RECyT
Year 27 / Nº 44 / 2025 /
DOI: https://doi.org/10.36995/j.recyt.2025.44.009

Study on the need for a new Technology Acceptance Model

Estudio sobre la necesidad de un nuevo Modelo de Aceptación de Tecnología

Fábio, Corrêa[1,*]; Dárlinton Barbosa Feres, Carvalho[2]; Vinícius, Figueiredo de Faria[1]; João Victor, Boechat Gomide[1]

1- Universidade FUMEC (Fundação Mineira de Educação e Cultura, FUMEC University. Minas Gerais, Belo Horizonte, Brasil.
2- Universidade Federal de São João del-Rei (UFSJ). Minas Gerais, Brasil.
* E-mail: fabiocontact@gmail.com

Received: 07/05/2024; Accepted: 13/05/2025

Abstract
This research aims to analyze the practical applications of the Technology Acceptance Model to verify whether there is a greater recurrence of the original version or its variations. It is basic exploratory research that adopts a qualitative approach for the analysis. Scientific bibliographic documents are analyzed through a systematic literature review and content analysis. As a result, firstly, the practical dominance of the Technology Acceptance Model application comes from its extensions and adaptations rather than from its original models. This does not mean that the predictors of the original versions are inadequate, but that, depending on the technology and the researcher's point of view, they are better used when adjustments are made. Secondly, given the above result, it is concluded that the Technology Acceptance Model is theoretically robust; otherwise, adaptations and extensions would not occur. The third conclusion arises from the previous ones and is based on a reflection: is an update, called Technology Acceptance Model 4, required? Therefore, we conclude that it is not necessary since 401 adaptations and 198 extensions were identified, proposing an additional structure would not eliminate the different perspectives of predictors to be included in future research.

Keywords: Technology Acceptance Model, TAM, Extension, Adaptation.

Resumen
Esta investigación tiene como objetivo analizar las aplicaciones prácticas del Modelo de Aceptación de Tecnología para verificar si existe una mayor recurrencia de la versión original o de sus variaciones. Es una investigación básica exploratoria con un enfoque cualitativo para el análisis. Los documentos bibliográficos científicos se analizan mediante una revisión sistemática de la literatura y un análisis de contenido. Como resultado, en primer lugar, el predominio práctico de la aplicación del Modelo de Aceptación de Tecnología proviene de sus ampliaciones y adaptaciones y no de sus modelos originales. No significa que los predictores de las versiones originales sean inadecuados, sino que, según la tecnología y el punto de vista del investigador, se aprovechan mejor con ajustes. En segundo lugar, dado el resultado anterior, se concluye que el Modelo de Aceptación de Tecnología es teóricamente robusto; de lo contrario, no se producirían adaptaciones y ampliaciones. La tercera conclusión surge de las anteriores y se establece a partir de una reflexión: ¿se exige una actualización, denominada Modelo 4 de Aceptación de Tecnología? En respuesta, entendemos que ¡no! Dado que se encontraron 401 adaptaciones y 198 extensiones, la propuesta de una estructura más no acabaría con las diferentes perspectivas de predictores a incluir en futuras investigaciones.

Palabras clave: Modelo de Aceptación de Tecnología, TAM, Extensión, Adaptación.

1 Introduction

Models that analyze the adoption of technological resources are positioned as a means to evaluate people's acceptance to a particular technology. These models represent the impact of scientific theory on understanding and guiding the scope of application and practical use of technology in society.

Among these models, for the purposes of this research, the Technology Acceptance Model (TAM) stands out. TAM was first proposed by Davis (1), and was later extended into the TAM2 (2) and TAM3 (3) versions. Across these versions, TAMs continue to be used in various studies, for instance, TAM in the research by Villa, Marín, and Salinas (4), Knox et al. (5); and Silva, Mendes Filho, and Marques Júnior (6); TAM2 in the study by Adji and Taufik (7); and TAM3 in Kusumastuti et al. (8). These cases may lead to the understanding that its predictors (i.e., variables) are sufficient to assess the acceptance of current technologies. However, studies by Al-Dokhny et al. (9) and Zhang et al. (10) proposed the adaptation (i.e., joining of models) and extension (i.e., addition and removal of predictors) of the TAM. Therefore, the aforementioned sufficiency of the predictors for evaluating today's technologies becomes questionable and inconsistent.

Through these two perspectives, this research aims to investigate the transformations (i.e., adaptations and extensions) carried out in the TAM to verify whether the original model or its variations are predominantly applied. It aims to reveal whether the theory underlying the TAM remains robust, as demarcated by Garcia et al. (11), or if the limitations presented by Marikyan and Papagiannidis (12) are compelling enough to create the need to update this model. These limitations are as follows: the lack of analysis of the impact of technology on performance; the suggestion that the greater the use of technology, the greater its performance; the limited attention given to what makes technology useful; and a specific focus on the organizational context (12).

In this sense, the following problem arises: is there a predominance in the application of the original TAM or its variations (i.e., adaptation and extension)? Based on this question, the objective is to analyze the practical application of the TAM in order to verify if the original version or its adjustments show a more prominent recurrence. Given this, we seek to understand the evolution of this theory in the context of its practical application and to assess whether a TAM4 is needed.

Furthermore, we want to foster a dialogue that contributes to the continuity of research focused on the evolution of acceptance models. For instance, the results are related to the study by Tamilmani et al. (13) that analyzed the evolution of the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model.

2 Technology Acceptance Model-TAM

The 1980s were a milestone for technology adoption studies, as at that time, there was a growth in the use of personal computers. The aim was to understand why users adopted personal computing and information systems. For this purpose, it was necessary to apprehend the users' perception of technologies, considering aspects that predicted their adoption, which led to the formulation of models.

