Universidad Rey Juan Carlos

TESIS DOCTORAL

Aplicación de la Teoría Unificada de Aceptación y Uso de la Tecnología Extendida (UTAUT 2) para estimar la intención de uso de la tecnología. Desarrollo de un modelo predictivo para la plataforma de pago móvil peer-to-peer y los asistentes virtuales

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Dedicatoria

A mi madre y a mi padre,

porque les debo todo lo

que soy…

Y en especial a mis hijos:

Fernando,

Irene,

María y

Francisco

Agradecimientos

No dejes que termine el día sin haber crecido un poco,
sin haber sido feliz, sin haber aumentado tus sueños.
No te dejes vencer por el desaliento.
No permitas que nadie te quite el derecho a expresarte, que es casi un deber.
No abandones las ansias de hacer de tu vida algo extraordinario.
No dejes de creer que las palabras y las poesías, sí pueden cambiar el mundo.
Pase lo que pase nuestra esencia está intacta.
Somos seres llenos de pasión.
La vida es desierto y es oasis.
Nos derriba, nos lastima, nos enseña,
y nos convierte en protagonistas de nuestra propia historia.
Aunque el viento sople en contra, la poderosa obra continúa:
Y Tú puedes aportar un verso.
No dejes nunca de soñar, porque sólo en sueños puedes ser libre.
No caigas en el peor de los errores: el silencio del alma.
La mayoría vive en un silencio espantoso.
No te resignes.
Disfruta del pánico que te provoca tener la vida por delante.
Vívela intensamente, sin mediocridad.
Piensa que en ti está el futuro y encara la tarea con orgullo y sin miedo.
Aprende de quienes puedan enseñarte.
Las experiencias de quienes nos precedieron,
de nuestros «Poetas Muertos»,
te ayudarán a caminar por la vida.
La sociedad de hoy somos nosotros:
Los «Poetas Vivos».
No permitas que la vida te pase a ti sin que la vivas …

Walt Whitman, 1855

Mi profundo agradecimiento a mi madre por transmitirme siempre su espíritu y a mi padre por estar siempre conmigo.

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Y a todos los que con sus palabras de ánimo, apoyo y comprensión han estado incondicionalmente y sin los que difícilmente hubiera podido llegar hasta aquí…

Carla, Norma, María Teresa, Marta, Gemma, Ana…

Y por último con todo mi amor a Fran, Fernando, Irene, María y Francisco, por su paciencia infinita… ¡Lo logramos ¡

Gracias a todos los que me habéis apoyado a culminar esta "estrofa" de mi vida.

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De esta tesis doctoral surgieron las siguientes publicaciones académicas:

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- García de Blanes Sebastián, M., Sarmiento Guede, J. R., & Antonovica, A. (2022). Tam versus utaut models: a contrasting study of scholarly production and its bibliometric analysis. TECHNO REVIEW. International Technology, Science and Society Review/Revista Internacional de Tecnología, Ciencia y Sociedad, 11(Monográfico), 1-27. https://doi.org/10.37467/revtechno.v11.4445

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- García de Blanes Sebastián, M., Sarmiento Guede, J. R., & Antonovica, A. (2022).

Application and extension of the UTAUT2 model for determining behavioral intention factors in use of the artificial intelligence virtual assistants. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.993935

Revista Frontiers in Psychology*:* WOS JCR: 4.23 (Q1 - 35/148); Web of Science- Social Sciences Citation Index (SSCI); SCOPUS Citescore: Q1 – 4 (99th); SCImago Journal Rank (SJR): Q1 – 0,87; Linguistic Bibliography; MLA - Modern Language Association Database; Psycinfo; IBZ Online; Directory of Open Access Journals (DOAJ); ERIHPlus; PubMed; UGC CARE.

