

Organizational and human factors influencing the acceptance of technologies in supply chains: Conceptual framework

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Disclosure Statement :	The authors declare that they have not received any financial support that could have influenced the objectivity of this study. They take full responsibility for any potential plagiarism, the use of artificial intelligence in the writing process, as well as for the results presented in this article.
Conflict of Interest :	The authors report no conflicts of interest.
Cite this article :	MIRKOU, L., & KADA, A. (2025). Organizational and human factors influencing the acceptance of technologies in supply chains: Conceptual framework. <i>International Journal of Accounting, Finance, Auditing, Management and Economics</i> , 6(11), 524–540. https://doi.org/10.5281/zenodo.17458646
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Received: 11/08/2025

Accepted: 25/10/2025

International Journal of Accounting, Finance, Auditing, Management and Economics - IJAFAME

ISSN: 2658-8455

Volume 6, Issue 11 (2025)

Organizational and human factors influencing the acceptance of technologies in supply chains: Conceptual framework.

Abstract:

Contemporary supply chains are increasingly confronted with the necessity to adopt advanced technologies such as blockchain, the Internet of Things (IoT), and artificial intelligence in order to enhance efficiency, traceability, and sustainability. However, the success of these initiatives does not rely solely on the expected technical performance, but also on their acceptance by stakeholders, which is strongly influenced by organizational and human factors.

This conceptual article relies on a narrative approach to describe and critically analyze the main theoretical models of technology acceptance. Drawing primarily on the Technology Acceptance Model (TAM) and its extensions, while also integrating alternative frameworks such as UTAUT and TOE, the study proposes an integrative conceptual framework that identifies the key enablers and barriers. These factors include perceived usefulness, ease of use, managerial support, training, and resistance to change.

By synthesizing insights from recent literature and adopting a critical stance toward existing models, this research contributes to a deeper understanding of the dynamics of technological adoption in supply chains. Theoretically, it clarifies the complementarities and limitations of current approaches. Practically, it provides managers with guidelines to anticipate organizational and human obstacles and to foster the successful integration of digital innovations.

Keywords: technology acceptance, TAM, UTAUT, TOE, organizational factors, human factors, adoption, supply chain.

Classification JEL : O33, L23, M15, O32, D8

Paper type: Theoretical Research

Résumé:

Les chaînes logistiques contemporaines sont de plus en plus confrontées à la nécessité d'adopter des technologies avancées telles que la blockchain, l'Internet des objets (IoT) et l'intelligence artificielle, afin d'améliorer l'efficacité, la traçabilité et la durabilité. Toutefois, le succès de ces initiatives ne dépend pas uniquement des performances techniques attendues, mais surtout de leur acceptation par les parties prenantes, laquelle est fortement influencée par des facteurs organisationnels et humains.

Décrire et analyser, de manière critique, les modèles théoriques de l'acceptation des technologies, sont le but de l'approche narrative de cet article conceptuel. En mobilisant principalement le Modèle d'Acceptation de la Technologie (TAM) et ses extensions, et aussi des cadres alternatifs tels que l'UTAUT et le TOE, l'étude propose un cadre conceptuel intégratif permettant d'identifier les principaux facilitateurs et freins. Parmi ces facteurs figurent l'utilité perçue, la facilité d'utilisation, le soutien managérial, la formation et la résistance au changement. En synthétisant les apports de la littérature récente et en adoptant une posture critique vis-à-vis des modèles existants, cette recherche contribue à une meilleure compréhension des dynamiques d'adoption technologique dans la chaîne logistique. Sur le plan théorique, elle clarifie les complémentarités et limites des approches actuelles. Sur le plan pratique, elle offre aux décideurs des orientations pour anticiper les obstacles humains et organisationnels et favoriser une intégration réussie des innovations numériques.

Mots-clés : acceptation des technologies, TAM, UTAUT, TOE, facteurs organisationnels, facteurs humains, adoption, chaîne logistique.

Classification JEL : O33, L23, M1, O32, D8

Type du papier : Recherche Théorique

1. Introduction

Today, in logistics processes, the integration of new technologies such as the Internet of Things (IoT), blockchain, and artificial intelligence is seen as a means of improving logistics performance, reducing costs, and optimizing traceability (Hofmann & Rüscher, 2017; Queiroz et al., 2020). Indeed, numerous studies highlight the concessional weight of costs and the significant contribution of these technologies to improving traceability, visibility, control of the logistics chain in terms of costs and quality, and optimal decision-making (Galvez et al., 2018; Zhao et al., 2020).

However, the success of these technological initiatives depends on their acceptance by the relevant stakeholders. Nevertheless, the adoption of these technologies depends not only on the theoretical benefits they promise, but also on the buy-in of stakeholders, whether internal (employees, managers) or external (customers, suppliers). (Venkatesh & Davis, 2000).

Adoption of technology is a complex process influenced by multiple organizational and human factors, such as organizational culture, user expertise, and industry-specific regulations (Rogers, 2003). According to the Technology Acceptance Model (TAM) developed by Davis (1989), acceptance of technologies depends heavily on ease of use and perceived usefulness.

