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Determinants of Technological Innovation Adoption:

An Overview of Modern Theories.

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Abstract

The adoption of technological innovations is a complex process influenced by various individual, social, and organizational factors. This paper provides an overview of key modern theories explaining this phenomenon. The Diffusion of Innovation Theory (Rogers, 1962) highlights the role of adopter categories and communication networks, while the Technology Acceptance Model (Davis, 1989) and the Theory of Reasoned Action (Fishbein & Ajzen, 1975) focus on cognitive perceptions and individual attitudes. The Theory of Planned Behavior (Ajzen, 1991) and its decomposed version (Taylor & Todd, 1995) introduce the concept of perceived behavioral control. More recently, the UTAUT1 and UTAUT2 models (Unified Theory of Acceptance and Use of Technology) have expanded these frameworks by incorporating additional factors such as habit, hedonic motivation, and contextual influences.

Through a comparative analysis of these models, this study highlights their complementarities and limitations. It emphasizes the need for a more integrative and dynamic approach to better understand technology adoption in an ever-evolving digital landscape. Finally, the paper discusses perspectives for enhancing existing theoretical frameworks to provide a more comprehensive and adaptive understanding of technological transformations.

Keywords: Technological innovation; Adoption of innovations; Determinants of adoption; Modern theories; Influential factors.

List of Abbreviations

- **IDT** – Innovation Diffusion Theory
- **OECD** – Organisation for Economic Co-operation and Development
- **PEU** – Perceived Ease of Use
- **PU** – Perceived Usefulness
- **TAM** – Technology Acceptance Model
- **TPB** – Theory of Planned Behavior
- **TRA** – Theory of Reasoned Action
- **UTAUT** – Unified Theory of Acceptance and Use of Technology

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

Introduction

In the current economic context, characterized by uncertainty and intense competition, the sustainability of businesses depends on their ability to rapidly adapt to changes and innovate. Therefore, it is crucial for companies to monitor the evolution and demands of their environment to ensure long-term viability while maintaining a competitive advantage. In this regard, the contemporary organizational landscape has undergone a digital revolution with significant implications at multiple levels. These transformations necessitate new working methods that challenge traditional approaches and reduce the effectiveness of existing information systems (Marchal, 2014).

The concept of digitalization refers to the integration of new technologies into business and social processes to enhance efficiency and, consequently, create added value for companies (Abriane et al., 2021). This digital transformation is reflected in the adoption of technological innovations, which represents a central challenge for organizations. Understanding the factors that influence this adoption is essential for anticipating resistance, optimizing technology implementation, and maximizing its socio-economic impact.

This reflection has led us to theoretically investigate the determinants that explain the adoption of technological innovations by businesses. Accordingly, the primary objective of this paper is to examine various theoretical frameworks and models that account for the key factors influencing technological innovation adoption in organizations.

Furthermore, the paper presents a critical analysis of these theories, assessing their relevance, applicability, and limitations. Through this analysis, this study aims to provide a structured understanding of the mechanisms governing technology acceptance, offering insights that can guide future research and practical implementations within organizations.

To this end, we seek to answer the following question: **What are the theoretical determinants of technological innovation adoption by organizations?**

This article is structured into three main sections. First, we present a conceptual framework that explores the notion and typology of innovations. Next, we review the principal theories explaining technological innovation adoption, highlighting their conceptual foundations and specific characteristics. We then provide a critical analysis of these models, discussing their strengths, limitations, and relevance in an ever-evolving technological landscape. Finally, we explore perspectives for integrating and refining existing theoretical frameworks to offer a more comprehensive and dynamic understanding of technology adoption.

African Scientific Journal
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1. Innovation: Conceptual Framework

The purpose of this first section is to clarify the concept of innovation that will be used throughout this work. Such clarification is necessary because, although innovation, in all its forms, is at the core of modern economic dynamics, its analysis must distinguish between the different objects it can pertain to and differentiate the intensity with which it can impact economic activity. Indeed, innovation has been the subject of several attempts at definition by various authors. Below, we will present the main definitions of innovation drawn from the literature.

1.1.Innovation: A multifaceted concept

Frequently, the terms creativity, discovery, and invention are considered synonymous with innovation. The polysemous nature of the term is at the root of confusions associated with its usage. A thorough understanding of the different approaches to innovation is essential for clarifying these ambiguities.

In this regard, Cooper (1998) noted that one of the major challenges in innovation research lies in the difficulty of establishing a common definition. Before examining the term in the literature, it is useful to define the term "innovate" at the dictionary level. On one hand, the word "innovate" in *Le Petit Robert* refers to "introducing something new into a domain." On the other hand, according to *Larousse*, the term means "introducing something new to replace something old in any given domain." From a dictionary perspective, it is clear that the term "innovation" carries the notion of "novelty," regardless of the field of study.

The earliest works attempting to provide a definition for this concept date back to Schumpeter (1935), who considered innovation as the origin of economic growth. According to this author, innovation is defined as a new way of combining means: "To produce is to combine the things and forces present in our domain. To produce something different or in a different way is to combine these forces and things differently" (Schumpeter, 1935, p. 94).

