# The Effect of the Subjective Norm, Image and Job Relevance on the of the TAM Technology Acceptance Model for the Adoption of Internet of Things Technology in Health Care(*)

**Master's Student Sarah Samir Salah**
**University of Al Mosul**
**College of Administration and Economics**
Sara.20bap145@student.uomosul.edu.iq

**Assist.Prof. Dr. Bassam Abdel Rahman Yousef Al-Yuzbaki**
**University of Al Mosul**
**College of Administration and Economics**
bassam_abdalrahman@uomosul.edu.iq

ISSN 2709-6475 DOI: https://dx.doi.org/10.37940/BEJAR.2023.4.2.13

تأريخ استلام البحث ٢٠٢٢/٨/٢٥ تأريخ قبول النشر ٢٠٢٢/٩/١ تأريخ النشر ٢٠٢٣/٢/٢٨

## Abstract

**Purpose**: Many countries are using Internet of Things (IoT) devices in the healthcare sector to take advantage of digital transformation and modern technologies. This transformation has been positively reflected on patient care, after enabling doctors to diagnose patients more accurately and obtain better treatment results for that, the current study seeks to achieve a main goal of identifying the acceptance of IoT technologies by medical care providers in health institutions in Nineveh Governorate.

**Design / Methodology / Approach**: The study used the deductive approach through the Technical Acceptance Model (TAM), which is represented by the variable of Subjective norm, job status, quality of output, job suitability and proof of result in addition to the perceived ease of use, perceived benefit, attitude and behavioral intention. For the purpose of data collection, the survey method was used by means of an electronic questionnaire prepared based on a number of studies in this field, and the study targeted doctors, dentists, and pharmacists as the elements of the study sample, and the sample size was (٣٠٠), and modeling with structural equations was used to test hypotheses the study.

**Results**: The results revealed that job fit has a significant impact on the perceived benefit of using IoT technology in the medical field, but job status, perceived ease of use, and Subjective norm have no direct effect on the perceived benefit of using this technology in the medical field. In addition, factors including behavioral intent, subjective criterion, and perceived ease of use significantly influenced clinicians' attitudes toward the use of IoT technology, the job status of medical staff, and physicians'

(*) البحث مستل من رسالة ماجستير للباحثة الأولى.

behavioral intention to use. Moreover, clinicians' perceived benefit does not significantly influence behavioral intent to use.

**Suggestion:** Developing the skills of the medical staff through self-learning or brainstorming sessions, which contributes to stimulating new ideas that help solve the difficulties facing the application of Internet of Things technology in the field of health care.

**Keywords:** Internet of Things (IOT), Healthcare, Technology Acceptance model.

مجلة اقتصاديات الأعمال
المجلد (٣) العدد (٣) ٢٠٢٢
الصفحات: ٢٢٩-٢٤٩

## 1. **Introduction:**

Changes in the social and economic systems resulting from the rapid development of contemporary technologies have led to a global revolution, represented by the technology of the Internet of Things and Big Data. (Aceto,*et.al.*,2020), The Fourth Industrial Revolution, and its modern and effective technologies in improving performance and quality of work, countries have tended to adapt and use these technologies in proportion to their multiple needs. One of the highlights of this revolution is the Internet of Things technology, which can be used in all fields. The Fourth Industrial Revolution represents the most prominent trend in the information technology sector today.

The first appearance of the term Internet of Things was at the end of the twentieth century, specifically in 1999, by the British scientist Kevin Ashton, where his idea was to connect some devices around us, such as electrical and household appliances, so that we can know their condition, where these devices can control the lighting Humidity and temperature inside the house by controlling various devices remotely. As well as the possibility of monitoring human health purposes to monitor his health and predict diseases that may affect him, especially those diseases that may be dangerous to his health. In addition to the enormous capabilities of this technology in other fields such as industry, such as enabling the provision of spare parts at the time of demand, their use in monitoring devices and equipment in factories, and prediction of what might happen from failures and reduce losses, in addition to the use of this technology in many other fields such as agriculture Education, infrastructure for cities and homes, and many other areas (Ismael Maolood,2021).

The Internet of Things is defined as a group of objects or devices that are connected and interact with each other (machine-to-machine) or interact with a human (machine-to-human) at any time and from anywhere (Karahoca,*et.al.*,2018). Internet-connected devices have become an integral part of everything from industrial machines to household appliances and cars, to health and care management systems in what has been termed the Internet of Things (IoT) (Martínez-Caro,*et.al.*,2018). The entry of healthcare systems and services into a new age of medicine and technology is a necessary need to meet the healthcare needs of individuals and society (Maksimović & Vujović,2017) and the research and practice communities of the Internet of Things have recognized the potential of this new

technology to move healthcare services beyond the use of IoT technologies. traditional information to provide a more advanced type of service (Su,*et.al.*,2011). Also, the application of this technology in health care is one of the research goals, so studying the technology of the Internet of things in health care is a very important achievement, to identify the current situation and what needs to be done for the future, and this is what the current study seeks to achieve.

