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ADOPTION INSIGHTS: EXPLORING CONSTRUCTS IN TECHNOLOGY ACCEPTANCE THEORIES

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Abstract:

The rapid evolution of technology necessitates a deeper understanding of the constructs influencing its adoption across various sectors. This systematic literature review examines the common constructs and suggest new constructs to be use within technology adoption theories to enhance understanding of user acceptance. The primary problem is the need an updated and structured review to identify the common construct use within the technology adoptions theory and suggest new constructs that is consider uncommon to be used for paper. To achieve this, we conduct a detailed search approach is implemented, applying specific keywords and criteria to reputable databases such as Scopus and Web of Science. The flow of research is based on PRISMA framework. The research targeted studies published from 2022 to 2024, resulting in the analysis of 45 primary data entries. The finding was divided into three themes which is (1) user acceptance and behavioural intentions, (2) technology integration and innovation and (3) sustainability and social impact. The analysis revealed among the 44 constructs analysed, only three are deemed common. These constructs are Trust, Security Risk, and Attitude. In conclusion, the constructs identified in this study form a foundational basis for further research and development of technology adoption theories, underlining the importance of ongoing research into their implications while also considering studying constructs that are outside of Computer Science subject.

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Introduction

In today's fast-paced digital landscape, where the effective integration of new technologies can greatly influence organizational performance and individual productivity, it is essential to understand technology adoption. Theoretical frameworks that have become fundamental tools for studying the factors that promote or impede technology adoption include the Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Diffusion of Innovations (DOI) and Unified Theory of Acceptance and Use of Technology (UTAUT). These models are useful to stakeholders seeking to enable more seamless transitions into new technology applications in addition to being academic frameworks (Aburbeian et al., 2022; Antonietti et al., 2022; Ilyas et al., 2023; Jayawardena et al., 2023; Ndebele & Mbodila, 2022; Putri et al., 2023). The applicability of these theories is becoming increasingly apparent as technology advances, calling for constant research and improvement.

Research on technology adoption is rich and varied right now. The Technology Acceptance Model (TAM), first presented by (Davis, 1989), emphasizes perceived usefulness and ease of use as key constructs influencing technology adoption. Later modifications, such as TAM2 by (Venkatesh & Davis, 2000), have expanded its application by adding contextual constructs and social influence. By incorporating psychological constructs like attitudes, subjective norms, and perceived behavioural control, TPB by (Ajzen, 1991) enhances this framework even more and offers a more complex picture of user intentions. While the DOI theory by (Rogers, 1962) highlights the features of innovations and their social context, the UTAUT by (Venkatesh et al., 2003) synthesizes important components from these models and focuses on performance expectancy, effort expectancy, social influence, and facilitating conditions. Together, these frameworks have produced important empirical findings across number of fields, such as information systems, healthcare, and education.

These theories have made significant contributions, although there are still disagreements and gaps. One significant problem is the limited integration of various frameworks; they frequently operate separately, producing fragmented conclusions about user behaviour(Chen et al., 2023; German Ruiz-Herrera et al., 2023; Rahmayanti et al., 2021). Some researchers support a unified strategy, arguing that combining several constructs could result in a more thorough understanding of technology adoption. Furthermore, even though the current models have undergone thorough testing, little study has been done on how well they work in quickly changing technology environments like blockchain and artificial intelligence (Chang et al., 2022; Naidoo, 2023; Rodríguez-Espíndola et al., 2022). This makes it difficult to validate the applicability of traditional constructions in new environments, which highlights the urgent need for updated theoretical perspectives.

This article aims to accomplish two distinct objectives. Firstly, it will thoroughly review and compare the key constructs found in different technology adoption theories, explaining the ways in which they are similar and different. Secondly, it will suggest new constructs and modifications that can be used in the current frameworks. The article intends to promote

scholarly understanding and practical application in the subject of technology adoption by filling theoretical gaps and offering integrative approaches. The main objectives of this paper are to inform users about feasible approaches to technology deployment in an ever-complex environment and to lay the foundations for future study.