- García de Blanes Sebastián, M., Antonovica, A., & Sarmiento Guede, J. R. (2023). What are the leading factors for using Spanish peer-to-peer mobile payment platform Bizum? The applied analysis of the UTAUT2 model. Technological Forecasting and Social Change, 187, 122235. https://doi.org/10.1016/j.techfore.2022.122235

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Resumen

Resumen

Conocer los motivos por los cuales las personas aceptamos la tecnología es fundamental para apoyar la digitalización y transformar la sociedad generando oportunidades en un rango de diversidad e inclusivo. En este contexto, la investigación es primordial para contribuir a los esfuerzos que realizan los gobiernos, las instituciones, las empresas y el sector de la tecnología para acabar con las barreras existentes en su uso. La adopción de los sistemas de información (SI) es una de las corrientes más en boga y con mayor continuidad en este campo de la investigación. La pandemia de la Covid-19 ha brindado una oportunidad para ampliar los conocimientos en adopción tecnológica, ya que los usuarios han realizado grandes esfuerzos en la adopción de nuevas tecnologías e innovación que les han permitido hacer frente a los daños causados por la Covid-19 a nivel personal y en el ámbito profesional (O'Leary, 2020). Estas oportunidades no solo sirven para avanzar en soluciones basadas en tecnología, sino también para estudiar el comportamiento de los usuarios frente a estas.

Con el fin de explicar la adopción y el uso individual de los sistemas de información y de tecnologías de la información, los investigadores han propuesto múltiples teorías y modelos. Las teorías proporcionan un conjunto de variables explicativas que se pueden utilizar para predecir un fenómeno en particular y los modelos son una descripción sistemática de un sistema, una teoría o un fenómeno que por sus propiedades conocidas o inferidas pueden ser utilizadas para estudios posteriores (Burch, 2003). Estas teorías y modelos desde diferentes enfoques se han desarrollado para intentar comprender las motivaciones y desarrollos intrínsecos relativos a la adopción: el "por qué" y "por qué no" las personas adoptan tecnologías digitales aplicadas.

El objetivo principal de este estudio es contribuir a la comprensión de las actitudes de los usuarios que se convierten bien en impulsores o bien en barreras para el uso aplicado de estas tecnologías.

Aunque, como se ha mencionado es un campo de conocimiento extenso y con amplia trayectoria, existe un vacío en la investigación, principalmente por dos motivos, por el impacto que ha supuesto la Covid-19 en el comportamiento de los usuarios en el uso de la tecnología y que todavía no ha sido ampliamente estudiado y por otro lado, por el grado de tecnologías emergentes, con potencial de desarrollo y transformación, por lo tanto, son tecnologías que por su novedad no han sido estudiadas previamente o lo han sido de forma escasa.

La aplicación de las teorías de la adopción de la tecnología en el contexto de la Covid-19 y su aplicación a nuevas tecnologías derivará en el surgimiento de nuevas variables y relaciones adecuadas para describir el nuevo entorno. Y conllevará no sólo producir nuevos resultados, sino que también afirmarán la generalización de esos modelos para poder ser utilizados en otros contextos o tecnologías o incluso la creación de nuevos modelos teóricos que se adapten mejor a la nueva situación.

Se ha seleccionado y aplicado la Teoría Unificada de Aceptación y Uso de la Tecnología Extendida (UTAUT2) (Venkatesh et al., 2012), después de una extensa revisión de la literatura. Esta teoría ha sido validada empíricamente en numerosas investigaciones previas ya que unifica ocho modelos de aceptación de la tecnología y sus extensiones. Es una base teórica sólida para comprender los problemas relacionados con

la adopción de tecnología en una variedad de entornos, ya sea de forma independiente, en combinación con otras teorías, o añadiendo variables externas.

La UTAUT2 predice el 74% por ciento de la variación en la intención de comportamiento de los consumidores y el 52% de la variación en el uso de tecnología por parte de los consumidores (Venkatesh et al., 2016), por lo que es la teoría con los resultados predictivos más altos y esto lleva a que muchos investigadores seleccionen esta teoría en detrimento de otras en sus estudios. La UTAUT2 fue publicada en el 2012 y desde entonces solo en Google Scholar hay más de 6.000 citas haciendo énfasis en su capacidad predictiva (Tamilmani et al., 2021).

El desarrollo de las nuevas tecnologías digitales, también conocidas como Industria 4.0 es un cambio de desarrollo que permite recopilar y procesar datos entre máquinas; esto lleva a realizar procesos, más rápidos, de mayor calidad, flexibles, eficientes y económicos para producir bienes y servicios. Se denomina Industria 4.0 a la cuarta revolución industrial que surge por la aparición de Internet. A lo largo de la historia, los avances tecnológicos por los cuales surge un periodo de alto rendimiento que se concentra en un período de tiempo determinado, que logran que su impacto proporcione un beneficio notable para la sociedad en conjunto y masivamente en el área de industria, se les denominan revoluciones industriales (Bisio et al., 2018)

Durante la cuarta revolución industrial, las tecnologías de Internet tienen como objetivo conectar todos los medios de producción para permitir su interacción en tiempo real, de esta manera facilita la comunicación entre los diferentes agentes y áreas de

conexión, gracias a tecnologías como computación en la nube, inteligencia artificial (IA), internet de las cosas (IoT), big data o la tecnología blockchain (BCT).