A model is a schematic representation of reality. It is a means by which reality is abstracted, outlining aspects that constitute the phenomenon to be investigated with the aim of understanding it. In the context of technology adoption (i.e., reality phenomenon), we seek to understand which factors (i.e., aspects) influenced this adoption. Therefore, it was necessary to establish the factors that could provide an understanding of this phenomenon.

In this context, the Theory of Reasoned Action (TRA), a model proposed by Martin Fishbein and Icek Ajzen (14), is especially useful. This model (Figure 1) established that an individual's behavior was influenced by their intention, which was shaped by attitudes and norms derived from personal beliefs. It is a generic model applicable to several areas. However, regarding the field of computing, it had limitations, as it failed to consider variables specific to technology use within this field.

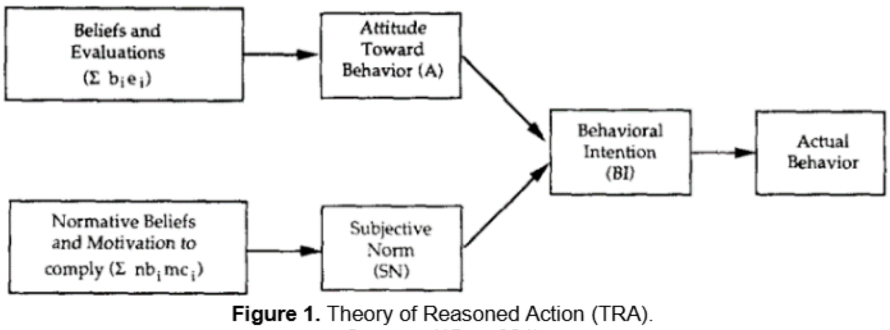

Figure 1. Theory of Reasoned Action (TRA).
Source: (15, p. 984)

Thus, the TAM (Figure 2) emerged as a model proposed by Fred D. Davis (1) for the context of digital information systems, which had the TRA as its foundation, along with the Theory of Behavioral Change (TBC) proposed by Albert Bandura (16). TBC established the concept of self-efficacy, characterized by the individual's belief in their capability to perform actions required to accomplish a task. Self-efficacy was adjusted to the perceived ease of use of the TAM, which is the degree to which the person considers (i.e., belief) that using a system is effortless. Accordingly, the individual's belief in the TRA is related to the self-efficacy in the TBC and constitutes the perceived ease of use in the TAM.

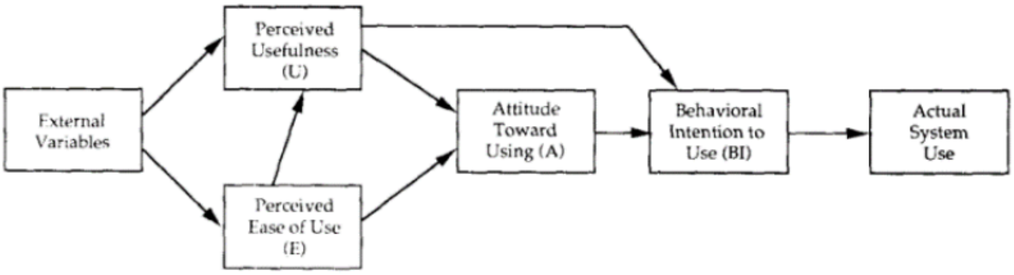

Figure 2. Technology Acceptance Model (TAM).
Source: (15, p. 985)

In the TAM, the use of the system is determined by the individual's intention to use it, which derives from perceived usefulness (i.e., performance expectation) and attitude toward using it. Attitude toward use is shaped by perceived ease of use (i.e., effort) and perceived usefulness, with the former influencing the latter. In other words:

The model implies that if an application is expected to be easy to use, users are more likely to find it useful, which increases the likelihood of technology acceptance (12, pp. 3).

On average, the TAM predicted 40% of the variance in technology acceptance (2). However, the research by Davis, Bagozzi, and Warshaw (15, p. 999) identified that the subjective norm, which corresponds to the perceived utility (i.e., performance expectation), required more research to "[...] investigate the conditions and mechanisms governing the impact of social influences on usage behavior".

In 2000 – 25 years after the proposal of the TRA, and 11 years after the presentation of the TAM – Viswanath Venkatesh, together with Fred D. Davis, pointed out that the adoption and use of technology still remained a theoretical and practical concern in the field of information systems. Although technological advances were significant, the concern was that "low usage of installed systems has been identified as a major factor underlying the 'productivity paradox' surrounding lackluster returns from organizational investments in information technology" (2, pp. 186).

For them, perceived usefulness is directly linked to the individual's performance expectation through the use of technology. The utility is presented as a strong determinant of the intention of use (coefficient close to 0.6). Therefore, to address the productivity paradox established at the time, the performance expectation (i.e., perceived usefulness) should be further explored by the model, which is the central point of the TAM extension, called TAM2 (Figure 3). Thus, "a better understanding of the determinants of perceived usefulness would enable us to design organizational interventions that would increase user acceptance and usage of new systems" (2, p. 187).