Literature Review

Technology adoption theories have developed to consider the dynamics of technology integration across different industries and the complexities of user behaviour. This review examines important constructs found in well-known models, including TRA, TAM, TPB, and even UTAUT, as supported by various research. An increasing emphasis is being placed on contextual factors and demographic influences on the adoption of technology, according to emerging research trends. For instance, in the context of clothing rental services, (Chi et al., 2023) defined factors like past behaviour and environmental knowledge, while (Song et al., 2022) emphasized the specific needs of older persons adopting voice-user interfaces. These studies show a change in focus away from fundamental usability and toward a knowledge of user motivations. The model of UTAUT acceptance theory shows significant patterns in the examination of various technological advancements in different settings. Recent studies have concentrated on broadening the UTAUT model by including elements that are relevant to specific technologies like mobile learning (Chand et al., 2022)(Hamzah et al., 2020), digital oriented learning (Yacob, A., Kadir, A.Z.A., Aziz, N.S., Sulaiman, N.S., Hamzah, 2022), blockchain (Ennajeh & Najar, 2024), and e-health applications (Aydin & Kumru, 2023). The expansion of these model indicates a growing recognition of the importance of adjusting theoretical frameworks to the intricacies of different user experiences and technological uses. By including extra elements such as trust, motivation, and e-health literacy, researchers have deepened their understanding of the factors that affect adoption behaviours, showing a trend toward a more user-centred approach in research on technology acceptance.

The integration of concepts from well-known models like UTAUT, TPB, and DOI has enhanced the effectiveness of research studies. In a study by (Dajani et al., 2022), cloud-based quality management systems were explored, while (Zhang et al., 2023) investigated digital technologies in construction, both utilizing a mix of qualitative and quantitative approaches. Nevertheless, (Hassan et al., 2022) found that adaptations of UTAUT often neglect important construct concerning privacy and trust, indicating that current models may require adjustments to better comprehend user behaviour intricacies, particularly in situations where privacy is a key issue. (Lenz et al., 2023) shed light on user behaviours concerning the replacement of smart devices, revealing significant insights that challenge traditional technology adoption theories, specifically in the areas of switching intentions and perceived usefulness. Their findings emphasize the critical role of privacy concerns, yet they also highlight a substantial gap in understanding the complex interplay of various constructs influencing user decisions.

Numerous research studies focused on certain areas or populations. For example, (Nguyen et al., 2022) investigation of the cultural influences on the adoption of mobile payments in Vietnam. Although these studies provide insightful data, they generally cannot be applied to larger populations or diverse cultural contexts. Furthermore, there is currently a lack of research on the factors that influence the adoption of certain technologies in educational contexts, such as knowledge-based chatbots, as (Manik et al., 2024) studied. In their cross-cultural analysis of the adoption of virtual reality, (Monteiro et al., 2024) point out that there is still much to learn about the impact of regional cultural norms on technology adoption. (Bahaddad et al.,

2022) examine the implementation of Bring Your Own Device (BYOD) initiatives in Saudi Arabia, emphasizing certain regional obstacles that might not be relevant in other contexts.

Although user acceptance of established technologies is positively impacted by the models in use today, research on new technologies is notably lacking. In order to close this gap, (Legesse et al., 2024) researched the adoption of blockchain technology in Ethiopia, highlighting the need for customized frameworks that take into account regional infrastructures and conditions. (Jajic et al., 2022) also emphasized the use of augmented reality in retail, but they recommended a more thorough examination of the factors that motivate users to engage with the technology. A notable gap is the limited research into socio-cultural factors that could impact the adoption of technology, especially in non-Western environments. Furthermore, (Li, 2023) offers perspectives on the acceptance of AI, but fails to thoroughly examine the motivational factors that impact its actual usage. This suggests a necessity for more thorough research that examines how user motivations intersect with technology acceptance.

