

Exploring the Development of the Technology Acceptance Model (TAM): A Chronological Overview

Imad-dine Bazine

Abdelmalek Essaâdi University, National School of Business and Management, Tangier, Morocco

DOI: <https://doi.org/10.51244/IJRSI.2025.120600138>

Received: 07 June 2025; Accepted: 10 June 2025; Published: 16 July 2025

ABSTRACT

This study explores the chronological development of the Technology Acceptance Model (TAM) from its inception in 1989 to its evolution into more comprehensive frameworks by 2024. Initially proposed by Davis (1989), TAM sought to explain individuals' acceptance of technology through constructs such as perceived usefulness and ease of use. Subsequent adaptations and extensions of TAM, such as TAM2, TAM3, and the Unified Theory of Acceptance and Use of Technology (UTAUT), introduced new variables and contextual considerations to enhance its applicability across diverse technological environments. This review synthesizes key milestones in TAM's evolution, highlighting its theoretical advancements, practical applications, and ongoing challenges in predicting and promoting technology acceptance.

Keywords : Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Technology adoption, User acceptance.

INTRODUCTION

The accelerating pace of technological innovation in recent decades has transformed nearly every aspect of modern life, from how we work and communicate to how we learn and consume information. As noted by Davis (1989), while technological advancements promise efficiency and improved performance, their successful implementation heavily depends on user acceptance. This is a critical concern for researchers in the field of information systems, as articulated by Fishbein and Ajzen (1975), who have long sought to understand why individuals choose to adopt or reject new technologies. Such inquiries have driven the development of models that elucidate the complex interplay of factors influencing technology adoption (Venkatesh and al., 2003).

Among these models, the Technology Acceptance Model (TAM) stands out as one of the most influential frameworks. Davis (1989) introduced TAM to explain and predict individual behavior toward technology usage. Building upon the *Theory of Reasoned Action (TRA)* developed by Fishbein and Ajzen (1975), TAM focuses on two critical determinants: perceived usefulness and perceived ease of use. According to Davis (1989), perceived usefulness reflects the degree to which an individual believes that using a specific system will enhance job performance, while perceived ease of use captures the extent to which the use of technology is perceived as free of effort. These constructs, alongside external variables influencing them, form the foundation of TAM's predictive capacity.

Initially applied to investigate the acceptance of word processing software, TAM quickly gained recognition as a robust and generalizable model (Davis, 1989). Its simplicity and strong theoretical grounding allowed researchers to adapt and extend the framework to diverse contexts, such as educational technology, e-commerce, and healthcare systems (Venkatesh & Davis, 2000). Over time, the model evolved to include additional constructs, reflecting the increasing complexity of technology adoption scenarios. Extensions like TAM2 (Venkatesh & Davis, 2000) and TAM3 (Venkatesh & Bala, 2008) incorporated factors such as social influence, perceived enjoyment, and contextual variables like voluntariness and organizational support. Later, the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh and al. (2003) further refined the framework, integrating insights from multiple acceptance models and accounting for demographic and experiential variables such as age, gender, and experience.

Despite its widespread application, TAM has faced notable criticisms. Bagozzi (2007) argued that relying on behavioral intention as a proxy for actual use oversimplifies the nuanced processes underlying technology adoption. Additionally, Goodhue and Thompson (1995) highlighted the importance of task-technology fit, emphasizing that perceptions of usefulness and ease of use are highly context-dependent, varying significantly based on specific tasks and organizational environments. Nevertheless, TAM remains a cornerstone of technology adoption research, offering valuable insights into user behavior and guiding the design and implementation of IT systems (Venkatesh and al., 2016).

This paper seeks to explore the genealogy of TAM, tracing its evolution from Davis's original 1989 model to its subsequent adaptations and extensions through 2024. By examining its theoretical advancements, empirical applications, and critiques, we aim to provide a comprehensive understanding of TAM's contributions to the field of information systems. Moreover, we address its limitations and propose avenues for future research, underscoring the need for context-sensitive approaches that reflect the dynamic and diverse nature of technology adoption.

1. Presentation of the Reference TAM Model of 1989

In the context of research studies on the impacts of Information Technology (IT) at the individual level (Taylor and Todd, 1995; Karhanna and al., 1999), the recurring question is: why do individuals accept or reject technologies?

Davis and al. (1989) emphasize that "understanding why people accept or reject computers is undoubtedly one of the most challenging issues in information systems research" (p. 587). To address this, Davis (1989) conceptualized one of the most widely used models by Information Systems researchers: the **Technology Acceptance Model (TAM)** (Figure 1).

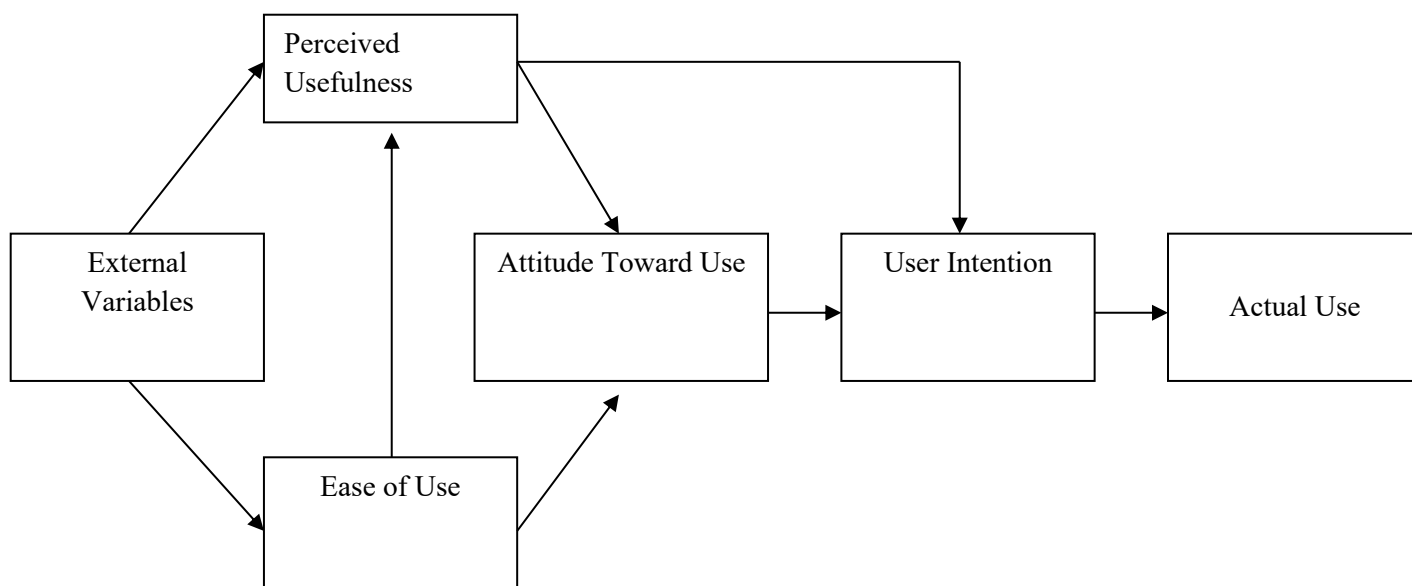


Figure 1: Technology Acceptance Model, (Davis, 1989)

This model is the most widely used to explain the concept of Information Technology (IT) usage (Chau, 1996; Mathieson, 1991; Straub and al., 1995; Szajna, 1996). Davis (1989) introduced this model to explain individuals' behavior toward computers. Drawing on the **Theory of Reasoned Action (TRA)**¹, he demonstrated that the success of an IT system depends on its acceptance by users.