**2. Literature Review:**

The researchers (Karahoca,*et.al.*,2018) presented a study entitled Intent Test for IoT adoption related to healthcare technologies. The purpose of the study was to investigate the factors that influence individuals' intention to adopt IoT devices in healthcare, and it agreed with the study (Alhasan,*et.al.*,2020) by integrating technology acceptance models (TAM) and innovation diffusion theory (IDT), but it was distinguished By adding Behavioral Reasoning Theory (BRT), Protection Motivation Theory (PMT) and Privacy Computation Theory (PCT) to assess the intention of individuals (patients and healthcare professionals) to adopt IoT-related healthcare devices in Turkey, and the study adopted a quantitative approach, as it was The data was collected using the online questionnaire and included all individuals in health care, as the owners and users of smart devices were considered as a sample in the study because such type of people can use health care devices that support the Internet of Things in the near future, the answers of (426) individuals were collected. In terms of results, the main finding of this study was that factors related to technology acceptance and innovation diffusion significantly effect the decision of individuals to adopt devices that support the Internet of Things in the healthcare field. The study first recommended extending this research study by applying the current research model of different countries to examine consumer intention to adopt IoT-enabled devices in healthcare between countries, because it was conducted in Turkey only. A study (Alhasan,*et.al.*,2020), which examined the intentions of using IoT devices in health care. One of the closest studies to the current study; Because they have three common denominators represented by the spatial aspect represented by the Republic of Iraq, the technical aspect represented by the Internet of Things, and the sectoral aspect represented by the application in the field of health care, but there are many differences between them, the first is the difference in the

governorate, the difference in time and the difference in the acceptance model used, the nature of The research sample and its size. This study was distinguished from the study (Karahoca,*et.al.*,2018) by focusing on physicians and their intention to use IoT in healthcare in Iraq during the COVID-19 epidemic. The data of this study was collected by means of a paper questionnaire, which was distributed to a number of 250 physicians, 124 responses were obtained. This study proposed a research model that includes Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT). The study found that doctors in Iraq are willing to use IoT technology during the COVID-19 pandemic. The study recommended the Iraqi health care administrative bodies to adopt IoT health care devices, which may have a useful role in the health care system in enhancing the overall quality of service. From the perspective of the use of health care technologies for the elderly, the researcher (Sivathanu,2018) conducted a study entitled Adoption of wearable devices based on the Internet of things for the care of the elderly. It aimed to take advantage of a new approach to applying behavioral thinking theory (BRT) to understand the relative impact of reasons for adoption and non-adoption of IoT-based wearable devices for healthcare among the elderly. This cross-sectional study was conducted in India, where data were collected from (815) Responding, this study was distinguished from its predecessors in three areas: the first represented by the spatial aspect as it was conducted in India, while the second by the target research group represented by the elderly, and finally by the research model based on the combination of the technical acceptance model TAM, IDT and BRT. This study finds that the reasons for wearable IoT devices have a more significant impact than the reasons for adopting the intentions of the elderly. The Behavioral Reasoning Theory framework provides the difference between pro- and anti-adoption factors. Wearable devices based on IoT technology for healthcare for the elderly. Marketers should focus on the reasons for adoption, develop appropriate strategies to overcome barriers and include each of these factors to estimate their relative impact, which will help them to understand in detail the drivers of IoT device adoption. These insights into consumer behavior should help marketers formulate appropriate health care strategies for the elderly. This study was conducted in India only and future research may be conducted in other countries to generalize the results. The financial aspect is one of the aspects that occupies a large space in the orientations of individuals and organizations

towards investing in information technologies, and from this standpoint, it was conducted (Ben Arfi,*et.al.*,2021) to identify the attitudes of beneficiaries of the adoption of the Internet of things in the field of health care from the perspective of financial cost, and using Unified Technology Acceptance Theory (UTAUT), the model has been validated based on data collected from a randomly selected sample of 268 potential users of IoT-based healthcare devices in France. The study concluded that the cost factor of using the Internet of Things in health care is one of the most important obstacles facing the beneficiary. Also, the adjusted factor represented by age is an important mediator that has a significant impact on the intention to use IoT in healthcare. It also found a dearth of healthcare research using the Internet of Things in general. The study suggested re-applying it in other countries with a wider sample and integrating a number of variables such as looking at additional characteristics of innovation, personality traits, and personality fears, in order to know the characteristics and characteristics of Internet of Things users. Based on the foregoing, the current study came to work with some recommendations of the study (Ben Arfi,*et.al.*,2021), the health care sector in Nineveh Governorate was targeted and the sample range was expanded. The areas of benefit from previous studies are summarized by noting the references that these studies dealt with in order to refer to them in order to build the proposed study model for the current study and test it in the field.

**The research problem:**

The decision to adopt this technology in health institutions helps in providing better medical services to patients at the lowest cost, as quickly as possible, and at any place. In addition, this technology can help in early identification of any health disorder or disease of the patient early and overcome it as soon as possible. Available time. Based on the above, the current study came to identify the level of readiness of the medical staff to adopt this technique. For the purpose of clarifying the research problem, the following research questions have been formulated: The research problem lies in answering the following questions:

1. Is it expected that the Internet of Things technology in the field of healthcare will be accepted by the medical staff?

2. What are the factors affecting the intention of medical staff to accept the use of IoT technology in health care in Nineveh Governorate, according to the TAM2 Technology Acceptance Model?
3. What are the main obstacles or challenges facing the medical staff in the field of accepting and using the Internet of Things?

## 3. Research Model and Hypotheses:

In this study, the researcher proposed a research model that includes the TAM and its variables, Subjective Norm, image, and Job Relevance variable to test health care personnel's intentions to use IoT devices in various aspects of medical practice. This proposed model includes four factors for TAM with three exogenous variables. Based on the proposed hypotheses to examine the intentions of medical staff in the field of health care to accept health care devices in the Internet of Things, the study model can be built as shown in Figure (1).

