

Adoption of Health Wearable Technology Among Working Adults in Abuja, Nigeria

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Abstract

This study investigates the adoption of health wearable technology among working adults in Abuja, the Nigerian Federal Capital Territory (FCT). Two research questions were formulated and tested. The study adopted a descriptive survey research design whereby a questionnaire was designed and administered both online using Google Forms and offline. The instrument was first validated by five experts and a pilot study was also conducted and analysed using Cronbach Alpha coefficient method on the instrument which yielded an overall reliability coefficient of 0.83. The expert validation process together with the pilot study helped the researchers to double-check the validity and reliability respectively of the research instrument. The survey items were shown to be adequately reliable for this research. Data was collected from 383 respondents who are working adults living in and around the FCT and analysed using Mean and Standard Deviation to answer the research questions. Findings revealed that the adoption of wearable technology among working adults in Abuja, Nigeria is very low. Additionally, the findings showed that both performance expectancy, effort expectancy, social influence, facilitating condition, and self-efficacy are positively related to the adoption of health wearable technology among working adults living and working in Abuja, Nigeria. The research therefore recommends both government and private organizations to design policies that would encourage these population to adopt the technology to benefit from the vast advantages of using such wearables, especially in the managing of their healthcare and fitness data.

1. Introduction

Internet of Things (IoT) has highly impacted the global network, being further enhanced by introduction of wearable devices into the data communications ecosystem, especially in developed nations. Wearable Technology is relevant to a wide variety of areas of human endeavour, especially in the area of health, including such areas as medicine, healthcare, nursing and fitness. Wearable technology utilizes such gadgets as smartwatches, smart google glasses, smart head bands, hand bands, ankle bands and other fitness trackers.

Wearable technology is a dynamic phenomenon whereby developers need to constantly step up their development of these portable monitoring systems to address the ever-increasing needs for real-time data monitoring and management (Sharma et al., 2022). There is a rise in the way users interact with smart wearable devices today, especially in the present health Artificial Intelligence (health-AI) market. This enables the execution and enhancement of interactive marketing by various companies if users adopt and use the wearable devices (Zhu et al., 2022). While many recent user-to-system interfaces are designed to use touchscreens and/ or touchpads with sensors that are mostly used in IoT developments, such sensors are mostly seen to be complicated, bulky and inflexible. Wearable technologies eliminate or reduce the complications and provide additional flexibilities with the introduction of devices which can easily be attached to users' clothing, or which are even worn directly on their bodies, usable in almost every area of human life (Anwer et al., 2022).

Knowing the importance of wearable technology,

working adults and the ageing population should generally adopt and use the devices to enhance their physical activities and improve their livelihoods. But they might be reluctant to adopt the technology for various reasons including but not limited to ignorance of the technology (Kalantari, 2017), unavailability of wearable devices, ignorance of the potential benefits, concerns over data privacy, user income, cost of purchase and maintenance of wearable devices, compatibility with other smart gadgets, and so on. Most times, economic and financial challenges may hamper consumers' ability to demand good brands or models of the wearables per time (Kalantari, 2017). But if the factors influencing wearable technology adoption are properly explored and awareness is created among working adults then, further research could be carried out on evaluating the advantages and drawbacks and developing strategies to overcome the drawbacks so that the target users would be encouraged to adopt and use the technology and benefit therefrom.

Wearable Technology is a new concept on IoT which offers various products and services for users, mostly in healthcare, in fitness tracking and in a wide range of other areas of human endeavour. Campelo & Katz (2020) opined that wearable technology can support users to increase their physical literacy, which will in turn stimulate their uptake and ongoing participation in physical activities. Today, it is believed that IoT, including wearable technologies, enhances success in several sectors of human life (Al-ravashdeh, 2022). Because of the importance, all and sundry should be encouraged to adopt and use wearable technology; although, this is not yet the case among dwellers in most underdeveloped countries like Nigeria.

