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RESEARCH ARTICLE

Unveiling the Technology Acceptance Model: A Systematic Review of Evolution, Impact Across Industries and Future Directions

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ARTICLE INFO	ABSTRACT
	With the growth of contemporary information technology and scientific research, people's lives are becoming increasingly inseparable from information technology. Since people can obtain information through technology, researchers have been committed to studying the relationship between users and technology. Since the mid-20th century, researchers have designed many theoretical models. However, among these models, the most frequently used by researchers is the Technology Acceptance Model (TAM). Based on this, this paper adopts a systematic literature review method and uses Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to collect, analyze, summarize and obtain results. This paper selects the Science Direct and ProQuest databases, with a time limit of 2015-2024, and selects 38 papers according to the screening criteria. This paper analyzes TAM's research trends, origins, development, research fields, and future development directions. It is pointed out that Perceived Ease of Use, Perceived Usefulness, attitude toward using, behavior intention to use, and subject normal are important reasons that affect users' use of technology. Moreover, behavioral intention to use and attitude toward using play a crucial role as mediators in the connection between users' perceived ease of use, perceived usefulness, and actual use behavior. This paper can provide valuable data and suggestions for future researchers studying TAM. This paper can also prompt the government and related technology companies to understand why users use technology. In particular, technology designers can grasp why users use technology, encourage users to use information technology, and increase user stickiness.

INTRODUCTION

Since modern information technology has advanced and the progress of science and technology, people's lives are becoming increasingly inseparable from information technology. Technology is the embodiment of human beings' active role in nature. Through practical activities, humans use technology to transform nature and achieve their goals and needs. Technology plays a vital role in human life, from basic food, clothing, housing, and transportation to more complex production and life needs (Jiang et al., 2023). Technology development has dramatically enriched people's lifestyles and social structures, and embracing technology has become a consensus among humans.

Since people can access information through technology, researchers have devoted themselves to studying the relationship between users and technology. Researchers have created numerous

theoretical models since the middle of the 20th century in an effort to better understand and identify the variables influencing an individual's adoption of technology. A few of these theories are the unified theory of acceptance and application of technology, the diffusion of innovations, the theory of planned behavior, the technology acceptance model, the theory of reasoned action, and Al-Emran et al. (2018). All these theoretical models aim to pinpoint the critical elements that impact a user's intention or real use of a given technology.

Among these models, researchers use the Technology Acceptance Model (TAM) most frequently. Researchers' research on TAM is generally divided into three categories (Garavand et al., 2022). First, the method of testing TAM; second, the variables and relationships in TAM; third, the core theoretical basis of TAM. However, few researchers have analyzed the specific publication trends of literature on TAM from a time perspective. Few researchers have considered TAM's research status from a time dimension. Not only that, It has been shown that three key factors—perceived usefulness, perceived ease of use, and attitude toward using—affect consumers' acceptance of technology since Davis introduced the Technology Acceptance Model (TAM) in 1986. Over the years, as development and research have progressed, researchers have continuously innovated based on TAM, actively sought reasons that affect users' use of technology, and proposed new variables. For example, behavioral intention to use and external variables (Rezaei et al., 2020; Tao et al., 2023). Although TAM is constantly developing and innovating, there is little literature that can classify and summarize these innovative variables. Although scholars' research topics involve various fields, few scholars have summarized them and discovered the laws of research.

The most prominent feature of TAM is its simplicity and ease of understanding. It was initially applied in the field of information technology. TAM is appealing since it has a solid theoretical base and a psychometric scale that has been thoroughly examined and validated. It has garnered substantial empirical backing for its comprehensive explanatory capacity and has evolved into a superb paradigm for technology adoption by users (Marangunić & Granić, 2015). In this paper, a systematic summary of the origin, development, article publication trends, research fields, and reasons affecting user acceptance of technology by TAM can fill the research gaps and solve practical problems in the future research direction of TAM. Based on this, this study proposes 6 research questions. A systematic literature review is used to analyze the theoretical connotation, popularity reasons, research content, and development of the Technology Acceptance Model (TAM) research fields.

RQ1: What is the publication trend of technology acceptance model papers between 2015 and 2024?

RQ2: What is the origin and development of the Technology Acceptance Model?

RQ3: What are the theoretical innovations of TAM?

RQ4: What are the research fields of TAM?

RQ5: What are the developments and contributions in the mainstream research fields of TAM?

RQ6: What are the factors that affect users' acceptance of technology?

The question 1 mainly aims to study the trend of TAM papers. This article is limited to 10 years to analyze the publication of papers related to TAM.

The questions 2 and 3 explain the origin of TAM and current researchers' verification and innovation of the theory. By summarizing the detailed theoretical connotation of TAM, it is beneficial for researchers to study the user's acceptance of technology.

Questions 4 and 5 mainly study the application field of TAM and its contribution to this field. This proves that TAM plays a vital role in the daily life of users accepting technology.

The question 6 mainly analyzes the reasons that impact consumers' adoption of a specific information technology when they accept it. This guides enterprises or governments to adopt specific

ways and methods to encourage users to accept particular information technology. This improves the quality of life for users and directs the path of contemporary IT development.

METHOD

This research screens papers using a systematic literature review (SLR) as one of its research approaches. This work uses the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method to screen papers to respond to the research inquiries and guarantee the literature review's reference value. PRISMA is a method for screening articles that researchers generally recognize. It describes the procedures for article selection, keyword extraction, deletion and retention strategies, data extraction, and data analysis (Takkouche & Norman, 2011). This paper conducts a detailed literature search in Science Direct and ProQuest databases and then uses Endnote to screen and collect literature. This paper uses Adobe Illustrator software to draw a PRISMA flowchart. Following the completion of the search and gathering of literature, Excel obtains the publication trend chart, and the screened literature is read and analyzed in detail.

Databases

In the literature review process, this study selected Science Direct and ProQuest databases to choose papers. Elsevier established Science Direct, a scientific and medical bibliographic database website, in March 1977. The website offers over 18 million articles from over 4,000 academic journals as well as 30,000 e-books from Elsevier. ScienceDirect offers a plethora of interdisciplinary research materials covering the social sciences, humanities, biological sciences, health sciences, physical sciences, and engineering. Researchers, educators, and students use it extensively to find and obtain high-quality academic articles for their research, teaching, and professional development. ProQuest was founded in 1983 by a global information content and technology company based in Michigan, USA. About 125 billion pages make up ProQuest's whole collection of materials, which also includes e-books, newspapers, journals, historical records, and government and cultural archives. ProQuest provides professional databases for the fields of business, health, humanities, arts and social sciences. ProQuest has become an essential resource for academic institutions, libraries, and professionals seeking reliable and comprehensive research materials. Researchers recognize both databases as databases with excellent and high-quality papers.