Schumpeter's pioneering work opened the field to researchers' concerns about innovation, notably with Burns and Stalker (1961), who published their book *The Management of Innovation*. Furthermore, according to Van De Ven (1986), innovation is defined as "the development and implementation of new ideas by individuals who, over time, engage in transactions with others within an institutional context" (Van De Ven, 1986, p. 591). Damanpour defined innovation as "a new product or service, a new technology for production processes, a new administrative structure or system, or a new plan or program affecting the members of the organization" (Damanpour, 1991, p. 556).

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

Baregheh, Rowley, and Sambrook (2009) attempted to address a range of definitions related to the concept of innovation. The authors examined 60 definitions from various fields. This literature review allowed them to propose the following definition of the concept: "a multi-step process through which organizations transform ideas into new or improved products, services, or processes in order to progress, compete, and successfully differentiate themselves in the market" (Baregheh et al., 2009, p. 1334). Moreover, Rogers stated that "an innovation is an idea, practice, or object that is perceived as new by the actors, regardless of whether it is truly new" (Rogers E.M., 2003, p. 12).

Very recently, the Organisation for Economic Co-operation and Development (OECD) provided a general definition of the concept of "innovation": "An innovation is a new or improved product or process (or a combination of both) that differs significantly from previous products or processes of a unit and has been made available to potential users (product) or implemented by the unit (process)" (OECD, 2018, p. 20).

Thus, the concept of innovation carries multiple interpretations: an invention, a new product, a new object, a new idea, a process, development, or change. Indeed, the literature related to this concept highlights the lack of consensus regarding its definition. This diversity has led us to question the typology of innovations.

1.2.Typology of Innovations

It seems necessary to distinguish between the different types of innovations based on their nature and the degree of innovation.

1.2.1. Typology Based on the Nature of Innovation

This typology can be refined by drawing on Schumpeter's work. More specifically, four levels of innovation intervention are identified (Oslo Manual, 2005).

Schumpeter (1935) distinguished several types of innovation, namely:

- **Product Innovation**: This involves creating a new product or improving the quality of an existing product already launched on the market.
- **Process Innovation**: This refers to the introduction of a completely new production method.
- **Marketing Innovation**: This aims to better satisfy consumer needs, open new markets, or position an existing product in a new way on the market to increase sales.
- **Market Innovation**: This pertains to the opening of new markets.
- **Raw Material Innovation**: This involves using new sources of raw materials, whether these sources already exist or accessing these resources was previously difficult.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

- **Organizational Innovation**: This refers to creating a new organizational structure, such as the establishment of a monopoly.
- **Technological Innovation**: On one hand, Damanpour (1987) suggests that technological innovation modifies the organization by introducing changes in technology, using new tools, techniques, or systems by organizational members. On the other hand, Brimm (1984) views technological innovation as the transformation of an idea into an improved process or new product for which a market exists, while managerial innovation involves transforming an idea into a new form of organization or management.

1.2.2. Typology Based on the Degree of Innovation

Two dimensions help define innovation models: the degree of novelty for the market and the degree of novelty for the firm. This distinction primarily encompasses two types of innovation: radical innovation and incremental innovation.

- **Radical Innovation**: This refers to the introduction of a generic technology that affects work organization and productivity across many activities, both from the perspective of the company that introduced it and the market that adopts it (Broustail and Fréry, 1993). Schumpeter (1942) perceives it as a source of "creative destruction" (a qualitative change) that continuously revolutionizes the economic structure by destroying old elements and creating new ones.
- **Incremental Innovation**: Incremental (or minor) innovation constitutes gradual change stemming from radical innovation, which improves technology to adapt it to the specific needs of sectors and markets that adopt it. It involves the introduction of improvements to existing products already on the market or the incorporation of innovative equipment and components that the company did not develop itself.

In conclusion, the literature reveals a diversity of definitions of innovation. Likewise, the types of innovation are numerous.

In the context of digitalization adoption by companies, our research problem aligns with technological and incremental innovations, as the adoption of digitalization requires the acceptance and continuous use of new technological tools. To address our main research question, it will therefore be useful to present the various models and theories addressing the adoption of innovations, particularly technological innovations.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

2. Theoretical models of technological innovation adoption

The literature offers a wide range of theories and models addressing the factors that determine the adoption of innovations by users or organizations. The main models and theories related to innovation adoption, particularly technological innovations, that are relevant to our research problem will be presented below.

2.1.Innovation Diffusion Theory (IDT)

Everett Rogers (1962) developed this theory to explain how, why, and at what rate new ideas and technologies spread among individuals and organizations. The major contributions of this theory can be summarized in three key aspects: the innovation diffusion process, adopter categories, and the characteristics of the innovation (Piot-Lepetit et al., 2023).

Regarding the innovation diffusion process, Rogers identified five stages that an individual or any adopting unit undergoes when considering the adoption of an innovation:

- **Knowledge or Awareness Stage**: This is the initial exposure to the innovation, providing the first opportunity to acquire information about its functionality.
- **Persuasion Stage**: At this stage, the individual evaluates the innovation, forming either a favorable or unfavorable attitude toward it.
- **Decision Stage**: The adopter (whether an individual or an organization) engages in activities that lead to either accepting or rejecting the innovation.
- **Implementation or Trial Stage**: The adopter tests the innovation to understand its practical applications and attributes.
- **Confirmation or Adoption Stage**: The adopter seeks reinforcement for their decision to adopt the innovation and continuously looks for justifications to support their choice.