Esta investigación toma dos tecnologías de la industria 4.0 para realizar el análisis empírico de la UTAUT2, con el fin de desarrollar un modelo predictivo que analice las actitudes que influyen en la intención de usar tecnologías con conectividad. La primera, la inteligencia artificial con un desarrollo tecnológico puntero, los asistentes virtuales, que son agentes conversacionales que permiten chatear con una máquina con lenguaje natural. Estos, en los últimos años se han vuelto cada vez más populares y han tenido un gran desarrollo durante la pandemia ya que se han utilizado en múltiples tareas.

En segundo lugar, se ha seleccionado la tecnología Blockchain (tecnología de contabilidad distribuida) que es un protocolo de software de red que permite, entre otras opciones la transferencia segura de dinero, activos e información a través de Internet, sin un intermediario, como por ejemplo un banco (Swan, 2015). Dentro del ámbito de blockchain, los medios de pago a través de cartera virtual o aplicaciones del pago persona a persona (P2P) con Bizum, permiten a los usuarios vincular sus cuentas bancarias a una aplicación facilitando la transferencia digital de dinero entre ellos. Esta tecnología ha incrementado exponencialmente su uso durante la pandemia, por su velocidad, conveniencia, eficiencia y seguridad como protección frente a la pandemia.

Como consecuencia del crecimientos de ambas tecnologías, el tema de investigación está creciendo en consecuencia y deberían realizarse investigaciones de análisis exhaustivo para obtener conclusiones relativas a las percepciones de los usuarios respecto a estos dispositivos.

Esta tesis se ha estructurado en seis capítulos, en el primer capítulo se ha presentado una introducción sobre el tema general, la justificación, las preguntas, objetivos, metodología y como se han llevado a cabo las publicaciones y su estructura dentro de esta investigación.

En el capítulo segundo se ha realizado una revisión sistemática de las publicaciones relacionadas con las teorías y modelos que se han utilizado a lo largo de los años para intentar explicar la aceptación o el rechazo de la tecnología. Se ha realizado un análisis de contenido para identificar las contribuciones fundamentales de estas teorías, en base a su utilidad, actualidad y ámbito de aplicación, para de esta manera poder definir la agenda de investigación.

En el capítulo tercero para continuar con la revisión de literatura se realiza un análisis bibliométrico, en el que se comparan las dos teorías conceptuales de mayor actualidad resultantes del estudio del capítulo segundo, el Modelo de Adopción de Tecnología (TAM), el Modelo de Adopción de Tecnología (TAM 2), el Modelo de Adopción de Tecnología 3 (TAM 3) versus la Teoría Unificada de Aceptación y Uso de Tecnología (UTAUT) y la Teoría de Aceptación y Uso de Tecnología extendida (UTAUT2). El objeto de este análisis es crear una representación de la estructura del área de

investigación mediante la partición de elementos (documentos, autores, revistas, palabras, temática) en diferentes grupos (Zupic y Cater, 2015). Esta visualización comparando ambas teorías nos sirven para seleccionar la teoría más adecuada para realizar el análisis empírico, en este caso el de la UTAUT2.

En los capítulos cuatro y cinco se estudian los factores que influyen a los usuarios en la intención de usar ambas tecnologías. Con una revisión exhaustiva de la literatura de los asistentes virtuales y plataforma P2P Bizum, se define el modelo conceptual, se proponen las hipótesis y se desarrolla el instrumento de medida. A través de un piloto se recopilan los datos en dos cuestionarios. Con la aplicación SPSS AMOS versión 27, se realiza el modelado de las ecuaciones estructurales. En la primera parte se realiza un procesamiento de los datos con un análisis factorial exploratorio (EFA), para explorar si los factores propuestos en el modelo son apropiados y si esos factores son representados por las variables observadas, que son las preguntas del cuestionario. Se aplican diferentes técnicas estadísticas con el objeto de confirmar que el modelo de medición es adecuado y se realizan los ajustes necesarios para que así sea. El siguiente paso es realizar el análisis factorial confirmatorio (CFA) que nos permiten probar la teoría que proponemos. En esta primera etapa, construiremos un modelo de medida que se ajusta adecuadamente a los datos para validar el modelo teórico propuesto.