Specifically, he explained the major relationships between, on the one hand, the different constructs that compose the model, namely: **Perceived Usefulness, Perceived Ease of Use, Attitude, Intention, and Actual Use**, and, on the other hand, the connections between external variables and the fundamental initial constructs.

¹ The main idea of TRA is that individual intention is the immediate determinant of most behaviors (Fishbein and Ajzen, 1975).

The table below presents the constructs of the TAM as defined by Davis (1989).

Definition of the Constructs of the TAM Model (1989)

TAM Model Constructs	Definition of Constructs
Perceived Ease of Use	It is the degree to which an individual believes that using a particular system will be free of difficulty or additional effort (Davis, 1989). This construct indicates the extent to which the user perceives that using the technology requires little to no effort.
Perceived Usefulness	It refers to the degree to which a person believes that using a particular system would enhance their job performance (Davis, 1989). In other words, it is the subjective probability that an individual will accept using a technology.
External Variables	These encompass three impact factors—organizational, individual, and technological—that influence individuals' intention to use IT (Agarwal and Prasad, 1997; Hong and al., 2002), thereby forming a causal link between internal beliefs: attitude, perceived ease of use, and perceived usefulness, and the intention to use.
Attitude Toward Use	These represent the expected consequences of use. They encompass social norms, habits, and ease of conditions. Perceptions and attitudes are studied in terms of perceived usefulness (Davis, 1989) or user satisfaction with the information (Baroudi and al., 1986).
Intention to Use	This construct has proven to be a better predictor of system use than its competing predictors (Sun and Zhang, 2006). It indicates the degree of an individual's commitment and valence toward the technology.
Actual Use	It is used as a "substitute" measure for the success of the information system. It is directly influenced by the intention to use IT (Davis and al., 1989).

The goal of the Technology Acceptance Model (TAM) is to provide an explanation of the determinants of acceptance that is general, while remaining parsimonious and theoretically justified (Lassoued, 2010). TAM is the most robust model for identifying the variables that influence individuals to accept or reject the use of a given technology (Hu and al., 1999; Venkatesh and Davis, 2000). This model was initially applied by Davis and his colleagues (1989) to measure the variable of intention to use IT (a word processing software). These authors tested the model using a longitudinal study conducted on 107 students. The results of this study confirmed that perceived usefulness had a positive impact on the intention to use within this group (Davis and al., 1989).

TAM also focuses on the intention to behave as the antecedent of behavior, but with two significant changes:

- The first change is related to the exclusion of the **subjective norm**² construct, which is included in the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior³. In this regard, Davis (1989) suggests that individuals may choose to use IT to improve their work or because normative reference groups encourage them to do so.
- The second change introduces two new constructs referring to specific beliefs that influence attitudes toward the intention to use technological innovations. These are two fundamental constructs: **perceived**

² **Subjective norm** is the degree to which an individual perceives that most people important to them believe they should or should not use the system (Fishbein and Ajzen, 1975).

³ The **Theory of Planned Behavior (TPB)** is an extension of the Theory of Reasoned Action (TRA), aiming to explain individuals' behavior toward IT by integrating a new variable, **Perceived Behavioral Control**

ease of use and perceived usefulness. These constructs influence IT adoption behavior at the user level (Davis, 1989).

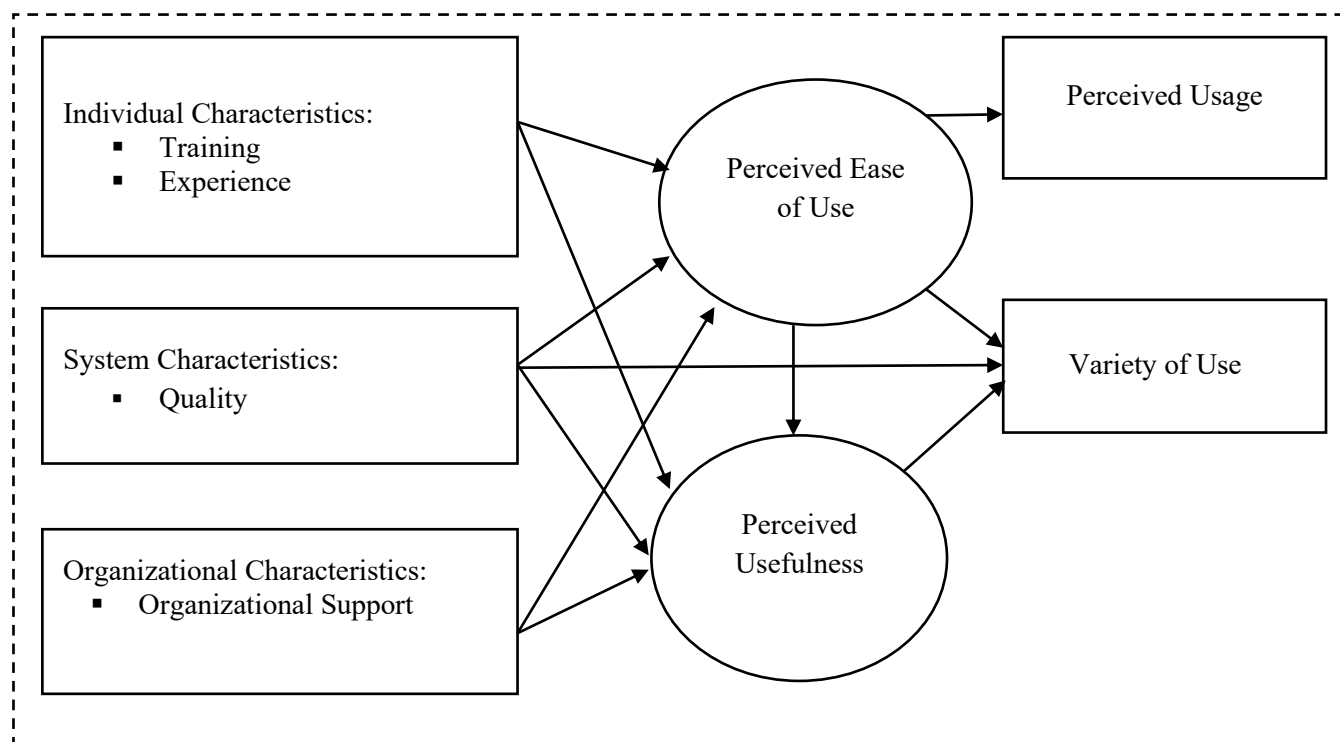
TAM explicitly integrates external variables into the modeling of user behavior. It also shows how these variables influence two specific beliefs—**perceived ease of use** and **perceived usefulness**—which then impact attitude toward use and intention to use the technology, ultimately predicting actual use.