This theory classifies innovation adopters into five distinct groups:

- **Innovators (2.5%)**: These individuals actively seek information from mass media and extend their interpersonal networks across a broad area. They are characterized by their socio-economic status, which enables them to stay well-informed, hold prestigious jobs, and possess greater technical competence in utilizing information and communication technologies.
- **Early Adopters (13.5%)**: While they are less focused on external networks, they play a key advisory role within organizations and occupy privileged positions in social spheres.
- **Early Majority (34%)**: Representing a statistically normal distribution, this group makes well-considered decisions and serves as a crucial link to the late majority.

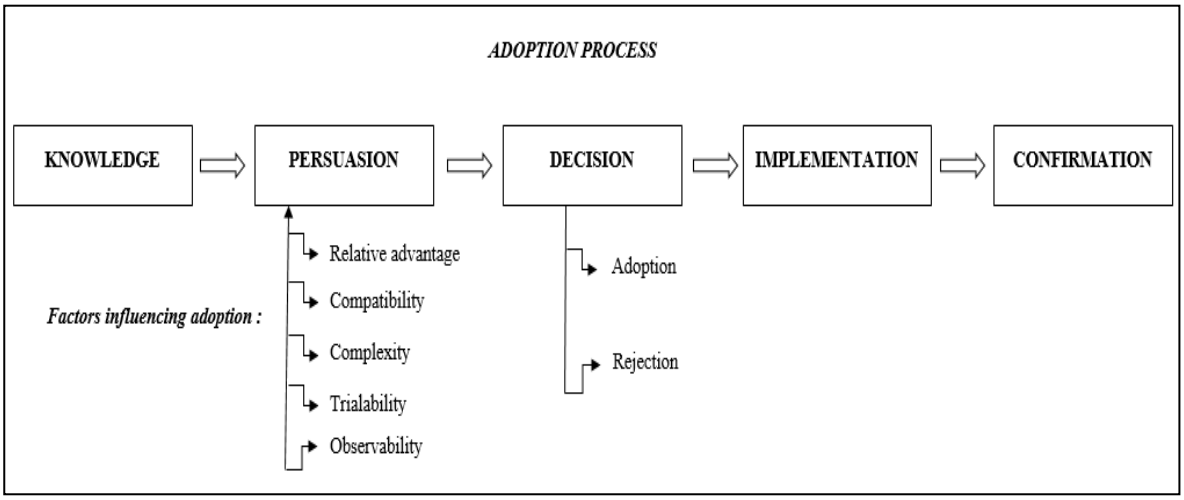
African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

- **Late Majority (34%)**: Members of this group tend to be skeptical of innovation and rely primarily on interpersonal communication channels.
- **Laggards (16%)**: Highly attached to traditional values within their social system, they are distrustful of novelty.

Furthermore, Rogers identifies five perceived attributes of innovation that influence its diffusion, collectively explaining, on average, 50% of the adoption rate, though variations exist depending on the sector studied. These attributes include:

- **Relative Advantage**: The extent to which an innovation is perceived as superior to the idea it replaces.
- **Compatibility**: The degree to which an innovation aligns with the values, past experiences, and needs of potential adopters.
- **Complexity**: The extent to which an innovation is perceived as difficult to understand and use.
- **Trialability**: The degree to which an innovation can be tested before full adoption.
- **Observability**: The extent to which the results of an innovation are visible to others.

Figure N°1: The Determinants of Innovation Adoption According to Rogers' Theory



Source: Adapted from (Rogers, 1983)

2.2.Theory of Reasoned Action (TRA)

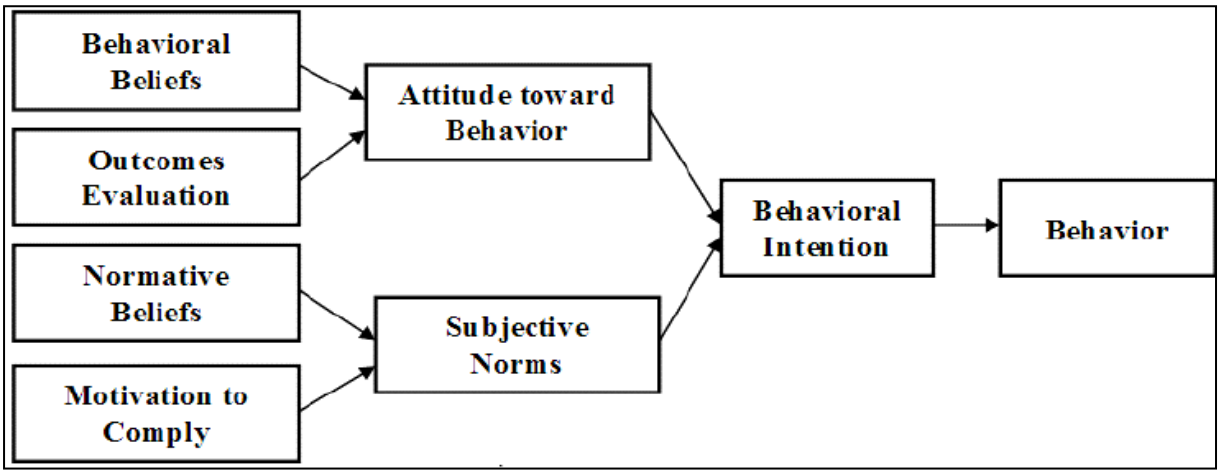
Fishbein and Ajzen (1975) developed the Theory of Reasoned Action (TRA) to explain individuals' intention to adopt innovations based on two key factors:

- **Attitude toward performing a behavior**: This refers to an individual's beliefs about the consequences of adopting the innovation.
- **Subjective norm**: This determines an individual's behavioral adoption and is related to social beliefs, meaning the influence of social factors on an individual's behavior.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

The explanatory variables influencing innovation adoption can be illustrated as follows:

Figure N°2: Determinants of Adoption According to Fishbein and Ajzen's Theory (1975)



Source: Adapted from (Fishbein & Ajzen (1975)

This theory has a limitation in that the intention to adopt a behavior may be influenced by external variables beyond the individual's control (Bennaceur, 2019). Consequently, Ajzen (1991) extended the aforementioned theory by introducing an additional explanatory variable.

2.3.Technology Acceptance Model (TAM)

Davis (1989) provides a framework for understanding the determinants of technological innovation adoption and acceptance processes. The TAM model captures individuals' intentions to use a new technology by focusing on two key determinants of adoption:

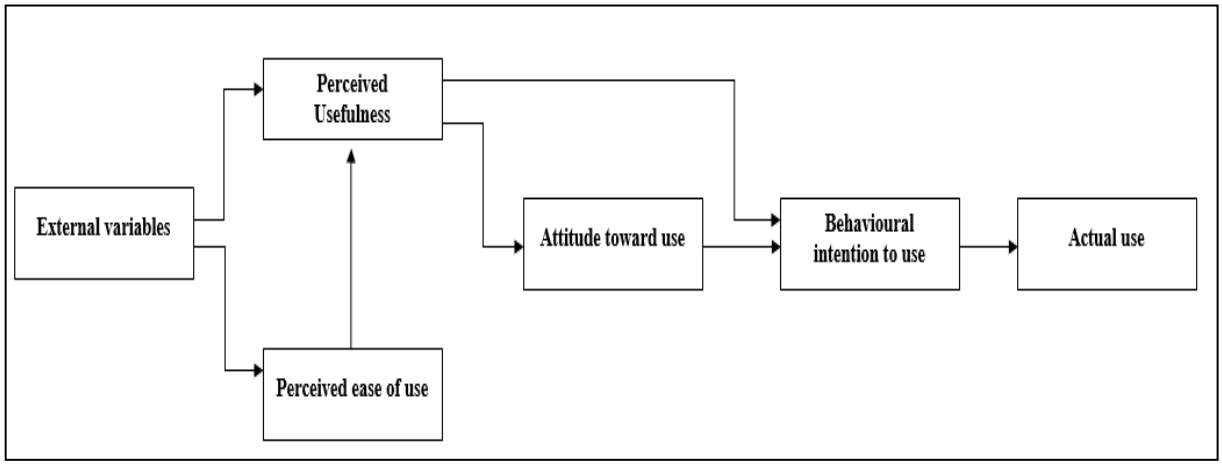
- **Perceived Usefulness (PU):** The subjective probability perceived by a potential user that adopting the innovation will enhance their job performance within their organization.
- **Perceived Ease of Use (PEU):** The degree of effort the potential user perceives as necessary to implement the innovation.

These two determinants of the TAM model account for approximately 40% of individuals' intention to use a technology (Autry et al., 2010). In other words, this model explains technology adoption through a four-step process (Davis, 1989):

- **External variables** influence users' beliefs about system usage.
- **Users' beliefs** shape their attitudes toward system usage.
- **Users' attitudes** impact their intentions to use the system.
- **Users' intentions** determine the actual level of system usage.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

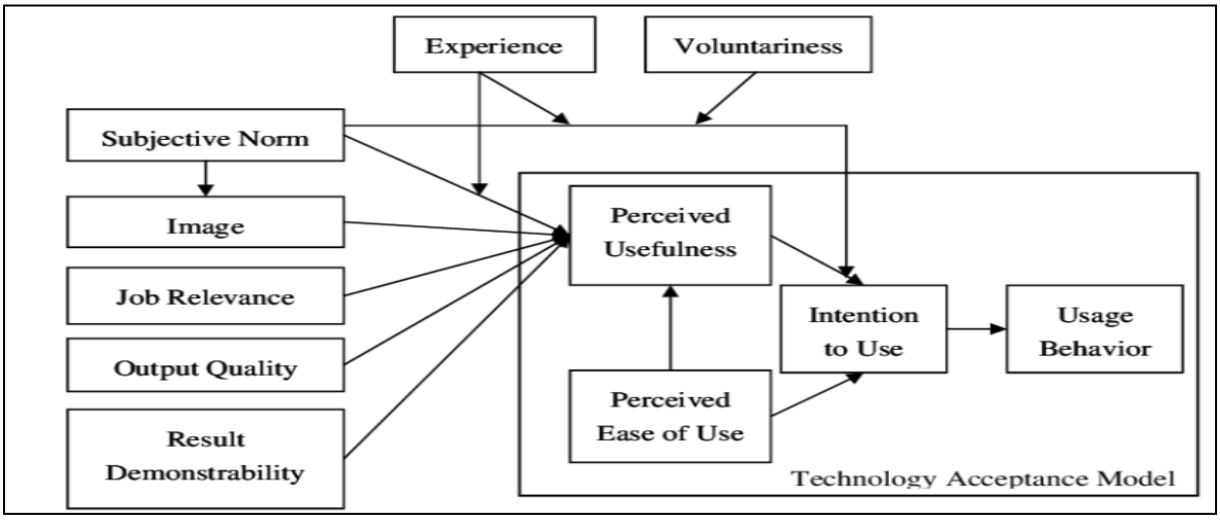
Figure N°3: The Original Version of the Technology Acceptance Model (TAM)