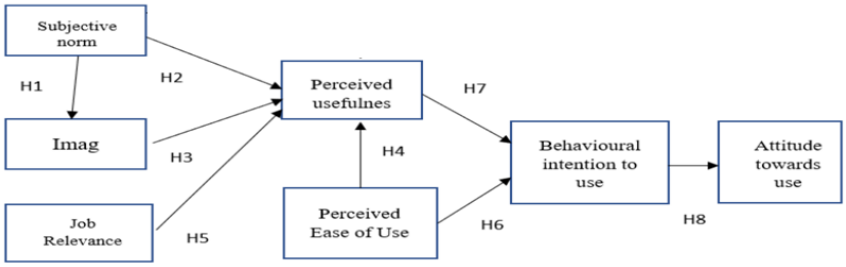


**Figure (1) Suggested study model**

**Source:** Created by researchers.

## Factors of the TAM Technology Acceptance Model:

Previous studies have confirmed that the main factor for the success and continuity of any new technology is user acceptance. TAM has been used along with other factors to explore and explain the acceptance and adoption of information technology (Venkatesh & Davis,2000). With three variables which is the image (IMG). And Subjective norm (SN) and Job Relevance (JR). In this study, the hypotheses of TAM factors are given by the following:

The Subjective norm affects the intention of medical personnel to use IoT technology. If an important person (such as family members and friends) believes that the use of technology is necessary, they will use it (William G Chismar & Wiley-patton,2003).

Researchers (Taylor & Todd,1995) found the effect of subjective norm on an individual's intent to use technology, whether an individual

wanted to use a technology or not, and that subjective norm has a significant effect on behavioral intent, perceived usefulness, and image (Wu,*et.al.*, 2011:140). Based on the foregoing, the following hypotheses were proposed:

(H1): The Subjective norm does not have a statistically significant effect on the image towards the Internet of Things.

(H2): The Subjective norm does not have a statistically significant effect on the perceived usefulness of the Internet of Things.

**The effect of the image on the perceived benefit:**

The picture indicates the degree to which the medical staff believes that the use of technology will enhance the individual's position within his social circle. The perceptions of many individuals can greatly influence the impression they make and the position they make of themselves within their social or professional circles. Regarding the technology of the Internet of Things, doctors may realize that the use of these devices can enhance their professional position in their work environment (Banderker & Van Belle, 2009:40). Based on the above, the following hypothesis has been proposed:

(H3): The image does not have a statistically significant effect on the perceived usefulness of the Internet of Things.

**Effect of perceived usability on perceived benefit:**

Perceived ease of use (PEU) is defined as the degree to which medical personnel believe that using a particular technology will be easy or less effortless in diagnosing patients. The researchers suggest that the perceived ease of use affects the perceived usefulness of this technology in the health sector (Alhashmi,*et.al.*,2019:30) (Holden & Karsh,2010:161).

The researchers (Venkatesh & Davis,2000) discovered that the greater the possibility of identifying the benefits of technology easily, the greater the benefit of using it. Based on the above, the following hypothesis was proposed:

(H4): Perceived ease of use does not have a statistically significant effect on the perceived usefulness of using IoT technology.

**The effect of Job Relevance on perceived benefit:**

Job Relevance reflects the user’s opinion that the technology matches an individual’s job or daily work, which helps in verifying if it causes an actual increase in the efficiency of the physician through its importance in daily activities such as monitoring the health of patients or analyzing health

data, each future technology must comply with current work practices Physicians can significantly improve the efficiency of work procedures in this way (Venkatesh & Davis,2000:198), as the researchers indicated (Kieras & Polson,1985) that Job Relevance fit has at and direct impact on the perceived benefit, and based on the above, a hypothesis can be presented the following:

(H5): Job Relevance does not have a statistically significant effect on the perceived usefulness of the Internet of Things.

The effect of perceived ease of use and perceived usefulness on behavioral intention to use:

Perceived benefit (PU) is defined as the extent to which medical staff believe that an information technology such as the Internet of Things will enhance work productivity and performance, and contribute to facilitating remote patient monitoring. On the other hand, Perceived Ease of Use (PEU) is defined as the degree to which medical personnel believe that using a particular technology will be easy or less effort required in diagnosing patients. The researchers suggest that the perceived ease of use affects the perceived usefulness of this technology in the health sector (Holden & Karsh,2010:161). Researchers (Venkatesh & Davis,2000) discovered that the more easily the benefits of technology can be recognized, the greater the benefit of using it. Therefore, the researcher (Davis,*et.al.*,1992) emphasized that the user's attitude is affected by the perceived usefulness and perceived ease of use, and the intention to use is directly affected by the user's attitude and benefit. Perceived ease of use affects perceived usefulness. Hence, the intent to use will ultimately affect the behavior of the attitude towards use (Wu,*et.al.*,2011:141).

(H6): Perceived ease of use does not have a statistically significant effect on the intention of medical staff to use IoT.

(H7): The perceived benefit does not have a statistically significant effect on the intention of the medical staff to use IoT technology.

(H8): The intention to use does not have a significant effect on the behavior of the attitude towards using IoT technology.

## 4. Research Methodology:

### 4.1 resolution tests:

The researcher subjected the questionnaire to the arbitrators' sincerity test before distributing it to the study sample. To achieve the test, the

questionnaire was presented to a group of (8) expert arbitrators specialized in management information systems, as the modifications indicated by the arbitrators were made. The convergent validity test, which showed all values higher than 0.70, and the discriminatory AVE value was (0.50) or more, and the reliability test after distribution on the study sample. Validity and reliability test.

**Table (1) Cronbach's alpha measure, discriminant validity and convergence**

| Variable | Cronbach's alpha | (AVE) | Composite Reliability |
|---|---|---|---|
| **PEU** | 0.730 | 0.590 | 0.851 |
| **PU** | 0.880 | 0.659 | 0.852 |
| **SN** | 0.797 | 0.620 | 0.763 |
| **IMG** | 0.881 | 0.680 | 0.864 |
| **JR** | 0.800 | 0.666 | 0.800 |
| **BIU** | 0.904 | 0.700 | 0.875 |
| **ATU** | 0.871 | 0.683 | 0.811 |