Indeed, managerial support variables, such as the contextual variables represented in TAM2 and TAM3, can indirectly influence the acceptance of new technologies. This acceptance, in the supply chains, depends on many factors, particularly organizational and human factors, but it can only be achieved through a conceptual framework that organizes these elements into a model that identifies and analyzes relationships and explores the dynamics of acceptance in the sector. This is particularly interesting for understanding resistance to change, user skills, and the link between technology and logistics processes (Sterns & Schweikhardt, 2020; Venkatesh et al., 2003).

However, despite a large number of studies focusing on the economic and operational benefits of these technologies, the literature does not provide us with critical insights into the human and organizational determinants of their adoption. In fact, several studies merely justify the performance gains brought about by IoT, AI, or blockchain without examining the extent to which behavioral and managerial barriers to their dissemination can be prohibitive (Ben-Daya et al., 2019; Wamba & Queiroz, 2020). Others stick to the purely technical dimension of adoption, effectively leaving the human dimension in the background.

Furthermore, no research critically questions the relevance of established theoretical models. While TAM is now a classic reference, it is not always able to address the complexity of technology acceptance and adoption in contemporary organizations (Venkatesh et al., 2012). The Unified Theory of Acceptance and Use of Technology (UTAUT) model, proposed by Venkatesh et al. (2003), while expanding on the classic TAM model by incorporating various factors such as social influence and facilitating conditions, remains underutilized in the field of logistics. Similarly, the TOE (Technology-Organization-Environment) model (Tornatzky & Fleischer, 1990) offers a broader perspective by considering organizational and environmental aspects, but it is rarely combined with the TAM or UTAUT models. The lack of mixing between theories is a real shortcoming.

Furthermore, few studies address the evolution of acceptance over time, preferring to stick to the initial intention to use rather than actual usage, or even continuation and routinization over time. This temporal shortcoming leads to a reduced understanding of resistance, learning, and organizational adaptations, which are nothing less than the conditions for the success of technological projects (Gupta et al., 2022). In addition, most of the empirical contributions are based on very specific contexts, which limits their scope.

Therefore, a comprehensive and committed reflection is needed. According to some viewpoints, TAM is sufficient and relevant to explain implementation (Davis, 1989), while others believe

it is important to recognize its limitations, particularly because it does not take into account the complexity of organizations and their environment (Venkatesh et al., 2012; Wamba et al., 2018). This highlights the importance of using a combined approach that draws on the best and worst of both models to better understand the dynamics of supply chain technologies in our globalized world. This article aims to fill that gap.

Therefore, the central question is: what are the human and organizational factors influencing the acceptance of new technologies within the supply chain?

In the first part, this article provides an in-depth literature review of models and theories explaining technology acceptance, focusing in particular on Davis' Technology Acceptance Model (TAM) (1989) and its ability to explain the human and organizational factors that determine the adoption of technologies within the supply chain (Choi & Kim, 2021). The review also addresses the advantages and challenges associated with this adoption, taking into account the specific characteristics and expectations of the various stakeholders involved (Dupont & Martin, 2021).

Furthermore, this article is based on the need to take a step back from alternative models such as UTAUT (Venkatesh et al., 2003) and TOE (Tornatzky & Fleischer, 1990), which, without being used together, shed light on the issue from different angles. Comparing these models allows us to go beyond the limitations of an approach focused exclusively on TAM and propose a more general model, within which we can identify features common to the research tradition model. In this way, we are also taking an approach that draws on real-world situations, which could form the culmination of our study through future qualitative research.

In the second part, the article builds a conceptual framework integrating the key variables identified, including managerial support, perceived usefulness, resistance to change, training and development, and perceived ease of use. Drawing on the contributions of TAM, this theoretical framework aims to organize the relationships between these variables in order to better understand the determinants of technology acceptance (Lopez & Garcia, 2019). The following discussion explores the managerial implications of this model for organizations and the guidance it offers them to promote the acceptance of new technologies and ensure their successful adoption.

2. Littérature review and conceptual research model

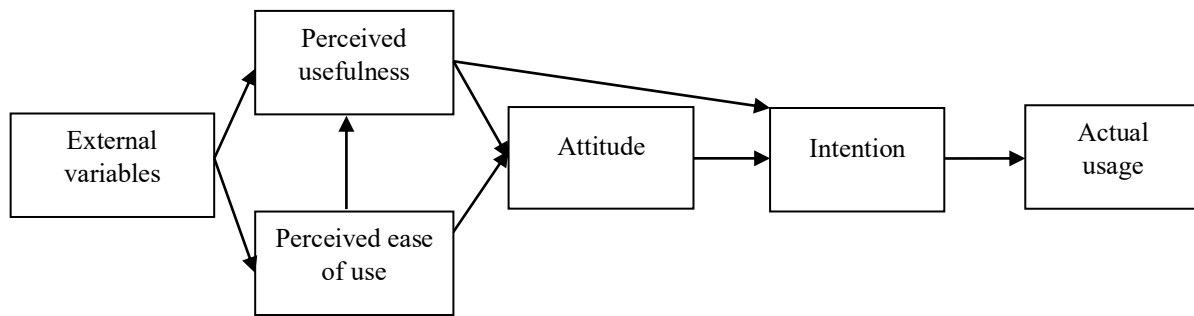
This article is based on a conceptual framework that can provide a solid foundation for future research on the acceptance of new technologies in the supply chain.