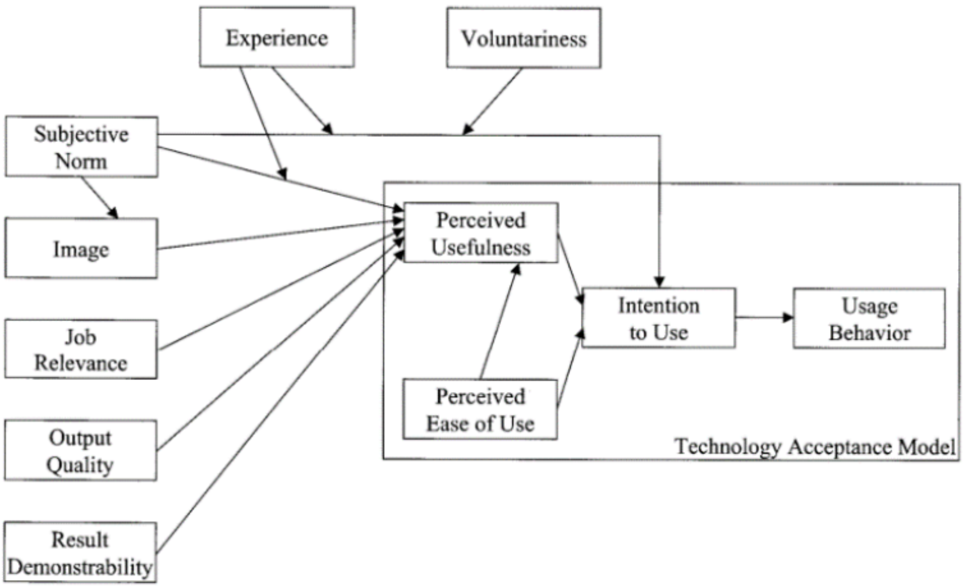

Figure 3. Technology Acceptance Model 2 (TAM2).
Source: (2, p. 188)

TAM2 introduced five additional exogenous variables (i.e., subjective norm, image, job relevance, output quality, and result demonstrability) influencing perceived usefulness as well as two moderators (i.e., experience and voluntariness) to extend the TAM. The subjective norm, image, and voluntariness represent social influence. Besides, the variables of job relevance, output quality, and result demonstrability incorporate cognitive instrumental processes into the framework.
The subjective norm, derived from the TRA, refers to the influence of people relevant to an individual regarding what he or she should or should not do (i.e., social aspect). For example, a co-worker may exert influence on an individual by expressing their opinion about the system's behavior, which in turn shapes the individual's perception. The experience moderator indicates that the subjective norm (i.e., social influence) may decrease as the system is used. Voluntariness indicates that the adoption of technology is not mandatory; in other words, it is voluntary according to the subjective norm.
Image refers to the status of an individual within a social group. Hence, belonging to a group or receiving its support may create a favorable image of the individual among its members, which may increase the probability of using the system (i.e., perceived usefulness). Job relevance establishes "[…] the individual's perception regarding the degree to which the target system is applicable to his or her job" (2, p. 191).
Output quality refers to how well the system performs tasks related to the individual's work objectives. Result demonstrability establishes that explicit results predict the perceived usefulness that the technology conveys to the individual; that is, the "[...] tangibility of the results of using the innovation" (17, p. 203).
While studies conducted with TAM showed a variation of approximately 40% in the intention to use, results based on TAM2 ranged between 37% and 52% for this factor, which is shaped by perceived usefulness. This result was verified through four field studies carried out with 48, 50, and 51 individuals from the manufacturing, financial, accounting, and banking sectors, respectively (2, 2000).
Even with the advances proposed by TAM2, Viswanath Venkatesh and Hillol Bala (3) pointed out in 2008 that the low adoption and use of technology in organizations remained a matter of concern. At that time, systems evolved to support decision-making, planning, and the management of supply chains and business resources, as well as customer relationship management. In this way, the low adoption and use of available technologies revealed a contradictory scenario regarding the promises of the technology for organizations.
The productivity paradox, presented by Venkatesh and Davis (2), expressed the divergence between investments in technology and business performance. This problem became even more pressing due to the technology failures at Nike in 2000, which cost $100 million and led to a 20% drop in stock value, and at Hewlett-Packard in 2004, which caused a financial impact of $160 million (3). The paradox became more concerning given that the global investment in technology was expected to increase by 7.7% per year from 2004 to 2008, compared to 5.1% from 2000 to 2004.
Considering the latent losses, the evolution of technological systems in the business context, and the prospect of increasing investments in technology to boost productivity, the scenario no longer seemed reasonable, as it resulted in losses. Hence, it became even more necessary to understand the factors that lead to the adoption and use of technology by "[...] identifying interventions that could influence adoption and use of new ITs, which can aid managerial decision making on successful IT implementation strategies" (3, p. 274).
TAM2 had reached successful rates of 37% to 52% in terms of intention to use. However, Venkatesh and Davis (2, p. 2000) indicated that "more broadly, future research should seek to further extend models of technology acceptance to encompass other important theoretical constructs". This statement, along with the productivity paradox, technology costs, and systems evolution, was based on the perspective that TAM2 expanded the factors predicting perceived usefulness, with no significant changes in perceived ease of use. Thus, building upon perceived ease of use, TAM3 (Figure 4) was proposed by Venkatesh and Bala (3) to increase the accuracy of the model. It is a fusion of TAM2 with the determinants of perceived ease of use, proposed by Venkatesh (18).