**Source:** Prepared by the researcher based on the results of the program (AMOS,V24, SPSS).

## 4.2 Data collection:

To examine the proposed research model and substantiate the proposed hypotheses, an online survey was conducted due to physicians' occupation. The research design aims to test consistency and accuracy at the local level. In the introduction to this survey, an overview of IoT technology is provided. This survey was distributed to 400 medical personnel, 300 of whom responded. Roughly speaking, after adjusting the survey questionnaire based on the results of the pilot study, the survey had two parts. The first consists of five demographic questions such as previous experience, age, educational attainment, gender, number of job cycles, and the number of hours of internet use per day, while the second consists of research-related items. A total of 35 questions were included in the survey questionnaire as shown in Table 2. The questionnaire was translated into Arabic. The research objective of the survey was for medical personnel working within the borders of Nineveh Governorate. A five-point Likert scale was used for all items in the second part of the questionnaire with the distribution of levels of approval for the subject in question as follows: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

**Table (2) List of survey items by factors**

| Construct | Questions | References |
|---|---|---|
| **PEU1** | I feel that using IoT technology will be easy for me. | Alharbi & Drew, 2014:149 |
| **PEU2** | I feel that my interaction with IoT technology will be clear and understandable. | |
| **PEU3** | I feel that it will be easy to become proficient in the use of IoT technology. | |
| **PEU4** | I think it would be easy for me to get IoT technology to do what I want to do. | |
| **PEU5** | I feel that my ability to determine the ease of use of IoT technology is limited by my lack of experience. | |
| **PU1** | I think using IoT technology in my job will enable me to get things done more quickly. | |
| **PU2** | I believe that using IoT technology will improve my job performance. | Iyer,*et.al.*,2020:246 Liang,*et.al.*,2003:381 |
| **PU3** | I expect that the use of IoT technology will enhance my effectiveness on the job. | |
| **PU4** | I expect that using IoT technology will make it easier to do my job. | |
| **PU5** | I anticipate that I will find IoT technology useful in my work. | |
| **ATU1** | I think using Internet of Things technology is a good idea. | Alhasan,*et.al.*, 2020 |
| **ATU2** | I like the idea of using Internet of Things technology. | |
| **ATU3** | I feel that the use of technologies in medical care in the field of the Internet of Things is important to me. | |
| **ATU4** | I would like to use IoT technology in medical care. | |
| **BIU1** | I plan to use IoT technology in the future. | Gao & Bai,2014:221 |
| **BIU2** | I intend to use IoT technology if available. | |
| **BIU3** | If given the opportunity, I intend to use IoT technology. | |
| **BIU4** | I intend to use IoT technology frequently. | |
| **BIU5** | I will recommend to others to use IoT technology. | |
| **BIU6** | I will continue to use IoT technology in the future. | |
| **SN1** | People who are important to me believe that I should use IoT technology. | Holden & Karsh, 2010:165 |
| **SN2** | People who are important to me will find it a good idea to use IoT technology. | |
| **SN3** | The bosses at work think I should use the Internet of Things. | |
| **SN4** | Doctors who influence my behavior think I should use IoT technology. | |
| **IMG1** | Individuals in medical care institutions who will use IoT technology will have a greater prestige than those who do not use it. | Iyer,*et.al.*,2020:246 |
| **IMG2** | People in medical care who will use IoT technology are highly regarded. | |
| **IMG3** | The presence of Internet of Things technology is a symbol of social standing in medical care. | |
| **IMG4** | I believe that the use of IoT technology in healthcare will give me a great job. | |
| **IMG5** | I think doctors who use IoT technology in their activities will be more famous. | |
| **JR1** | IoT technology is very important to my job. | Liang,*et.al.*,2003:831 |
| **JR2** | The use of IoT technology is relevant to my job. | |
| **JR3** | I can do my business using IoT technology if someone else helps me get started. | |
| **JR4** | I can work with IoT healthcare devices if I see someone else using them before trying them myself. | |
| **JR5** | Using Internet of Things technology will enhance my career. | |
| **JR6** | It would be difficult to do my own business without IoT technology. | |

### 4.3 Demographics:

The demographics of the sample constituted 61.3% females and 38.7% males. Moreover, 6.5% of the respondents were less than 26 years old, then followed by the age group (26-35 years) with a percentage of (33.1%), and then followed by the age group (36-45 years) with a percentage (26.7%) and the age group (46-55 years) its rate is (22.9%), and the age group (more than 55 years) has a rate of (10.9%). More than 22.3% of the respondents were experienced with more than 20 years of work in this field, while the age group (16-20 years) accounted for (19.1%), and the age group (11-15 years) had results of (16.7%). The age group (6-10 years) accounted for (20.5%), the percentage of answers for the age group (1-5 years) represented (21.4%). The number of job cycles for respondents in the category (1-2 cycles) represents their percentage (21.1%), while the second category (3-4 cycles) represents (26.4%) of the sample, and the third category (5-6 cycles) is 21.1% The fourth category (7-8 cycles) represented (14.4%) of the sample population, and finally the fifth category (8 cycles or more) represented the respondents (17%) of the sample population. The educational level of the respondents indicated that 36.7% have a bachelor's degree, 29.3% have a master's degree, 14.7% have a doctorate and 15.5% have a higher diploma, only 3.8% have a diploma. In the number of hours of using the Internet every day (not more than 1 hour), they represent (5.9%), while (2-3 hours) by (32.6%) of the respondents, and (4-5 hours) in the first place by (35.8%), either (6-7 hours), the results represented (15.5%) of the respondents, and (7 hours or more) they represented (10.3%) of the respondents, as shown in Table 3.

