

# An Exploratory Research to Analyse the Current Level of Technological Support for Adaptive Ageing in the Digital Era with Reference to Kerala State in India

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## ABSTRACT

At the dawn of this digital era, Indians are faced with a plethora of technological services and digital devices. These services offered on digital platforms not only support intellectual curiosity and increased social interaction but provide increased safety and expedite tedious processes such as money transfers, thereby bettering the quality of life. Although the advent of these services holds great promise for all, older adults find it difficult to adapt to these new techniques. As the benefits of technology for seniors are plentiful it becomes imperative to understand the hurdles faced by them in adopting these new technologies. Currently every country in the world is experiencing an exponential growth in the percentage of seniors in their population. So, it is essential to ascertain the challenges faced by seniors when they attempt to employ technological services. This study proposes a model DATS [Digital Assistive Technology for seniors] that may guide future researchers in enabling the elderly to reap the benefits of technological services.

## Keywords

DATS [Digital Assistive Technology for Seniors]; Ageing well; Digital revolution; Digital literacy, Technology adoption; Technology acceptance; Digital economy; Assistive technology;

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## Introduction

Digital India, a prominent initiative launched by the Government of India aims to transform India into a country of digitally literate citizens. This transformation process is challenging in a country like India, where more than 300 million citizens do not possess credit / debit cards or smart phones and are also not financially literate enough to handle PINs, passwords etc. and their implied securities. Among the total population nearly one third can be classified as senior citizens. The number of elderly persons in India in 2011 was 90 million and is expected to escalate to 173 million by 2026 as pointed out by the report released by the United Nations Population Fund (UNPF) and Help Age India (Harikrishnan, 2012). The (India Ageing Report, 2017) noted that 30 million amongst the 90 million elderly surveyed were living alone and further 90% needed to work for their livelihood.

As humans age, they take more time to react to simple stimuli and to learn new material. This decreases their capacity to adapt to changes. Their increasing age can also impair their auditory and visual capabilities. This is often coupled with more temporal variations in sensory, motor, and abstract cognitive abilities than in those younger than them (Stern et al., 2000). This deterioration in adaptability was not addressed by the technology of the yester years. The advent of computers that are powerful yet easily embedded in other technological devices and processes has paved the way for constructing technology that can be easily embraced by the elderly.

One of the challenges faced by Digital India is to ensure safe and easy to use digital modes of transactions among senior citizens. The area of this study includes the

identification of the challenges in technology usage among senior citizens. The study determines the pattern of usage of digital devices among senior citizens, so that it may open avenues of research, to identify technologies that will enable seniors to confidently use the digital platform to enhance their lives.

## Understanding the Ageing Scenario Through A Literature Review

A relative increase in the number of seniors in a population is referred to as ageing. It has been noted that for elders who are able to embrace the online technological services it forms an essential part of their day to day living.

## Global Scenario

A marked increase in the percentage of senior citizens in the population is being seen all over the world. The 2017 Revision of the World Population Prospects predicts that by 2050, the number of senior citizens will be at least double and by 2100 triple the present number (United Nations-Department of Economic Affairs, 2017). In 2017 senior citizens accounted for 13 per cent of the global population and numbered about 962 million and their sub-population was increasing yearly at a rate of about 3 per cent. Currently, this sub- population is highest in Europe at 25 per cent. With ageing on an upward spiral, it is expected that by 2050 senior citizens will account for nearly quarter of the population globally except in Africa. The recent study (World Health Organization – Ageing and Health, 2018) has estimated that the global population of senior citizens would number about 1.4 billion in 2030, 2.1 billion in 2050,

and may rise to 3.1 billion in 2100, while the population aged 80 or over is anticipated to increase from 137 million in 2017 to 425 million in 2050. It is predicted that the population of aged people in 2100 would be seven times its strength in 2017.