These gaps reveal the importance of comprehensive models are needed, ones that incorporate a variety of factors related to user emotions and cultural context, cover a larger geographic area, and use longitudinal designs to capture the changing acceptance of technology over time. Moreover, it emphasizes the need for more detailed research to investigate the appropriate integration of these technologies into current educational frameworks and to tackle the difficulties brought about by new technological developments.

The analysis of technology adoption theories highlights a dynamic field characterized by both established constructs and emerging considerations. While core constructs like perceived usefulness and ease of use remain significant, there is an increasing recognition of the importance of integrating additional factors such as trust, risk perception, and cultural influences. The current literature demonstrates the necessity for theoretical frameworks to evolve in response to the complexities of contemporary technology use, advocating for a multidimensional approach that encompasses diverse contextual and demographic variables.

Methodology

The methodology used in this study are based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework (Moher et al., 2009). The PRISMA framework used in this study involved four main processes which are identification, screening, eligibility, and included as refer to Figure 1.

Identification

In this study, key steps of the systematic review process were utilized to gather a substantial amount of relevant literature. The process began with the selection of keywords, followed by searching for related terms using dictionaries, thesauri, encyclopedias, and prior research. All relevant terms were identified, and search strings were created for the Scopus and Web of Science (WoS) databases as refer to Table 1. This initial phase of the systematic review yielded 2061 publications pertinent to the study topic from the three databases.

Screening

During the screening step, potentially relevant research items are evaluated to ensure they align with the predefined research question(s). This phase often involves selecting research items

based on the constructs in technology adoptions theories. Duplicate papers are removed at this stage. Initially, 1951 publications were excluded, leaving 110 papers for further examination based on specific inclusion and exclusion criteria (see Table 2). The first criterion was a article in journal, as it is the main source of practical recommendations, including reviews, meta-syntheses, meta-analyses, books, book series, chapters, and conference proceedings not covered in the most recent study. The review was limited to English-language publications from 2022 to 2024. Another criterion chosen is for it to be related to computer science field. Overall, four publications were rejected due to duplication.

Table 1: The Search String

Scopus	TITLE-ABS-KEY (("Technology Adoption" OR "User Acceptance" OR "Adoption Models" OR "Integration of Frameworks") AND ("TRA" OR "TPB" OR "TAM" OR "TAM2" OR "DOI" OR "UTAUT") AND ("Constructs" OR "determinant")) AND PUBYEAR > 2021 AND PUBYEAR < 2025 AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "COMP")) AND (LIMIT-TO (LANGUAGE , "English")) Date of Access: Sep 2024
WoS	("Technology Adoption" OR "User Acceptance" OR "Adoption Models" OR "Integration of Frameworks") AND ("TRA" OR "TPB" OR "TAM" OR "TAM2" OR "DOI" OR "UTAUT") AND ("Constructs" OR "determinant") (Topic) and 2024 or 2023 or 2022 (Publication Years) and Article (Document Types) and English (Languages) and Computer Science (Research Areas) Date of Access: Sep 2024

Source: Database's Search Queries

Eligibility

In the third step, known as the eligibility phase, 106 articles were prepared for review. During this stage, the titles and key content of all articles were carefully examined to ensure they met the inclusion criteria and aligned with the current research objectives. Consequently, 61 articles were excluded as they did not qualify as due to the out of field, title not significantly, abstract not related on the objective of the study and no full text access founded on empirical evidence. As a result, a total of 45 articles remains for the upcoming review.