2.1. The Technology Acceptance Model (TAM)

In order to explore and identify the factors that may influence this process, we will draw on the various modules of the TAM. This theoretical model (technology acceptance model) is a modeled evolution of the theory of reasoned action (Fishbein, AJZEN, 1975).

This model was first proposed by Davis (1989) to account for the factors that determine users' acceptance of new technologies. The TAM is based on two key concepts: perceived usefulness and perceived ease of use. Perceived usefulness can be defined as "the degree to which an individual believes that using a specific technology will improve their performance" (Davis, 1989). Perceived ease of use corresponds to "the perception that a particular technology does not require effort" (Davis, 1989). These two factors therefore combine to form the attitude of users, which is itself a determining factor in the intention to use a technology, which in turn determines actual behavior (Venkatesh & Davis, 2000). Figure 1 presents the TAM model.

Figure 1: TAM conceptual framework (Davis, 1989)



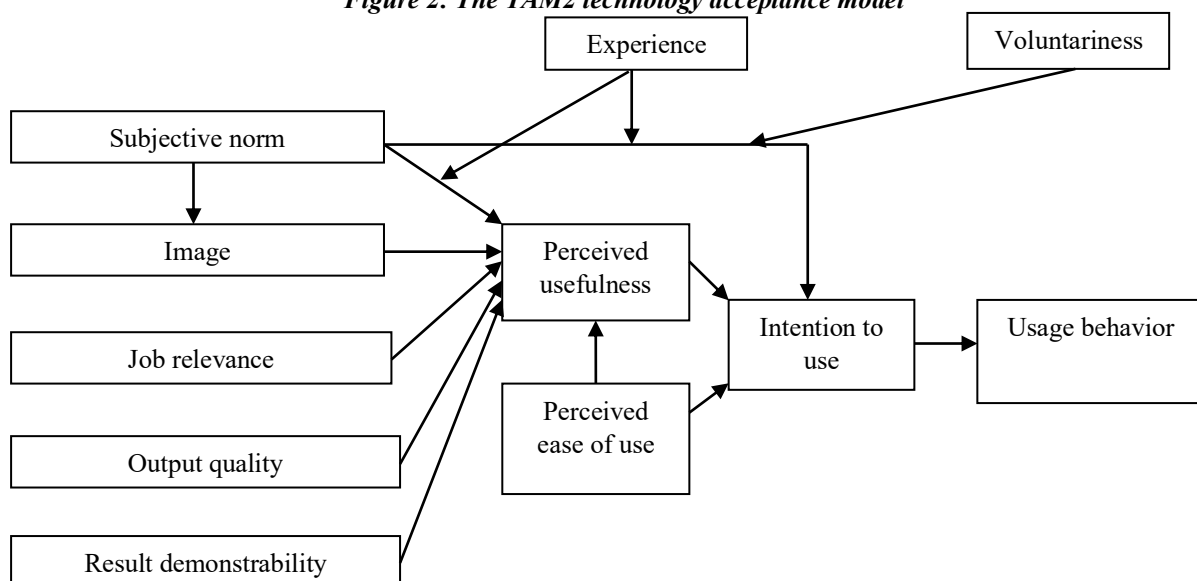
Source: “The Theoretical Extension of the Technology Acceptance Model” (Venkatesh and Davis, 2000)

The Technology Acceptance Model (TAM) has been used in various disciplines to analyze technology acceptance, including computer science, education, and supply chain management (King & He, 2006). However, it has been criticized for not sufficiently taking into account contextual and social factors that can have a significant impact on technology adoption (Lee, Kozar & Larsen, 2003).

2.2. TAM 2: Extension of TAM

To overcome the limitations of the initial model, Venkatesh and Davis (2000) developed TAM 2, an extension in which they incorporated additional variables influencing perceived usefulness, including subjective norms, information quality, and image. Subjective norms refer to perceived social influence, i.e., “the degree to which an individual perceives that others who are important to them think they should use the new technology” (Venkatesh & Davis, 2000). The image variable (see Figure 2) refers to how the adoption of technology impacts the user's professional esteem, highlighting the importance of social recognition in the organizational context of the workplace when adopting a technology (Venkatesh & Davis, 2000). The user experience, whether positive or negative, and the quality of information are also key determinants of perceived usefulness in predicting the intention to use the technology (Venkatesh & Davis, 2000). These additions make TAM 2 particularly relevant in environments where social influence or the quality of information can become a decisive factor in the acceptance of technologies.

Figure 2: The TAM2 technology acceptance model



Source: “The Theoretical Extension of the Technology Acceptance Model” (Venkatesh and Davis, 2000)

The research reported here also provided insight into the determinants of perceived usefulness: user experience and information quality, thereby improving the prediction of intention to use the technology (Venkatesh & Davis, 2000). These additions will increase the relevance of TAM 2 to more complex environments, applying more to situations where information and social influence are critical to technology acceptance.

2.3. TAM 3: A greater understanding of acceptance

In 2008, Venkatesh and Bala proposed a new variant of the model, incorporating a more holistic approach and additional contextual variables. TAM 3 adopts additional determinants of perceived ease of use, including: compatibility, complexity, observability, and the importance of training (Venkatesh & Bala, 2008). Compatibility is “the degree to which a technology is perceived to be consistent with the values and needs of users” (Venkatesh & Bala, 2008). Complexity measures the degree of perceived difficulty in using the technology, which negatively impacts perceived ease of use.