### Indian Scenario

The Population Census of 2011 revealed that elderly males numbered 5.1 crore and elderly females 5.3 crore so that the subpopulation of elderly totalled to 10.4 crore. It was also observed that the size of the elderly population was continuously increasing over time, from 5.6 per cent in 1961 to 8.6 per cent in 2011, wherein the male subpopulation had increased to 8.2 per cent, while the female subpopulation was marginally higher at 9.0 per cent (State Planning Board–Economic Review [SPBER], 2017). The study (SPBER, 2017) also noted that among the elderly the ratio of rural to urban residents was 71:29.

### Kerala Scenario

In 1961 the population aged 60 and over was found to be 5.1 per cent of the total in Kerala which was just below the national proportion of 5.6 per cent. However, since 1980, Kerala has overtaken the rest of India vis a vis this subpopulation. In 2001, this ratio stood at 10.5 in Kerala which was far higher than the national proportion of 7.5 and in 2011 it shot up to 13 percent. The study conducted by the Centre for Development Studies (“The New Indian Express”, 2014) points out that the subpopulation of elderly in Kerala is perpetually increasing at a rate of 2.3 per cent. Among the elderly the growth rate of the sub population of elders aged 70 or 80 and above is also high (SPBER, 2017). Currently, seniors of age over 60 years number 42 lakhs in Kerala and 13 per cent of them are 80 years and above, the fastest growing subset among the aged.

### Background Study

#### Adoption Vs. Acceptance Of Technology.

For the Digital India Initiative to succeed it is imperative to realise the fine distinction between adoption and acceptance of technology. Adoption of technology would imply the awareness of the technological process and embracing it as a part of one’s lifestyle. A positive attitude towards technology would mean an acceptance of it. Numerous technology acceptance models have been recommended and are briefly discussed below.

#### Technology Acceptance.

Technology acceptance and adoption are vital factors in the exploratory study into marketing, ergonomics, pedagogy, psychology, and sociology. Of the available models the Technology Acceptance Model (TAM) proposed by Davis (Technology Acceptance Model [TAM], n.d.), with two main factors influencing an individual’s intention to use new technology that is perceived ease of use and perceived usefulness is of significance. While some of the senior citizens may feel that digital games are beyond their

comprehension or are a waste of time and so may not venture to learn to utilise this technology, other seniors may think of these games as much needed and easily available mental stimulation and so may be inclined to master them. TAM works on the hypothesis that when a technology is perceived by a person as useful and easy to use, they will be inclined to utilise it. TAM functions as an outline and is in accordance with several studies on the dynamics that guide older adults’ objective to use new technology (Charness et al., 2016).

The prediction of the acceptability of an information system is of vital importance in the TAM. However, some studies have pointed out the shortcoming of TAM in not perceiving the interconnection between technology and its assimilation and utilisation. Although research published in this topic perceived usefulness as an important predictor in TAM model, in online gaming where technology is utilised for entertainment or to relax and pass time this is not relevant as pointed out by (Ajibade, 2018).

The acceptance and utilisation of hedonic-motivation systems (HMS) mostly used for pleasure rather than productivity is increasingly becoming relevant to the global economy. The Hedonic Motivation System Adoption Model (HMSAM), an extension of TAM, is a HMS-specific system acceptance model grounded on flow-based cognitive absorption (CA) and seems more suitable as it is based on an alternative theoretical perspective (Lowry et al., 2013). By including CA as a key mediator of perceived ease of use (PEOU) and of behavioural intentions to use (BIU) the HMSAM extends the acceptance model proposed by van der Heijden, to a hedonic system (Heijden et al., 2004).

Taking into cognizance the distinctive individualities, competencies and limitations of the elderly in the acceptance of technology Renaud, K. and van Biljon, J. proposed the Senior Technology Acceptance Model (STAM) (Biljon et al., 2007), tailored specifically to the acceptance of mobile phones among seniors.. The improvement of STAM over models like TAM which study technology acceptance is that it focuses on understanding technology acceptance by senior users (Biljon et al., 2008), (Jia et al., 2015).