Table 2: The Selection Criterion Is Searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2022 – 2024	< 2022
Literature type	Journal (Article)	Conference, Book, Review
Publication Stage	Final	In Press
Subject	Computer Science	Besides Computer Science

Data Abstraction and Analysis

An integrative analysis was used as one of the assessment strategies in this study to examine and synthesise a variety of research designs (quantitative methods). The goal of the study was to identify relevant topics and subtopics. The stage of data collection was the first step in the development of the theme. Figure 1 shows how the authors meticulously analysed a compilation of 45 publications for assertions or material relevant to the topics of the current study. The authors then evaluated the current significant studies related to constructs in technology adoptions theory. The methodology used in all studies, as well as the research results, are being investigated. Next, the author collaborated with other co-authors to develop themes based on the evidence in this study's context. A log was kept throughout the data analysis process to record any analyses, viewpoints, riddles, or other thoughts relevant to the data interpretation. Finally, the authors compared the results to see if there were any inconsistencies in the theme design process. It is worth noting that, if there are any disagreements between the concepts, the authors discuss them amongst themselves.
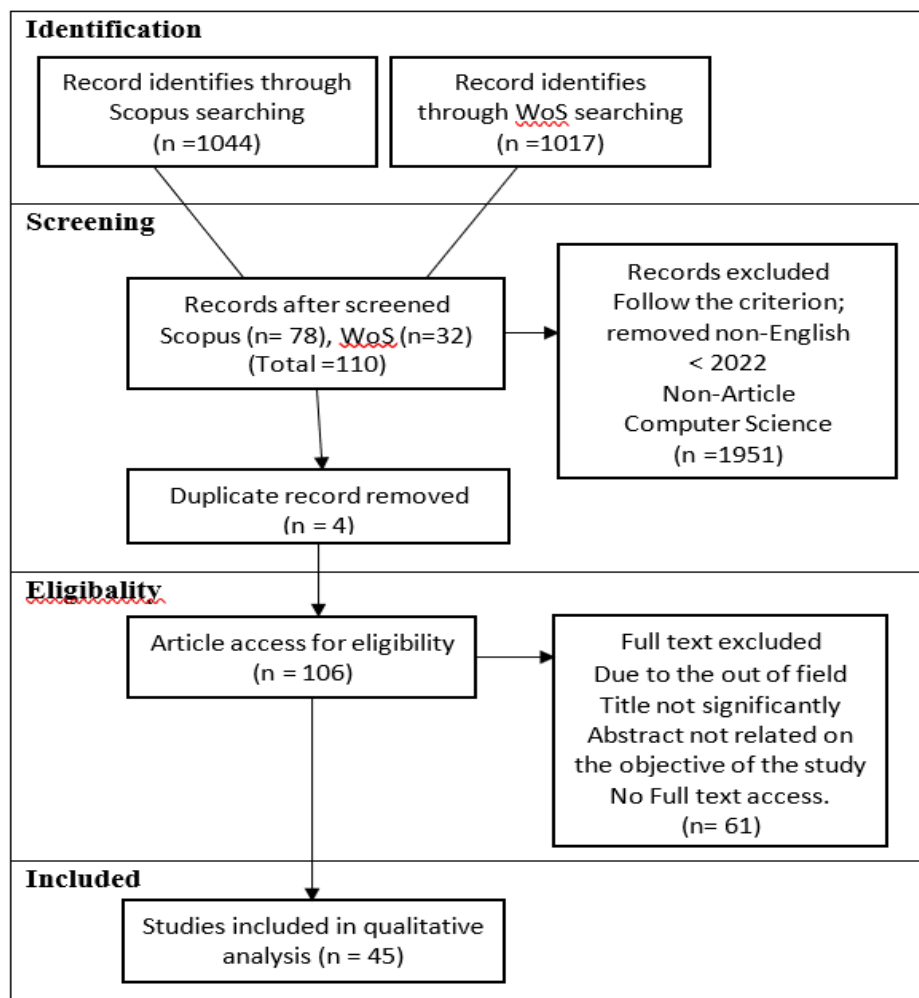

Figure 1: PRISMA Framework Of The Proposed Searching Study
(Moher et al., 2009)

Result And Findings

This study selected 45 articles that were used to answer the research questions. The results of this study which focused on the constructs that isn't part of the core construct of a technology adoption theory mentioned in their study. The findings discovered are focus on three main themes: 'User Acceptance and Behavioural Intentions', 'Technology Integration and Innovation', and 'Sustainability and Social Impact'.