**Table (3) Demographics**

| Demographics of the responding medical staff | Numbering | (%) | Demographics of the responding medical staff | Numbering | (%) |
|---|---|---|---|---|---|
| Number of years of service | | | Age group, years | | |
| 1-5 | 65 | 21.4 | Female | 188 | 60.3 |
| 6-10 | 60 | 20.5 | Male | 112 | 39.7 |
| 11-15 | 15 | 16.7 | 26< | 21 | 6.5 |
| 16-20 | 57 | 19.1 | 26-35 | 99 | 33.1 |
| 20> | 67 | 22.3 | 36-45 | 78 | 26.7 |
| Number of job courses | | | 46-55 | 69 | 22.9 |
| 1-2 | 63 | 21.1 | > 55 | 33 | 10.9 |
| -43 | 78 | 26.4 | Scholastic Achievement | | |
| 5-6 | 66 | 21.1 | diploma | 13 | 3.8 |
| 7-8 | 34 | 14.4 | Bachelor's | 108 | 36.7 |
| 8 > | 50 | 17 | Higher Diploma | 47 | 15.5 |
| Number of hours of internet use every day: | | | Master's | 88 | 29.3 |
| 1< | 15 | 5.9 | PhD | ٤٤ | 14.7 |
| 2-3 | 100 | 32.6 | | | |
| 4-5 | 110 | 35.8 | | | |

| Demographics of the responding medical staff | Numbering | (%) | Demographics of the responding medical staff | Numbering | (%) |
|---|---|---|---|---|---|
| 6-7 | 45 | 15.5 | | | |
| >7 | 30 | 10.3 | | | |

**Source:** Prepared by the researcher based on the results of electronic questionnaire.

### 4.4 Descriptive Statistics:

Detailed statistics for each of the variables in the proposed model are presented in Table 4. The medical staff mostly had a positive perspective towards all tested variables. The mean scores for all factors ranged from (3.74) to (4.24), while the standard deviation ranged from (0.52) to (0.74), Moreover the coefficient of variation values ranged from (13.3) to (19.13), while the relative importance index ranged from (74.90) to (84.84).

**Table (4) Descriptive statistics of the investigated factors**

| Variable | Mean | STDV | Variation coefficient | RII |
|---|---|---|---|---|
| PEU | 3.876 | 0.706 | 18.299 | 77.513 |
| PU | 4.13 | 0.58 | 14.16 | 82.50 |
| SN | 3.90 | 0.61 | 15.68 | 77.99 |
| IMG | 3.94 | 0.74 | 18.68 | 78.84 |
| JR | 3.96 | 0.67 | 16.83 | 79.23 |
| BIU | 4.17 | 0.60 | 14.47 | 83.37 |
| ATU | 4.24 | 0.58 | 13.73 | 84.84 |

**Source:** prepared by the researcher based on the results of (AMOS, v24).

## 5. Data Analysis and Results:

To test the proposed hypothesis, a two-step technique was used to analyze the data collected from the online survey. The first step of the measurement model examined demographic factors, and factor loading, using the Statistical Package for Social Sciences (SPSS). The second step checked the quality of the structural model for the fit and trajectory analyzes using software (Amos-SEM).

### 5.1 Measurement Model:

Initially, the reliability of all 10 factors was checked by Cronbach's alpha factor loading test and Cronbach user factor, as shown in Table 5. All Cronbach's alpha values of 0.7 or more were recorded (Canan & Tan,2005). The validity of all factors was tested by checking the loading of each factor. Previous studies recommended that each variable should contain at least two problems and that the load factor for each dimension be greater than 0.40 (Hare,*et.al.*,1998). Factor loading values were within unacceptable limits, as shown in Table 5. Various items were used to assess the fit of the measurement model. (Poetry,*et.al.*,2006) suggested that the most necessary

indicator for reporting is chi-square (x2). However, it is not appropriate to use x2 as the sole indicator of goodness of fit (Hair,*et.al.*,2006). It should be noted that some other measures of fitness such as RMSR, RMSEA, quality of fit (GFI), quality of rate-goodness (AGFI) and at least one additional fit measure, such as the comparative fitness index (CFI), Increased Conformity Index (IFI) and Quality of Conformity Index (TLI). As shown in Table 6, this study used AMOS to evaluate scaling models. The results showed that all indicators are below their acceptable levels except for (RMR) and (RMSR), which are acceptable.

**Table (5) Factor loading measurement**

| Factor | Factor loading | Factor | Factor loading |
|---|---|---|---|
| **PEU1** | 0.78 | **BIU5** | 0.82 |
| **PEU2** | 0.80 | **BIU6** | 0.83 |
| **PEU3** | 0.80 | **SN1** | 0.70 |
| **PEU4** | 0.70 | **SN2** | 0.66 |
| **PEU5** | 0.11 | **SN3** | 0.68 |
| **PU1** | 0.69 | **SN4** | 0.80 |
| **PU2** | 0.77 | **IMG1** | 0.76 |
| **PU3** | 0.81 | **IMG2** | 0.83 |
| **PU4** | 0.84 | **IMG3** | 0.76 |
| **PU5** | 0.75 | **IMG4** | 0.86 |
| **ATU1** | 0.58 | **IMG5** | 0.66 |
| **ATU2** | 0.62 | **JR1** | 0.63 |
| **ATU3** | 0.67 | **JR2** | 0.77 |
| **ATU4** | 0.64 | **JR3** | 0.56 |
| **BIU1** | 0.68 | **JR4** | 0.49 |
| **BIU2** | 0.76 | **JR5** | 0.65 |
| **BIU3** | 0.75 | **JR6** | 0.63 |
| **BIU4** | 0.84 | | |

**Source:** prepared by the researcher based on the results of (AMOS, v24).

## 5.2 Structural Equation Modeling:

To test the fit between the proposed research model (Fig.1), SEM was used on the collected data. This mechanism was chosen to test dependent hypotheses exclusively when there is a direct or indirect influence of factors within the proposed model. In SEM, there are two steps to explain the result. The first step tests the relevance of the fit with the relevance of the proposed model, as shown in Table 6. The second step involves evaluating the relationship between the variables of the proposed model. A similar set of fitting items was used to test the structural model. The result is revealed through the results of the conformity quality indicators, whose values appeared as follows; x2/df = 2.548, GFI = 0.765, AGFI = 0.732, CFI =

0.849, RMR = 0.025, RMSEA = 0.067, IFI = 0.850, TLI = 0.835. The researcher has to link the variables whose saturations on the latent factor are weak or delete them. After making the adjustments, the results of quality indicators conforming to the default model were obtained: x2 / df = 1.802, GFI = 0.918, AGFI = 0.884, CFI = 0.964, RMR = 0.015, RMSEA = 0.049, IFI = 0.964, TLI = 0.953. Matching quality achieved standard cutoff scores, as shown in Figure (2).