This paper focuses on ascertaining the elements which contributes to the acceptance of technology by elders, by seeking an answer to the query: “Does the ease of use of technological devices influence their acceptance by the elderly?” This would lead to avenues of further research to enhance technological devices by making them easier to use for the elderly, thereby, greatly enriching the quality of their ageing.

### Scope of the Work

The study aims at identifying the requirements and usage of digital devices among senior citizens with reference to Kerala.

#### Why Kerala

Among the states of India, Kerala is ageing fastest. The high proportion of elders in the population has a lot of repercussions on the socio-economic status quo of Kerala. In the traditional Indian culture of joint family systems, the

extended family provided adequate social and financial security for the elderly. However, the current nuclear family system hardly provides any care for the elderly. This scenario is further aggravated by the migration of a large number young and middle aged overseas (especially to Gulf Countries), in search of job prospects leaving the elderly to fend for themselves. An interesting fact is that the State has 4 International Airports. Further, most women, the traditional care givers of the family who provided the mental and physical sustenance to the elderly are now engaged in jobs outside their homes. The culture of sending elderly persons to Old Age Homes is therefore becoming prevalent. The age configuration of Kerala's Senior Citizens is given in below.

**Table 1:** Age Composition of Kerala's Senior Citizens

Age composition	Total	Men	Women
Total population	33,406,061	16,027,412	17,378,649
Total old age population	4,193,393	1,853,595	2,309,798
60-69	2,416,805 (58%)	1,114,368 (60%)	1,272,437 (55%)
70-79	1,234,739 (29%)	534,879 (29%)	699,860 (30%)
80+	541,849 (13%)	204,348 (11%)	337,501 (15%)

Source: Census of India, 2011

### Kerala Disability Census 2015.

According to the Census 2011 there were 41, 93,393 Senior Citizens in Kerala, the major disabilities among them being the loco motor and visual disabilities. However, the Disability Survey of 2015 revealed that there were 8,217,434 households with a population of 34,254,086 of whom 4,233,474 were Senior Citizens constituting 12.36 % of the total. 1,934,758 of the Senior Citizens were male and 2,298,716 were female. Also 432,953 of the households that is, 5.27 % of the total comprised only of Senior Citizens (SPBER, 2017).

### Special Reference To Usage Of Smart Devices By Elderly In Kerala.

The state of Kerala whose population numbers about 33 million, boasts of more than 30 million mobile phone users. As 40 % of the population has access to the internet, the proportion of smartphone users is continually increasing. Telecom regulator TRAI (Jose, 2017) estimates that more than 20 % of the households in Kerala utilise high-speed broadband and about 15% of them accesses the internet on smartphones.

Kerala boasts the country's highest life expectancy at birth - 71.8 and 77.8 years for men and women, respectively. Thiruvananthapuram based psychologist Shiju Joseph (Jose, 2017), has pointed out that, smartphone-aided digital infrastructure has greatly bettered the quality of the lives of the elderly subpopulation, who constitute 13 % of the total and until now spent their time on routine activities.

By ensuring broadband connectivity to all villages under the National Optical Fibre Network project Kerala had become

India's first 'digital' state. As Kerala is also a fully literate state the digital revolution empowered by smart devices has completely transformed the entire lifestyle of its people. This transformation has been highly profitable for many data and smart device companies who now have found new clients in over four million senior citizens of the State.

The study 'On the Road to Digitization: The Case of Kerala', by Anindita Paul and Radhakrishna Pillai of IIM Kozhikode (Jose, 2017) emphasizes that the digital programmes of Kerala have been exemplary, and that the Malappuram district has become the country's first fully e-literate district where the utilisation of smart gadgets is extremely high, possibly due to monetary remittances from West Asia.