User Acceptance and Behavioural Intentions

User acceptance and behavioural intention refers to how a person accept and adopt new technologies and is the most significant among the three themes as majority of the article fit this theme. According to (Song et al., 2022), older adults are more likely to adopt voice-user interfaces (VUI) in smart home systems if they find them useful, easy to use, and trustworthy. Their findings suggest that factors like mobile self-efficacy and technology anxiety, which are common in older individuals, influence these aspects, indicating that products should be designed with this age group in mind. Similarly, (Nakisa et al., 2022) examine palm vein authentication technology and conclude that user trust and perceptions of risk are essential for its adoption. Their study emphasizes the need for developers to foster trust and address privacy concerns to boost user acceptance. (Zogheib, 2024) continues this discussion by focusing on user engagement with educational technologies like Google Classroom, linking ease of use and perceived usefulness to how well students accept these tools in a Middle Eastern context.

Recent studies, like the one by (Nusir et al., 2023) on smart city technologies, show that how easy people think it is to use these technologies and the quality of ICT infrastructure are crucial for citizens in Jordan when deciding to adopt them. Similarly, (Panagiotopoulos et al., 2024) found that enjoyment and the cost of automated passenger vehicles play a big role in how consumers in Europe accept these innovations. Their research points out that different socio-economic factors can really affect how people decide to adopt new technologies. Moreover, (Posselt et al., 2024) looked into digital treatments for depression and found that patients' trust in their healthcare providers greatly influences their willingness to accept tech-based treatments. Other research, like the work of (Zobair et al., 2022) and (Jajic et al., 2022), explores how these models are applied in the health and retail industries. Zobair et al. take a mixed-methods approach that combines Expectation Disconfirmation Theory with the Technology Acceptance Model to explain what affects patient satisfaction with telemedicine. They emphasize how performance expectations relate to the actual service provided. On the other hand, (Jajic et al., 2022) investigate the role of augmented reality in retail, showing that both performance expectations and enjoyment are key to encouraging positive customer behaviour.

In conclusion, the topic of user acceptance and behavioural intentions sheds light on important aspects across different tech fields, showing how contextual elements can impact technology adoption. Major constructs like perceived usefulness and ease of use are essential, with research often referencing models like the TAM and the UTAUT. For older individuals, technologies that allow for simple interactions, such as voice interfaces, can be very beneficial, while biometric systems often encounter issues related to privacy and perceived risks. In educational environments, platforms like Google Classroom that are easy to use promote acceptance, emphasizing the importance of cultural context and support from institutions. Overall, understanding these dynamics is vital for the successful integration of technology, guiding

future research on user experiences and strategies to enhance technology adoption and satisfaction across different sectors.

Technology Integration and Innovation
Technology integration and innovations refers to how technologies are integrated to various sectors such as education and healthcare.(Julianti et al., 2024) explored the acceptance of Outcome-Based Education (OBE) systems among educators in Indonesia using the UTAUT-3 model. Their findings revealed that Behavioural Intention (B.I.) is essential for influencing User Behaviour (U.B.), with significant correlations found between personal habits and the intention to utilize technology. By incorporating hedonic motivation and personal innovativeness into the UTAUT-3 model, the study sheds light on how these factors collectively affect the adoption of educational technologies. This emphasizes the importance for educational institutions to implement such frameworks for effective technology integration. In the field of drone technology, (Valencia-Arias et al., 2022) explored what influences the use of drone delivery systems in Medellín during the COVID-19 pandemic. Their findings showed that factors like performance risk, compatibility, and environmental advantages play a crucial role in whether people decide to use this technology. This indicates that how people view the innovative features is crucial for its acceptance. This research is similar to that of (Cheng & Chong, 2022), who looked into blockchain adoption in the construction sector, emphasizing the significance of institutional pressures and perceived benefits among different stakeholders. Both studies provide important insights into how various contextual elements affect technology acceptance in different settings.