Source: Adapted from (Davis, 1989)

Davis proposed further extensions to the initial model (TAM 2) as an improvement over the first model (TAM 1). This second model incorporates additional explanatory variables. The first extended version was developed by Venkatesh and Davis (2000), who revised the original TAM by integrating cognitive and social influence variables, assuming that these factors affect beliefs related to perceived usefulness. To achieve this, the authors introduced the following variables: **subjective norm, voluntariness, image, experience or ability to use a technology, job relevance, output quality, and result demonstrability.** Other variables, such as perceived usefulness, perceived ease of use, intention to use, and actual system usage, were retained from the original version of the model. Thus, the model proposed by these authors is as follows:

Figure N°4: The Revised Version of the Technology Acceptance Model (TAM)



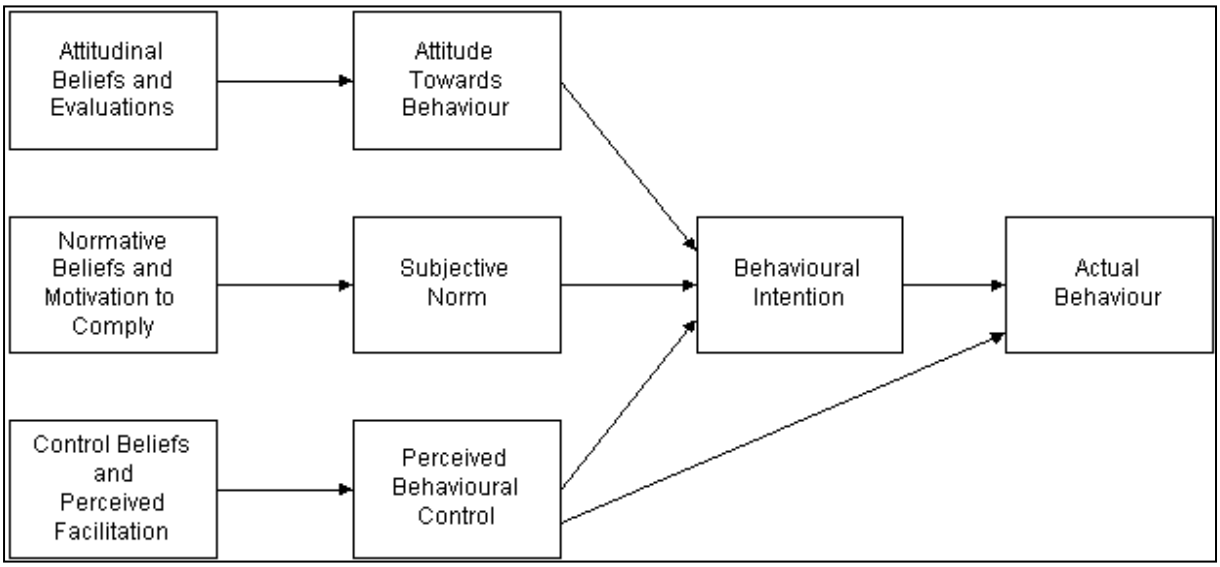
Source: Adapted from (Venkatesh & Davis, 2000)

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

2.4.Theory of Planned Behavior

Ajzen (1991) enhanced the Theory of Reasoned Action by introducing the Theory of Planned Behavior. This theory incorporates a third explanatory variable for the adoption behavior of innovations, in addition to attitude and subjective norm: **behavioral control**. This variable reflects the degree of ease or difficulty an individual may experience in performing a behavior. Indeed, this theory addresses the limitation of the Theory of Reasoned Action, which does not account for external factors that may facilitate or hinder the expected behavior. In summary, this third variable represents the resources, specific expertise, or skills that the individual may not control, yet which can influence their behavior. Thus, this perception of control over behavior is a variable that relates to the degree of ease or difficulty an individual perceives in performing a behavior. The following diagram summarizes the determinants of adoption according to the Theory of Planned Behavior:

Figure N°5: Determinants of adoption according to Ajzen's theory (1991)