Kerala's achievement in the e-sphere is attributed to the visionary measures of the government through the projects like Akshaya and IT@School way back in 2002 which opened the doors of digital literacy to its citizens (Abraham, 2015). IT@School was later transformed into Kerala Infrastructure and Technology for Education (KITE) in August 2017. KITE supports the State Government's Public Education Rejuvenation Mission (Pothu Vidyabhyasa Samrakshana Yagnam) with schemes such as Samagra Content Portal, Sampurna School Management software etc(Kerala Infrastructure and Technology for Education, 2019).

### Research Questions

What are the digital devices currently used by senior citizens?

What are the digital services preferred by senior citizens?

What is the level of acceptance of digital device usage by senior citizens?

What is the level of comfort enjoyed by senior citizens for using digital devices?

What is the level of support sought by senior citizens for using digital devices?

Are senior citizens aware of various digital services currently available for common usage?

Does education, employment, and financial status have an impact on the acceptance of digital devices by the senior citizens?

### Research Gap

Modern technology is easily embraced by the young. However, older adults face several hurdles in adopting them, despite the enormous direct and indirect benefits they hold such as:

Medical interventions using technological advancements

Access to various financial and health schemes of Government.

Social connectivity

Entertainment

In enhancing the capability of the senior citizens in the utilization of these digital devices, one would be greatly contributing to enhancing their quality of life.

### Research Methodology and Data Analysis

Employing simple random sampling an exploratory survey was undertaken, the sample size being 90. A comprehensive questionnaire was administered sometimes accompanied by a face to face interview.

#### Participants Age

The age wise distribution of the respondents was as follows: 50% of the respondents belong to 60 to 80 age group, 34% of the respondents belongs to 40 to 60 years, remaining 16% of the respondents were more than 80 years old.

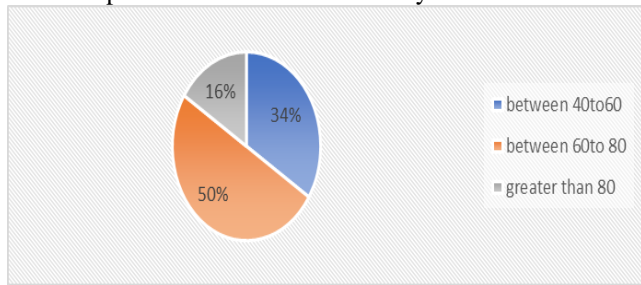


Fig 1- Age wise distribution

#### Sex

53% of the respondents were Male and 47% Female.

#### Education

37% of the respondents had studied up to the Undergraduate level, 37% till PUC/12, 20% were below secondary school level, 3% finished diploma and 3% were post graduate.

#### Income

The income of 38% of the respondents were below Rs. 50000 pa, 24% were earning between Rs.50000 and Rs.1 lakh pa, 14% were earning between Rs. 1 lakh and Rs.2 lakh, 21% were earning between Rs. 2 lakh and Rs. 5 lakh and 3% were earning between Rs.5 Lakh and Rs. 10 lakh pa.