Research Strategy

In this paper, Science Direct and ProQuest databases were selected to perform a Boolean operator. In the process of literature screening, the screening condition was ("Technology Acceptance Model" OR "TAM") as the Title. The time range of literature publication was controlled in 2015-2024 for the literature search. The publication trend chart of literature with TAM as the theme was analyzed.

Subsequently, according to the study questions and research purposes of this paper, the keywords for screening were determined. The screening of literature strictly followed the Title ("Technology Acceptance Model" OR "TAM") and Keywords ("User acceptance " OR "information acceptance") AND ("attitude" OR "behavior intention" OR "actual use") for search.

Include Criteria and Exclude Criteria

This research developed the Include Criteria and Exclude Criteria in Table 1 to guarantee the precision and dependability of the literature analysis results.

Table 1. Include Criteria and Exclude Criteria

Number	Index	Include criteria	Exclude criteria
1	Theory	Related to the Technology Acceptance Model	Irrelevant to the Technology Acceptance Model
2	Research field	Research conducted using Technology Acceptance Model	Research not conducted using Technology Acceptance Model
3	Main research topics	Preserve the popular research topic conducted using the Technology Acceptance Model.	Exclude the popular research topic conducted using the Technology Acceptance Model.
4	Languages	English	Non-English
5	Years	2015-2024	Exclude less than 2015 and more than 2024
6	Types	Review articles, Research articles, Academic journals	Books, conference, Encyclopedia, reports, newspapers, student's theses etc.
7	Number of occurrences	One time	Repetition
8	Pages	More than 10 pages	Less than 10 pages
9	Research design	The research design includes clear questions, objectives, methods, data collection procedures, and conclusions.	The research design did not include clear questions, objectives, methods, data collection procedures, and conclusions.

This paper selected English journal articles from 2015 to 2024. First, English is a universal language worldwide, and screening English literature is more representative. Simultaneously, only works published in the last ten years were chosen in order to guarantee the literature's relevance. Second, besides the theory and research field related to TAM, the main research topics must also be consistent with TAM. Third, only articles and journals were selected for the selection of literature, and duplicate literature in the two databases was deleted. Articles and journals are essential representative content carriers of academic research and communication and are more scientific, standardized, and verifiable. Fourth, the number of pages of the literature must be greater than ten pages. A high-quality paper requires a large amount of data as support. This paper selects more than 10 pages of literature that is more representative. Fifth, the research design includes straightforward questions, objectives, methods, data collection procedures, and conclusions. This ensures the accuracy, standardization, and completeness of the literature.

Screen Procedure

The screening process of this paper strictly follows the predetermined screening criteria. In Figure 1, the screening procedure is displayed.
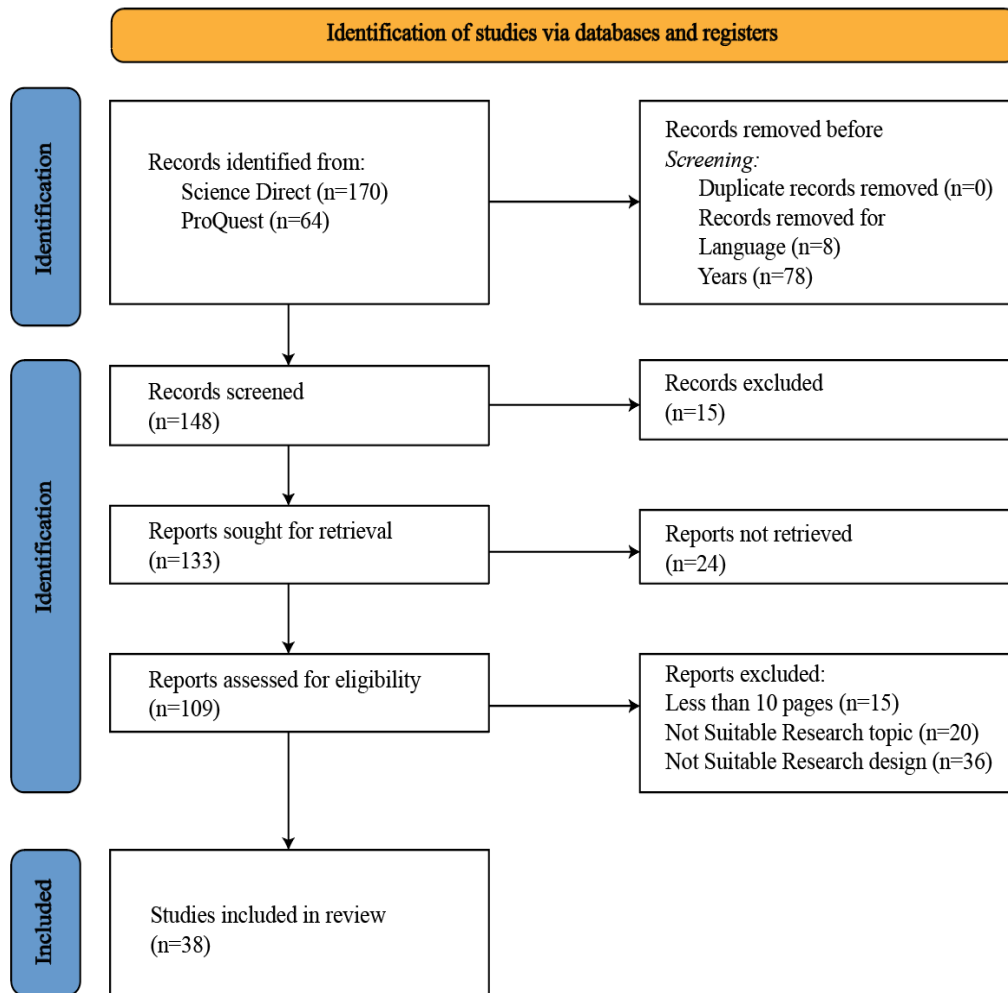
Figure 1. PRISMA flow diagram for the systematic review

First, based on the title and keywords, this paper obtained 234 documents in Science Direct and ProQuest. Second, this paper eliminated 86 documents using the database tools and screening criteria provided by Endnote. Third, in the record screened, 15 documents that did not match the topic and keywords of this paper were deleted. Fourth, in the report sought for retrieval, 24 documents that were not articles and journals were deleted. Fifth, depending on the quantity of pages devoted to the research design and topic, 71 inappropriate documents were deleted. Finally, the 38 papers obtained were viewed and analyzed in detail.