By adopting this reasoning, several researchers have added new dimensions of analysis to better understand the factors influencing IT adoption in various contexts. In the following, we will present the works, in chronological order, that have contributed to the improvement of the TAM model.

2. Enrichment of the TAM Model from 1995 to 1998

To understand the factors impacting the prediction of IT usage (specifically microcomputers), Igbaria and his colleagues (1995) conceptualized a research model (Figure 2). Referring to the original TAM model by Davis (1989) and the Theory of Planned Behavior (Ajzen, 1991), they emphasized the construct of "**external variables**", which encompasses three blocks of variables: individual characteristics (user education and experience), organizational characteristics (organizational support), and system characteristics (system quality). These authors analyze the impact of external variables on perceived ease of use and perceived usefulness, and more generally on the perceived usage of microcomputers.

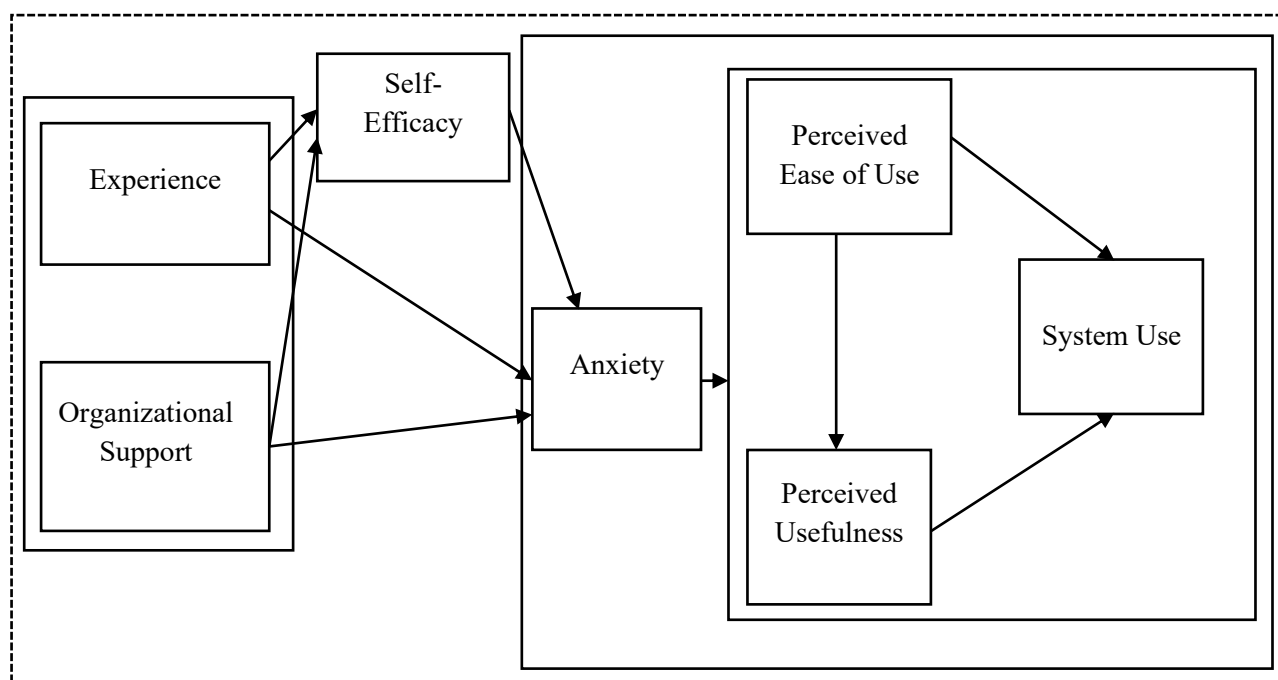
Figure 2: Microcomputer Usage Model (Igbaria and al., 1995)



The main results from the questionnaire test, conducted with 280 MBA students, showed, on the one hand, the positive influences of individual, organizational, and technological characteristics on perceived usefulness and perceived ease of use, and on the other hand, the influence of the latter on perceived usefulness and perceived usage.

Still referring to Davis's original model, Igbaria and Livari (1995) developed a conceptual model on computer usage (Figure 3). They introduced the variable of "**Self-efficacy**" into their model. This variable is impacted by two other variables: "**Experience**" and "**Organizational Support**". They also emphasized other variables: **anxiety**, **perceived usefulness**, **perceived ease of use**, and **system usage**.

Figure 3: Computer Use Model (Igbaria and Iivari, 1995)



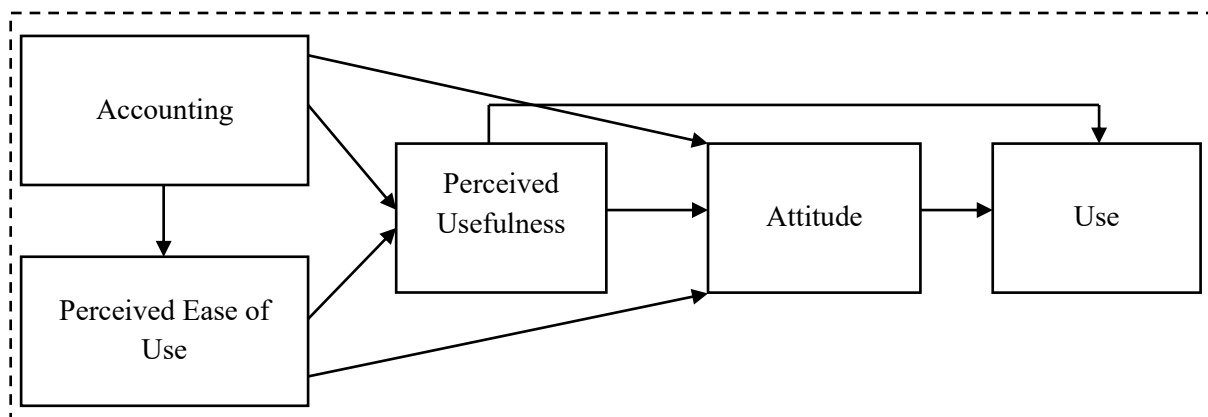
To operationalize their model, 806 users from 81 companies were surveyed using a questionnaire. Among the administered questionnaires, only 450 were completed.