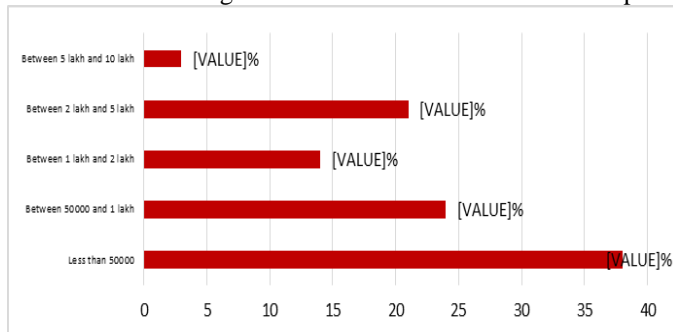


Fig 2- Income Distribution

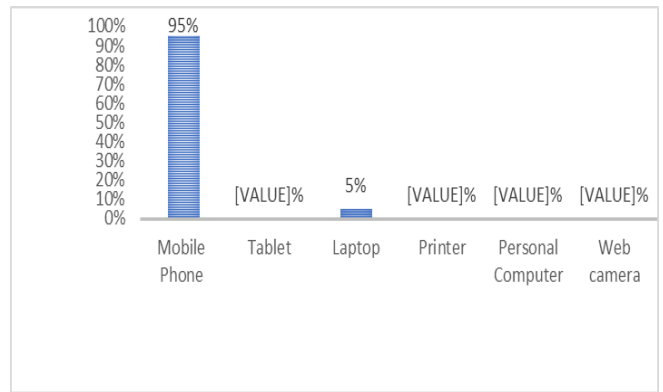


Fig 3 - List of electronic devices used

#### Electronic Device Usage

It was found that 95% of the elderly used mobile phones and 5% used laptops.

#### Data Analysis

The most common digital service used by most of the senior citizens was ATM transactions. It accounted for 44% of all digital services.

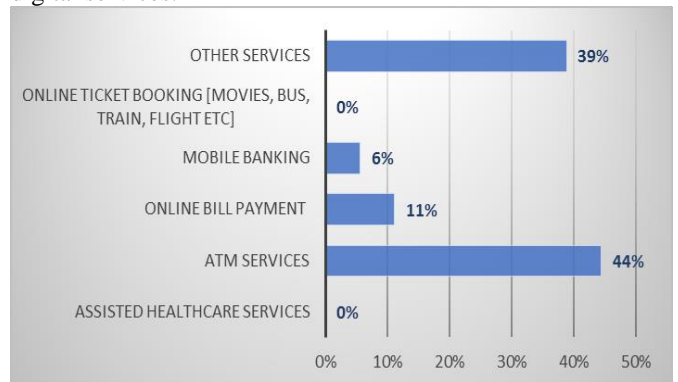


Fig 4 - The services used through digital devices

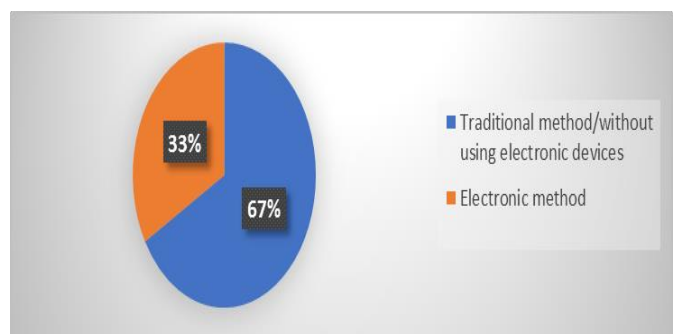
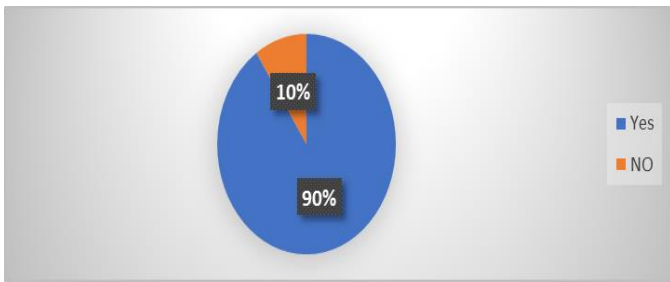


Fig 5 - Most preferred mode of service

The most preferred mode of service for the senior citizens was found to be the traditional method which accounts for 67% whereas 33% preferred electronic mode of doing transactions.

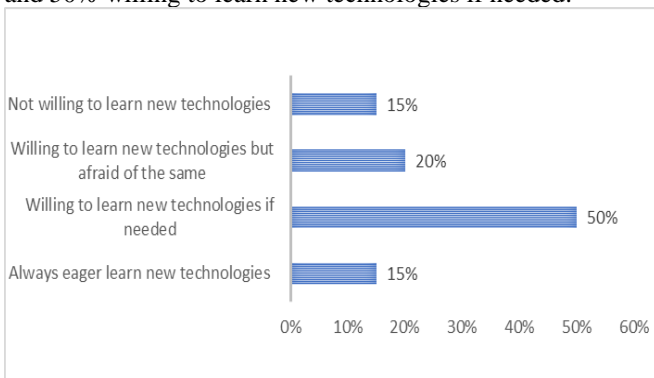
It was found that 90% of the senior citizens had sought help to use electronic devices and services.