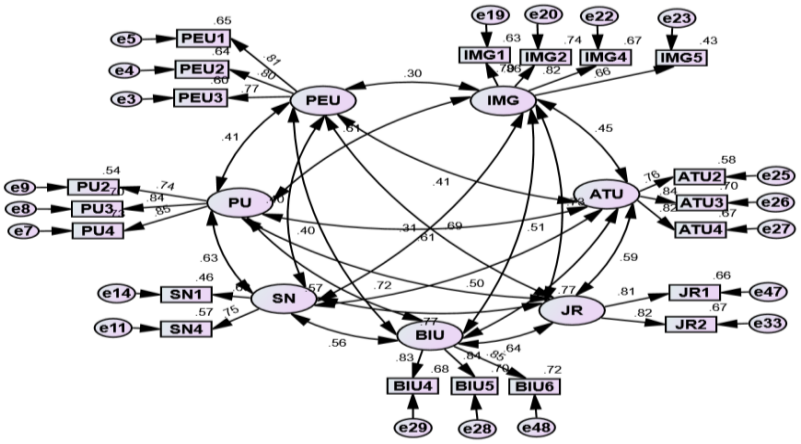


**Figure (2) Shows Results Confirmatory Factor Analysis**

**Source:** Results of the program (AMOS, V 24).

According to a study by (Hair,*et.al.*,2006) The second step in performing a data analysis tests the importance and severity of the relationships assumed in the research model. The results revealed that the total hypotheses proposed in this research model support 4 of the 8 hypotheses, as shown in Table 7.

**Table (6) Goodness-of-fit measurement**

| Goodness-of-fit Measure | Recommended Value | Value | Value After Modification |
|---|---|---|---|
| x2/df | > 3.00 | 2.548 | 1.802 |
| GFI | ≥ 0.90 | 0.765 | 0.918 |
| AGFI | ≥ 0.85 | 0.732 | 0.884 |
| CFI | > 0.90 | 0.849 | 0.964 |
| RMR | ≤ 0.05 | 0.025 | 0.015 |
| RMSEA | ≤ 0.08 | 0.067 | 0.049 |
| IFI | > 0.90 | 0.850 | 0.964 |
| TLI | > 0.90 | 0.835 | 0.953 |

**Source:** prepared by the researcher based on the results of (AMOS,V24).

**Table (7) Path analysis**

| Hypotheses | Path | P-Value | Result |
|---|---|---|---|
| H1 | SN IMG | 0.001 | Supported |
| H2 | SN PU | 0.117 | Not supported |
| H3 | IMG PU | 0.213 | Not supported |
| H4 | PEU PU | 0.230 | Not supported |
| H5 | JR PU | 0.001 | Supported |
| H6 | PEU BIU | 0.007 | Supported |
| H7 | PU BIU | 0.366 | Not supported |
| H8 | BIU ATU | 0.001 | Supported |

**Source:** prepared by the researcher based on the results of (AMOS,V24).

## 6. Discussion:

This study investigated the factors that influence the intention of medical staff to approve any IoT product in the healthcare field. To our knowledge, there is a marked lack of research addressing the intentions of medical personnel to use IoT devices for healthcare, particularly in developing countries. Therefore, this study proposes a research model that takes into account the intention of medical personnel to use IoT technology in their medical practices. The TAM Technology Acceptance Model was selected to examine medical staff's perspectives on intent to use IoT devices for healthcare. This model includes factors, namely PU, PEU, BIU, ATU, SN, IMG, JR, The results of this study support some of the conclusions made by previous studies, which study (Venkatesh & Davis,2000:198) indicated that JR and PEU have an effect Big on PU, the result is that clinicians expect that the ease of use of IoT healthcare devices will have a significant impact on their job performance. Before using IoT devices for healthcare, clinicians must assess whether they will meet their professional needs. Recognizing that IoT technology will facilitate their professional requirements indicates that it is useful and easy to use. However, the results of (Karahoca,*et.al.*,2018) PEU indicates significant effects on PU, which were inconsistent with the results of a study (Chau & Hu,2002). One possible explanation also indicated that clinicians are often experienced in using electronic devices from a layperson's perspective. Showed that SN do not have a significant effect on PU. On the contrary, the results of studies (Teo,2011) indicated that SN have a significant effect on PU. In addition, the results of this study indicated In contrast to the results of the study (Lu, 2021) which shows that there is no effect between the proven result and the perceived benefit, although Iraqi clinicians are not generally aware of the

use of IoT technology in health care, the A possible explanation for this finding may be the relatively young clinicians in the research sample. Therefore, they are familiar with technology used in other areas, such as online shopping and social media applications. They have recognized that technology has a social impact around them and indicated that the use of IoT health care devices will attract you Bah in the healthcare community, these devices are useful and easy to use, as shown in Table 7. However, IMG did not have a significant effect on PU, in contrast to the results of a study (Karahoca,*et.al.*,2018) which revealed an effect between Functional standing and perceived usefulness. The results of this study revealed that PU had no effect on the BIU in contrast to the results of the study (W.G. Chismar & Wiley-Patton,2003) which revealed that the perceived benefit had a significant effect on the medical staff's intention to use the technique, that PEU had a significant effect on the BIU was supported. This finding is partly through the result of a previous study (Ketikidis,*et.al.*,2012) showing that perceived ease of use has a direct impact on the intentions of medical staff to use a technology. This may be because most clinicians have high levels of confidence in their self-efficacy, as shown in Table 7. In this study, BIU had a significant effect on ATU, which the results of this study (Teo, 2011) confirmed the presence of an effect of intention to use on attitude behavior toward Internet of Things technology. One possible explanation may be that the intention of the medical staff to use the Internet of Things in their field of work affects the attitude of the medical staff to the use of IoT technology. This results in a positive impact on their attitudes towards the use of IoT healthcare devices. Moreover, it will eventually lead to a positive attitude towards the use of IoT healthcare devices, which will influence their decision to use this technology.