Data Analysis

This study's data analysis includes using Endnote and Excel software to collect and analyze the literature. After obtaining 38 articles, the main content of each article was read in detail. This includes questions, objectives, methods, data collection procedures, and conclusions. First, based on the data from 2015-2024, the time trend chart of TAM literature was analyzed to find research patterns. Secondly, from a time perspective, the origin and development of TAM were analyzed. Thirdly, the research fields of these documents were summarized to find similarities. Finally, the relevant variables of TAM were analyzed to find the main reasons users accept information technology. Appendix A lists all the numbers, authors, years, and titles under review.

RESULT

Literature publication trends in 2015-2024

From 2015 to 2024, there were 50,252 TAM-related articles in the Science Direct database (ScienceDirect website, 2024.6). At the same time, the same screening method was used to screen journal articles in the ProQuest database. In the ProQuest database, there were 184,117 papers related to TAM by researchers (ProQuest website, 2024.6). Based on the annual literature publication, this article draws a corresponding line graph to analyze the research status of researchers on TAM in Figure 2 and Figure 3.
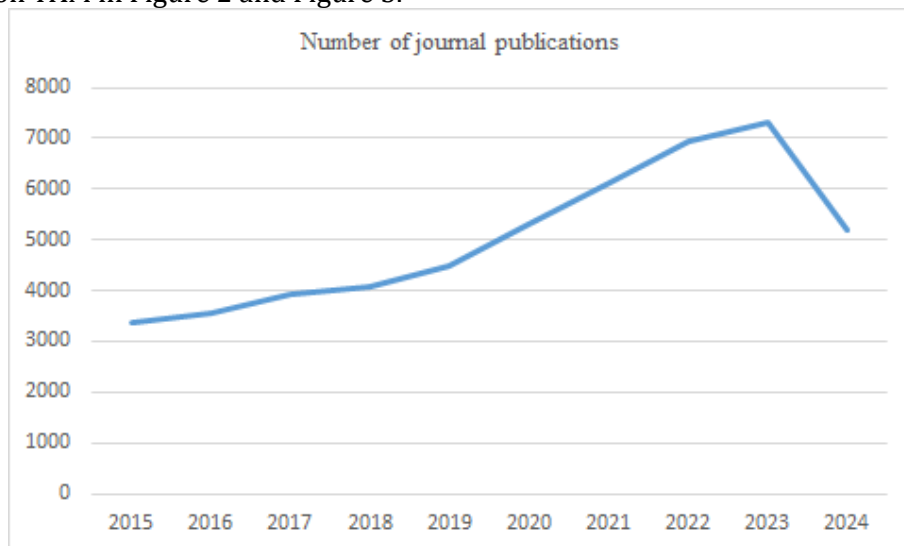

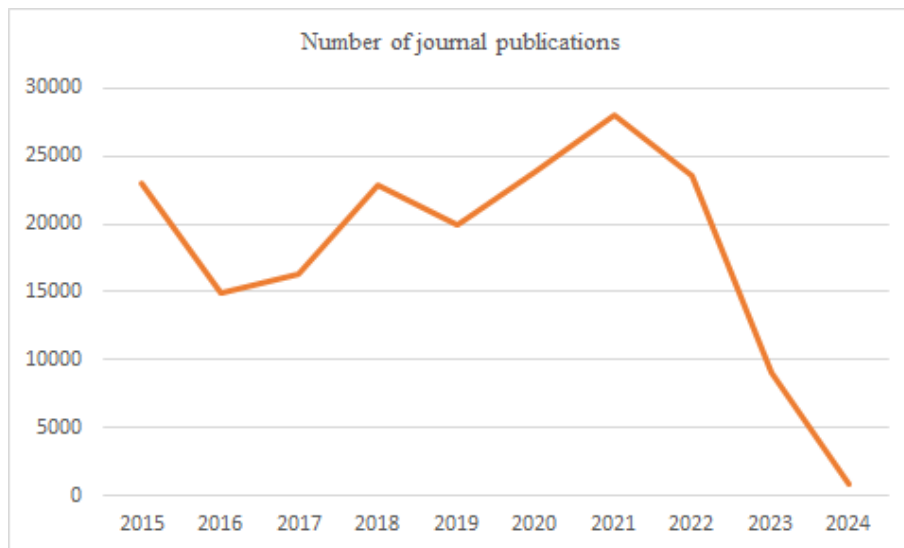**Figure 2. Research timeline (Science Direct Database)**

**Figure 3. Research timeline (ProQuest Database)**

In Figure 2, the research on TAM by researchers shows an upward trend year by year. But in 2023, there is a downward inflection point. This may be because the whole year of 2024 has not ended yet, and some papers have not been published. In Figure 3., the attention of researchers to TAM has changed dramatically. The year 2021 saw the highest amount of research papers published. It started to fall in 2022, and the least amount of research papers were published in 2024. From these two

figures, researchers' attention to TAM is exceptionally high. However, starting from 2022 and 2023, the attention of researchers to TAM has decreased.
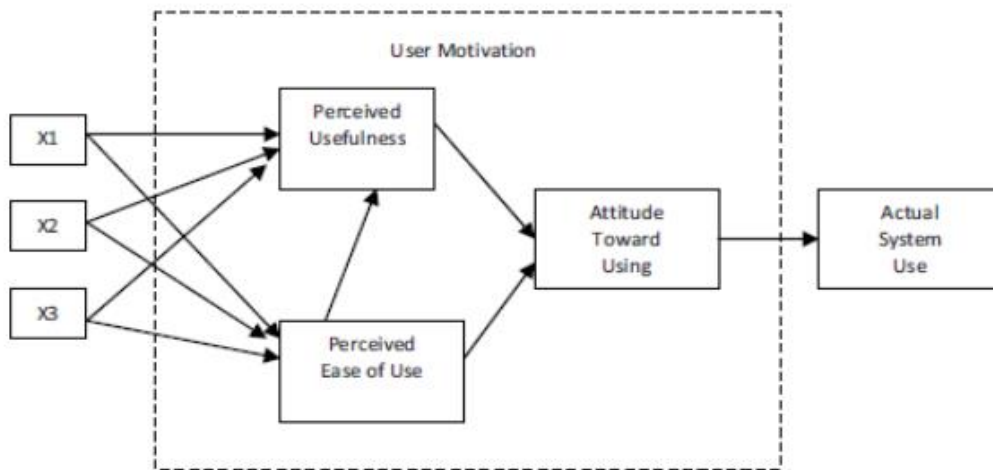
Technology Acceptance Model

