in the interviews conducted.

In another example highlighted by the elders, an elder riding a public bus could be Assistive Technologically assisted with the installation of vertical poles and hand rails to support with stability. Nevertheless, the elder users can benefit further if the installations were designed to be more accessible by the size and reachability of local users. This was a clear observation conveyed by the interviewed elders in sharing their experience using the public transportation.

5.4 Self-readiness and capacity

Responses to the interviews confirmed that certain advantages present in the individual self are factors

that would help to accelerate behavioural intention into actual use of Assistive Technologies.

Parts of the interview responses could be summarized that a positive perception on how others behave towards aiding the elders' usage of technology could create a higher level of confidence for the elders, which in turn give a morale boost to the elders to accelerate towards technology usage. The positive perception would constitute the elders' personal experience that ante cede the behavioural intention. It would also be the elders' own positive perception that would accelerate the drive towards use behaviour without which, the behavioural intention would remain at its current stage and not be accelerated into actual technology usage.

It was also identified from the interviews that elders with encouraging cultural exposure would have a positive outlook and expectations on how others provide assistance. Similarly, the elders' growing-up experiences too would lead them to a higher level of resilience. Examples of acquired wisdom and trust in God were conveyed to explain that elders would be driven to realize technology usage and confront any given challenges, and not resigned to the limitations of old age.

Elders with certain specific physical characteristics were said to have the advantage in accelerating towards actual usage of Assistive Technologies. Elders who are tall would have a shorter length to cover to move from one side to the other in a vehicle that had been equipped with relevant Assistive Technologies including a slide or a ramp. Also conveyed by the interviewed participants, elders who have less limitations in specific angular movement would be quicker to actualize the use of a step to go into a motor vehicle.

5.5 Family Support

Family support is another key factor concluded as an accelerator to Assistive Technology usage actualization. Family support involved both financial, non-financial and, physical and physical forms.

The interviewed elder participants were notably either well supported by affluent family members or were individually financially capable to afford the living expenses at the Homes.

The interviewed participants shared that their family members frequented the Homes to provide support During the visits, family members were responsible to provide physical and non-physical assistance to the

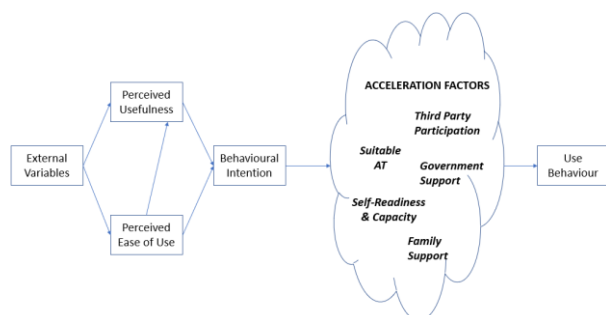


elders and drive them to actualize technology usage. Family members were described to provide moral confidence and endorsement to the elders on the option to use the Home's provided Assistive Technologies. They also physically assist the elders including to push the wheelchairs and guide the walking apparatus.

The support from family on Assistive Technologies use was not limited within the compounds of the Homes. Families too were responsible to bring the elders out for private outings and provided both physical and non-physical assistance in using Assistive Technologies including wheel chairs, lifts and ramps, and ensure that the elders were not further challenged in their Assistive Technology use by for example uneven flooring and any other hurdles.

Conceptual Framework

A Conceptual Framework which has been deduced from TAM to describe the acceptance of technology process for elders could then with the incorporation of the Themes appear as per the figure below:



Notably the variables Perceived Usefulness and Perceived Ease of Use are both self-reflective factors. General adopters of technology or elders alike developed the perceptions potentially based on the highlighted and studied external variables. Largely, these variables reflect the psychological positions of the adopters and are potentially influenced by the adopters' experience, exposure and knowledge acquired through various means. What has yet to be extensively recommended by TAM are the probable factors that influence the Behavioural Intention and actualize them into Use Behaviour. These influencing factors are located within the Chasm of Influencing Factors as per the Conceptual Framework depicted. Elders being in the senior age group of 65 and above are likeably faced with certain kinds of challenges or limitations, be they physical or cognitive. Despite having very positive perceptions on the ease of use and usefulness of Assistive Technologies in both voluntary and mandatory environments, the elders will face

subsequent challenges in performing the intended behaviour of technology adoption should the elders possess specific forms of physical or cognitive limitations? For example, a visually impaired elder who wishes and is motivated to communicate with external communities beyond the boundaries of his home will face difficulties to do so if the care home is equipped with computers complete with social media applications yet without suitable braille applications. Similarly, an elder with chronic arthritis and is unable to type well will be limited in using short messaging applications on the best mobile phone made available to him or her.