**7. Constraints, future work and future challenges:**

Improvements could be made in future research in the following aspects. First, although the results provided meaningful insights into the eagerness of medical staff to use IoT healthcare devices, and make them more reliable; A larger sample size will provide a more accurate measurement. Future research initiatives are advised to have a broader representation of the target sample. Second, a quantitative method was used in this research, which may have neglected potential qualitative aspects of potential personal considerations and concerns for medical staff that our

model may not have been equipped to deal with. Future research initiatives are encouraged with a more comprehensive approach using a mixed method and direct qualitative interviews with medical staff to assist the researcher with a more transparent opinion and you will gain in-depth analysis, allowing the medical staff to write their suggestions for employing this technology in their practice. Third, in the context of healthcare in Nineveh Governorate, despite the availability of information about IoT technology, medical personnel may not have the clarity of information about the full spectrum of IoT healthcare device applications. Future research examining intentions for use by clinical staff in other areas facing similar challenges will provide the opportunity for a comprehensive analysis comparison to validate the proposed model by comparing results.

## 8. Suggestion:

1. Developing the skills of the medical staff through self-learning or brainstorming sessions, which contributes to stimulating new ideas that help solve the difficulties facing the application of Internet of Things technology in the field of health care.
2. The necessity of recommending to the beneficiaries (patients) the importance of introducing this technology to monitor the health status and improve the patients' condition, by holding courses that explain to the beneficiaries the importance of this technology.
3. Increasing interest in the benefits and capabilities of the Internet of Things technology in healthcare to achieve the maximum benefit from these services for the beneficiaries, by providing advertising means that show the extent of benefit from their use of Internet of Things applications in the field of healthcare.

## References:

1. Aceto, G., Persico, V., & Pescapé, A. (2020). Industry 4.0 and Health: Internet of Things, Big Data, and Cloud Computing for Healthcare 4.0. Journal of Industrial Information Integration, 18(October 2019), 100129. https://doi.org/10.1016/j.jii. 2020.100129
2. Alharbi, S., & Drew, S. (2014). Using the Technology Acceptance Model in Understanding Academics' Behavioural Intention to Use Learning Management Systems. International Journal of Advanced Computer Science and Applications, 5(1), 143–155. https://doi.org/10.14569/ijacsa.2014.050120
3. Alhasan, A., Audah, L., Ibrahim, I., Al-Sharaa, A., Al-Ogaili, A. S., & M. Mohammed, J. (2020). A case-study to examine doctors' intentions to use IoT healthcare devices in Iraq during COVID-19 pandemic. International Journal of Pervasive Computing and Communications. https://doi.org/10.1108/IJPCC-10-2020-0175

4. Alhashmi, Shaikha FS, Salloum, Said A & Mhamdi, Chaker. (2019). Implementing Artificial Intelligence in the United Arab Emirates Healthcare Sector: An Extended Technology Acceptance Model. International Journal of Information Technology and Language Studies (IJITLS), (3), 3. 27-42.
5. Banderker, N., & Van Belle, J. P. (2009). Adoption of mobile technology by public healthcare doctors: A developing country perspective. International Journal of Healthcare Delivery Reform Initiatives, 1 (3), 368–383. https://doi.org/10.4018/978-1-60566-030-1.ch022.
6. Ben Arfi, W., Ben Nasr, I., Khvatova, T., & Ben Zaied, Y. (2021). Understanding acceptance of eHealthcare by IoT natives and IoT immigrants: An integrated model of UTAUT, perceived risk, and financial cost. Technological Forecasting and Social Change, 163(May), 120437. https://doi.org/10.1016/j.techfore.2020.120437
7. Chau, P. Y. K., & Hu, P. J. H. (2002). Investigating healthcare professionals' decisions to accept telemedicine technology: An empirical test of competing theories. Information and Management, 39(4), 297–311. https://doi.org/10.1016/S0378-7206(01)00098-2.
8. Chismar, W. G., & Wiley-Patton, S. (2003). Does the extended technology acceptance model apply to physicians. Proceedings of the 36th Annual Hawaii International Conference on System Sciences, HICSS 2003, 00(C), 1–8. https://doi.org/10.1109/HICSS.2003.1174354
9. Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. Journal of Applied Social Psychology, 22(14), 1111–1132. https://doi.org/10.1111/j.1559-1816.1992.tb00945.x.
10. Dorsemaine, B., Gaulier, J. P., Wary, J. P., Kheir, N., & Urien, P. (2016). Internet of Things: A Definition and Taxonomy. Proceedings - NGMAST 2015: The 9th International Conference on Next Generation Mobile Applications, Services and Technologies, 72–77. https://doi.org/10.1109/NGMAST.2015.71
11. Gao, L., & Bai, X. (2014). A unified perspective on the factors influencing consumer acceptance of internet of things technology. Asia Pacific Journal of Marketing and Logistics, 26(2), 211–231. https://doi.org/10.1108/APJML-06-2013-0061
12. Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. Journal of Marketing Theory and Practice, 19(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202.
13. Holden, R. J., & Karsh, B. T. (2010). The Technology Acceptance Model: Its past and its future in health care. Journal of Biomedical Informatics, 43(1), 159–172. https://doi.org/10.1016/j.jbi.2009.07.002
14. Iyer, S., Pani, A. K., & Gurunathan, L. (2020). User Adoption of eHRM-An Empirical Investigation of Individual Adoption Factors Using Technology Acceptance Model. International Working Conference on Transfer and Diffusion of IT, 231–248.
15. Jain, R. (2021). Doctors' Perceptions on the Use of Internet of Things Medical Devices (IOT-MDs) for Anemic Pregnant Women: A TAM2 Study. International Journal of Healthcare Information Systems and Informatics (IJHISI), 16(1), 58–80.
16. Javaid, M., & Khan, I. H. (2021). Internet of Things (IoT) enabled healthcare helps to take the challenges of COVID-19 Pandemic. In Journal of Oral Biology and Craniofacial Research (Vol. 11, Issue 2, pp. 209–214). https://doi.org/10.1016/j.jobcr.2021.01.015
17. Karahoca, A., Karahoca, D., & Aksöz, M. (2018). Examining intention to adopt to internet of things in healthcare technology products. Kybernetes, 47(4), 742–770. https://doi.org/10.1108/K-02-2017-0045
18. Kalayou, M. H., Endehabtu, B. F., & Tilahun, B. (2020). The applicability of the modified technology acceptance model (Tam) on the sustainable adoption of ehealth systems in resource-limited settings. Journal of Multidisciplinary Healthcare, 13, 1827–1837. https://doi.org/10.2147/JMDH.S284973