Technology Acceptance Model Origin

The Technology Acceptance Model (TAM) hypothesis was proposed by Fred Davis in 1986. The key factors influencing users' acceptance of new technologies are examined using a theoretical model known as the Technology Acceptance Model (Davis et al., 1989). He was inspired by Fishbein and Ajzen's (1975) proposed Theory of Reasoned Action (see Figure 4) to build on their earlier work.
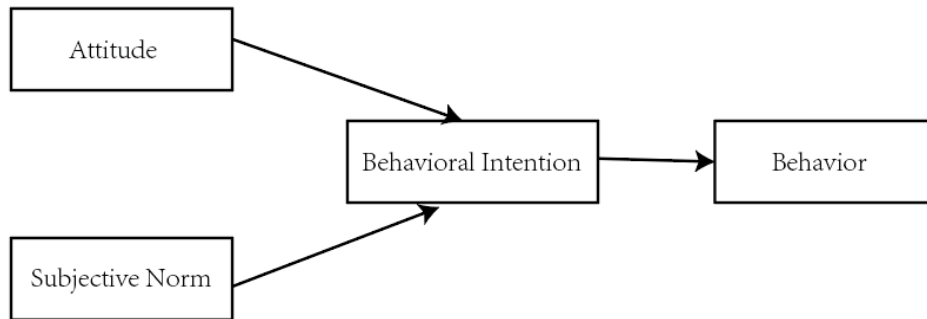
**Figure 4. Theory of reasoned action (Fishbein& Ajzen, 1975)**

Davis created TAM in order to comprehend the elements affecting people's adoption and acceptance of new technology. The goal is to construct a behavioral model that can effectively describe how users behave while accepting information systems and to examine the variables that influence user acceptance, which in turn influences how technology is used. There are several applications for this model, including the explanation or prediction of the variables influencing information technology adoption. Davis (1986) offered four characteristics (see Figure 5): actual system use, attitude toward using, perceived usefulness, and perceived ease of use. One mediating variable among them is Attitude Toward Using. One of the most important and popular frameworks for examining how users embrace new technologies and information systems is TAM.

Figure 5. Original Technology Acceptance Model (Davis, 1986)

Technology Acceptance Model Development

Figure 6 shows the various stages of development and enhancement that TAM has experienced since its founding in 1986 (Marangunić & Granić, 2015). In 1989, Davis enriched the theoretical framework based on his theory. He tried to explain the general characteristics that influence computer acceptance and user behavior across a wide range of computing technologies and user demographics. He went into great length to clarify every variable. These variables consist of the following: Attitude toward Using, Behavioral Intention to Use, Perceived Usefulness, Perceived Ease of Use, and Actual Use.
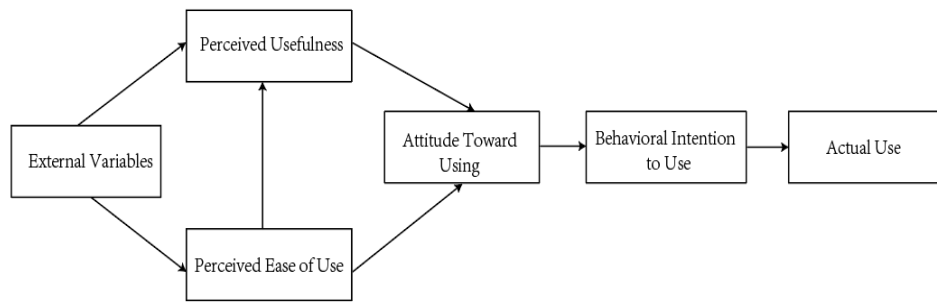
Figure 6. Technology acceptance model (Davis, 1989)

According to the theoretical implications proposed by Davis, these variables have their operational definitions. External Variables refer to the execution of activities, which are conditions believed to help users obtain valuable results, regardless of the activities themselves. Perceived usefulness is the extent to which consumers believe a particular technology will improve work performance. That example, people's erroneous notion that utilizing a particular piece of information technology will increase their output at work. Users will be motivated to put in the same amount of effort to finish more work when they believe the system is simple to use. The degree to which users feel utilizing a particular technology doesn't demand energy is known as perceived ease of use. Users' attitudes about the system will be more positive and they will feel more confident in their ability to self-regulate and self-efficacy when it is easy to use. Fishbein and Ajzen (1975) defined "behavior" as the outcome of purpose and "attitude" as a person's assessment of an object. Emotional in nature, attitude stems from convictions regarding the subject of conduct. according to the assessment effect, "an individual's positive or negative emotions towards the target behavior" is known as attitude toward using. Behavioral Intention to Use refers to the fact that when users accept information technology, they usually have a particular purpose, and users will choose the corresponding media and content according to their needs and goals.

External factors may influence both perceived utility and perceived ease of usage. For instance, the user's internal qualities, self-efficacy, and learning style, as well as their external environment, organizational support, computer user interface, and convenience. Users' perceptions of information technology's usefulness will be positively impacted when they believe it to be simple to use. Attitude Toward Using is positively impacted by Perceived Usefulness and Perceived Ease of Use, which in turn encourages Behavior Intention to Use. In the end, individuals' intentions to use technology will influence how they behave with technological media, which will ultimately influence how they actually use it. Users' employment of technical tools is primarily determined by their perceived usefulness, with perceived ease of use serving as a secondary factor. The TAM uses the following variables as dependents: Attitude Toward Using, Behavior Intention to Use, Perceived Usefulness, and Perceived Ease of Use. When users have a more positive attitude about new technologies, they are more likely to accept them and engage in more usage patterns.
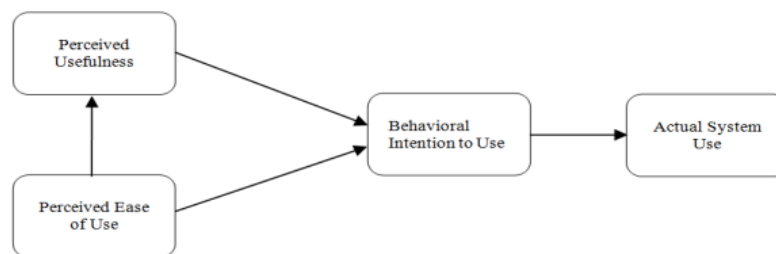
Technology Acceptance Model Innovation