TAM 3 also incorporates variables related to user learning and their path to increasing experience with technology, so the role of training and skills development is to facilitate the adoption of the device and the perception of ease of use (Venkatesh & Bala, 2008). This is a redesigned version of the model that allows for the analysis of technology acceptance in more complex environments, such as highly digital organizational contexts.

2.4. Discussion points concerning the application of TAM models in the supply chain

In the context of the supply chain, the use of multiple TAM models provides an interesting framework for analyzing the determinants of new technology acceptance by supply chain actors (Zhou et al., 2020). TAM allows us to analyze the impact of perceived usefulness and ease of use. TAM 2 combines important social and informational components in an environment where peers and leaders exert a strong influence, and TAM 3 allows us to study the impact of technological compatibility or training, or perceived complexity on the acceptance of digital innovations in logistics (Singh et al., 2021).

Therefore, TAM appears to be relevant for addressing this topic, as can be seen in Table 1, by analyzing the effects of organizational factors (managerial support, resistance to change, and perceived usefulness) and human factors (training and development, perceived complexity) on the acceptance of new technologies in order to ensure their successful adoption, which will thus constitute the dependent variable of a study.

Table 1: Examples of TAM Model Applications in Technology Acceptance Studies

Authors	TAM Version	Technologies	Factors Used	Countries
Davis (1989)	TAM	ERP systems	Perceived ease of use, perceived usefulness	United States
Venkatesh & Davis (2000)	TAM2	IoT tools for traceability	Social norms, technology compatibility	India
Venkatesh & Bala (2008)	TAM3	Blockchain for food traceability	Psychological barriers (resistance), perceived facilitators	China
Kumar et al. (2019)	TAM2	Cold chain monitoring systems	Compatibility, cognitive processes	Australia
Mou et al. (2021)	TAM3	AI applications for inventory forecasting	Training, Training, anxiety about technology	Canada
Zhang et al. (2022)	TAM3	Drones for agricultural monitoring	Facilitating conditions (resources, technical support)	Brazil

Source: Authors

However, while TAM remains an essential reference point, several authors point out that its limitations have led to the development of alternative models that incorporate broader

dimensions. Among these models, UTAUT and TOE appear to be two major theoretical frameworks, allowing us to move beyond TAM's focus on the individual and broaden the analysis to include social, organizational, and environmental factors.

2.5. Presentation of UTAUT and TOE

2.5.1. Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT model, proposed by Venkatesh et al. (2003), is an attempt to unify the main existing models of technology acceptance, including TAM, Theory of Reasoned Action (TRA), and Theory of Planned Behavior (TPB). This model identifies four key determinants: performance expectancy, effort expectancy, social influence, and facilitating conditions, which explain the intention and behavior of using a technology.

UTAUT stands out for its superior predictive power compared to TAM and its ability to integrate social and organizational factors. However, its complexity and the need for contextual adaptations sometimes limit its practical applicability.

While UTAUT enriches the analysis by incorporating social influence and facilitating conditions at the individual and collective levels, TOE takes a more comprehensive perspective by including organizational and environmental dimensions. These two models are therefore complementary, offering a more holistic view of technology adoption.

2.5.2. Technology–Organization–Environment (TOE) Framework

The TOE model, introduced by Tornatzky and Fleischer (1990), is based on the idea that technology adoption is influenced by three main dimensions: technological characteristics (e.g., compatibility, perceived benefits), organizational characteristics (e.g., size, resources, structure), and environmental factors (e.g., competitive pressure, regulation).

Its strength lies in its holistic approach, which goes beyond the individual level to include the overall context of adoption. However, its very general nature and the lack of consensus on the operational variables to be measured may limit its empirical accuracy.

2.6. Critical analysis of models

The Technology Acceptance Model (TAM), proposed by Davis (1989), is one of the most widely used theoretical frameworks for studying the acceptance of technological innovations. Its main contribution lies in highlighting two key variables, perceived usefulness and ease of use, which provide a robust explanation for the intention to adopt a technology.

However, several limitations have been highlighted in the literature. First, TAM adopts an individual-centered approach and does not sufficiently take into account organizational, cultural, and environmental dimensions (Ben-Daya et al., 2019; Wamba & Queiroz, 2020). Second, its predictive power has sometimes been deemed too general, which reduces its ability to explain contextual specificities.

Table 2: The following table illustrates the strengths and weaknesses of each TAM model.

Model	Strengths	Limitations	Critical summary / Recommendations
TAM (Davis, 1989)	-Simplicity and clarity of the model. -Two robust variables: perceived utility & ease of use. -Empirically validated in numerous contexts (education,	-Too focused on the individual. -Neglects organizational, social, and environmental dimensions. -Excessive reduction of	The TAM is an essential reference framework thanks to its simplicity and empirical robustness. However, it must be used with caution and supplemented by contextual variables (managerial support, training, resistance to change) to better understand the real complexity of technology adoption.

	healthcare, logistics, etc.).	acceptance to two main variables.	
TAM2 (Venkatesh & Davis, 2000)	-Adds social influence and facilitating conditions. -Improves the explanatory power of TAM.	- Increasing complexity. - Limited empirical validation in certain logistical contexts.	TAM2 enriches the analysis by incorporating social factors but remains insufficient to explain overall organizational dynamics.
TAM3 (Venkatesh & Bala, 2008)	-Incorporates cognitive and emotional history (ex. experience, computer anxiety). -More comprehensive approach.	-Lack of concrete applications in supply chains. -Model more difficult to implement.	TAM3 represents a promising extension but still suffers from a lack of empirical applications. It needs to be tested in complex organizational environments.