According to the results of their research, system usage is influenced by perceived usefulness, and through this, perceived ease of use influences system usage. Furthermore, self-efficacy has a direct effect on both anxiety, perceived ease of use, and usage, highlighting its importance in the decision to use computers. These results also showed that self-efficacy has a direct impact on perceived ease of use and an indirect impact on perceived usefulness through perceived ease of use. Additionally, self-efficacy, influenced by experience and organizational support, has a direct effect on anxiety, which in turn influences perceived ease of use and perceived usefulness.

In 1998, Agarwal and Karahanna drew from Rogers' (1995) work on the diffusion of innovation theory to integrate a new variable into TAM called "**Compatibility**" (Figure 4). This variable has a significant impact on IT usage.

To operationalize the variables in their model, these authors distributed a questionnaire to 76 students who were users of Web technology. The results of this research revealed the indirect influence of compatibility on Web usage through perceived usefulness, perceived ease of use, or attitude.

Figure 4: Acceptance Model (Agarwal and Karahanna, 1998)



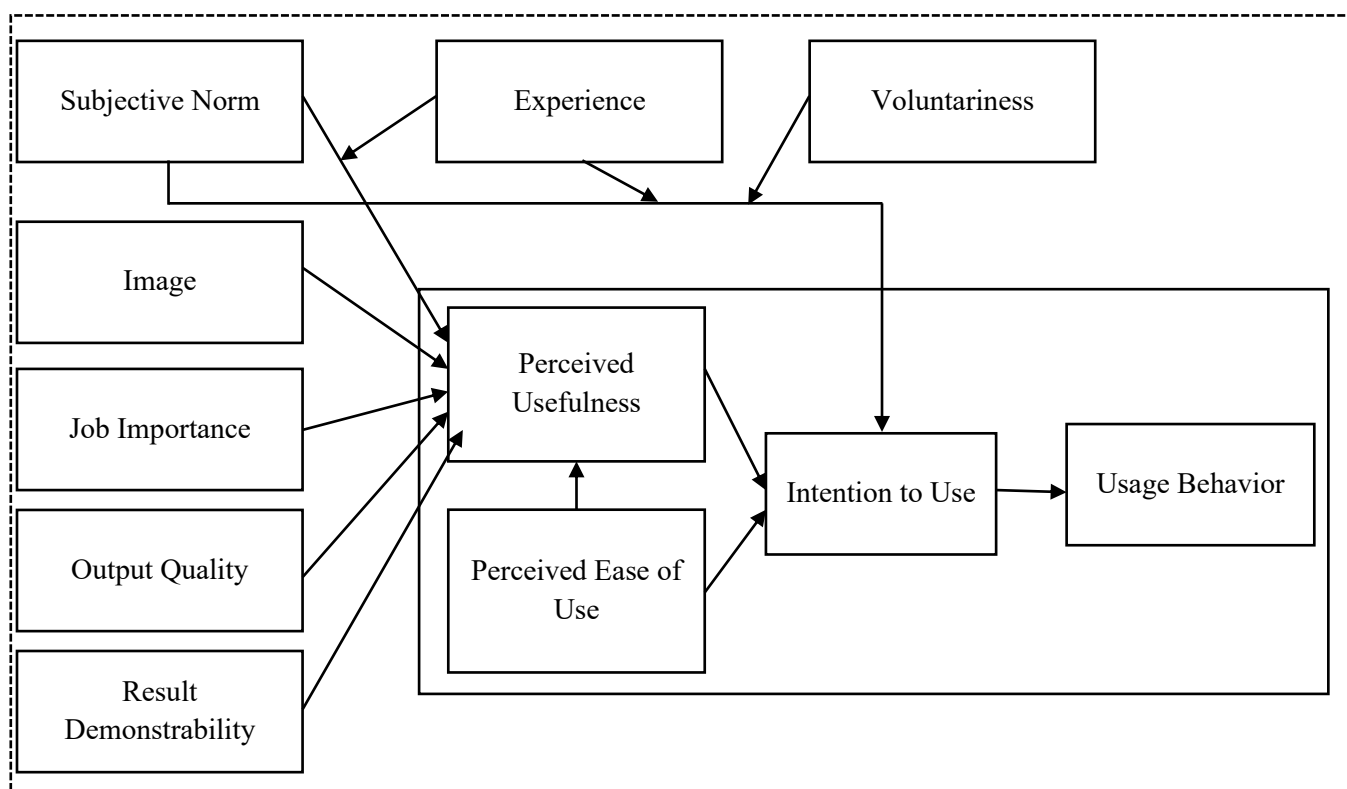
Evolution of the TAM Acceptance Model (2000, 2024)

In 2000, Venkatesh and Davis developed a model that extends the original TAM model (Davis, 1989). This model (Figure 5), called TAM2, predicts the intention to use IT/IS. It incorporates additional theoretical constructs derived from the social influence process (subjective norm, voluntariness, and image) and the cognitive instrumental process (work importance, output quality, and demonstrability of results). All these constructs are considered variables integrated into this extended model, which impact perceived use. Additionally, the variables of self-efficacy and external control directly impact perceived usefulness.

Using a longitudinal study in four company cases, a questionnaire was distributed to different types of users. After analyzing 156 completed questionnaires, the results revealed that:

- In the case of mandatory systems, subjective norms have a direct and significant effect on the intention to use, and an indirect effect through perceived usefulness;
- The direct influence of work importance and output quality on perceived usefulness;
- The weight of user experience in influencing all explanatory variables;
- A strong significance of the two variables: perceived usefulness and ease of use in applying the TAM2 model.