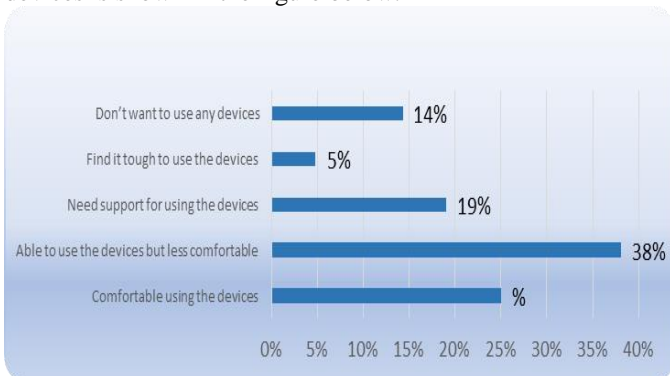
**Fig 6** - Do you seek help when using electronic devices and services?

The senior citizens had expressed varied levels of interest in learning new technologies with 15% always willing to learn and 50% willing to learn new technologies if needed.



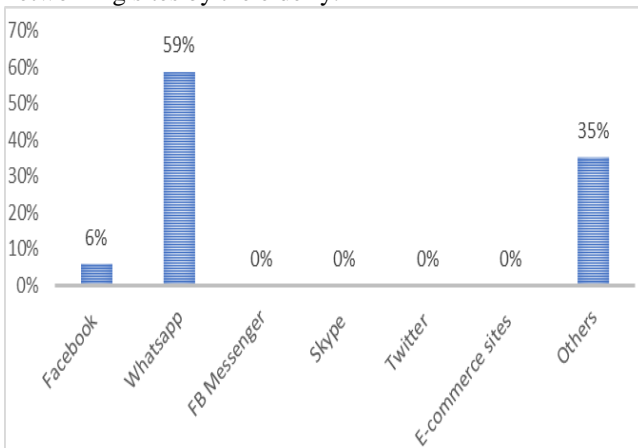
**Fig 7** - Level of interest in learning new technologies

The level of comfort of senior citizens in using electronic devices is shown in the figure below.



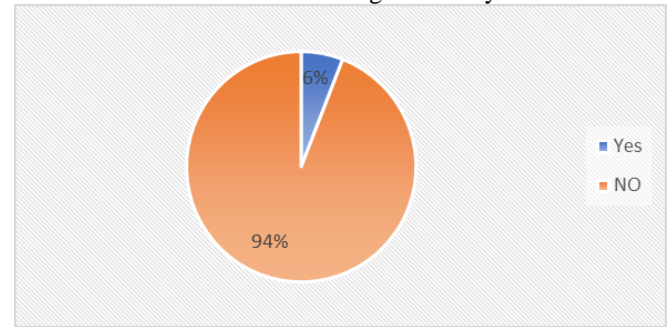
**Fig 8** - Level of comfort for using electronic devices

WhatsApp and Facebook are the most visited social networking sites by the elderly.



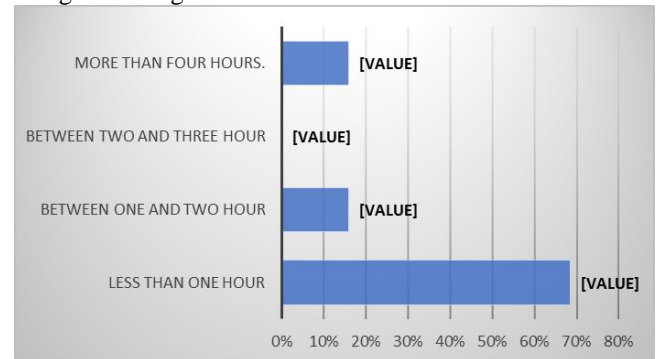
**Fig 9** - The social networking sites visited often

94% of the elderly are found to be happy to use the social media and found it not obstructing their daily life activities.