En una segunda etapa, desarrollaremos y evaluaremos el modelo estructural, para probar las hipótesis planteadas. Se aplican técnicas estadísticas para hacer los ajustes necesarios e identificar el modelo de estructura final, logrando un ajuste adecuado que nos sirve para analizar las hipótesis. Una vez realizada esta parte empírica se describirán

los resultados, conclusiones, contribuciones, limitaciones y futuras líneas de investigación de los asistentes virtuales y P2P Bizum.

Por último, en el capítulo 6 se incluyen las conclusiones, se especifican las contribuciones a la teoría y a la práctica, así como las limitaciones y futuras líneas de investigación.

Esta tesis realiza varias contribuciones importantes. En primer lugar, se presenta una revisión de la literatura sobre las teorías y modelos desarrollados o utilizados para intentar explicar la tecnología a través de técnicas de contenido y bibliométricas, identificando las teorías predominantes en cuestión de predicción e investigación. En segundo lugar, se propone un modelo integrado basado en UTAUT2 que tiene como objetivo proporcionar una comprensión holística y completa sobre la adopción de los asistentes virtuales y plataforma P2P Bizum con el impacto de la pandemia Covid-19. Con este conocimiento se contribuye al desarrollo de estas tecnologías, especialmente en España, donde esta industria se encuentra en gran crecimiento. En tercer lugar, nuestro estudio presenta una extensión del modelo UTAUT2 al evaluar otros constructos adicionales que han sido empíricamente utilizados en numerosas investigaciones. Este modelo propuesto se podrá utilizar en otros contextos, entornos o tecnologías. Y, por último, estos resultados, proporcionarán información muy valiosa a los gobiernos, instituciones, empresas y el sector de la tecnología que podrán ayudarle en el diseño e implementación de estas tecnologías, con el objeto final de disminuir la brecha digital existente.

Palabras Clave

Modelos de aceptación tecnológica, Intención de comportamiento, Web of Science, MAXQDA software, análisis bibliométrico, mapa de visualización, VOSviewer, TAM, UTAUT2, P2P, plataforma pago móvil, Bizum, asistentes virtuales, inteligencia artificial, ecuaciones estructurales.

Abstract

Finding a productive ground about the reasons for technology acceptance is essential for the ongoing process of digitization and transformation happening in Information Technologies to the present day. A knowledgeable approach in this area leads to an extended range in diversity, access, and inclusive use of technology. In the context of societal change, research provides a bottom line towards united efforts from different spheres, by taking into account government projects, institutional mandates and businesses alike. SI or Information technologies are being oversight with longevity for new opportunities. After the recent spread of Covid-19 and restrictions arising from pandemic-relief efforts, nationals, citizens, and users adopted platforms at a faster pace, in order to be up to date with demands in their everyday flows. These changes in usage affect both, personal and professional areas in individuals according to O'Leary (2020); it will provide a base for undertaking initiatives directed to implement solutions that are technology-base and, that, in turn, provoke a reaction from users.

Adoption and Technology usage are at the front of this wave of advancement in the SI area. Consequently, scholars and researchers are keeping are operating with the objective in sight of a framework that establishes a flexible and comprehensive theoretical ground. From a theoretical standpoint the variables that guide the heuristic model for underpinning these trends, explain as well as predict the specific phenomenon, in this case, technology adoption as it relates to new digital applications, and, additionally, provide a system for a known set of rules, expected to appear during the early stage during adoption; these are inferred from the model in later studies (Burch, 2003). The sum of theories under the umbrella of a unifying model, evolves from a core understanding of

the motivations and intrinsic evolution in the behavioral intention relative to the applied technology, this is, the "why" and "why not" of the acquisition of an applied platform.

The main objective of the present work is to add an edge to guidelines in intention and variables as measurable from a user approach, that will enact a role as innovators or as opposer when it comes to use of applied digital technology.