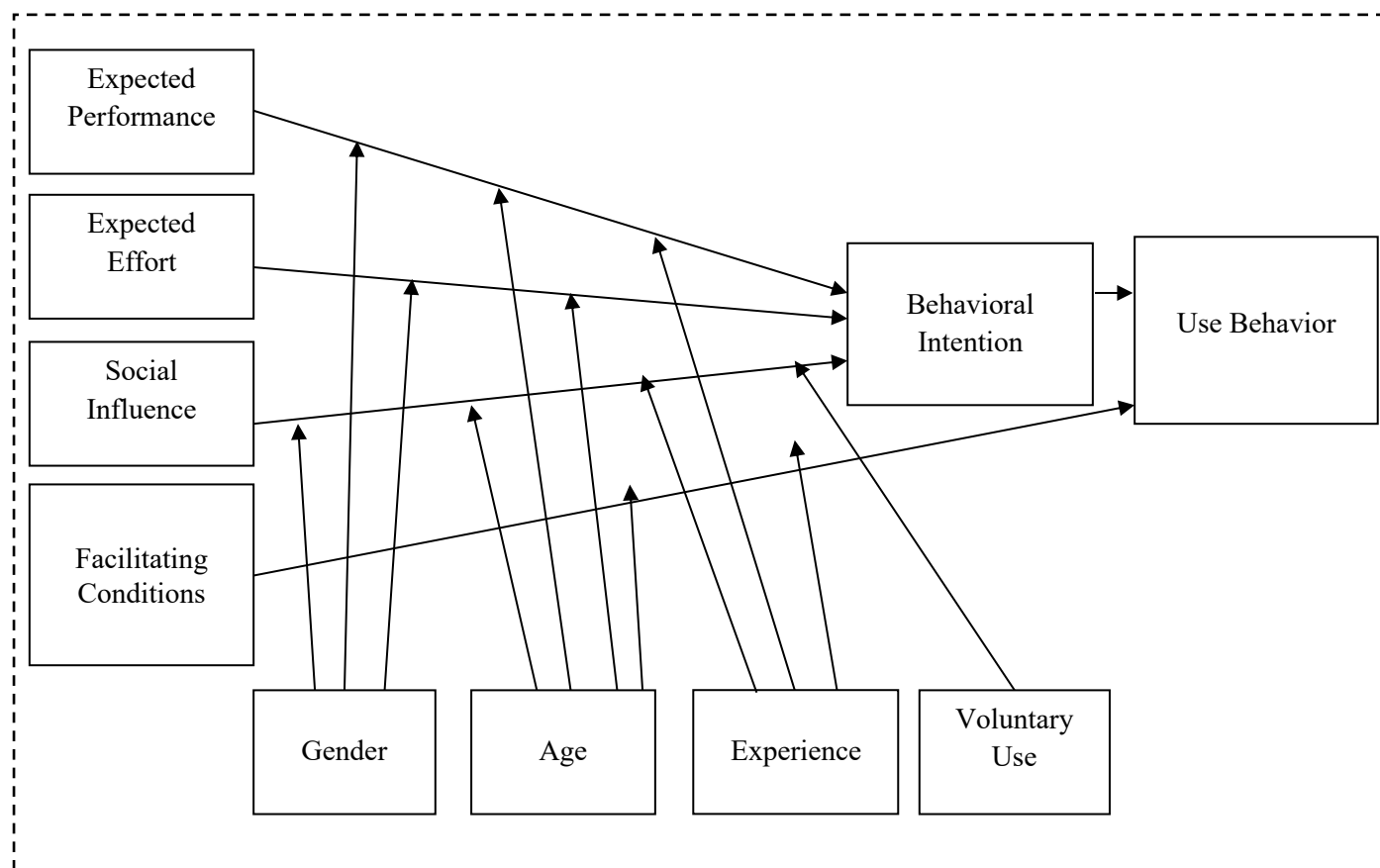
Figure 5: Extended Technology Acceptance Model, TAM 2 (Venkatesh and Davis, 2000)



In 2003, Venkatesh and his collaborators examined eight models for predicting IT usage (Technology Acceptance Model, Theory of Reasoned Action, Motivation Model, Personal Computer Usage Model, Theory of Planned Behavior, a combined model of TAM and Theory of Planned Behavior, Diffusion of Innovation Theory, and Social Cognitive Theory). These authors unified the insights from these eight models and developed the **Unified Theory of Acceptance and Use of Technology (UTAUT)** (Figure 6). This model was tested in four organizations incorporating new IT users. It explains 70% of the variance in acceptability among these users (Venkatesh and al., 2003).

The test results show three direct effects: expected performance, expected effort, and social influence on the intention to use IT. They also reveal two direct effects: the intention to use and facilitating conditions on usage behavior. Furthermore, four moderating variables—gender, age, experience, and voluntary usage—were integrated to assess their impact on the explanatory variables.

Figure 6: Unified Theory of Acceptance and Use of Technology (UTAUT) Model (Venkatesh and al., 2003)

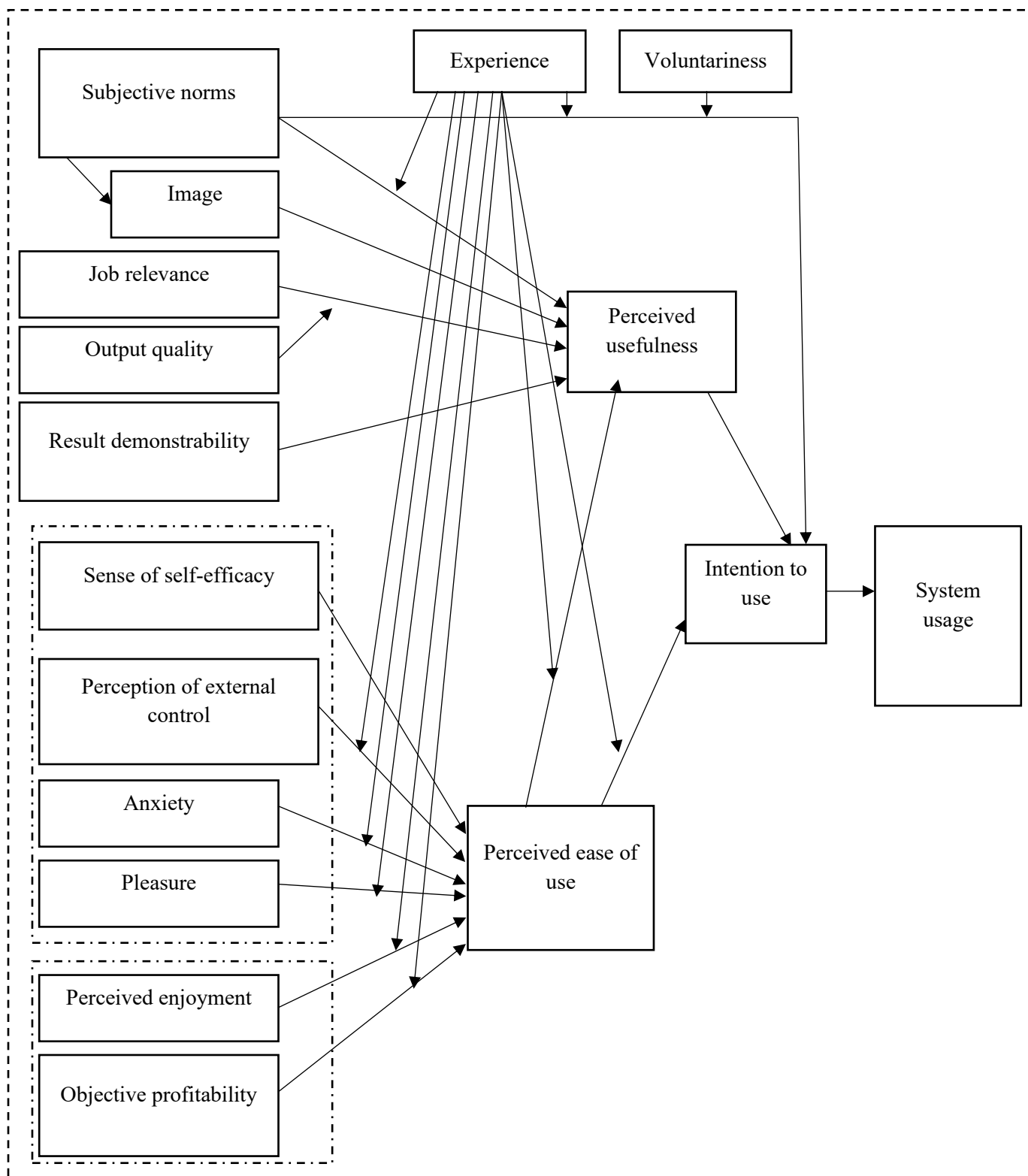


Similarly, these results confirmed that the impact of the expected performance variable on the intention to use varies depending on the gender and age of the user. This expected performance is more significant for men and younger users. The intention to use variable is positively influenced by older employees (age) and women (gender). It is also negatively influenced by the experience variable.