2. Statement of The Problem

There is a rising rate of public healthcare challenges in Nigeria, especially in such areas as hypertension, diabetes, arthritis, and other cardiovascular diseases. Hypertension is said to be the leading cause of other chronic diseases and deaths from heart diseases with a prevalence of some 30% (Falase et al., 2015; Pius et al., 2020; Kehinde et al., 2023). Despite the prevalence and rapid advancement in health wearables (Al-Daraghme & Stone, 2023; Bodur et al., 2019); not much Nigerians leverage the technology for effective healthcare and fitness monitoring. This could be because of unawareness of the technology which could in turn be due to lack of research on these wearable technologies and/ or less research also exploring how users would benefit from these technologies (Gowin et al., 2019) and cost of purchase

and maintaining the devices. But target users can only take advantage of the huge benefits of using wearable technology if they know and understand the technology and can afford the devices. For example, Al-Daraghme & Stone (2023) showed that the wearable technology market is yet to be fully explored despite the fact that the technology is widely applied and hugely beneficial to users in such areas as medicine, healthcare, fitness tracking; in recognizing activities, sports, rehabilitation and indeed, almost all other areas of human endeavour.

Shipments of wearable devices went up to some 14.89 million units valued at about \$2.86 billion in 2022 (Nourhan, 2023). However, it is not fully known whether consumers adopted such devices for healthcare and fitness purposes or whether they just adopted them as fashion statement. In Nigeria for example, there is about 45% rise in shipment of wearable devices annually, leading up to some 60.6% of the market value in 2022. However, it is not clearly known how these smart devices have profited the Nigerian working-class citizens since research on this subject is quite scanty in literature. The disconnect between the vast potential benefits of health wearable technology and its actual usage among Nigerian working adults presents a critical challenge which this research sought to address. The study assessed the current level of adoption of health wearable technology among working adults in Abuja, the Nigerian Capital City, leading to targeted strategies to encourage the adoption. The study utilizes a model called SUTAUT which brings together the four key constructs of UTAUT and one additional construct (which is Self-Efficacy) from SCT, with IT Knowledge serving as a moderating variable.

The adoption and use of wearable technologies effectively allow for quick access to relevant data which accurately provide insights into healthcare and fitness conditions of users, helping both the users and care providers to make more informed health related decisions. Extensive control of healthcare challenges by deployment and use of wearable technologies can prevent or greatly curtail the incidences of cardiovascular diseases and other heart related attacks (Leupold et al., 2022; Patil et al., 2022). Wearable technology comes with promises to significantly revolutionize our living standards in such areas as healthcare, fitness tracking and to improve performances. The research (Al-Daraghme & Stone, 2023) shows wearable technology to have vast areas of application including such areas in healthcare and medical treatments, rehabilitation, sports and fitness, and recognizing activities. The research added that much remains hitherto to be explored in the wearable technology market. Wearable technology gadgets come in different hardware types, including different

types of accessories, patches and even textiles. According to Ryu et al. (2023), wearable technologies used in healthcare, medicine, nursing and the like, are now quite widespread and known to improve individual physical activity and to enhance user-behaviour.

Being that the technology adopted by any organization would influence the organization over a long period of time, the organizations need to prioritize technology adoption to subsist; also taking into consideration the fact that how users adapt to and/or respond to the introduction of a technology will go a long way to encouraging how these technologies are deployed (Adikoeswanto et al., 2022). According to Ryu et al. (2023), constant effort is being made to develop some effective physical activities to improve user participation. Considering the ubiquitous nature of technology to human lives today, the integration of health wearable technology has become broadly accepted and so, promoting physical activities, fitness, and health, both in practice and in research. These wearables enable users to track fitness parameters and record physical activities automatically (Casado-Robles et al., 2022; Creaser et al., 2021). This research will therefore investigate the level of adoption of health wearable technology in the study area, with the hope to enhancing the adoption and helping users benefit from the vast advantages of adopting these wearables. The research will also examine the relationship of the study constructs with this adoption.

2.1 research questions

1. What is the current level of adoption of health wearable technology among working adults in Abuja, Nigeria?
2. What is the relationship among performance expectancy, effort expectancy, social influence, facilitating condition, and self-efficacy, with adoption of health wearable technology among working adults in Abuja, Nigeria?