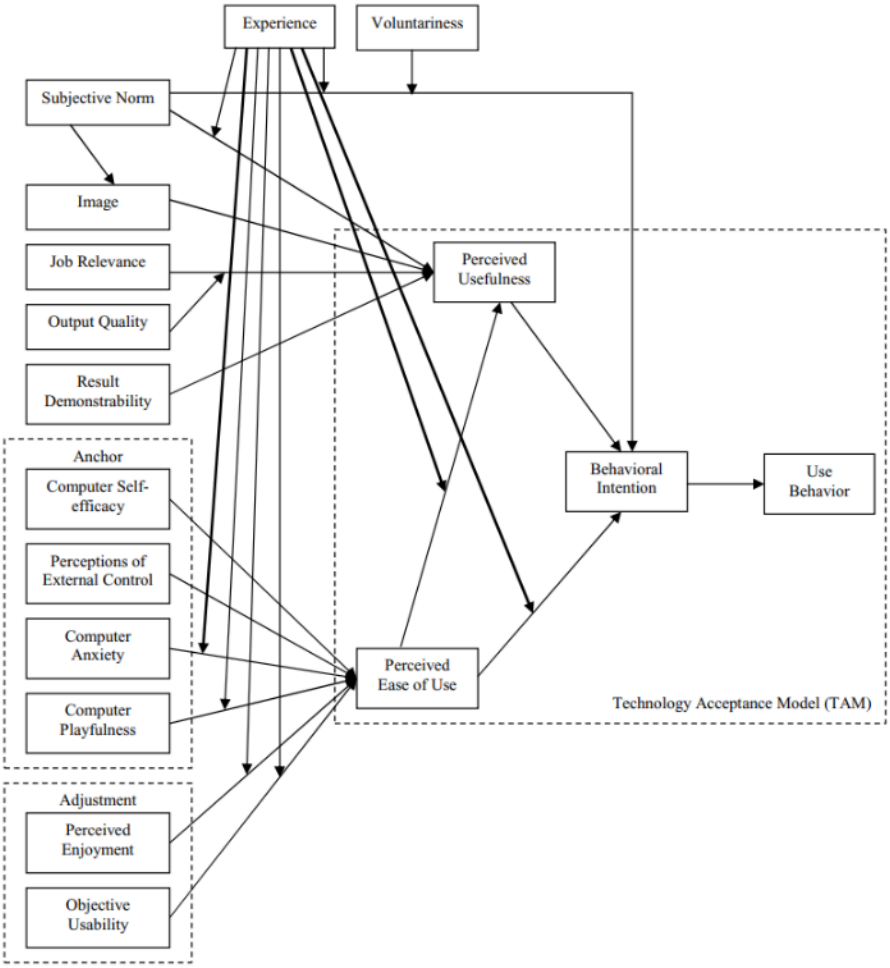

Figure 4. Technology Acceptance Model 3 (TAM3).
Source: (3, p. 280)

The determinants of the perceived ease of use construct are grouped into the anchor and adjustment groups. Regarding the anchor, Venkatesh (2000) "argued that individuals will form early perceptions of the perceived ease of use of a system based on several anchors related to individuals' general beliefs as to computers and computer use" (3, pp. 278). The anchor determinants are articulated as follows:

- Computer self-efficacy: "The degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer" (3, p. 279);
- Perceptions of external control: "The degree to which an individual believes that organizational and technical resources exist to support the use of the system" (3, p. 279);
- Computer anxiety: The degree of "an individual's apprehension or even fear, when she/he is faced with the possibility of using computers" (18, p. 349); and
- Computer playfulness: "[…] 'the degree of cognitive spontaneity in microcomputer interactions'" (3, p. 279).

The pre-judgments made by the individual, based on the anchor group's computer anxiety and computer playfulness determinants, are moderated by the individual's practical experience with the new system. Practical experience also moderates the determinants of the adjustment group, theorized "[...] to play a role in determining perceived ease of use after individuals gain experience with the new system" (3, pp. 278), namely:

- Perceived enjoyment: "The extent to which 'the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use'" (18, p. 351); and
- Objective usability: "comparison of systems based on the actual level (rather than perceptions) of effort required to complete specific tasks" (18, pp. 350–351).

In addition to the determinants of perceived ease of use, experience also began to moderate the influence of ease of use on perceived usefulness and behavioral intention (Figure 4). TAM3 was applied in four organizations in the same segments as TAM2 – the manufacturing, financial, accounting, and banking sectors. Data were collected over five months, with samples of 38, 39, 51, and 36 respondents for the aforementioned segments, respectively, validating the model extension.

Supporting this validation, TAM3 explained between 40% and 53% of the variance in behavioral intention. This result is similar to its predecessors – TAM presented an approximate variation of 40% in this factor, while TAM2 ranged between 37% and 52% for the intention to use. However, the new determinants include broader aspects, as well as conditions and scenarios associated with facilitating technology acceptance.

Due to the evolution of technology and the high costs of implementation, TAM3 also presents, according to Venkatesh and Bala (3, p. 303), "[...] direct implications for two types of decision making in organizations—(i) employees' IT adoption decisions; and (ii) managerial decisions about managing the IT implementation process". Therefore, this model is believed to support the organization in decision-making and management.

Technology management decisions predict actions, referred to by the authors as interventions, to be carried out during the pre- and post-implementation stages of the technology adoption. For instance, for complex systems, user participation in the process, along with training and support, is an intervention that tends to favor the perception of ease of use. For voluntary systems, institutional support and system design are actions that tend to influence perceived usefulness. For organizational systems, top management support is a beneficial intervention. Thus, "[...] managers can decide on resource allocation for interventions based on the impact of interventions on different determinants of IT adoption and system types" (3, p. 304).

TAMs, in all versions, continue to be used to this day. In the field of tourism, Silva, Mendes Filho, and Marques Júnior (6) applied the TAM to assess the intention to use cryptocurrencies by managers of tourist developments. As a result, perceived usefulness influences the attitude toward use, while both perceived usefulness and perceived ease of use influence the adoption of cryptocurrencies. Therefore, they conclude that managers demonstrate a positive attitude toward using cryptocurrencies and intend to adopt them as a form of payment.