19. Ketikidis, P., Dimitrovski, T., Lazuras, L., & Bath, P. A. (2012). Acceptance of health information technology in health professionals: An application of the revised technology acceptance model. Health Informatics Journal, 18(2), 124–134. https://doi.org/10.1177/1460458211435425.
20. Kieras, D., & Polson, P. G. (1985). An approach to the formal analysis of user complexity. International Journal of Man-Machine Studies, 22(4), 365–394.
21. Liang, H., Xue, Y., & Byrd, T. A. (2003). PDA usage in healthcare professionals: testing an extended technology acceptance model. International Journal of Mobile Communications, 1(4), 372–389. https://doi.org/10.1504/IJMC.2003.003992
22. Lu, Y. (2021). Examining user acceptance and adoption of the internet of things. International Journal of Business Science and Applied Management, 16(3), 1–17.
23. Maksimović, M., & Vujović, V. (2017). Internet of Things Based E-health Systems: Ideas, Expectations and Concerns (pp. 241–280). https://doi.org/10.1007/978-3-319-58280-1_10
24. Martínez-Caro, E., Cegarra-Navarro, J. G., García-Pérez, A., & Fait, M. (2018). Healthcare service evolution towards the Internet of Things: An end-user perspective. Technological Forecasting and Social Change, 136(July 2017), 268–276. https://doi.org/10.1016/j.techfore.2018.03.025
25. Masmali, F. H., Miah, S. J., & Mathkoor, N. Y. (2020). Internet of Things-based innovations in Saudi healthcare sector: A methodological approach for investigating adoption issues. 2020 IEEE Asia-Pacific Conference on Computer Science and Data Engineering, CSDE 2020, 1–5. https://doi.org/10.1109/CSDE50874.2020.9411588
26. Rajmohan, R., & Johar, M. G. M. (2020). Adoption of the Internet of Things in the Healthcare Services of Sri Lanka. https://doi.org: 10.35940/ijrte.A2260.059120
27. Sivathanu, B. (2018). Adoption of internet of things (IOT) based wearables for elderly healthcare – a behavioural reasoning theory (BRT) approach. https://doi.org/10.1108/JET-12-2017-0048
28. Su, K., Li, J., & Fu, H. (2011). Smart city and the applications. 2011 International Conference on Electronics, Communications and Control, ICECC 2011 - Proceedings, 1028–1031. https://doi.org/10.1109/ICECC.2011.6066743
29. Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. Computers and Education, 57(4), 2432–2440. https://doi.org/10.1016/j.compedu.2011.06.008.
30. Venkatesh, V., & Davis, F. D. (2000). Theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. Management Science, 46(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926
31. Wu, M. Y., Chou, H. P., Weng, Y. C., & Huang, Y. H. (2011). TAM2-based study of website user behavior-using web 2.0 websites as an example. In WSEAS Transactions on Business and Economics (Vol. 8, Issue 4, pp. 133–151).
32. Yang, L., Ge, Y., Li, W., Rao, W., & Shen, W. (2014). A home mobile healthcare system for wheelchair users. Proceedings of the 2014 IEEE 18th International Conference on Computer Supported Cooperative Work in Design, CSCWD 2014, July 2016, 609–614. https://doi.org/10.1109/CSCWD.2014.6846914

| Abbreviated | Terms |
|---|---|
| ATU | Attitudes Toward Use |
| AVE | Average Variance Extracted |
| BIU | Behavioral Intention of Use |
| BRT | Behavioral Reasoning Theory |
| CFA | Confirmatory Factor Analysis |
| IDT | Innovation Diffusion Theory |
| IOT | Internet of Things |
| IMG | Image |
| JR | Job Relevance |
| PCT | Privacy Computation Theory |
| PEU | Perceived Ease of Use |
| PMT | Protection Motive Theory |
| PU | Perceived Usefulness |
| RII | Relative Importance Index |
| SEM | Structural Equation Modeling |
| SN | Subjective Norm |
| ٢TAM | Extended Technology Acceptance Model |
| TPB | Theory of Planned Behavior |
| TRA | Theory of Reasonable Action |
| UTAUT | Unified Theory of Acceptance and Use of Technology |