2.2 Research objectives

The specific objectives of this research are:

1. To determine the current level of adoption of wearable technology among working adults in Abuja, Nigeria
2. To examine the relationship among performance expectancy, effort expectancy, social influence, facilitating condition, self-efficacy, with adoption of health wearable technology among working adults in Abuja, Nigeria

3. Methodology

The study employed descriptive survey research design whereby a structured questionnaire was developed and used to collect primary data from 383 respondents both online (using Google Forms) and offline. Purposive sampling technique was used. The questionnaire included two sections: demographic data and data related to questions of adoption. Five experts validated the questionnaire and a pilot test was also carried out to check the reliability of the instrument. The overall Cronbach Alpha coefficient reliability of the instrument was 0.83 using Statistical Package for Social Sciences (SPSS). Participants were informed on the purpose of the study and assured that their data would be treated in confidence. Mean and standard deviation method of analysis were conducted to answer the research question, the results of which are presented in the next section.

4. Results

Table 1: Frequency Statistics on the Adoption of Health Wearable Technologies among Working Adults N= 383

S/N	Statements	\bar{X}	SD	Dec
1	I currently own at least one health wearable device (e.g. Smartwatch, Smart Google Glass, Smart Bands, etc.)	1.44	0.89	Low
2	I use health wearable technology to monitor my health and fitness data	1.88	0.46	Low
3	I am familiar with various types of wearable technologies available in the market	1.19	0.48	Low

4	I feel comfortable using wearable technologies for personal or professional purposes	1.87	0.44	Low
5	I use wearable technology devices regularly in my daily activities	1.83	0.38	Low
6	I actively seek information about new wearable technologies	3.98	0.58	High
7	Wearable technologies have become an essential part of my daily lifestyle	2.60	1.43	Moderate
8	I believe wearable technologies improve my productivity or efficiency	2.81	0.67	Moderate
9	I have recommended wearable technology to others	2.72	1.32	Moderate
10	I am willing to invest in newer or more advanced wearable technologies	2.67	0.68	Moderate
11	I use wearable technologies to receive notifications, calls and messages	1.21	0.49	Low

12	I trust the accuracy and reliability of data provided by wearable technologies	2.84	0.43	Moderate
13	I believe wearable technologies are easy to use and integrate into daily routines	3.37	1.44	Moderate
14	I prefer using health wearable technologies to other non-wearable health devices	1.87	0.44	Low
15	I plan to continue or increase my use of health wearable technologies in the future	2.98	1.29	Moderate
	Overall	2.35	0.36	Low

Key: \bar{X} =Mean, SD=Standard Deviation, Dec=Decision

The results of the sub questions that address the main issues in this Research Question are summarized on Table 1 above. These results show that the main (\bar{X}) for all the items lie within the range of 2.54-3.40 which are within the mean range of 1.19-3.98; with an overall mean value of 2.35 which suggests that the current level of adoption of health wearable technology among working adults in Abuja is reasonably low since the figure falls below the midpoint on the measurement scale of 2.50. Thus, it is indicative to say that on average, respondents do not frequently use or integrate such devices into their daily lives. Practically speaking, the findings infer that health wearables such as fitness trackers, smartwatches with health monitoring features, or other digital health devices are not yet widely embraced by the working adults in Abuja, Nigeria.

Table 2: Descriptive Statistics, Cronbach's a Coefficients and Relationships of the Study Variables

	\bar{X}	SD	1	2	3	4	5	6	7
PE	3.95	0.60	1						
EE	2.57	0.40	.046	1					
SI	2.69	0.52	-.024	.460	1				
FC	2.48	0.54	-.016	.410	.919	1			
SE	2.36	0.42	.026	.78	.524	.617	1		
IT	2.42	0.44	-.063	.264	.818	.692	.281	1	
AHWT	2.35	0.36	.021	.829	.743	.734	.852	.479	1

Note: \bar{X} = Mean, SD = standard deviation, PE= performance expectancy, EE = effort expectancy, SI = social influence, FC= facilitating condition, SE= self-efficacy, IT= IT knowledge, AHWT = adoption of health wearable technology