In the context of informatics applied to health, Adji and Taufik (7) evaluated the use of an application by doctors and professionals using TAM2. They concluded that this model "[...] can explain the variation of the total factor by 73.826%" (7, p. 1).

TAM3 was applied by Kusumastuti et al. (8) in the Islamic accounting sector. The intention was to evaluate the accrual-based accounting systems used in the State Budget and the Treasury System. They concluded that "[...] the accrual-based accounting system in SPAN practically does not provide convenience and tends to have a low intensity of use" (8, p. 97).

Despite the significant use of TAMs over the years, Marikyan and Papagiannidis (12) point out several limitations of these models, such as:

1. Focus on factors that make people use technology, while overlooking its impact on performance;
2. Suggest that the greater the use of technology, the better the performance, which is not valid in practice;
3. Pay little attention to what makes technology useful – namely its design and fit to the task – which are important to achieve high performance through technology use; and
4. Focus on development specifically within the organizational context.

Nevertheless, Marikyan and Papagiannidis (12) point out that these limitations cannot overshadow the contributions of TAM theory.

In this regard, the theories that support the TAM, TAM2, and TAM3 show theoretical and practical robustness, as they were developed between 1989 and 2008 —the years corresponding to TAM and TAM3 —and have been empirically applied across different contexts (6, 7, 8). The question is whether the TAM, in all its versions, remains robust, as noted by Garcia et al. (11), or whether the limitations identified by Marikyan and Papagiannidis (12) signal the need for a new version of the model. In order to provide a better understanding of the matter, a review of the literature is conducted to support the analysis of practical applications of TAM, with the aim of identifying which of the two perspectives shows greater differentiation. The methodological procedures adopted for this research are described next.

3 Methodology

This research is characterized as basic research, exploratory in nature and qualitative in its analysis. Regarding the methodological procedures, a systematic review of the

literature and content analysis (19) are employed to perform a qualitative analysis of relevant bibliographic documents (i.e., scientific research results).
Based on this characterization, the following steps are taken to conduct this research:

1. Identification of research with practical applications of TAM;
2. Selection of research to be included in the analysis corpus;
3. Analysis of the research corpus to identify the dominance of TAM applications in their original versions or transformations (i.e., adaptations and extensions).

A systematic literature review was applied to identify research with practical applications of TAM (step 1). A research protocol (Table 1) was adopted based on the one proposed by Dresch, Lacerda, and Antunes Jr. (20).

Table 1. Research Protocol.

Aspect	Description
Conceptual framework:	Practical applications of TAM.
Context:	Applied surveys that measure technology acceptance through TAM.
Time horizon:	2017-2021.
Theoretical current:	The research aims to measure the adoption of technologies through the perspective of users' acceptance.
Languages:	Portuguese and English.
The question underlying the review:	What are the practical applications of TAM?
Exclusion criteria:	1. Research that does not contain the search terms in the keywords; 2. Research other than articles from scientific journals (e.g., proceedings, abstracts, etc.), 3. Research whose abstract does not mention the TAM acceptance model.
Search terms:	"Technology acceptance model" in Keywords
Data source:	SCOPUS

The SCOPUS database was selected based on a report by Falagalas et al. (21) and Faria et al. (22), who stated that it covers research since 1966 and indexes 12,850 journals from different areas. Thus, considering the proposition of the TAM in 1989 and application of this model in several areas (6, 7, 8), this database is regarded as relevant for the purposes of this research.
Subsequently, the decision regarding which research was considered for the analysis corpus (step 2) was made by applying the exclusion criteria established in Table 1. Therefore, this research only included scientific articles available for download that applied TAM, regardless of its extensions or adaptations.

Finally, step 3 consisted of analyzing the research corpus to identify the dominance of TAM applications, whether in their original version or in modified versions (i.e., adaptations and extensions). At this stage, content analysis is applied, which consists of analyzing communications through systematic and objective procedures to describe the content of the messages in order to obtain indicators (quantitative or not) that allow knowledge to be inferred (19).
In this sense, the articles included in the corpus (step 2) were analyzed to identify which version of the TAM prevails (step 3). This is achieved through content analysis, which enables inferring whether the original version of the TAM or its adapted and extended versions are more prevalent in the corpus is applied.

4 Discussion

The search was conducted on December 18, 2021, at 08:42, according to the terms established in the research protocol (Table 1). The initial search returned 1,726 documents. Of these, 317 articles were excluded because they did not contain the search terms in the keywords (exclusion criterion 1). This occurred because SCOPUS applies its own indexing during searches, which may result in false positives. Consequently, 1,409 articles remained after applying this criterion (1,726 − 317).
At this stage, all remaining articles were from scientific journals (exclusion criterion 2). Subsequently, based on abstract analysis, 634 articles that did not mention the TAM (exclusion criterion 3) were excluded. These documents were not included because other models, such as UTAUT, match the search terms but do not align with the purposes of this research. Thus, the resulting number was 775 (1,409 - 634) documents.
After that, the articles were read in order to identify whether TAM was applied or not (exclusion criterion 4). A total of 170 studies were discarded, as they consisted of reviews and/or comparisons of acceptance models, among others, without presenting a practical application of the TAM. Thus, the final corpus of this search consists of 605 (775 – 170) scientific articles.
Only six studies, namely Estrada Villa, Marín, and Salinas (23); D'Souza, Joshi, and D'Souza (24); Knox et al. (5), Oliveira Jr., Zorzo and Neu (25); Saadatzi et al. (26) and Al-Maroof and Al-Emran (27), employed the TAM. The first four studies addressed software application technologies, while the remaining two focused on a healthcare robot and on online teaching, the latter using the Classroom platform.