In the same vein, Venkatesh and Bala (2008) sought to understand how managers make relevant decisions that enable high acceptance and effective use of IT. To analyze the pre-implementation and post-implementation phases, these authors developed a model called TAM3 (Figure 7). This model offers a new synthesis and greater detail of the explanatory variables, as well as a grouping of the moderating variables' influence into two concepts: experience and voluntary usage (Venkatesh and al., 2016). It also seeks to show three links that were not empirically evaluated in the TAM2 model by Venkatesh and Davis (2000). These three links reside at the level of the experience variable, which moderates the relationships between: perceived usefulness and perceived ease of use; anxiety and perceived ease of use; behavioral intention and perceived ease of use.

To test this model, the authors distributed questionnaires using a longitudinal study approach to IT users in four organizations across different sites. The study lasted for a period of five months. The results of this study highlight the crucial role of the perceived usefulness and perceived ease of use variables. They also reveal that the determinants influencing perceived usefulness are not the same as those influencing perceived ease of use, and vice versa. Venkatesh and Bala (2008) emphasized, through the results, that the effect of perceived ease of use on behavioral intention is diminished, unlike the effect of perceived usefulness, and the effect of perceived ease of use on perceived usefulness is increased.

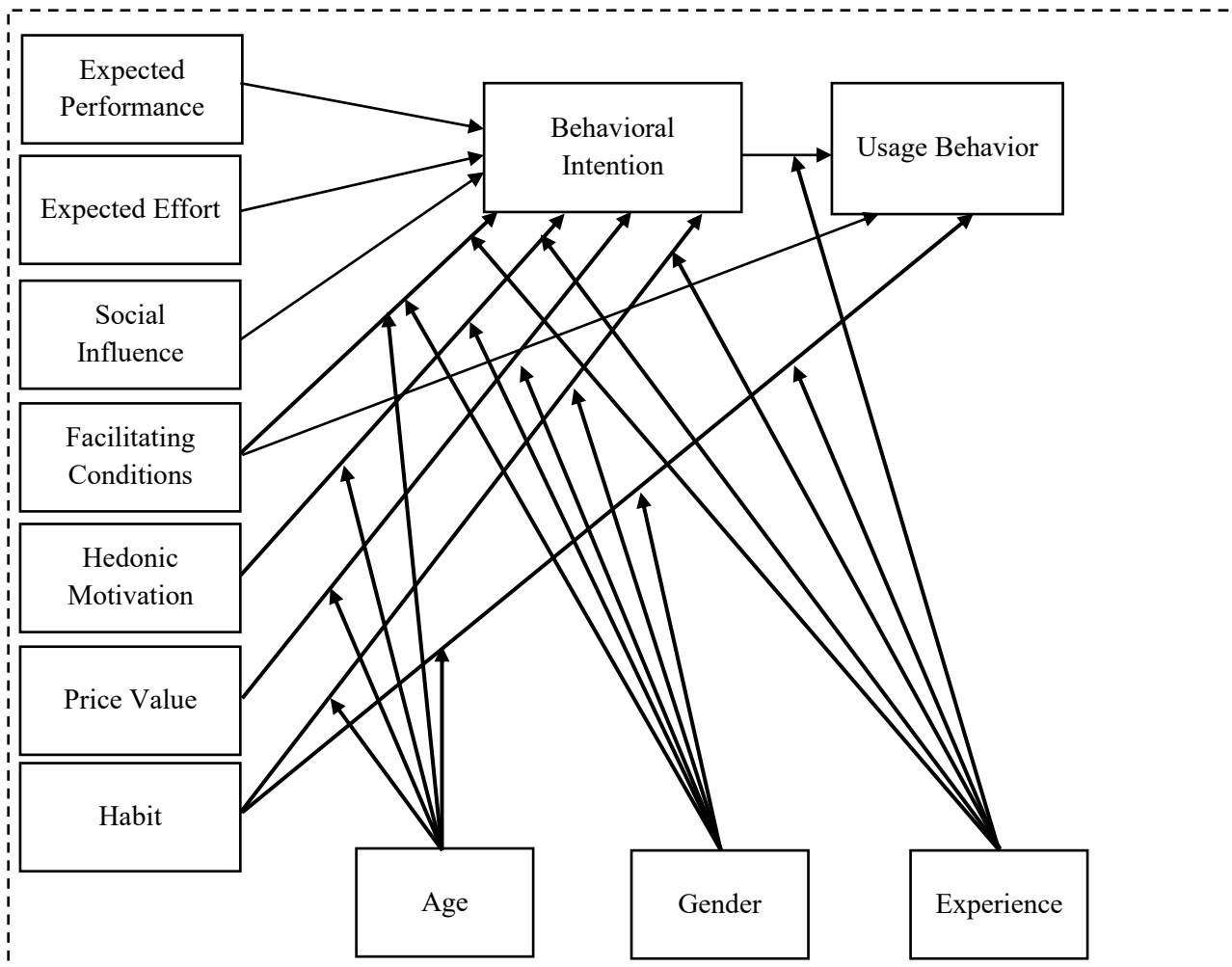
Figure 7: Extended Technology Acceptance Model, TAM 3(Venkatesh and Bala, 2008)



In 2012, Venkatesh and his colleagues developed a second version of UTAUT to study the acceptance and use of IT in the context of individual consumption. The UTAUT 2 model (Figure 8) contains seven explanatory variables and three moderating variables.

The principle of UTAUT 2 is based on the recommendations of Johns (2006), who suggests that specific contexts can lead to changes in existing theories in various ways.