The Pearson correlation results presented in Table 2 shows a positive but very weak relationship (+0.02) between performance expectancy and adoption of health wearable technology, a positive and very strong relationship (+0.83) between effort expectancy and adoption of health wearable technology, a positive and very strong relationship (+0.74) between social influence and adoption of health wearable technology, a positive and very strong relationship (+0.73) between facilitating condition and adoption of health wearable technology, a positive and very strong relationship (+0.85) between self-efficacy and adoption of health wearable technology, a positive and moderate relationship (+0.48) between IT knowledge and adoption of health wearable technology among working adults in Abuja, Nigeria. In summary therefore, the study variables showed positive relationships with adoption of health wearable technology among working adults in Abuja, the Nigerian Federal Capita City and its environs.

5. Discussion of Findings

5.1 Discussion - Research Question 1

The objective of this research was to determine the current level of adoption of health wearable technology among working adults in Abuja, Nigeria. A total of fifteen (15) sub questions were proposed for the research and the responses analysed to show whether the level of adoption is high, medium or low.

The results presented in Table 1 show that all the items had mean (\bar{X}) values ranging from 2.54-3.40 which are within the mean range of 1.19-3.98 and possessing an overall mean value of 2.35. The response items 1, 2, 3, 4, 5, 11 and 14 have corresponding mean (\bar{X}) values as follows: I currently

own at least one health wearable device (eg. Smartwatch, Smart Google Glass, Smart Bands, etc.) (1.44), I use health wearable technology to monitor my health and fitness data (1.88), I am familiar with various types of wearable technologies available in the market (1.19), I feel comfortable using wearable technologies for personal or professional purposes (1.87), I use wearable technology devices regularly in my daily activities (1.83), I use wearable technologies to receive notifications, calls and messages (1.21) and I prefer using health wearable technologies to other non-wearable health devices (1.87). These mean scores all fall far below 2.50 which indicates low level of adoption of health wearable technologies among working adults in the study area. Also, the response items 7, 8, 9, 10, 12, 13 and 15 with corresponding mean (\bar{X}) values are: wearable technologies have become an essential part of my daily lifestyle (2.60), I believe wearable technologies improve my productivity or efficiency (2.81), I have recommended wearable technology to others (2.72), I am willing to invest in newer or more advanced wearable technologies (2.67), I trust the accuracy and reliability of data provided by wearable technologies (2.84), I believe wearable technologies are easy to use and integrate into daily routines (3.37), I plan to continue or increase my use of health wearable technologies in the future (2.98). The mean score for these falls within the range 2.50-3.50 which indicates moderate level of adoption of health wearable technologies among working adults. The findings of the study show only item 6 which states that; I actively seek information about new wearable technologies to have a mean score 3.98, which is above the measuring score of 3.50, indicating high level of adoption of health wearable technologies of working adults.

However, the overall mean value of 2.35 which falls below the midpoint on the measurement scale of 2.50 and this shows that the current level of adoption of health wearable technology among working adults in Abuja, Nigeria is low. Thus, it is safe to point out that on the average, the respondents in this research do not frequently use or integrate health wearable technology into their daily lives. In practical terms, the findings imply that health wearables such as fitness trackers, smartwatches with health monitoring features, or other digital health devices are not yet widely embraced by the working adults in Abuja, Nigeria.

The results on Table 1 also showed standard deviations within the range 0.38-1.44; with a variation of 1.06 which implies that the responses of the respondents were consistent and close to each other with high agreement and the value close to the mean. The overall standard deviation of 0.36 indicates a relatively low score, signifying that responses are fairly consistent and clustered around the mean. This

implies that most working adults have similar adoption level of health wearable technologies. The low standard deviation suggests agreement among respondents, meaning that other factors influencing their adoption may be similar. Hence, the findings of this study have shown that the level of adoption of the health wearable technology among working adults in Abuja, the Nigerian capital city is quite low.