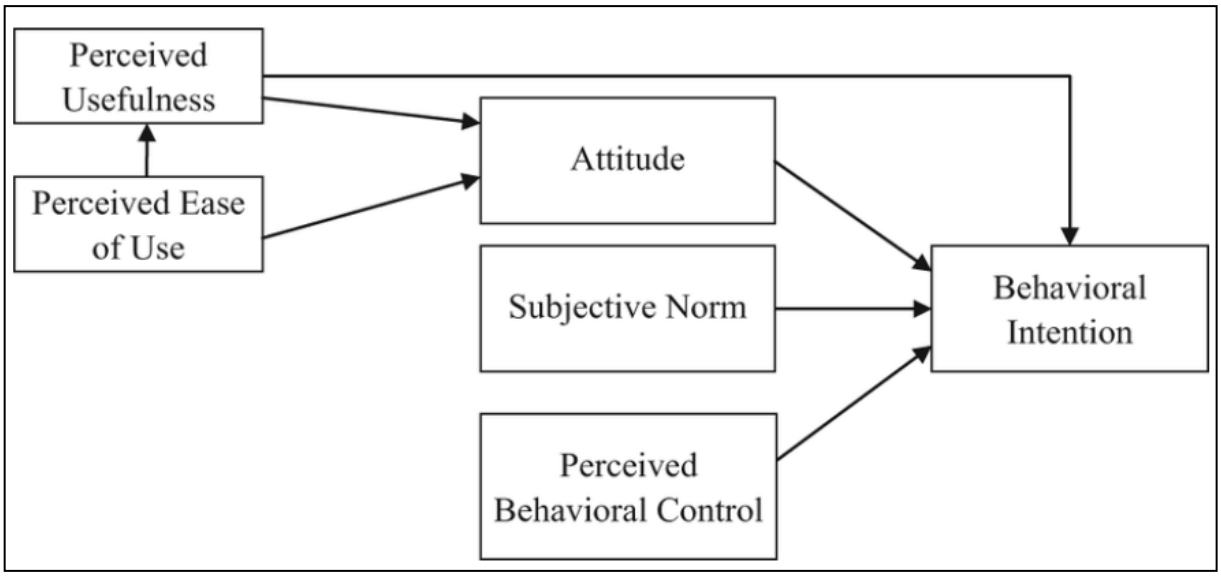
Source : Adapted from (Ajzen, 1991)

2.5.The Decomposed Theory of Planned Behavior

Taylor and Todd (1995) developed a theory that references the basic constructs of various technology acceptance models and the Theory of Planned Behavior, which they termed the "Decomposed Theory of Planned Behavior." These authors aligned themselves with the notion that social and cognitive influencing factors play a critical role in shaping behavioral intentions regarding the acceptance of new technologies. To achieve this, they aimed to reposition the components of various reference models in order to assign dimensions that were more suited to the framework of technology acceptance. The following figure illustrates the model of this theory.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

Figure N°6: Determinants of adoption according to Taylor and Todd's theory (1995)



Source: Adapted from (Taylor & Todd, 1995)

To support the explanatory power of their combined model compared to the two models considered independently, the authors conducted a study involving 786 students using a computer resource center. The results of this study indicated that the Technology Acceptance Model explains 52% of the variance in behavioral intention, the classical Theory of Planned Behavior explains 57% of this variance, and the Decomposed Theory of Planned Behavior explains 60% of this variance (Taylor & Todd, 1995).

2.6.UTAUT1 Model (Unified Theory of Acceptance and Use of Technology 1)

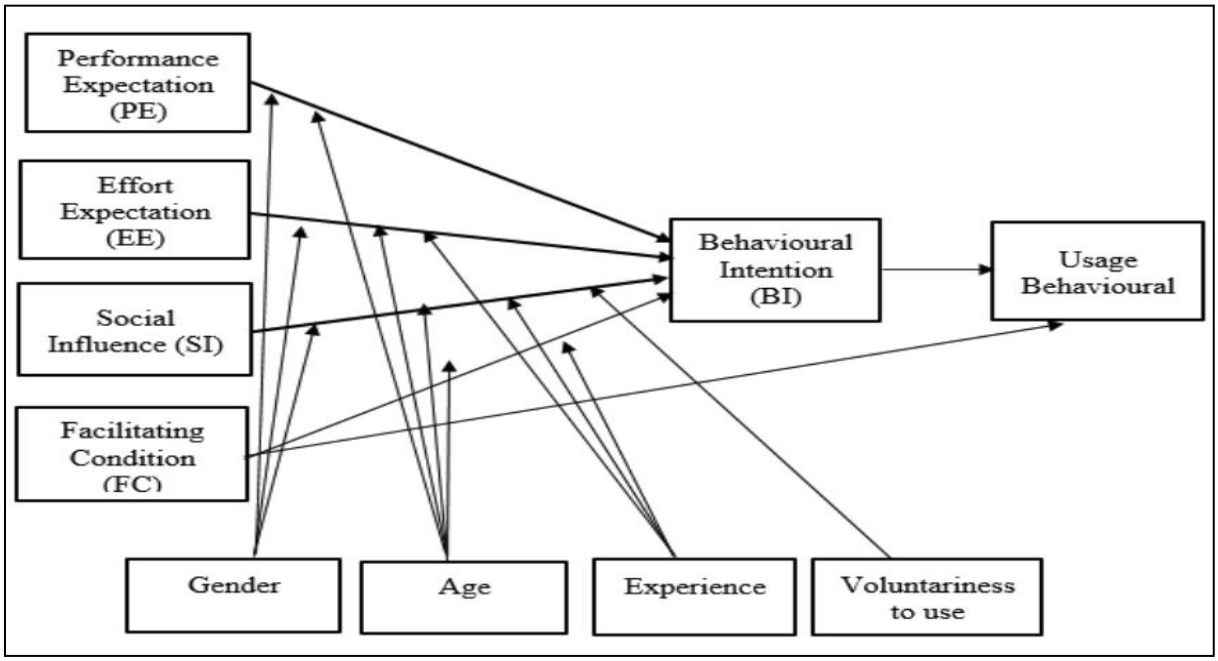
Venkatesh, Morris, and Davis (2003) introduced an integrative model incorporating eight theories. It consists of four explanatory variables:

- **Performance Expectancy**: Defined by Venkatesh et al. as "the degree to which an individual believes that using the system will help them achieve gains in job performance" (Venkatesh et al., 2003, p. 446).
- **Effort Expectancy**: According to the authors, this variable corresponds to "the degree of ease associated with system use" (Venkatesh et al., 2003, p. 450).
- **Social Influence**: Defined as "the degree to which an individual perceives that important others believe they should use the new system" (Venkatesh et al., 2003, p. 451).
- **Facilitating Conditions**: Refers to "the degree to which an individual believes that an organizational and technical infrastructure exists to support system use" (Venkatesh et al., 2003, p. 453).

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

The following diagram summarizes the key determinants of technology adoption in the Unified Theory of Acceptance and Use of Technology (UTAUT1).

Figure N°7 : Determinants of adoption according to Venkatesh's theory (2003) (UTAUT 1)



Source: Adapted from (Venkatesh et al., 2003)

In their model, Venkatesh et al. incorporated moderating variables that influence the explanatory variables in question. These moderators include gender, age, experience, and willingness to use the system.

To validate this model, Venkatesh et al. (2003) conducted a longitudinal study across four organizations over a six-month period. The eight studied models—the Theory of Reasoned Action, the Technology Acceptance Model, the Motivational Model, the Theory of Planned Behavior, the combined TAM and TPB model, the Model of PC Utilization, the Diffusion of Innovations Theory, and the Social Cognitive Theory—explained between 17% and 53% of the variance in users' intentions to adopt information technology. However, the UTAUT model accounted for 69% of the variance in intention.

The explanatory power of this model was further confirmed by data from two additional organizations, yielding similar results, with the model explaining 70% of the variance in intention.

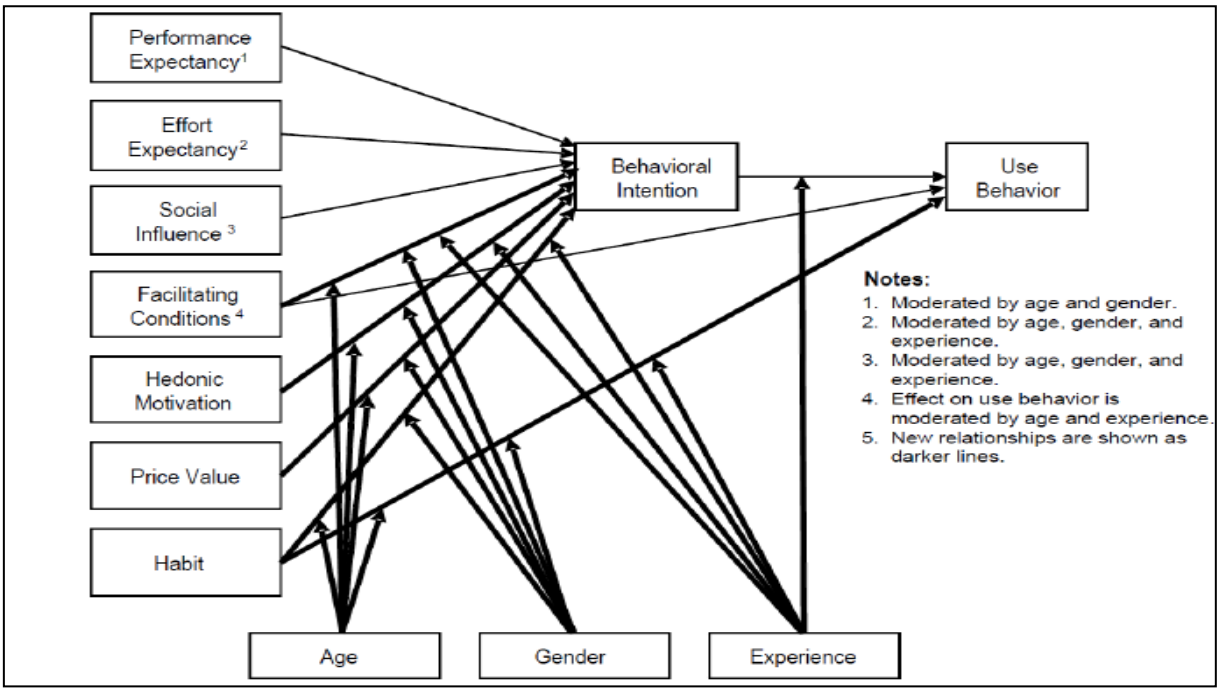
2.7.UTAUT2 Model (Unified Theory of Acceptance and Use of Technology 2)

Venkatesh (2012) proposed improvements to the original model (UTAUT1) by incorporating additional explanatory variables, such as hedonic motivation, price value, and habit. Consequently, the new model no longer includes the moderating variable "**willingness to use**."

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

The following diagram summarizes the key determinants of technology adoption in the Unified Theory of Acceptance and Use of Technology (UTAUT2).