**Fig 10** - Does usage of social media reduce your productivity?

68% of the elderly were found to spend less than an hour using technological devices.



**Fig 11** - On an average, how much time in a week do you spend on technological devices

On employing the chi square test using the R statistical package it was found that for the sample under study the level of usage of digital devices was dependent on the age of the respondent. However, it was seen that the level of usage of digital devices was independent of the gender of the respondent.

## Results and Findings of the Study

### Attitude

The study revealed that nearly 65 % of senior citizens were willing to learn new technologies, which is consistent with the findings of Kim (González et al., 2012). On interacting with the seniors surveyed some of them professed that the utilization of digital devices would usher lifelong learning and better social interactions. One observation was that, even academically well qualified elders, for example, retired bank employees were not comfortable in using digital devices, including ATM services. Further, some of the elderly were found to be memorising the operation steps to be performed on the digital devices, which makes us to wonder whether digital devices bettered their quality of life.

The survey found that only 20% of the elders evinced interest in new technology whereas 80% of them preferred to use the traditional modes of banking, payment etc. that they were familiar with. As seniors who are engrossed in improving their knowledge using the computer are found to be more capable, self-reliant, and self-confident (Lin et al.,

2016), it is imperative to ascertain the psychological obstacles that prevent them to adapt to electronics mode of services.

Of the respondents of the study 76% had reported that they sought help from others to use the devices. This again provides impetus to seek enhancements of digital devices and services to make them usable by elders without seeking support (which may not be available in some cases).

The study revealed the attitude of senior citizens towards technology is positive and they are willing to learn new technology. That is psychologically they were willing to accept new technology but needed help in utilising them. Hence it is imperative to identify the factors to motivate them to adopt it.

### Culture

In Kerala, where even highly educated youth, are unable to find employment commensurate to their qualification, international migration has been considered the norm, whereby they could improve their financial status and contribute to the upkeep of relatives in India. Such remittances are especially important for their aged relatives in India, who probably, neither receive a pension nor have a comprehensive health insurance, despite national and local efforts for a re-organization of social welfare. Thus for transnational families from Kerala, remittances help to enact labour migration as an elder care practice in itself (Ahlin et al., 2019).

Digital anthropology is the anthropological study of the relationship between humans and digital-era technology (Miller, 2018). Digital anthropology refers to the consequences of the growth of digital technologies for specific populations, the application of these technologies within anthropological methodology, or the study of digital technologies. The topic raises wider questions about the nature of contemporary anthropology. The question of what it now means to be human and how anthropology as a discipline should incorporate worlds that were neither preceded nor possible in the past will emerge. The study provides the impetus to study the Anthropological factors contributing to the acceptance of technology (Miller, 2018).

### Fitness Factors

The two prevalent models often utilised in studies on technology acceptance, namely, the Technology Acceptance model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAT), were intended to elucidate the issues affecting the utilisation of technology by individuals. Recent reviews of research involving older adults have pointed out that the TAM and UTAT lack vital predictors of technology utilisation that are specific to older adults living in communities, including physical, psychological, and contextual factors.

Research should be carried out to identify the reason for technology usage by senior citizens. The study shows that only 14% of the elderly spend more than four hours a week on an average on using technological devices and 90% of the respondents do not have problems like insomnia, due to longer screen time. As digital services may help the elderly

to overcome physical and cognitive disabilities. They can be motivated to improve their usage (Sebastian et al., 2015).

### Sociological Factors

TAM gives vital importance to the prediction of the acceptability of an information system. The limitation of TAM is that it does not account for social influence. Another inadequacy of TAM is that the only determining factor leading to actual system use is behavioural intention to use (TAM, n.d.).