5.2 Discussion - Research Question 2

The second objective of this study was to investigate the relationship of performance expectancy, effort expectancy, social influence, facilitating condition and self-efficacy with adoption of health wearable technology among working adults in Abuja, Nigeria. This is to ascertain in what ways each of these constructs (or factors) affects the adoption of wearable technologies among working adults in the study area. The results as presented on Table 2 provided insight into the relationships between each of the study constructs and adoption of health wearable technology among working adults in Abuja, Nigeria.

5.2.1 Performance Expectancy and Adoption of Health Wearable Technology

Overall, the findings of the study on the relationship of performance expectancy with Adoption of health wearable technology among working adults in Abuja, Nigeria revealed a significantly low adoption of health wearable technology among working adults. Although, there is a positively significant relationship between performance expectancy and adoption of health wearable technology among working adults. This suggests that individuals are more likely to adopt these wearable devices when they believe that the technology will enhance their performance or productivity. Such finding is consistent with previous research which have highlighted the importance of performance expectancy in predicting usage and adoption of health wearable technology. For example, the finding agrees with findings from (Venkatesh & Davis, 2000) and from (Chen & Chan, 2014) who stated that performance expectancy significantly influences users' intention to adopt health wearable devices, as individuals expect these tools to improve their health outcomes and fitness monitoring. Also, Davis (1989) found that perceived usefulness, which is a component of performance expectancy, is a primary predictor of technology adoption among health-conscious users.

5.2.2 Effort Expectancy and Adoption of Health Wearable Technology

The findings of this study show that there is a positive relationship between effort expectancy and adoption of health wearable technology among working adults. Effort Expectancy (EE) talks of the degree to which someone believes that using a particular technology will be free of physical and mental efforts (Venkatesh & Davis, 2000). The findings also revealed a strong positive and significant relationship between effort expectancy and Adoption of Health Wearable Technology which is in agreement with findings of many other extant studies which were conducted using the UTAUT model. For example, (Chen & Chan, 2014) shows that effort expectancy is positively associated with adoption and usage behaviour. This means that working adults in Abuja are more likely to feel confident about, and to adopt health wearable technologies if they find them to be easy to use and operate without much mental and physical effort. (Al-rawashdeh, 2022) also found effort expectancy to be a positive factor of adoption. In other words, this study submits that simplifying technology functionality and reducing learning barriers can significantly drive and enhance adoption of such technology. Hence, effort expectancy would play a crucial role in encouraging the adoption and widespread use of health wearable technologies, even among working adults in Abuja, Nigeria.

5.2.3 Social Influence and Adoption of health Wearable Technology

The findings of this study also show that there is a positively significant relationship between social influence and Adoption of health wearable technology by the working adults, which means that these workers are most likely to adopt health wearable devices when they are influenced by family, friends and other acquaintances. These findings are consistent with previous research which have hitherto highlighted the importance of social influence in predicting usage and adoption of health wearable technology. Social influence is defined as the degree to which an individual is motivated to adopt and use a technology following the importance they attach to how others believe he or she should use the new system (Venkatesh & Davis, 2000). (Al-rawashdeh, 2022) found social influence to be one of the key elements of adoption at the level of individual application of IoT in healthcare. Although, some studies show technology adoption not to directly relate to various aspects of technology, but to evolve more complicatedly in processes containing the users' attitudinal and personality parameters including social

influence and facilitating conditions (Sharma & Mishra, 2014), there exist theories and models which explain technology adoption from the concept of social influences (Sharma & Mishra, 2014) indicating that it positively supports adoption of health wearable technologies.

5.2.4 Facilitating condition and Adoption of health Wearable Technology

The findings of this study reveal a positively significant relationship between facilitating condition and adoption of health wearable technology among working adults in Abuja, Nigeria. Thus, these working adults are most likely to adopt health wearable technologies if they believe that a system will encourage them to accept and use this technology. This finding corroborates the findings in extant literature. For instance, both (Al-Momani et al., 2018) and (Al-rawashdeh, 2022), found facilitating conditions to be among the factors that significantly affect the adoption of mHealth technologies.