The results reveal that TAM continues to be used and applied to evaluate technologies that are not in line with its inception time. When Davis (1) proposed the TAM, the intention was to understand why users adopted personal computing and information systems. The study by Saadatzi et al. (26), which applied the model to healthcare robots, suggests that the TAM continues to be suitable in contemporary contexts.
However, 401 extensions and 198 adaptations of the TAM were identified [1]. Following the inference that this model is contemporary, the number of adaptations (i.e., joining models) and extensions (i.e., addition and/or removal of predictors) leads to a reflection on why this happens. When analyzing the predictors, there are a total of 737 different articles presenting extensions and 483 unique adaptations, which allows us to infer that the aspects (i.e., factors) analyzed by the TAM are insufficient to assess the adoption of specific technologies.
As with extensions, research by Caffaro et al. (28) and Michels et al. (29) evaluated the acceptance of drone technology in Italian and German agriculture, respectively. Caffaro et al. (28) announce that using drones in agriculture can improve production, minimize costs, and conserve resources; however, adoption remains limited, thereby justifying the research. Caffaro et al. (28) extended the TAM with 18 predictors, with a total of 10 being confirmed after the application of the model (Figure 5). In this extension, the perceived ease of use (PEU) was considered but not confirmed, while the perceived usefulness (PU) remains a determining factor in the intention to adopt drone technology in agriculture.

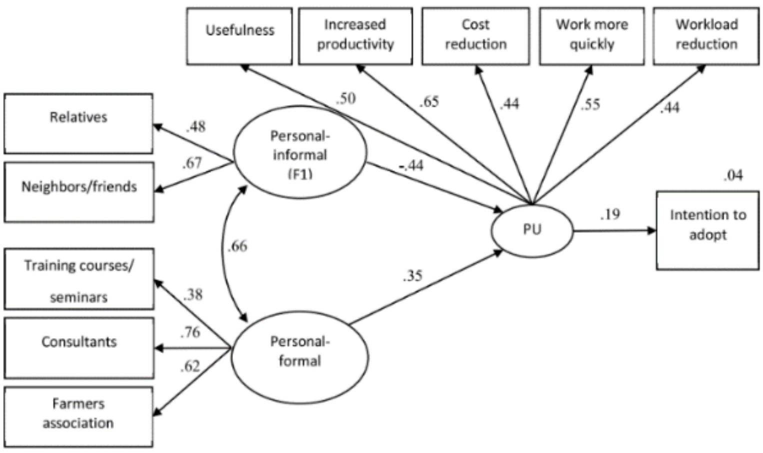

Figure 5. Extension 203 of TAM.
Source: (28, p. 6)

Likewise, Michaels et al. (2021) also identify the low adoption of drones in agriculture as the motivation for their research. Michels et al. (29) extended the TAM by incorporating the predictors of attitude of confidence in using drones in agriculture and job relevance of drone technology in agriculture (Figure 6).

[1] Access 10.5281/zenodo.11125946 (after publication) or supplementary document to the submission.

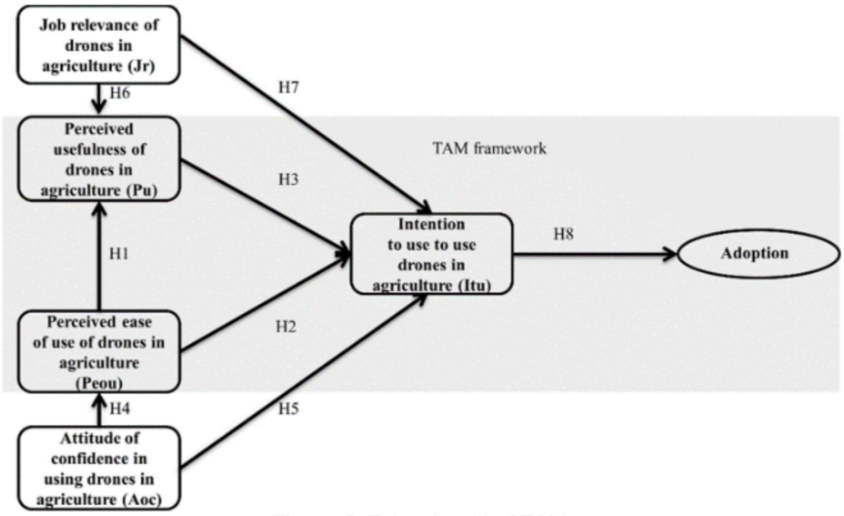

Figure 6. Extension 11 of TAM.
Source: (29, pp. 1732)

The vast amount of information required to operate drone technology justifies the inclusion of confidence in using drones in agriculture as a predictor. Therefore, producers must have confidence in the use of this technology for its adoption in precision agriculture (29). The job relevance of drones in agriculture is based on the study by Venkatesh and Davis (2), in which the job relevance predictor was added to TAM2. However, this factor was renamed in Michels et al. (29).

The hypotheses related to the predictors (H4, H5, H6, and H7) were confirmed, which led Michels et al. (29, p. 1742) to conclude that "[…] the results contribute to further empirical evidence towards the robustness of the TAM and its generality across several research disciplines". According to these researchers, despite the limitations of the explanatory and predictive power of the TAM, it continues to be the most widely applied model for predicting the intention to use technology.