Source: Authors

To overcome these limitations, extensions such as TAM2 (Venkatesh & Davis, 2000) and TAM3 (Venkatesh & Bala, 2008) have incorporated new variables, including social influence and enabling conditions. Nevertheless, these expanded versions continue to be criticized for their increasing complexity and lack of empirical validation in certain logistical contexts.

The UTAUT model (Venkatesh et al., 2003) offers a more integrative approach by combining several theoretical frameworks and adding explanatory variables such as performance expectancy, effort expectancy, social influence, and facilitating conditions. While it offers greater predictive power than TAM, it is still criticized for its limited consideration of factors related to resistance to change or user training.

Finally, the TOE model (Tornatzky & Fleischer, 1990) enriches the analysis by considering technological, organizational, and environmental dimensions. Its strength lies in its ability to go beyond the individual level to integrate contextual determinants. However, it is often considered too general and requires significant adjustments to be operationalized in empirical studies. This table clarifies the strengths and limitations of the UTAUT and TOE models.

Table 3: the strengths and limitations of the UTAUT and TOE models

Model	Strengths	Limitations	Critical summary / Recommendations
UTAUT (Unified Theory of Acceptance and Use of Technology) (Venkatesh et al., 2003)	- Integrates several previous models (TAM, TRA, TPB). - Greater explanatory power than TAM. - Enhanced variables: performance expectancy, effort expectancy, social influence, facilitating conditions.	- Significant complexity, difficult model to implement. - Contextual factors (e.g., resistance to change, organizational culture) still insufficiently taken into account.	UTAUT offers a more integrated understanding than TAM, but its complexity may limit its practical application. It is relevant for enriching analyses but must be adapted according to logistical contexts.
TOE (Technology–Organization–Environment) (Tornatzky & Fleischer, 1990)	- Holistic vision: includes technological, organizational, and environmental dimensions.	- Very general model, lack of precise operationalization.	The TOE provides valuable contextual perspective. However, its generic nature requires specific adaptations. It usefully complements TAM and UTAUT

	- Allows us to go beyond the individual level to integrate the global context.	- Difficulty in identifying universal measurable variables.	by offering a broader, multi-level approach.
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Source: Authors

In summary, none of these models alone can capture the full complexity of technology acceptance in supply chains. Their complementarity suggests the need for a hybrid approach, capable of articulating the contributions of TAM, UTAUT, and TOE, in order to better account for organizational and human dynamics.

3. Conceptual research model:

3.1. Choice of variables and research hypotheses

The Technology Acceptance Model (TAM), proposed by Davis in 1989, is one of the most relevant frameworks for understanding and anticipating the acceptance of new technologies. Initially, this model focused on analyzing the factors that influence the intention to use information technologies. It is based on two central variables: perceived usefulness and perceived ease of use. In this study, we enrich the model by incorporating additional variables specific to the supply chain. These variables include human aspects, such as training and development, as well as organizational dimensions such as managerial support and resistance to change, with the aim of better understanding the dynamics of acceptance of emerging technologies.

3.2. Origin and relevance of variables

According to Davis's work, perceived usefulness is a key variable in the Technology Acceptance Model (TAM). It refers to a user's perception of the effectiveness of a technology in improving their professional performance. In the supply chains, this concept is of major importance. Technologies such as inventory management systems and traceability tools aim to optimize processes and reduce inefficiencies. A high perception of their usefulness thus promotes their adoption, as users perceive concrete benefits (Venkatesh & Davis, 2000).

This concept is based on Fishbein and Ajzen's (1975) theory of reasoned action, which posits that beliefs about outcomes influence attitudes and behaviors.

Perceived ease of use is another essential component of TAM. It reflects the degree to which a user believes that a technology can be adopted without significant effort (Davis, 1989). This dimension is all the more crucial. An interface that is perceived as complex can hinder the acceptance of a technology, even if its usefulness is recognized (Venkatesh, 2000). This concept originates from cognitive theory, which suggests that individuals are more inclined to accept systems that they perceive as easy to learn and use (Bandura, 1986).

Furthermore, resistance to change is a major organizational obstacle, often cited as a barrier to the acceptance of new technologies (Kotter, 1996). It corresponds to the degree of opposition among employees to change, particularly when it involves innovation. Where traditional practices are deeply rooted, this reluctance can be exacerbated by uncertainty or fear of losing control (Oreg, 2003). This phenomenon can be explained by the theory of resistance to change (Lewin, 1951), which highlights the role of individual perceptions in the acceptance of organizational transitions.

3.2.1. Organizational factors

Managerial support plays a decisive role in the acceptance of new technologies by directly influencing users' perceptions, particularly in terms of perceived usefulness. According to theories of leadership and organizational change (Kotter, 1996), it is an essential motivational

lever. Effective management can reduce internal resistance and promote the integration of technologies into a supportive organizational framework. Perceived usefulness, a central dimension of TAM (Davis, 1989), should not be considered in isolation, but in conjunction with other factors such as training and managerial support, which reinforce the adoption of innovations.