Although many authors opine that with Performance Expectancy, Effort Expectancy and Social Influence which are the key intention models of UTAUT, research would have reached the end of determinants of intention to use, some of them believe that a fourth determinant is needed to be able to examine the impact of possible external variable use of the technology. This fourth determinant is known as Facilitating Condition (Al-Qeisi, 2009), thus agreeing with the findings of the current study that Facilitating Condition is positively related to adoption of health wearable technologies among working adults in Abuja, the Nigerian capital city. Also, building from the initial TAM model, In 2003, Venkatesh proposed the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003) with such key constructs including facilitating conditions to influence technology adoption; the constructs sometimes being moderated by such factors as age, gender, voluntariness to use, and experience and (Taherdoost, 2018) found facilitating condition to be one of the key factors that affect technology adoption.

In another study (Al-rawashdeh, 2022), it is stated that although facilitating conditions may not have direct impact on intention to use a technology, that it does have some direct influence on adoption and use behaviour; also adding that facilitating condition form part of the environmental factors that encourage IoT adoption and application for smart healthcare technologies.

5.2.5 Self-efficacy and Adoption of health Wearable Technology

The findings of this study showed a positive and significant relationship between self-efficacy and adoption of health wearable technology among working adults in Abuja, Nigeria. Thus, working adults in Abuja, Nigeria will most likely adopt health wearable technologies if they are confident of their abilities to utilize the technology and its various devices. This finding is in consonant rhyme with the findings of other studies in the literature. For instance, Bandura (1986)'s model, the Social Cognitive Technology (SCT), considers self-efficacy and outcome expectations to be the main constructs that influence behaviour, and that these two constructs can either be weakened or they could be strengthened depending on users' source(s) of information/feedback (Bandura, 1986). The research to study the intention of users to adopt mobile health smartphones included Self-Efficacy (SE) and two other important constructs to the UTAUT model, to explore their effect on adoption of new systems found self-efficacy to have a strong influence on the users' intention especially when a technology is new. In 1986, Bandura (1986) founded the Social Cognitive Theory (SCT) and indicated that behaviours could be influenced directly by self-efficacy Gowin et al. (2019).

Although self-efficacy isn't the actual ability and/ or skill possessed by users, it is "the extent to which the users judge themselves to be capable to carry out certain actions required to attain designated types of performance" Bandura (1986). Self-efficacy is one of the key constructs of SCT and it is found that when people are endued with positive thought of their abilities to complete tasks, they are more likely to participate than when they have a low degree of self-efficacy; the latter case actually leads to avoiding the task. This is especially important when trying to adopt a novel technology which may seem to be complex in operation (Kalantari, 2017). According to Kalantari (2017), self-efficacy could be positively influenced by participation since consumers who are more concerned in new technologies are more likely to judge their abilities as positive to use these technologies. SCT shows that perceived self-efficacy and outcome expectations are important in forming behaviour and goals and these constructs are achievable by knowledge or having the right information per time (Simmich et al., 2021).

6. Conclusion

This study aimed to evaluate the level of adoption of wearable technology for health purposes by working adults (aged between 30 and 60 years) in Abuja, the Nigerian federal capital territory and to also determine the relationships among performance expectancy,

effort expectancy, social influence, facilitating condition, self-efficacy and adoption of health wearable technology among working adults aged between 30 and 60 years of age inclusive. The findings firstly revealed that there is a very low level of adoption of health wearable technology among this population. The results also show that there is positive significant relationship between the constructs of the SUTAUT model and the adoption of health wearable technology among working adults in Abuja. But, not many working adults in Abuja partake of the enormous benefits health wearable devices proffer in managing personal healthcare and fitness data or in information handling and sharing with health experts.

7. Recommendations

Understanding the vast benefits of wearable technologies, especially in healthcare and fitness handling; and discovering that most working adults in Abuja, Nigeria do not adopt and use these wearables to benefit therefrom, this research recommends that governments, companies and other non-governmental employers formulate policies that would encourage their working class to adopt wearable technologies as these have the benefits to profit them in the areas of their medical, healthcare and fitness managements. If working adults in the Nigerian capital city maximize the benefits of health wearable technologies then, it would only be a matter of time until the entire Nigerian population begins to adopt these wearable devices and to maximally benefit therefrom.

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