6. Conclusion and Future Research

The study proposes a Conceptual Framework based on TAM as a key outcome. Instead of adding more external factors to Perceived Usefulness and Perceived Ease of Use, the proposed Conceptual Framework provides a new contribution to TAM as a theory. Based on the study outcome, it can be confirmed that there exist factors that influence the acceleration of behavioural intention into actual usage of technologies or specifically Assistive Technologies. The discovery of the acceleration factors transforms the growth of TAM and its subsequent TAM2 and TAM3 models.

The proposed Conceptual Framework invites further studies on each of the recommended acceleration factors as they represent individual domains of interest including the elders' personal self or close circle, government policies and regulation, and technology references to name but a few. There could be further studies to be undertaken on the interdependence of each of the acceleration factors or should any of them be a prerequisite to the other. Similarly, studies could also be initiated whether any of the acceleration factors are more dominant than the other, or if the acceleration factors are situational or time-dependent in nature. Each of the acceleration factors is an interesting focus of study in its own regard. For example, Government Support as a recommended acceleration factor has an extensive enough breadth to be explored. Issues involving the formation of a regulatory framework, implementation guideline and financial support schemes if explored adequately will provide enough contribution for the design of Policies for the Elderly at the national level.

The study outcome also brings forth various potential contributions to the business world. As the study proposes the discovery of factors which accelerate behavioural intentions into actual usage, there can be several business domains which could be positively affected by the proposal. For example, the study



highlights that elders may be influenced and affected by the suitability of the Assistive Technologies. Being Non-Homogenous, elders would require technologies which are designed-specific to address their challenges for them to optimally benefit from the Assistive Technologies. Assistive Technology designers need to arrive at a solution which can benefit a larger Elder demography and not limiting the technology of choice to a small group of users only. Characteristics of the technology including material, colour, flexibility and modularity may be the areas of interest of the designers to meet additional design requirements.

The exponential growth of the elder community group is a global phenomenon and Malaysia is not falling far from similar traits. It is by realizing the exponential growth and the gap in the management of the elders that a huge commercial potential becomes more visible and should immediately be captured. The gap identified brings forth interesting business opportunities although further assessment would be required. The outcome of study is far reaching and provides clear contribution firstly towards the growth of the Technology Acceptance Model (TAM) which is a highly referenced theory. The study also catalyses subsequent inquiries into a variety of domains including policy making and technology design whilst emphasizing the non-homogenous nature of the elderly demography. Equally as important, the study provides a glimpse into business opportunities that are made apparent by the gaps in elder community management and service provision. It is therefore recommended for the various authorities, special interest groups and the community at-large to make close reference to this study and the potential it highlights to continually contribute towards the betterment of the elders.

References

1. Burgess A.M & Burgess C.G, 2006, '*Aging-in-Place: Present Realities and Future Directions*', Forum on Public Policy
2. Miskelly F.G, 2001, '*Assistive Technology in elderly care*', Age and Ageing 2001; 30; 45-458, British Geriatrics Society
3. Hoey J, Monk A & Mihailidis A, 2012, '*People, Sensors, Decisions: Customizable and Adaptive Technologies for Assistance in Healthcare*', ACM Transactions on Interactive Intelligent Systems (TiIS) - Special issue on highlights of the decade in interactive intelligent systems, Volume 2 Issue 4, December 2012 Article No. 20
4. Hutter, Hennink and Bailey, 2011 "Qualitative Research Methods" (Book) SAGE Publications Ltd.
5. Taherdoost H, 2017 "A review of technology acceptance and adoption models and theories" 11th International Conference Interdisciplinary in Engineering, INTER-ENG 2017, 5-6 October 2017, Tirgu-Mores, Romania
6. Lai P C 2017 "The Literature Review of Technology Adoption Models and Theories For the Novelty Technology" Journal of Information Systems and Technology Management Vol 14, No 1 Jan/Apr 2017 pp. 21-38
7. Bradley J 2009 "The Technology Acceptance Model and Other User Acceptance Theories" Handbook of Research on Contemporary Theoretical Models in Information Systems. 277-294
8. Lee Y, Kozar K A and Larsen K R T 2003 "The technology acceptance model; past, present and future" Communications of AIS 12 (50), 752-780
9. Sharma A K, Ganpati A and Kumar D 2013 "Effect of Moderators on Determinants: A Case Study of Technology Acceptance Models" International Journal of Research in Computer and Communications Technology Vol 2 Issue 5 May-2013, PN: 254-260
10. Mulhall A 2003 "In the field: Notes on observation in qualitative research" Journal of Advanced Nursing 41 (3):306-13
11. Brown T 2017 "The Aging of the Sandwich Generation: Meet the Boomerangs" <https://www.allianceehhcare.com/aging-sandwich-generation-meet-boomerangs/> viewed on 30th Oct 2018
12. Davis F D 1989 "Perceived Usefulness, Perceived Ease of Use and User Acceptance of Information Technology" MIS Quarterly Vol 13 No 3 (Sep 1989) pp. 3
13. United Nations Department of Economic and Social Affairs, Population Division (2020) World Population Ageing 2020 Highlights viewed at https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/files/documents/2020/Sep/un_pop_2020_pf_ageing_10_key_messages.pdf
14. <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>
15. Eda Unal and Aysel Ozdemir, "Old Age and Aging", ST. KLIMENT OHRIDSKI UNIVERSITY PRESS SOFIA (2019)