In the long-term innovation and verification of researchers, the operational variables of TAM have also been given new meanings. According to Venkatesh and Davis (2000), outside factors could potentially have an impact on how users use the system. External variables include training compatibility, system quality, computer anxiety, enjoyment, computing assistance, self-efficacy, and experience, following research and growth by researchers. Over seventy external variables have been proposed by some researchers. These external elements were separated into four groups by Yousafzai et al. (2007): system, organization, user characteristics, and other variables. Ohme (2021) believes that Attitude Toward Using is a stable psychological tendency users hold toward a specific media. The subjective assessment of the person and the ensuing behavioral tendency—which may be good or negative—are included in this psychological tendency. Other researchers have concluded that the dimensions of Attitude Toward Using include Affective and cognitive attitudes (Moon et al., 2022). Users' Behavior Intention to Use can be measured by the user's usage time and frequency. Some researchers analyzed social media use habits and experiences as dimensions of Behavior Intention to Use (Bae, 2018). Additionally, it employed social influence, enabling conditions, performance expectancy, and effort expectancy as predictive criteria.

Regarding the theoretical framework, TAM has also undergone multiple iterations and supplements. Gillenson et al. (2002) added a variable, Perceived Playfulness, to the Technology Acceptance Model. "The degree to which a person perceives that he is paying attention while interacting on the World Wide Web; and finds the process to be enjoyable and exciting" is how they describe perceived gameplay. They also discovered a strong correlation between attitude toward use and perceived playfulness. Conversely, TAM has almost thirty research systems. In the end, the researchers separated them into four target systems: communication systems, office systems, general-purpose systems, and specialized business systems (Lee et al., 2003). Windows, workstations, microcomputers, personal computers, the Internet, and computer facilities are examples. The technology acceptance model has adaptability, simplicity, and soundness and has become one of the most commonly used acceptance models.

In addition to Attitude toward Using as a mediating variable, Venkatesh and Davis (2000) proposed behavioral intention as a mediating variable between perceived ease of use, perceived Usefulness, and actual use. Many researchers also used behavioral intention as a mediating variable in this process. However, some studies have shown that the utility of behavioral intention will gradually disappear over time, and Attitude can only partially transmit the effect of belief on intention. Yang and Yoo (2003) believe Attitude impacts users' system use. Therefore, Attitude is used as a mediating variable; the dimensions are emotion and cognition. But in the Technology Acceptance Model shown in Figure 7, researcher Naeini (2012) replaced Attitude Toward utilizing with Behavioral Intention to Use as a mediating variable. The measurement dimensions of Behavioral intention to Use are usually measured by usage time, number of uses, and usage diversity (Al-Emran et al., 2018). Since then, researchers have continued to analyze whether Behavioral intention to Use and Attitude toward Using mediation effect users' actual usage behavior.

Figure 7. Technology Acceptance Model (Naeini, 2012)

Zhang et al. (2023) studied users' willingness to buy new energy vehicles. The findings demonstrated that, through attitude mediation, perceived utility, perceived ease of use, and perceived danger strongly impacted the readiness to purchase new energy vehicles. Mantello et al. (2023) found that users' attitudes toward artificial intelligence can affect their usage behavior. Among users' social media behaviors, perceived Usefulness and attitude towards social media were shown to be the intention predictors to use social media for business activities. These studies also prove that Attitude Toward Using has a vital mediating role. Not only that, Yap et al. (2022) studied the willingness of the elderly to shop online. Among them, independent living ability and subjective well-being affect the behavioral intention of the elderly. Duong et al. (2023) studied the role of ChatGPT in education. Students' actual usage of ChatGPT is directly impacted by effort expectancy, which also steadily and indirectly raises actual use through performance expectations and intention to use ChatGPT. These studies prove that Behavior Intention to Use also has an important mediating role.

The Field of Technology Acceptance Model

According to the literature review, scholars mainly study Canada, the United States, Singapore, the Netherlands, Germany, Australia, Malaysia, France, and the United Kingdom etc. Most of the research on China is devoted to Hong Kong and Taiwan, and there are fewer papers on related research on mainland China. Among these studies, quantitative research methods are the most popular, followed by qualitative research and mixed research.

This article also summarizes the research fields in the final screened articles and finally obtains 7 crucial research fields. They are Social Sciences (Students); Computer Science (Information Technology); Decision Sciences (Decision Making); Medicine and Dentistry (Pandemics); Environmental Science (Sustainability); Engineering and Business; Covid-19.

The field of Social Sciences (Students)

In the Social Sciences (Students) field, researchers mainly studied social science technology, students, and learning. Saif et al. (2024) studied Chat-GPT and found a negative impact between Perceived Usefulness and attitude towards use. This is different from the original theory of TAM. They believe that students' stress leads to the emergence of anxiety. Although Perceived Usefulness is high, students' attitude towards use is negative. In most TAM studies involving mobile learning, the research purpose is to use external variables to expand TAM. According to Zogheib et al. (2015), self-efficacy, user happiness, subjective norms, perceived utility, perceived ease of use, and student attitudes all have a favorable effect on students' behavioral intention to utilize digital learning technology in mathematics classes. Additionally, several researchers have examined e-learning platforms and discovered that the most frequently employed external elements in TAM are experience, enjoyment, computer fear, self-efficacy, and subjective norms (Abdullah & Ward, 2016). This greatly enriches the verification dimension of external variables.

Some researchers have analyzed face recognition technology. The findings demonstrate that perceived usefulness is highly influenced by security, trust, and convenience of use. Use of the system is influenced behaviorally by perceived usefulness (Rukhiran et al., 2023). According to the results, multimodal biometrics received more positive reviews than unimodal biometrics. This research can offer managers, educators, and other stakeholders new insights and technologies, and teachers so that they can better understand innovative biometric systems, thereby improving the security, reliability, and efficiency of educational examinations. In addition to analyzing regular learning techniques, some researchers have also analyzed online gamification learning techniques. The intention is to allow students to achieve the purpose of learning in the game. Among them, perceived usefulness and enjoyment partially mediate between learning style and willingness to participate in online gamification classes; the relationship between perceived utility and motivation to engage in

online gamification classes can be somewhat mediated by perceived learning demands (Ahmad et al., 2023).