On the other hand, resistance to change, initially absent from TAM, has been integrated in light of research on organizational change, notably that of Lewin (1947). It explains why some technological initiatives fail despite their apparent advantages. By taking psychological and emotional barriers into account, this conceptual framework refines the analysis of factors influencing the intention to accept and the actual use of new technologies.

3.2.2. Human factors

Training and skills development are key elements in improving the perception of ease of use, an essential factor in TAM. According to Argyris and Schön's (1978) work on organizational learning, acquiring new skills helps reduce both cognitive and technical barriers. This facilitates user engagement in adopting new technologies. This dimension is particularly relevant in supply chains where technological tools, which are often complex, require prior learning.

Finally, perceived ease of use remains a fundamental pillar of TAM. Its integration with other factors, such as training and managerial support, enriches the analysis of adoption intention by taking into account the actual conditions of technology implementation. This approach goes beyond a simple perceptual assessment to include the practical elements that influence their acceptance and effective use.

3.3. Consistency and justification of the model

The selection of variables studied is clearly based on a precise analysis of the needs of the supply chains and the adaptation of the TAM to this context. Human variables aim to reflect individual perceptions that generate acceptance of technologies, while organizational variables highlight the strategies and resources implemented by the company to facilitate this acceptance. These variables provide an enriched conceptual framework that offers a more comprehensive and nuanced analysis of the determinants of acceptance of new technologies by integrating individual and organizational dynamics.

3.3.1. Optimization of the Conceptual Framework with Expanded Variables

The integration of organizational variables, such as managerial support and resistance to change, as well as human variables, such as training and development, helps to address the shortcomings of TAM. This approach broadens the explanatory scope of the model. It provides essential contextualization, making this model more relevant for analyzing technology acceptance in complex environments, such as supply chains. The improved conceptual framework becomes not only more robust but also more adaptable to organizational realities, offering a better understanding of the mechanisms of technology acceptance and integration in the logistics context.

Table 4: Organizational and Human Factors

Category	Variable	Origin	Justification within the Conceptual Framework	Contribution to TAM
Organizational	Managerial Support	Organizational theories and	Direct influence on perceived usefulness and	Fills a gap by introducing the contextual influence of

		leadership (Kotter, 1996)	reduction of organizational barriers.	management on technology adoption.
	Perceived Usefulness	TAM Model (Davis, 1989)	Key variable related to logistics performance, directly influenced by other factors (e.g., support, training).	Strengthens adherence to the model by maintaining a central variable of intention to use.
	Resistance to Change	Theories of organizational change (Lewin, 1947; Kotter & Schlesinger, 1979)	Identifies behavioral and organizational barriers that hinder adoption.	Adds a behavioral dimension to TAM, which is absent in its original version.
Human factors	Training and development	Theories of organizational learning (Argyris & Schön, 1978)	Improves perceptions of ease of use and reduces cognitive barriers associated with new technologies.	Expands the model by explaining how to reinforce perceptions of ease of use through learning.
	Perceived ease of use	TAM model (Davis, 1989)	Central factors directly influence intention and perceived usefulness, linked to training and managerial initiatives.	Maintains the validity of the model while incorporating additional variables that reinforce its explanatory power.

Source: Authors

The adoption of new information processing technologies in an organizational setting depends on the acceptance of these technologies, which is based on a set of factors, both organizational and human, that influence the perception of their value and ease of use. From an organizational perspective, managerial support appears to be a key factor in promoting the integration of innovations and overcoming structural obstacles.

Based on leadership theories (Kotter, 1996), the importance of a managerial context conducive to reducing resistance to change is highlighted. Similarly, resistance to change, as theorized by Lewin (1947) and Kotter & Schlesinger (1979), is a prevalent behavioral barrier to technology adoption. These elements directly influence perceived usefulness, considered a prerequisite of the TAM model (Davis, 1989), which serves as an indicator of the added value brought about by the acceptance of advanced technologies.

In terms of human factors, training and development are the main levers for improving perceived ease of use. Based on organizational learning theories (Argyris & Schön, 1978), this dimension reduces cognitive barriers to new technologies and increases the intention to adopt them. From the perspective of the TAM model, this enrichment takes the form of integrating contextual and behavioral elements that are often absent from its basic version.

Based on these findings, it is essential to examine the assumptions underlying the integration of organizational and human factors in the adoption of technologies. The following table presents the hypotheses formulated, linking the variables studied and their respective influences on users' intention to adopt.

Based on Davis's (1989) Technology Acceptance Model (TAM) and related organizational theories, several hypotheses have been formulated to explain the impact of organizational and human factors on the acceptance of new technologies.

First, perceived usefulness is a determining factor in the technology acceptance process. According to hypothesis H₂, the higher the perceived usefulness of a technology, the easier it will be to accept. This assumption is in line with the work of Davis (1989), which emphasizes that the perception of increased efficiency directly influences the willingness to integrate new technology into a professional environment.