16. S. U. Mohd Tobi; M. S. Fathi; D. Amaratunga (2017) Ageing in place, an overview for the elderly in Malaysia. AIP Conf. Proc. 1891, 020101
17. Guerin, B., Hoorens, S., Khodyakov, D. and Yaqub, O., (2015). A growing and ageing population. Global societal trends to, 2030.
18. Noor'ain Mohamad Yunus, Noor Hazilah Abd Manaf, Azura Omar, Nurita Juhdi, Mohd Azahadi Omar, Mohmad Salleh (2017). Determinants of Healthcare Utilisation among the Elderly in Malaysia. Institutions and Economics Vol. 9, No. 3, July 2017, pp. 115-140
19. Filzah Md Isa, Shaista Noor, Goh Wei Wei, Sharifah Diyana Binti Syed Hussain, Hairunnisa Mohamad Ibrahim and Muhd Afiq Syazwan Ahmdon. (2020) Exploring the facet of elderly care centre in multiethnic Malaysia. PSU Research Review.
20. Noor, S., Isa, F.M., Nor, L.M. and Ahmed, E.C. (2019), "Identifying the current trends and challenges of ageing care centres in Malaysia", International Review of Social Science, IRSS, Academy of IRMBR, Vol. 7 No. 7, ISSN 2309-0081.
21. Smit, B., & Onwuegbuzie, A. J. (2018). Observations in Qualitative Inquiry: When What You See Is Not What You See. International Journal of Qualitative Methods, 17(1). <https://doi.org/10.1177/1609406918816766>
22. McKechnie L. E. F. (2008). Observational research. In Given L. M. (Ed.), The Sage encyclopedia of qualitative research methods (pp. 573–577). Thousand Oaks, CA: Sage.
23. <https://www.myrts.com/RTS-Access/What-is-Paratransit>
24. Marikyan D and Papagiannidis S (2023) "Technology Acceptance Model: A Review" In S. Papagiannidis Ed, (TheoryHub Book) ISBN: 9781739604400
25. WHO "Assistive Technology" <https://www.who.int/news-room/fact-sheets/detail/assistive-technology>, 15 May 2023
26. Joshi and Bratteteig, (2016) "Designing for prolonged mastery. On involving old people in participatory design." Scandinavian Journal of Information Systems
27. Nirmalya Thakur and Chia Y. Han "A Review of Assistive Technologies for Activities of Daily Living of Elderly" © 2020 Nova Science Publishers, Inc. ISBN: 978-1-53618-446-4
28. Kon, B., Lam, A. and Chan, J. (2017), "Evolution of Smart Homes for the Elderly" "Proceedings of the 2017 International World Wide Web Conference Committee (IW3C2), Perth, Australia.
29. Seltzer, J. and Yahirun, J. J. (2014), "Diversity in Old Age: The Elderly in Changing Economic and Family Contexts," In Diversity and Disparities: America Enters a New Century, edited by John Logan. The Russell Sage Foundation, ISBN: 978-1-61044-846-8.
30. Suchada Vichitvanichphong, Amir Talaei-Khoei, Don Kerr, Amir Hossein Ghapanchi, "Assistive technologies for aged care: comparative literature survey on the effectiveness of theories for supportive and empowering technologies", Information Technology & People, <https://doi.org/10.1108/ITP-03-2017-0090> 27 February 2018
31. Luc de Witte, Emily Steel, Shivani Gupta, Vinicius Delgado Ramos & Uta Roentgen (2018) Assistive technology provision: towards an international framework for assuring availability and accessibility of affordable high-quality assistive technology, Disability and Rehabilitation: Assistive Technology, 13:5, 467-472, DOI: 10.1080/17483107.2018.1470264
32. <https://codeblue.galencentre.org/2021/11/24/malaysias-ageing-population-finds-shortage-of-doctors/>
33. Ambient Assisted Living Association (AAL). Methods of User Integration for AAL Innovations; YOUSE GmbH: Berlin, Germany, 2013.
34. Jodi Forlizzi, Carl DiSalvo and Francine Gemperle, "Assistive Robotics and an Ecology of Elders Living Independently in Their Homes" (2004) Carnegie Mellon University
35. Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley.
36. Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", MIS Quarterly,
37. Viswanath Venkatesh, Fred D. Davis (2000) "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies" Management Science 46(2):186-204
38. P. Legris, J Ingham and P. Collette, "Why Do People Use Information Technology? A Critical Review of the Acceptance Model," J. Inf. Manag vol 40 pp 191-201, 2003