The field of Computer Science （Information Technology）

In the subject of computer science (Information Technology), researchers have mainly analyzed a variety of modern information technologies. Verma et al. (2018) examined the features of large-scale data systems. They confirmed that the features of the system had a major direct and indirect impact on its usefulness, attitudes, and adoption. In addition, users' attitudes toward extensive data systems mediate the relationship between big data systems' characteristics, advantages, usefulness, and behavioral intentions. Some researchers have also analyzed innovative city service technologies. The perceived utility and use of innovative municipal services are positively impacted by its compatibility, service quality, and comparable advantages (Choi, 2022). These results can help local government representatives and tech developers make judgments about the development of intelligent city services. In addition, the research findings can be used as a guide for cities and regions when proposing service strategies. Some researchers have also analyzed virtual reality technology. According to Lee et al. (2019), users' reported enjoyment is positively correlated with the intensity of their social interactions and connections, and this correlation has a greater effect on their intention to use than does perceived usefulness. The study's findings on satisfaction with virtual reality technology can help to spread the technology and gear and further knowledge of how people behave when utilizing it.

Coincidentally, some researchers have also studied VR technology. Although audience curiosity is a significant and important predictor of usage intention, self-awareness and subjective norms have a greater influence on audience curiosity (Capasa et al., 2022). Curiosity, perceived delight, and experience account for a large percentage of the usage intention variance. When users see others using VR technology, they are more inclined to plan to use it themselves. Other researchers mix engineering disciplines with qualitative analysis. Inocencio et al. (2022) investigated the use of algorithmic technology in the examination of geological rocks using TAM. The method for three-dimensional reconstruction of geological samples can be enhanced using this technology, which directly depends on factors like sample heterogeneity, size, and general shape to yield results that are useful and have the right geometric quality and visual effects. Additionally, the theoretical underpinnings of TAM can enhance users' comprehension of acceptance behavior in software engineering more quickly and increase the precision of their predictions on the uptake or acceptance of a certain technology or method of operation (Börstler et al., 2024).

The field of Decision Sciences (Decision Making)

In the Decision Sciences (Decision Making) field, researchers focus on studying users' decisions to use a particular technology. The tendency to use mobile payment services is positively influenced by perceived social impact, perceived personal ingenuity, perceived compatibility, and perceived utility (Schmidthuber et al., 2020). When users use another electronic technology, such as mobile crowdfunding technology, perceived usefulness, trust, and empathy directly affect the use intention (Djimesah et al., 2022). Organizational trust, perceived utility, hedonic motivation, and privacy all have a beneficial impact on users' intents when deciding whether or not to use corporate wearables, and reward mechanisms act as a mediating factor (Magni et al., 2021). This study offers novel methods for corporate and societal transformation and adds to the corpus of knowledge on digital tools, data intelligence, and internal company analysis.

Perceived utility and simplicity of use combination have been shown in certain research to have a big influence on how people use mobile health (Tao et al., 2023). When users believe mobile health is effortless, they are more likely to believe it is efficient and effective. These results offer empirical support for improved design and utilization of mobile health by medical personnel, as well as a

theoretical foundation for future studies on acceptability of mobile health. Additionally, three new predictors—perceived compatibility, perceived privacy, and security concerns—have been added to the TAM by some researchers (Karkonasasi et al., 2023). Some researchers also use qualitative research methods to analyze and study TAM's theoretical and practical significance. They made the point that autonomous technology is anticipated to enhance journey time utilization, lessen social isolation, enhance traffic conditions, and decrease traffic accidents (Adnan et al., 2024).

The field of Medicine and Dentistry (Pandemics)

In Medicine and Dentistry (Pandemics), researchers mainly conduct research from the perspectives of medicine, health, and patients. Some researchers use electronic health technology as a starting point to analyze the collective usefulness of the project, personal innovation, patient influence, and resistance to change, which directly affect the user's behavioral intention (Beglaryan et al., 2017). In telemedicine technology, situational factors directly affect the use intention (Jansen-Kosterink et al., 2019). Some researchers have also incorporated other variables and believe that perceived efficacy, attitude, perceived use, subjective norms, self-efficacy, and convenience conditions will affect the user's behavioral intention (Garavand et al., 2022). According to Samadbeik et al. (2023), there is a significant positive association between behavioral intention and attitude in this domain, as well as the idea of our simplicity and usefulness. Samadbeik et al.'s (2023) research shown a substantial positive correlation between attitude and behavioral intention in this area and perceived usefulness and perceived ease of use.

In order to improve healthcare providers' familiarity with and comfort level with mobile health technologies, this offers training programs for medical students and professionals. Ting et al. (2024) conducted a study on telemedicine services for the elderly (TELEG), and the study results offer insightful information to policymakers, relevant departments, and medical practitioners. This shows that the implementation of telemedicine is beneficial, can reduce hospital emissions, and remotely controls patients' chronic diseases (Safi et al., 2018), and is widely accepted by the elderly. Some researchers used TAM to describe the intention and impact of patients with diabetes and chronic hypertension, proving that perceived usefulness affects users' intention to use when using the Acceptance of Electronic Patient Portal (EPP) (Honein-AbouHaidar et al., 2020). In addition, some researchers also focus on people with mental illness. According to Luo et al. (2024), mobile psychological intervention is beneficial in decreasing behaviors connected to self-harm and suicide. Thus, encouraging the development of mobile mental health interventions requires consistently enhancing the user experience and attending to patients' demands.

The field of Environmental Science (Sustainability)

In the Environmental Science (Sustainability) field, the core keywords are environment and sustainability. Researchers have found that risk perception and safety concerns have led to a lower user acceptance of nuclear energy technology (Kim & Park, 2017). Rezaei et al. (2020) expanded the TAM framework and added four structures: social influence, result display, compatibility, and self-efficacy. This improved the understanding of the critical elements influencing farmers' actions to safeguard the environment and contributed to the promotion and application of Integrated Pest Management (IPM) technology in developing nations. It also enhanced the TAM knowledge system. Jain et al. (2023) also believed incorporating new technologies into agricultural practices is a top priority. In the modern world, technology aids users in decreasing workload, cutting expenses, and increasing production in a number of ways. Some researchers, starting from the perspective of new energy, took shared electric skateboards as an entry point and verified that subjective norms, hedonic motivations, and environmental awareness positively affect the acceptance of new technologies (Rejali et al., 2021). Other researchers believe that users' environmental awareness is crucial in accepting renewable energy, and those who are highly conscious of the environment are more inclination to adopt renewable energy (Yang et al., 2021). The research conclusions provide in-

depth knowledge and perceptive suggestions that will aid governments and other organizations in promoting the application of sustainable energy.