In the context of the studies that conducted adaptations, the study by Bhardwaj, Garg, and Gajpal (30) investigated blockchain technology in supply chains in India, motivated by the advantages of cost optimization, effective and verified record-keeping, transparency, and route tracking. The adaptation, called TAM-TOE-DOI (Figure 7), results from the integration of TAM with the Diffusion of Innovation (DOI) and Technology-Organization-Environment (TOE) models.

Figure 7. Adaptation 75 of TAM.
Source: (30, p. 10)

These TAM variations come from the technologies analyzed. Technologies range from physical systems, such as vehicles (31), robots (32), and wearables (33), to logical systems, such as chatbots (34), e-commerce (35), cryptocurrencies (36), and management software (37).

Thus, there is the possibility that the combination of models and the incorporation of new predictors are justified when a technology displays unique characteristics compared to other models. For example, cryptocurrencies, vehicles, and e-commerce may consider aspects related to security, while wearables, such as smartwatches, tend to consider other predictors like surface texture.

The differing perspectives observed in the practical use of TAM unveiled by this research allow us to infer that the study by Saadatzi et al. (26), which analyzed healthcare robot technology, presents TAM as a contemporary theory. However, the extensions (28, 29) and the adaptation (30) lead to the inference that the aspects (i.e., factors) analyzed by TAM are insufficient to assess the adoption of specific technologies.

5 Conclusion

Based on the analyses conducted in this research, we understood that the foreseen prospects for TAM are not dichotomous; thus, three conclusions were reached. First, the practical dominance of the application of TAM comes from its extensions and adaptations and not from its original model. This outcome does not mean that the predictors of TAM, TAM2, and TAM3 are inadequate but that, according to the technology and the researcher's perspective, they are subject to adjustments to provide a better fit between the model and reality.

Secondly, in the light of the above, it is concluded that the TAM is theoretically robust, since adaptations and extensions would not occur otherwise. Thus, despite the limitations presented by Michels et al. (29) and Marikyan and Papagiannidis (12), it is plausible to determine that the TAM theory remains robust, as defined by Garcia et al. (11) and Michels et al. (29).

The third conclusion derives from the previous considerations and involves a reflection on whether it would be appropriate to update the TAM and call it TAM4. However, given the existence of 401 adaptations and 198 extensions, the proposition of one more structure would not eliminate the different perspectives regarding potential predictors to be included in future research. It is likely that this would lead to the rise of new adaptations and extensions. Furthermore, this would increase the variability of framework applications, as identified through this research, without addressing all technology-specific nuances regarding acceptance determinants required for a broad and robust theory.

Nevertheless, emerging technologies cannot be predicted with certainty, while the robustness of a theory depends on what has been previously and correctly theorized. This consequence means that a theory that evolves is one that provides the means for others to do so. This feature is plausibly attributed to the TAM, given the discussion above.

In the meantime, we believe this research contributes by investigating the theoretical-empirical evolution of acceptance models, specifically the TAM. The theory is thus explained through its evolutionary development and practical application over time, endorsing the science-technology-society triad and supporting broader understanding and practices.

Regarding limitations, this research relied on a single database to operationalize the systematic literature review. Although the number of analyzed documents is quantitatively representative, future research could expand this investigation by including additional scientific databases.

References

1. **Davis, F.D.** (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13,3:319–340.
2. **Venkatesh, V., & Davis, F.D.** (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science*, 462:186–204.
3. **Venkatesh, V. & Bala, H.** (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences*, 392:273–315.
4. **Villa, E.J.E., Marín, V.I., & Salinas, J.** (2021). Research Skills for Information Management: Uses of Mobile Devices in Research Training. *Education Sciences*, 11:749–760.
5. **Knox, L., Gemine, R., Rees, S., Bowen, S., Groom, P., Taylor, D., & Lewis, K.** (2021). Using the Technology Acceptance Model to conceptualise experiences of the usability and acceptability of a self-management app (COPD. Pal®) for Chronic Obstructive Pulmonary Disease. *Health and technology*, 11,1:111–117.
6. **Silva, G., Mendes Filho, L., & Marques Júnior, S.** (2022). Intenção de usar criptomoedas por gestores de empreendimentos turísticos: uma abordagem utilizando o Technology Acceptance Model (TAM). *Revista Brasileira de Pesquisa em Turismo*, 16:1–15.
7. **Adji, H.I., & Taufik, T.A.** (2022). Analysis of the adoption and commercialization of XYZ app using TRL, CRL, TRI2 and TAM2. *In: The 5th International Conference on Management of Technology, Innovation, and Project*, 1–9.
8. **Kusumastuti, R., Touriano, D., Rosita, S., & Fatricia, R. S.** (2022). Effectiveness of accrual basis accounting system in state budget and treasury system in TAM 3 framework. *Journal of Islamic Accounting and Finance Research*, 4:1, 97–130.
9. **Al-Dokhny, A., Drwish, A., Alyoussef, I., & Al-Abdullatif, A.** (2021). Students' intentions to use distance education platforms: An investigation into expanding the technology acceptance model through social cognitive theory. *Electronics*, 10,23:2992–3015.
10. **Zhang, X., Tlili, A., Shubeck, K., Hu, X., Huang, R., & Zhu, L.** (2021). Teachers' adoption of an open and interactive e-book for teaching K-12 students Artificial Intelligence: a mixed methods inquiry. *Smart Learning Environments*, 8,1:1-20.
11. **Garcia, S.F.A., Bottaro, H.Z., da Silva, D.D.S., & Galli, L.C.D.L.A.** (2020). O impacto da facilidade de uso percebida na adoção do Instagram. *In: XXIII Seminários em Administração*, SemeAd, 1–15.
12. **Marikyan, D., & Papagiannidis, S.** (2022) Technology Acceptance Model: A review. In Papagiannidis, S. (Ed), *TheoryHub Book*. http://open.ncl.ac.uk
13. **Tamilmani, K., Rana, N. P., Wamba, S. F., & Dwivedi, R.** (2021). The extended Unified Theory of Acceptance and Use of Technology (UTAUT2): A systematic literature review and theory evaluation. *International Journal of Information Management*, 57, 102269.
14. **Fishbein,M, & Ajzen, I.** (1975). *Belief, Attitude, Intention and Behavior: an Introduction to Theory and Research*.
15. **Davis, F.D., Bagozzi, R.P., & Warshaw, P.R.** (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, 35,8:982–1003.
16. **Bandura, A.** (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84,2:191–215.
17. **Moore, G.C.I., & Benbasat, I.** (1991). Development of an instrument to measure the