Figure 8: Unified Theory Model ‘UTAUT’ 2 (Venkatesh et al., 2012)



Venkatesh and his colleagues (2012) introduced three new indicators:

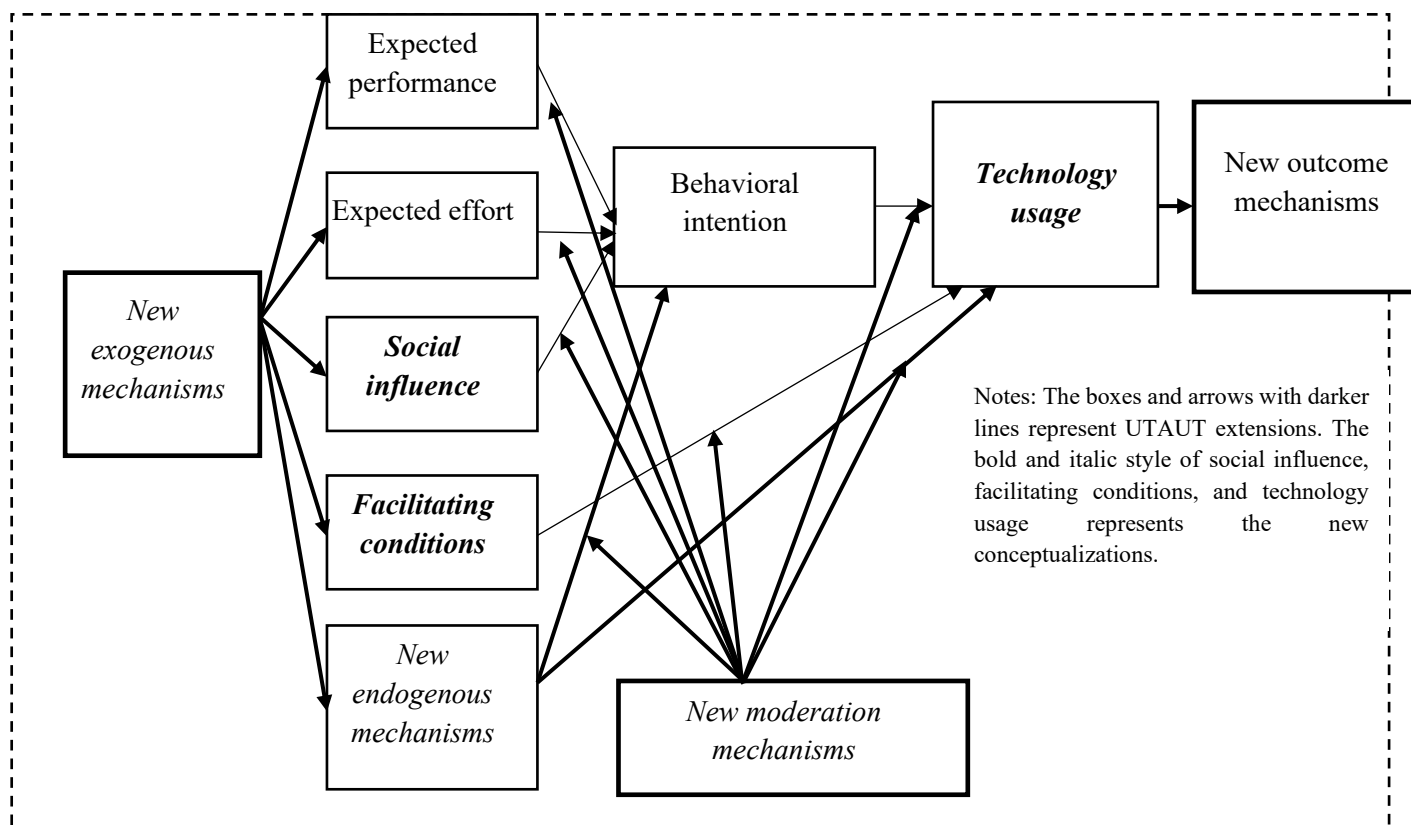
- Hedonic motivation: This concept is defined as "the pleasure or joy derived from using a technology" (p. 161).
- Price value: It is "the cognitive value of users (a trade-off between the perceived benefits of the technology and the monetary cost of using the systems)" (p. 161).
- Habit: "The extent to which people tend to automatically adopt behaviors due to learning" (p. 161).

Furthermore, the moderating variable "voluntary use" was removed in UTAUT2 because, unlike work contexts where the degree of voluntary use of a system may vary, use is entirely voluntary in consumption environments.

In 2016, Venkatesh and his colleagues published an article summarizing their model and suggesting paths for its development. These authors developed a multi-level framework for the acceptance and use of IT, where they reorganized both the UTAUT and UTAUT2 models. They added two additional layers to their model (Figure 9) (Venkatesh and al., 2016, p. 346-347):

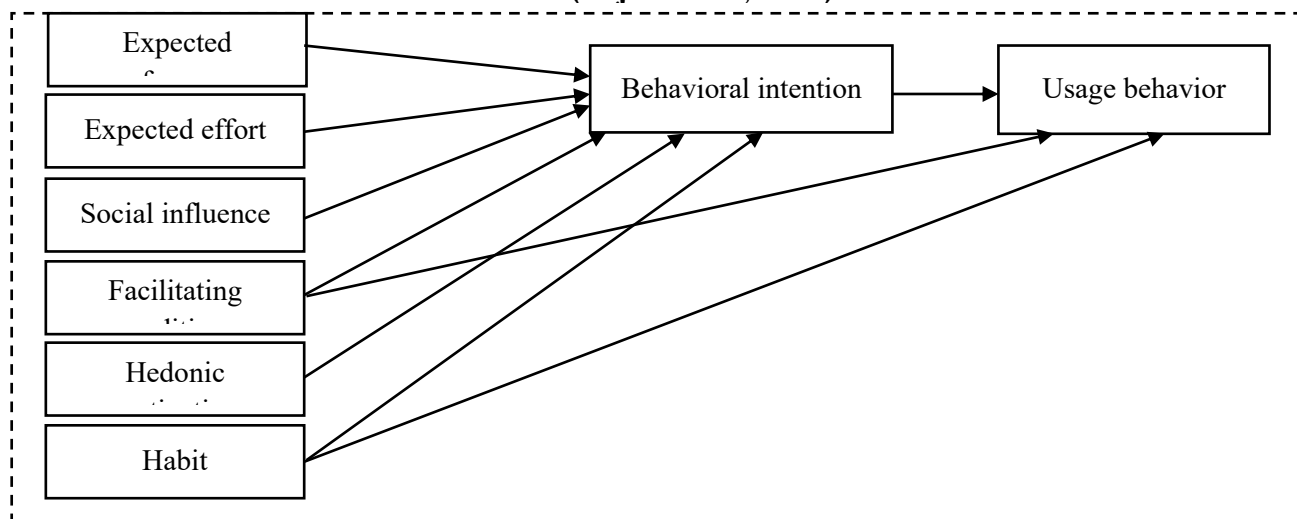
- High-level contextual factors: These consist of environmental characteristics (e.g., physical environment), organizational characteristics (e.g., organizational culture), and local characteristics (e.g., local competition).
- Individual-level contextual factors: This includes user characteristics (e.g., age, gender, experience), technologies, tasks, and events.