The field of Engineering and Business

In Engineering and Business, some researchers analyzed the commercial leasing of electric buses. They found that organizational variables and the reaction of organizational members to the introduction of electric vehicles are significant in supporting users to rent cars. (Globisch et al., 2018). Some researchers also analyzed shared parking lots. Acceptance of shared parking lots' technology has a big impact on how often people visit them again, and perceived danger is a key factor that influences how people park. Users of shared parking patterns' behavioral intention is substantially influenced by perceived availability, and perceived usefulness functions as a mediator variable between social influence and behavioral intention (Niu et al., 2021). This framework will help companies expand their market share in shared parking services and governments promote cutting-edge transportation innovations in urban areas.

Zhang et al. (2023) examined users' rental car and parking space habits as well as their want to purchase new energy vehicles. Through a partial mediation by attitude, perceived ease of use, perceived usefulness, and perceived risk significantly influence the intention to purchase new energy vehicles. Some researchers have also analyzed Building information modeling in engineering. In the model, social influence, effort expectations, attitudes, and facilitating conditions have been shown to significantly impact behavioral intentions and actual user behavior in Building information modeling (BIM) work (Howard et al., 2017). Other researchers have analyzed e-procurement services. The study's findings validated the idea that the caliber of information flow has a beneficial effect on organizational buyers' perceptions of e-procurement services and their subsequent satisfaction (Ramkumar et al., 2019). They gained a deeper comprehension of the contributing elements that influence purchasers' satisfaction with ongoing e-procurement service use, which will be helpful for e-procurement service providers.

The field of Covid-19

In the COVID-19 field, researchers focus on users' health during the pandemic, online exams, and online learning for college students. Some researchers have analyzed the acceptance of digital health by the elderly. Korean older adults' attitude towards using intelligent health watches is significantly affected by practicality, simplicity of use, and convenience. Conversely, there is no statistically significant correlation between social influence and the use of smart health watches (Zin et al., 2023). From the research results, digital wearable device suppliers, manufacturers, and promoters can strengthen strategic cooperation to use of wearables for digital health devices among the elderly while guaranteeing that these goods are reasonably priced, of high quality, and capable of offering the support that the elderly require in utilizing and embracing wearable technology in their day-to-day lives.

Jiang et al. (2023) analyzed the online supervision examination system for students. They discovered that social presence positively impacted perceived ease of use, and social influence had a strong favorable impact on online guardian acceptance through perceived utility. This shows the critical role of government and schools in implementing online guardianship. Schools and educational institutions should encourage the switch from paper examinations to online exams and expand the chances for online proctoring. Students' willingness to use e-learning social media platforms was found to be highly influenced by perceived cost, self-efficacy, perceived ease of use, perceived utility and perceived effectiveness (Peng & Hwang, 2021). Therefore, if a severe epidemic occurs again, colleges and universities should improve students' behavioral intentions by improving their self-efficacy and their behavior in using the Internet for learning.

DISCUSSION

Principal Findings

Since TAM was proposed, many researchers have continuously improved and expanded TAM to cope with the increasingly developing and changing social environment, information technology, and user groups. TAM has developed into one of the primary theoretical frameworks for examining consumer technology adoption behavior after ongoing refinement and expansion.

According to the systematic literature review, this study solves 6 research questions. First, from 2015 to 2024, the quantity of research articles that are published shows that the research on TAM is increasing yearly. TAM is still an important theoretical model for researchers to analyze user and technology relationships. Second, Davis proposed TAM in 1989, and after continuous verification by researchers, different theoretical frameworks suitable for users' acceptance of information systems have been produced. Many researchers have innovated based on Davis' theory, which has also provided fresh blood for TAM and expanded the scope of application of the theory. Third, researchers have verified the original theory of TAM and measured the relationship between variables in the theory. Researchers have also made many innovations according to the original framework. Researchers have also verified an abundance of external factors and newly added variables. This article summarizes it into three main parts: Social influence, System characteristics, and individual differences.

Fourth, some researchers have applied TAM to other disciplines, enriching the research scope of TAM. For example, engineering, medicine, and environmental science. Fifth, in the new research topic, perceived ease of use, perceived usefulness, and users' actual use behavior are all mediated by attitude toward and behavioral intention to use, as demonstrated by the study. Not only that, perceived innovation and social influence have also become essential variables for analyzing users' technology acceptance behavior. Sixth, the external determinants of subjective ordinary will influence users' behavior in addition to perceived utility, user attitude, perceived ease of use, and behavioral intention.

Research Field Findings

In the Social Sciences (students) theme, researchers mainly study social science technology, students, and learning. In the computer science (information technology) theme, researchers mainly analyze a variety of modern information technologies. In the Decision Sciences (decision making) theme, researchers focus on studying the decision of users to use a technology. In the Medicine and Dentistry (pandemics) theme, researchers mainly conduct research from the perspectives of medicine, health, and patients. In the Environmental Science (Sustainability) theme, the core keywords are environment and sustainability. In the Engineering and Business theme, some researchers analyze the commercial leasing of electric buses. In the COVID-19 theme, researchers focus on users' health during the pandemic, online exams, and online learning for college students.

The research direction has also expanded from the former information technology to social media, education, e-commerce, healthcare engineering, and other fields. Throughout the research process, TAM and its innovative new variables give insightful explanations among the elements influencing how people use technology. This also promotes designing and implementing user-friendly and effective information systems and technologies. Today, TAM research is ongoing, and researchers have never stopped innovating and verifying TAM.

Future Direction

One popular model for forecasting and explaining system utilization is the Technology Acceptance Model. Although, in general, the research on TAM by researchers has been increasing yearly, it has declined in recent years. Researchers can increase their research on TAM in the future.

Although the research on TAM by researchers covers a wide range of areas, it is distributed all over the world. However, it is recommended that research on mainland China be strengthened. China has a population of 1.3 billion and a large population base. Research on Chinese people can also provide valuable data and conclusions.

So far, there have been many studies on TAM. However, some confirmed results have been obtained, and some researchers still need to be convinced about the application and theoretical accuracy of the model. Therefore, researchers should continue to verify and innovate TAM, develop new models, and use the advantages of the TAM model while abandoning its weaknesses. Researchers can also conduct more qualitative research, make more theoretical innovations, and enrich the theoretical connotation of TAM.

In the future, researchers can also strengthen research in other fields. For example, TAM can be applied to new media software, short video platforms, Genetics, Materials Science, Biochemistry, and other fields. Especially the recently popular AI (Artificial Intelligence) technology. AI technology can be linked with smart home fields, medical care, transportation, innovative e-commerce, clever engineering, intelligent life, and innovative education. These bright fields are closely related to people's lives. Researchers can strengthen the research on users and AI technology.