perceptions of adopting an information technology innovation. *Inform. Systems Res*, 2:192–222.
18. **Venkatesh, V.** (2000). Determinants of perceived ease of use: Integrating perceived behavioral control, computer anxiety and enjoyment into the technology acceptance model. *Information Systems Research*, 11:342–365.
19. **Bardin, L.** (1977). *Análise de Conteúdo*.
20. **Dresch, A, Lacerda, D. P., & Antunes Jr., J. A. V.** (2020). *Design Science Research: Método de Pesquisa para Avanço da Ciência e Tecnologia*.
21. **Falagalas, M.E., Pitsouni, E.I., Malietzis, G.A., & Pappas, G.** (2008). Comparison of PubMed, Scopus, web of science, and Google scholar: strengths and weaknesses. *The FASEB journal*, 22,2:338–342.
22. **Faria, V.F., Corrêa, F., Lima, P.P., Santos Jr, Z., & Dutra, F. G.C.** (2022). Propósitos para mensuração do Capital Intelectual. *Fronteiras de Representação do Conhecimento*, 1:105–112.
23. **Estrada Villa, E. J., Marín, V. I., & Salinas, J.** (2021). Research skills for information management: Uses of mobile devices in research training. *Education Sciences*, 11(11), 749.
24. **D'Souza, D.J., Joshi, H.G., & Prabhu, R.** (2021). Assessment of Consumers Acceptance of E-Commerce to Purchase Geographical Indication Based Crop Using Technology Acceptance Model (TAM). *Agris On-line Papers in Economics and Informatics*, 13,3:25–33.
25. **Oliveira Jr, E., Zorzo, A.F., & Neu, C.V.** (2020). Towards a conceptual model for promoting digital forensics experiments. *Forensic Science International: Digital Investigation*, 35:1–15.
26. **Saadatzi, M.N., Logsdon, M.C., Abubakar, S., Das, S., Jankoski, P., Mitchell, H., Chlebowy, D., & Popa, D.O.** (2020). Acceptability of using a robotic nursing assistant in health care environments: experimental pilot study. *Journal of medical Internet research*, 22,11:1–7.
27. **Al-Maroof, R.A.S., & Al-Emran, M.** (2018). Students acceptance of google classroom: An exploratory study using PLS-SEM approach. *International Journal of Emerging Technologies in Learning*, 13,6:112–123.
28. **Caffaro, F., Cremasco, M.M., Roccato, M., & Cavallo, E.** (2020). Drivers of farmers' intention to adopt technological innovations in Italy: The role of information sources, perceived usefulness, and perceived ease of use. *Journal of Rural Studies*, 76:264–271.
29. **Michels, M., Hobe, C.F.V., Ahlefeld, P.J.W.V., & Musshoff, O.** (2021). The adoption of drones in German agriculture: a structural equation model. *Precision Agriculture*, 22,6: 1728–1748.
30. **Bhardwaj, A.K., Garg, A., & Gajpal, Y.** (2021). Determinants of Blockchain Technology Adoption in Supply Chains by Small and Medium Enterprises (SMEs) in India. *Mathematical Problems in Engineering*, 2021:1–14.
31. **Jaiswal, D., Kaushal, V., Kant, R., & Singh, P.K.** (2021). Consumer adoption intention for electric vehicles: Insights and evidence from Indian sustainable transportation. *Technological Forecasting and Social Change*, 173:1–13.
32. **Martins M., & Costa, C.** (2021). Are the Portuguese ready for the future of tourism? A technology acceptance model application for the use of robots in tourism. *Journal of Tourism and Development*, 36,2:39–54.
33. **Al-Maroof, R.S., Alhumaid, K., Alhamad, A.Q., Aburayya, A., & Salloum, S.** (2021). User acceptance of smart watch for medical purposes: an empirical study. *Future Internet*, 13,5:1–19.
34. **Kim, A.J., Yang, J., Jang, Y., & Baek, J.S.** (2021). Acceptance of an Informational Antituberculosis Chatbot Among Korean Adults: Mixed Methods Research. *JMIR mHealth and uHealth*, 9,11:1–17.
35. **Bauerová, R., & Klepek, M.** (2018). Technology acceptance as a determinant of online grocery shopping adoption. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 66,3:737–746.
36. **Nadeem, M.A., Liu, Z., Pitafi, A.H., Younis, A., & Xu, Y.** (2021). Investigating the adoption factors of cryptocurrencies—a case of bitcoin: empirical evidence from China. *SAGE open*, 11,1:1–15
37. **Mohammed, A.H., Mousa, A.H., Almeyali, N.M., & Nasir, I.S.** (2021). M2CIM-DSS: A Model for Measuring Continuance Intention in Decision Support Systems. *Indonesian Journal of Electrical Engineering and Informatics*, 9-3:756–765.