Figure N°8 : Determinants of adoption according to Venkatesh's theory (2012) (UTAUT 2)



Source: Adapted from (Venkatesh et al., 2012)

In conclusion, the literature appears to be rich in theories and models that establish a set of variables capable of explaining the adoption of innovations.
In the following section, we will analyze these approaches by highlighting both their complementarities and their limitations.

3. Discussion

The adoption of technological innovations is a multidimensional phenomenon that relies on a complex interaction between individual, organizational, and social factors. Modern theories provide robust analytical frameworks, with each theoretical model offering a specific perspective, emphasizing cognitive, social, or structural factors. However, a critical review of these approaches reveals both their complementarities and their limitations, highlighting the need for a more dynamic and contextual integrative approach.

3.1.Complementarity of Models: A Progressive Evolution of Theories

Early theories, such as the Diffusion of Innovation Theory (Rogers, 1962), adopt a sociological perspective, describing adoption as a collective process influenced by adopter categories and communication channels. However, this model does not sufficiently account for the psychological mechanisms underlying individual adoption decisions.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

The Technology Acceptance Model (TAM) (Davis, 1989) and the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) partially address this gap by introducing cognitive variables such as perceived usefulness and perceived ease of use (TAM), as well as attitudes and subjective norms (TRA). However, these models remain limited in their consideration of external constraints and complex behavioral influences.

To overcome these limitations, the Theory of Planned Behavior (TPB) (Ajzen, 1991) and its decomposed version (Taylor & Todd, 1995) incorporate perceived behavioral control, recognizing that external factors can moderate adoption intentions. This approach represents a significant advancement but remains centered on individual decision-making without fully considering organizational dynamics or the rapid evolution of technology.

The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) and its extensions (UTAUT1 and UTAUT2) aim to address these gaps by integrating additional dimensions such as hedonic motivation, habit, social influence, and facilitating conditions. These models provide a more holistic perspective, particularly suited to digital and connected environments.

3.2.Limitations and the Need for an Integrative Approach

These models primarily rely on a rationalist approach, where individuals are assumed to adopt technology based on a linear evaluation process weighing benefits and costs. However, this perspective fails to sufficiently account for social and cultural dynamics that shape the perception and use of technology. For example, social norms and collective representations may sometimes take precedence over purely utilitarian considerations.

Moreover, most existing models remain anchored in an individual- or organization-centered vision, often overlooking macroeconomic and political contexts. Access to technological infrastructure, public innovation policies, and digital inequalities are crucial determinants of large-scale adoption. Furthermore, the rapid emergence of technologies such as artificial intelligence and blockchain raises new challenges related to trust, regulation, and ethical acceptability, which are not always well addressed by classical theories.

Thus, an integrative and interdisciplinary approach, combining insights from cognitive sciences, sociology, and public policy studies, is necessary to better understand the determinants of technology adoption. The goal is not only to explain why a technology is adopted but also to understand how innovation ecosystems continuously influence and redefine technological appropriation dynamics.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

3.3.Toward a Dynamic and Contextual Model of Technology Adoption

The analysis of existing theories suggests that technology adoption cannot be understood through a single framework. A comprehensive and dynamic approach should integrate multiple levels of analysis:

- **Individual factors** (cognition, attitude, habit): derived from TAM, TRA, and UTAUT.
- **Social and organizational factors** (peer influence, institutional norms, corporate culture): developed in Diffusion of Innovation Theory and UTAUT2.
- **Contextual and structural factors** (infrastructure, regulation, technological accessibility): inadequately addressed in classical models but essential for sustainable adoption.

By integrating these dimensions, a more flexible and adaptive framework could be developed, accounting for rapid technological advancements, diverse usage contexts, and multi-level interactions between individuals, organizations, and digital ecosystems.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

Conclusion

This study has explored the definition and typology of innovation, as well as the theoretical models explaining the adoption of technological innovations by organisations. Through an in-depth analysis of key frameworks ranging from Rogers' Diffusion of Innovation Theory (1962) to the Unified Theory of Acceptance and Use of Technology (UTAUT2) (2012). We have highlighted the progressive evolution of these models in capturing the complexity of technology adoption processes.

Our critical discussion has underscored both the complementarities and limitations of these theories. While early models, such as TAM, TRA, and TPB, have significantly contributed to understanding individual adoption behaviors, they often fall short in addressing external constraints, social influences, and organizational dynamics. More recent approaches, such as UTAUT and its extensions, provide a more integrative perspective by incorporating additional factors like hedonic motivation, habit, and facilitating conditions. However, despite their advancements, these models still rely heavily on rationalist assumptions, neglecting broader contextual determinants such as regulatory frameworks, infrastructure disparities, and emerging ethical concerns related to disruptive technologies.

Given these findings, our study calls for a more dynamic and interdisciplinary approach to innovation adoption. Future research should strive to develop models that bridge cognitive, social, and structural dimensions, while also accounting for evolving technological landscapes. Rather than viewing adoption as a linear decision-making process, it is crucial to recognize it as a continuous and context-dependent phenomenon, shaped by multi-level interactions between individuals, organizations, and innovation ecosystems.

By integrating insights from sociology, psychology, public policy, and emerging technology studies, a more comprehensive framework could be developed, allowing for a nuanced understanding of technology adoption in an increasingly digital and interconnected world.

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

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