Figure 9: Unified Theory of Acceptance and Use of Technology ‘UTAUT3’ Model (Venkatesh and al., 2016)



In a banking context, Fajar and his colleagues (2018) tested the UTAUT model of Venkatesh and al. (2012) to determine the factors that encourage the use of a Visual Electronic Banking System (VEBS) application (a customer complaint processing application) in an Asian central bank. After the qualitative analysis of interviews with application users, these authors did not consider sociodemographic variables (since the use of this application is mandatory) and the price value variable. The results of the model test (Figure 10) show that the variables that most influence the use of VEBS are: facilitator conditions (the degree of user trust in the availability of the infrastructure supporting the use of the system); expected performance (the extent to which the application can provide benefits from its use); and behavioral intention (the level of user engagement with the application).

Figure 10: UTAUT Model for Evaluating the VEBS Application (Fajr and al., 2018)

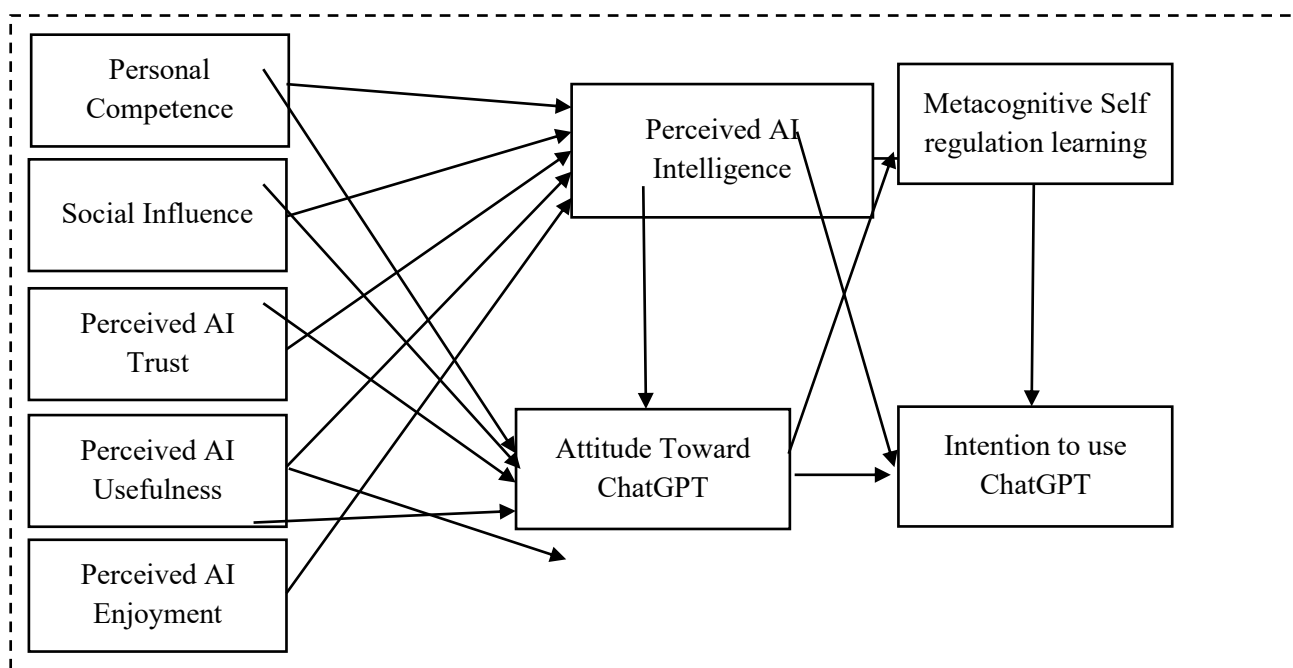


In the context of growing artificial intelligence integration in education, Dahri et al. (2024) conducted a study examining the adoption of ChatGPT, as illustrated in Figure 11, as a tool for metacognitive self-regulated learning (SRL) in educational settings, using an extended version of the Technology Acceptance Model (TAM). Their findings reveal that ChatGPT is perceived as an effective instrument to support self-regulated learning processes, particularly in facilitating task planning, progress monitoring, and knowledge self-assessment. These benefits are largely attributed to the tool's user-friendly interface and interactive features. 9

However, the study also highlights several significant challenges. Primary concerns include the reliability of generated responses, with risks of inaccuracies or hallucinations, as well as ethical issues related to its use, such as potential cheating or plagiarism. Furthermore, the authors emphasize the danger of excessive technological dependence, which could impair the development of fundamental cognitive skills in learners.

Despite these limitations, the researchers conclude that ChatGPT holds significant potential to enhance educational practices, provided its integration is accompanied by appropriate measures. They specifically recommend implementing training programs for teachers and students, establishing clear guidelines for responsible use, and technical improvements to enhance response accuracy and transparency. Finally, the study validates the utility of the extended TAM model as a theoretical framework for understanding factors influencing the adoption of AI-based educational technologies.

Figure 11: Extended TAM based acceptance of AI-Powered ChatGPT for supporting metacognitive self-regulated learning in education (Dahri and al., 2024)



In summary, the TAM models provide relevant answers to the question of technology acceptance and use. However, they have certain limitations:

- A challenge to the choice of the variable "use" as a substitute measure for the success of IS (Gelderman, 1998). This author shows that the amount of IS use does not reflect its success. On the contrary, it may be an indicator of dysfunction. He also adds that the use of an IS may benefit the users at the expense of the organization's performance.
- Users may develop positive attitudes toward the system (IT acceptance), but these attitudes may not lead to the desired outcomes for the organization (Venkatesh and Bala, 2008).
- The simplicity of TAM models makes their practical application difficult. One may ask that the implemented technology should be accepted by users and easy to use. But the question arises: how can this technology be made useful and easy to use?

- Finally, one of the main drawbacks of TAM models is that they have been applied to very broad tasks. However, many studies show that the perception of technology varies according to tasks (Goodhue, 1995).

The acceptance of IT remains a concept that requires further exploration and refinement at the conceptual level. Moreover, the intention or behavior of IT use, in a context where the use is mandatory, poses a problem. Therefore, an incentive for a better match between tasks and technologies is needed. This incentive can increase IT acceptance by users (Venkatesh and al., 2008). Goodhue and Thompson (1995) were the first to address this issue by conceptualizing a Task-Technology Fit (TTF) model.

CONCLUSION

The Technology Acceptance Model and its derivatives have profoundly shaped the understanding of IT adoption and usage. From the foundational constructs proposed by Davis to the multi-faceted frameworks like UTAUT, TAM's evolution underscores the need for continuous adaptation to address emerging technologies and user behaviors. Despite its widespread applicability, the model faces critiques related to its simplicity and over-reliance on intention and use as success indicators. Future research should emphasize task-technology alignment, contextual customization, and the integration of novel variables to enhance predictive accuracy and practical relevance. TAM's journey illustrates not only the dynamic nature of technology adoption but also the enduring quest for models that bridge theoretical insights and real-world applications.

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