Limitations

This article's analysis of TAM also has some things that could be improved. First, this article selects literature from the Science Direct and ProQuest databases between 2015 and 2024. Although this article uses titles and keywords to find accurate articles, it may also miss excellent literature from other years and databases. Secondly, this article focuses on keywords related to user acceptance, attitude, behavioral intention, and actual use, which may be missing some inconsistent literature. Finally, from the 38 documents selected in this article, although they involve different research fields, researchers' research on TAM mainly focuses on technologies that rely on the Internet. There are many kinds of technology, not just limited to technologies that require Internet use for users to enjoy.

CONCLUSION

This article provides a thorough assessment of current trends in TAM research additionally the elements influencing consumers' technology acceptance. Through the systematic literature review research method, this paper profoundly studies the articles that use TAM to analyze users' technology acceptance behavior. This study discusses TAM research trends after summarizing the literature review, the origin and development of TAM, the research field, and the main reasons that affect users' use of information technology. Among them, Perceived Ease of Use, attitude toward using, Perceived Usefulness, and behavior intention use, and subjective normal in external variables are the main reasons that affect users' actual use. Attitude toward using and behavior intention use have an important mediating role between Perceived Ease of Use, Perceived Usefulness and actual use. This paper provides suggestions for future enterprises and governments to promote technology to users. Also, it promotes future research and development of related technologies to assist people's daily lives. At the same time, this paper also provides certain conclusions and practical data for future research on TAM.

COMPETING INTERESTS

The Authors declare that there is no conflict of interest.

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Appendix A: All articles for screening review

No.	Author & Year	Title
1	Saif et al., (2024)	Chat-GPT; validating Technology Acceptance Model (TAM) in education sector via ubiquitous learning mechanism.
2	Zogheib et al., (2015)	University student perceptions of technology use in mathematics learning.
3	Abdullah & Ward (2016)	Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors.
4	Rukhiran et al., (2023)	User acceptance factors related to biometric recognition technologies of examination attendance in higher education: TAM model.
5	Ahmad et al., (2023)	Leading edge or bleeding edge: Designing a framework for the adoption of ai technology in an educational organization.
6	Verma et al., (2018)	An extension of the technology acceptance model in the big data analytics system implementation environment.
7	Choi (2022)	Enablers and inhibitors of smart city service adoption: A dual factor approach based on the technology acceptance model.
8	Lee et al., (2019)	The adoption of virtual reality devices: The technology acceptance model integrating enjoyment, social interaction, and strength of the social ties.
9	Capasa et al., (2022)	Virtual reality experience of mega sports events: A technology acceptance study.
10	Inocencio et al., (2022)	3-D reconstruction of rock samples via structure-from-motion for virtual reality applications: A methodological proposal.

11	Börstler et al., (2024)	Acceptance behavior theories and models in software engineering—A mapping study.
12	Schmidthuber et al., (2020)	Disruptive technologies and abundance in the service sector-toward a refined technology acceptance model.
13	Djimesah et al., (2022)	Analyzing the technology of acceptance model of Ghanaian crowdfunding stakeholders.
14	Magni et al., (2021)	Employees' acceptance of wearable devices: Towards a predictive model.
15	Tao et al., (2023)	Modeling consumer acceptance and usage behaviors of m-Health: An integrated model of self-determination theory, task–technology fit, and the technology acceptance model.
16	Karkonasasi et al., (2023)	Acceptance of a Text Messaging Vaccination Reminder and Recall System in Malaysia's Healthcare Sector: Extending the Technology Acceptance Model.
17	Adnan et al, (2018)	How trust can drive forward the user acceptance to the technology? In-vehicle technology for autonomous vehicle.
18	Beglaryan et al., (2017)	Development of a tripolar model of technology acceptance: Hospital-based physicians' perspective on EHR.
19	Jansen-Kosterink et al., (2019)	Patient acceptance of a telemedicine service for rehabilitation care: A focus group study.
20	Garavand et al., (2022)	Acceptance of telemedicine technology among physicians: A systematic review.
21	Samadbeik et al., (2023)	Acceptance of mobile health in medical sciences students: Applying technology acceptance model.
22	Ting et al., (2024)	The use of a multi-disciplinary geriatric telemedicine service (TELEG) and its acceptance at a tertiary care centre in Malaysia.
23	Safi et al., (2018)	Acceptance and resistance of new digital technologies in medicine: qualitative study.
24	Honein-AbouHaidar et al., (2020)	Users' acceptance of electronic patient portals in Lebanon.
25	Luo et al., (2024)	Needs for mobile and internet-based psychological intervention in patients with self-injury and suicide-related behaviors: a qualitative systematic review.
26	Kim & Park (2017)	Perceptional differences in the factors of local acceptance of spent nuclear fuel repositories.
27	Rezaei et al., (2020)	Understanding farmers' ecological conservation behavior regarding the use of integrated pest management-an application of the technology acceptance model.
28	Jain et al., (2023)	Selection of technology acceptance model for adoption of industry 4.0 technologies in agri-fresh supply chain.
29	Rejali et al., (2021)	Assessing a priori acceptance of shared dockless e-scooters in Iran.
30	Yang et al., (2021)	An empirical study of renewable energy technology acceptance in Ghana using an extended technology acceptance model.
31	Globisch et al., (2018)	Acceptance of electric passenger cars in commercial fleets.
32	Niu et al., (2021)	Determinants to parking mode alternatives: A model integrating technology acceptance model and satisfaction–loyalty model.
33	Zhang et al., (2020)	Predicting unsafe behaviors at nuclear power plants: An integration of Theory of Planned Behavior and Technology Acceptance Model.
34	Howard et al., (2017)	Addressing individual perceptions: An application of the unified theory of acceptance and use of technology to building information modelling.

35	Ramkumar et al., (2019)	Q-TAM: A quality technology acceptance model for predicting organizational buyers' continuance intentions for e-procurement services.
36	Zin et al., (2023)	A study on technology acceptance of digital healthcare among older korean adults using extended tam (extended technology acceptance model).
37	Jiang et al., (2023)	Investigating university students' online proctoring acceptance during COVID-19: An extension of the technology acceptance model.
38	Peng & Hwang (2021)	An empirical study to explore the adoption of e-learning social media platform in Taiwan: An integrated conceptual adoption framework based on technology acceptance model and technology threat avoidance theory.