(Legesse et al., 2024) investigated the use of blockchain technology in Ethiopia's National Quality Infrastructure, employing a combined TAM-TOE framework. Their results revealed that technological compatibility and perceived usefulness are essential for adoption. This is similar to the findings of (Zhang et al., 2023), which pointed out that resource availability and collaboration are vital for the adoption of digital technologies in the construction sector. Collectively, these studies highlight the need for approaches that are tailored to local conditions and technological environments, demonstrating how various constructs can shape adoption outcomes in various fields.

In conclusion, the study of technology integration and innovation sheds light on important insights across different sectors, revealing the factors that affect the acceptance of new technologies. In educational settings, models like UTAUT-3 show how user behaviour, enjoyment, and existing habits can enhance the teaching and learning process. Similarly, the use of drones for delivery and blockchain technology in various industries highlights the significance of perceived benefits, compatibility, and support from organizations in shaping adoption decisions. The application of virtual reality in practical learning demonstrates the potential of immersive technologies to address challenges in remote education, while also emphasizing the cultural factors that influence user acceptance. These findings indicate the need for customized approaches that consider user experiences and environmental contexts to ensure successful technology adoption across different fields.

Sustainability and Social Impact
Sustainability and social impact refer to the extensive societal consequences of adopting technology, with a particular emphasis on sustainability. The research conducted by (Chi et al., 2023) revealed that attitudes, subjective norms, and perceived consumer effectiveness are

pivotal in determining the intention to use apparel rental services in the U.S. This investigation, based on the TPB, found that these factors together accounted for a significant portion of the variance in consumer intentions, thereby underscoring the importance of environmental knowledge and personal relevance in the decision-making framework. In a parallel study, (Wang et al., 2022) explored the adoption of electric shuttle bus services, identifying attitude as the primary predictor of acceptance, with performance expectancy and social influence providing additional support. These outcomes highlight the necessity of enhancing consumer awareness regarding environmental benefits to encourage greater acceptance of sustainable transportation solutions.

In a different aspect of technology adoption, (Albastaki et al., 2024) examined the acceptance of the work-from-home (WFH) model among technical staff in the electricity sector. This study utilized the UTAUT theory and introduced new variables such as emotional well-being and cultural considerations, which were found to be crucial in the WFH setting. The insights derived from this research indicate that fulfilling the holistic needs of employees can lead to the creation of more sustainable work environments, a factor that is especially significant in the context of the post-pandemic world. Similarly, (Alkhwaldi, 2024) investigated the perceptions of students regarding Metaverse technology in higher education, finding that performance expectancy and facilitating conditions were significant factors influencing acceptance. This research highlights the potential of immersive technologies to enhance both social engagement and learning experiences, particularly in developing nations.

(Dajani et al., 2022) conducted a study on the factors influencing the adoption of sustainable cloud-based quality management systems among academics in Jordan. Utilizing the UTAUT2 model and the TPB, the research highlighted perceived behavioural control and performance expectancy as significant determinants of usage intentions. This research not only enhances the understanding of technology adoption within educational contexts but also underscores the importance of institutions fostering environments that support the integration of sustainable technologies. In a related study, (Karpurapu & Naga Venkata Raghuram, 2024) explored the usage of electric vehicles (EVs) in South India, finding that perceived risks played a crucial role in shaping behavioural intentions. Their results indicate that mitigating risk perceptions is vital for encouraging the adoption of electric vehicles, which are essential for achieving sustainable transportation.