Table 5: Variables and assumptions

Variables	Original theories	Hypotheses
Managerial Support	TOE (Technology-Organization-Environment) model (Torntzky & Fleischer, 1990)	H₁: <i>Managerial support has a positive impact on employees' acceptance of new technologies.</i>
Perceived usefulness	TAM (Fred Davis, 1989)	H₂: <i>Perceived usefulness has a positive impact on the acceptance of new technologies.</i>
Resistance to change	Theory of resistance to change (Kurt Lewin, 1947)	H₃: <i>Resistance has a negative impact on the acceptance and integration of new technologies.</i>
Training and development	Organizational learning theory (Argyris Schön, 1978)	H₄: <i>The availability of training programs has a positive impact on the acceptance of new technologies.</i>
Perceived ease of use	TAM (Fred Davis, 1989)	H₅: <i>Perceived ease of use has a positive impact on the acceptance of new technologies.</i>

Source: Authors

Next, perceived ease of use plays a complementary role in reducing the complexity of adoption. Hypothesis H₅ states that the higher the perceived ease of use, the greater the acceptance of new technologies by employees. In other words, a technology that is considered intuitive and accessible is more likely to be adopted on a large scale within an organization.

We have therefore added a sixth hypothesis, which assumes that acceptance of new technologies has a positive impact on the success of their adoption.

These hypotheses are part of an integrative approach that aims to explain the dynamics of technology acceptance by taking into account both user perceptions and the organizational levers that influence their adoption.

The integration of new technologies by organizations is the result of the interaction of a multitude of organizational and human factors that determine the perception and acceptance of innovations. This dynamic is at the heart of the conceptual model we propose, which draws on Davis' Technology Acceptance Model (TAM) (1989) but also incorporates theoretical proposals relating to leadership, organizational change, and organizational learning.

The model thus emphasizes the central role of acceptance of new technologies, which is itself influenced by a set of determining variables. Organizational factors include managerial support, perceived usefulness, and resistance to change, which influence how employees perceive the value and relevance of the technologies introduced. Other factors are human: training and development and perceived ease of use are, in this perspective, elements that facilitate learning and adoption of new technological solutions.

3.3.2. Theoretical justification of hypotheses

Drawing from the conceptual framework and the theoretical models examined, five main factors stand out as key drivers of technology acceptance in organizations.

H₁ (*Managerial support*): *reflects the crucial role of active leadership in facilitating resource allocation, legitimizing change, and reducing resistance among employees. A wealth of research has highlighted that management backing is essential for successful adoption (Ifinedo, 2012; Venkatesh et al., 2003).*

H₂ (*Perceived usefulness*): *emphasizes that technologies considered valuable and practical are much more likely to be embraced by users, a principle well supported by the Technology Acceptance Model (Davis, 1989) and empirical studies (King & He, 2006; Venkatesh & Davis, 2000).*

H₃ (*Resistance to change*): *addresses the behavioral barriers that often hinder adoption, as studies consistently show that higher resistance diminishes both acceptance and integration of innovations (Kim & Kankanhalli, 2009; Oreg, 2006).*

H₄ (*Training and development*): *underlines the importance of providing learning opportunities: proper training not only builds confidence and reduces uncertainty but also equips employees*

with the skills necessary to engage effectively with new technologies (Al-Gahtani, 2001; Amoako-Gyampah & Salam, 2004).

H₅ (Perceived ease of use): highlights that intuitive and user-friendly technologies minimize cognitive effort, making adoption smoother and more widespread, and complementing the influence of other human and organizational factors (Davis, 1989; Venkatesh & Bala, 2008). Together, these hypotheses form a coherent framework for understanding the dynamics of technology acceptance, which is summarized in Table 6, illustrating each variable, its expected effect, and the theoretical rationale behind it.

Table 6: Summary table of hypotheses:

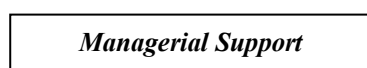
Hypothesis	Formulation	Theoretical justification
H1	Managerial support has a positive effect on employees' acceptance of new technologies.	Managerial support has a positive effect on employees' acceptance of new technologies.
H2	Perceived usefulness has a positive effect on the acceptance of new technologies.	Perceived usefulness is the main factor predicting adoption intention, according to the TAM model (Davis, 1989; King & He, 2006; Venkatesh & Davis, 2000).
H3	La résistance au changement a un effet négatif sur l'acceptation et l'intégration des nouvelles technologies.	Resistance to change has a negative effect on the acceptance and integration of new technologies.
H4	La disponibilité de programmes de formation a un effet positif sur l'acceptation des nouvelles technologies par le personnel.	The availability of training programs has a positive effect on staff acceptance of new technologies.
H5	Perceived ease of use has a positive effect on the acceptance of new technologies.	Technology that is perceived as easy to use requires less cognitive effort and encourages its adoption (Davis, 1989; Venkatesh & Bala, 2008).