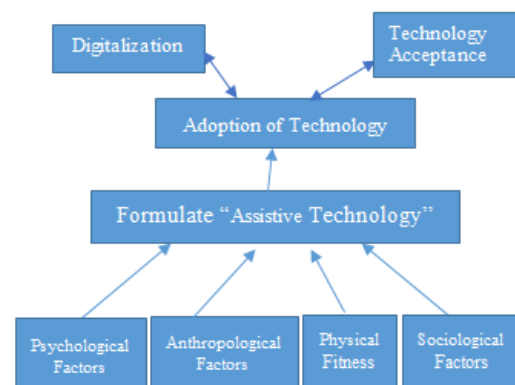
Senior citizens prefer technological applications which can connect them to the society. This contributes in a major way to ageing well. Sociological factors may enhance the benefits of digital device usage and acceptance.

As per our study only 48% of the elderly are on WhatsApp which presumably help them connect to their relatives and peers. It would be to their benefit if elderly can be motivated to use technology to be in touch with their kin and colleagues through such apps.

### Proposed Model Based on the Findings

Based on the findings, this paper proposes a model, Digital Assistive Technology for Seniors (DATS), showcasing the factors to be considered in the formulation of assistive technology, which will in turn provide effective and efficient use of digital devices by the elderly, increase the acceptance and adoption of technology, there by assimilating them in the digital economy.

The model proposes that factors discussed above such as Psychology, Anthropology, Sociology and Health sciences have an impact on technology usage and needs to be considered while creating assistive technology for seniors which in turn can help the seniors in adopting newer technologies.



**Fig12 - DATS [Digital Assistive Technology for Seniors]**

Future research may formulate Assistive Technology by considering the factors from the fields of Psychology, Anthropology, Sociology and Health sciences along with the technological advancements like inventions of IoT devices and machine learning methods and AI, so as to increase the ease of use of digital devices for senior citizens

## Conclusion and Future Enhancements

As the Government of India insists on the country moving towards the digital era, there exists more scope for research to identify and suggest methods to enhance the ease of use of digital devices for senior citizens thus help them in ageing well. As of now, the services used by the elderly persons are limited to mobile phone and core banking services. Even though they would like to utilise digital methods for other services and purposes, they are not confident enough and are less comfortable using it. Emerging research in the field of cognitive science may help to contribute to identifying and resolving the challenges faced by the senior citizens in using the digital devices. The researchers aim to suggest enhanced technological methods incorporating Artificial Intelligence and Internet of Things (IoT), that is utilising third wave technology to assist elderly to use second wave technology.

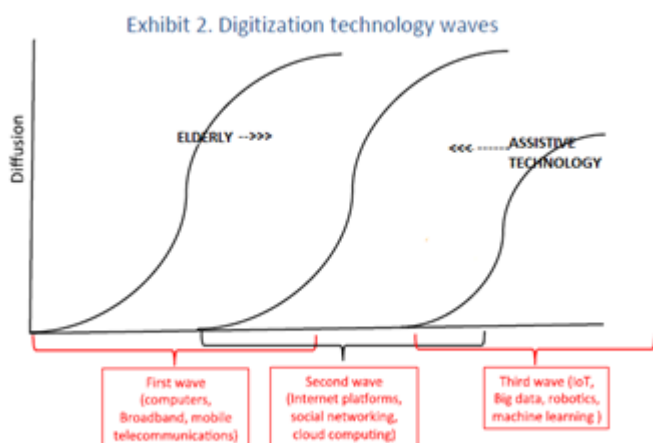


Fig13 – Digitization technology waves

This article is the consequence of a preliminary empirical study that has employed a questionnaire developed explicitly to quantify some characteristics exhibited by the elderly towards technology.

Further research to identify and formulate “Assistive Technology(ies)” is to be undertaken by employing technological advancements to augment the ease of use of digital devices by elderly thereby enhancing the quality of their lives.

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