(Manik et al., 2024) conducted research on knowledge-based chatbots with the objective of promoting species literacy, highlighting the synergy between education and technology. Their analysis reveals that the fit between specific tasks and technological solutions is pivotal in determining users' intentions to adopt these educational tools, thereby providing critical insights into user engagement strategies. Furthermore, (Saqib & Qin, 2024) examined the role of digital innovations in the logistics sector, demonstrating that the adoption and integration of technology contribute positively to diverse sustainability outcomes. This study underscores the significant impact of digital technologies on advancing operational sustainability across different sectors.

In conclusion, the analysis of sustainability and social impact indicates a rising interest in collaborative consumption, innovative technologies, and sustainable practices across different sectors. Research findings reveal that factors such as consumer attitudes, social influences, and

perceived effectiveness significantly affect the intention to adopt sustainable solutions, including apparel rental services and electric vehicles.

Discussion

During the analysis of several articles for this paper, the significance of the term "construct" is highlighted as a crucial aspect across diverse academic fields. It typically represents an abstract concept that denotes quantifiable features of human behaviour or perceptions. Constructs are utilized as theoretical framework to dissect complex phenomena into more manageable elements. Within the realm of technology adoption, constructs may be referred to by different terms, including "variables," "dimensions," or "factors," contingent upon the research emphasis and the theoretical framework utilized.

The core constructs of these technology adoptance theories are fundamentally flexible, allowing for adjustments that cater to contexts and populations. This flexibility is crucial, as it permits researchers to refine these frameworks to improve their relevance, particularly when exploring new technologies or considering cultural factors that may shape user behaviour. As an example from a criticism study TAM, it highlight that its narrow focus on technical aspects while overlooking personal characteristics and negative perceptions (Malatji et al., 2020). Therefore, while the foundational constructs offer a strong basis, the need for modifications is driven by the necessity for practical relevance in both academic research and real-world applications, as well as the imperative to enhance our understanding of user behaviour across different contexts. It is important that any adaptations are based on empirical evidence to ensure their validity and reliability, thereby contributing to a more sophisticated understanding of technology acceptance dynamics.

As this paper is to discuss the common construct use within technology adoptance theory and suggesting constructs that are less common or just uncommon to be used for future research. In order to categorise the constructs as either common or uncommon we calculated it frequency of being used using the formula given above. However, we will also be noting if the construct belongs to a construct of another technology adoptance theory and deemed the construct as common as the construct is already a part of an established technology adoptance theory. This is due some of the articles we reviewed have add additional construct into their technology adoptance theory framework that are from another established technology adoptance theory. As example the study of (Song et al., 2022) the needs of older persons adopting voice-user interfaces, they use Senior Technology Adoption Model (STAM)'s constructs to add into their framework. The STAM is a multifaceted assessment of the willingness of senior citizens to embrace general technological advancements and have been use to study South Korean adults regarding their intention to use daily living assistive technologies (Shin et al., 2023). Thus, it is another technology adoptance theory.

Among the 44 constructs analysed, only three are deemed common. These constructs are Trust, Security Risk, and Attitude. Both Trust and Security Risk have been frequently utilised as additional constructs in authors' adapted Technology Adoptance Theory framework, each demonstrating a frequency percentage exceeding 20%. and they do not belong to any established framework, which results in their classification as common constructs. In contrast, the Attitude construct is acknowledged as a construct from established theories, specifically the Theory of Planned Behavior (TPB) and the Theory of Reasoned Action (TRA), thereby automatically qualifying it as common.

The remaining 41 constructs are categorized as uncommon, a classification that underscores their potential to enhance future research initiatives within the frameworks of Technology Adoption Theory, despite their infrequent application over the last three years. Some of these uncommon constructs may be particularly relevant to specific contexts, as shown in the study by (Wang et al., 2022) where they analysed user adoption of electric bus shuttle services through the Norm Activation Model (NAM) by (Schwartz, 1977). The NAM model is designed to elucidate individuals' awareness of the negative consequences of non-environmental behaviours, thereby emphasizing the contextual applicability of certain constructs.

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