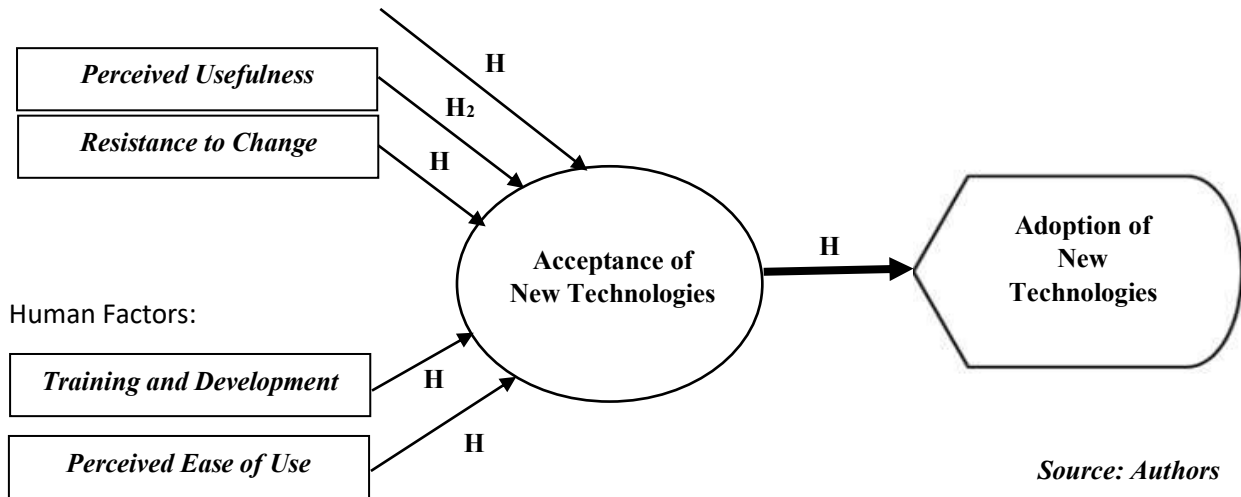
Source: Authors

These hypotheses aim to link the main theoretical determinants identified in the literature to the organizational and human dynamics that influence the acceptance of technologies. They thus form the basis of the conceptual framework proposed in this article and guide the analysis that follows.

The relationships established between the different variables are translated into research hypotheses, as shown in the following brief diagram, which illustrates the expected links between the different variables, their impact on acceptance, and their influence on employees' ability to effectively adopt technologies.

Figure 3: HYPOTHETICAL FRAMEWORK





This hypothetical framework aims to present real progress in the analysis of new technologies by integrating organizational and human dimensions that are only partially integrated into traditional models such as TAM. While well known for its effectiveness in explaining technology acceptance based on notions of perceived usefulness and perceived ease of use, TAM is also criticized for underestimating the contextual and behavioral factors that influence user choices.

This conceptual framework proposes several avenues for improvement to address these shortcomings:

- **Consideration of organizational factors:**

The proposed framework innovates compared to traditional approaches by introducing dimensions such as managerial support or resistance to change, which are decisive in the successful integration of new technologies within organizations due to their impact on acceptance and use. These variables help explain the poor adoption rate of certain innovations despite their high perceived usefulness.

- **Integration of the behavioral dimension:**

Resistance to change, which is often described by theories of organizational change (Lewin, 1947; Kotter & Schlesinger, 1979), is a factor that is generally ignored in technology adoption models, yet it can contribute to a better understanding of the psychological and structural barriers that prevent the adoption of technological innovations.

- **Strengthening the role of training:**

The introduction of the training-development factor, based on the framework of organizational learning theories (Argyris & Schön, 1978), adds another layer to TAM by emphasizing the importance of improving skills in order to enhance perceived ease of use and minimize the cognitive barriers that complicate the learning of new technologies.

- **Direct link between acceptance and adoption:**

The proposed framework removes ambiguity by establishing a direct relationship between the acceptance of new technologies and their effective application. This distinction between acceptance and effective use of a digital tool is crucial because it reminds us that acceptance of a digital tool does not necessarily translate into new active practice in a professional context. By incorporating these new dimensions, this conceptual framework fills several gaps identified in traditional models:

- ✓ It takes into account contextual, managerial, and behavioral influences.

- ✓ It enriches TAM by highlighting organizational and human levers that promote technological adoption and digital transformation in companies.

In short, this conceptual framework provides a more holistic and realistic view of technology adoption, highlighting the complex interactions between individual perception, organizational dynamics, and change processes.

4. Conclusion

The integration of advanced technologies into the supply chain represents a strategic opportunity to improve the performance, sustainability, and resilience. However, the acceptance of these technologies remains a major challenge, conditioned by organizational and human factors.

Through this conceptual article, we have developed a theoretical framework mobilizing recognized approaches, notably the Technology Acceptance Model (TAM), in order to better understand the dynamics of technology adoption.

This framework highlights key drivers such as perceived usefulness, ease of use, managerial support, and training and skills development. It also identifies potential barriers, including resistance to change and perceived complexity. These elements provide a solid foundation for future research aimed at testing and enriching this framework in a variety of empirical contexts. On a theoretical level, this work contributes to broadening our understanding of technology acceptance by confirming the relevance of TAM, while highlighting the need to enrich it with organizational and human variables. It thus provides a critical reflection on existing models and paves the way for integrative approaches, combining the clarity of TAM with the depth of alternative frameworks such as UTAUT or TOE.

On a practical level, the results offer useful guidance for decision-makers. By raising awareness, investing in tailored training programs, and aligning organizational objectives with the perceived benefits of technology, companies can maximize the benefits of their digital transition. For example, managerial support and internal communication can reduce resistance to change and accelerate the adoption of digital tools.

In conclusion, this work contributes to a better understanding of the factors influencing technology acceptance in supply chains and paves the way for future in-depth research, combining theoretical analyses and empirical case studies to validate the proposed hypotheses.

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