Having established a primary goal, the overarching extensions on the area of knowledge expand to frame the relevance of theories during the time of Pandemic Global crisis (2020-2023), since this period created the conditions for a required, continued distancing, and demanded an extra effort in bridging within communities, a situation that affected technology users behaviours and that has not been properly accounted for, in its full extend, mainly for the novelty of the scenario impacting the development of trends in remote working and settings for connectivity.

From an applied theory perspective within the area of adoption and applications in new technologies, the landscape opens to new variables impacting relationships and for the establishment of bridging connectors, points of synergy occurring in the renewed framework. With this extensive area of scope in mind, the findings and general working hypothesis arise from systematic surveying to underline what is relevant to adoption; therefore, generally established preconceptions and biases are brought to the screening process of selecting a theoretical approach and a set of variables that correlates with changes happening around the new models and systems.

The Theory Unified of Acceptance Technology and Extended Use of Technology (UTAUT2) (Venkatesh et al., 2012), after a critical revision of previous academic literature, validates empirical bases for technology adoption and research, under eight models that are comprehensive within a vast area of study. This base for anchoring the study provides a common ground to understand the matters that are relative to technology adoption in diverse settings, either from an angled approach or from the intersection of variables taking on several theoretical approaches.

UTAUT2 is a predictor of 74% of variation and range within Behavioral intention in consumer adoption of technology and up to a 52% of the variation in the consumer side (Venkatesh et al., 2016). The high prediction ratio is recognized among specialists so that this framework comes first for many scholars working in technology adoption from a diverse perspective. After its first systematic underlining is agreed upon in 2012, Google Scholar displays more than 6,000 entries that pointed at this theoretical approach for the predictive and accuracy yield in value insights, from GS results (Tamilmani et al; 2021).

The recent evolution of new technologies often known as Industry 4.0 for a more efficient performance in data compilation, and network protocols, carries a sophisticated standard of quality and rules applying to normative in the manufacturing of good and provision of services. These standards and evolved criteria evolve from the appearance and universal use of Internet. Throughout history, (when) technological advances for which a period of high-performance rises, in a concentrated, defined period of time, have achieved impact providing a notable benefit for society as a whole and massively advancement to industry in a wide range of areas, so they are called industrial revolutions.

During the 4th industrial revolution, Internet based on IP protocols, connected production and media in regular interactions so manufacturing can be planned and assessed in real time, with a number of agents involved in the chain of production to be able to cut through the communication and to affect the interaction happening according to a rationalized measure and expectation; this evolution is possible mainly via new platforms and hardware creations, such as, Artificial Intelligence, AI, Internet of things, IofT, Big Data and Blockchain technology, BCT.

The present study underpins a set of technology platforms created under Industry 4.0 for an end result that lies ground in the UTAUT2, first and foremost for an accurate model of predictive power, to lay ground on the hypotheses in adoption; additionally, for presenting a verifiable analysis of user intention, when it relates to a set of technology that inherently assumes connectivity; namely: AI, for advantage preview, virtual assistants in the development of conversational bots using a resembling-natural language. These two sets of platforms and developments reached a peak in market penetration during the years of pandemic crisis, as these led to usage in a wide range of tasks and production line.

The second technological developments, Blockchain technology, is a software, chain network entrusted in a log protocol that allows transferring of assets in a secure method (distributed log chain network) via internet, and without intermediaries; it is used for the analysis in technology adoption without banks mediating transactions (Swan, 2015). As part of blockchain technology, virtual wallets replace P2P, person to person payments.

Bizum allows users link their account via an intermediary platform to transfer currency from bank to bank. This platform use has increased exponentially during the pandemic due its built-in value, speed of transaction, convenience, efficiency, and security, all of these factors to avoid the risks associated with C19 virus contagion.

As a result, after the increased usage of both platforms, virtual assistants and blockchain, this area of research grew and the current trend in scholarly approaches undertake an in-depth analysis around perceptions from the user side in using the new applications.

For the present study, the analysis and presentation are structured along six chapters. The first part introduces the general scope for the area of study, critical review of literature, research questions, objectives, methodology and exhibit of preliminary publications on the matter. The second chapter undertake on a critical review of the theoretical background along the years, around the main area of technology adoption. From this light, acceptance or rejection are explained as resulting from behavioral intention. The presented analysis around theories and frameworks underlines its utility, relevancy, areas of application, and agenda for the sample, applied research. Chapter three covers the bibliometric analysis on TAM and UTAUT. From this perspective, the area of study is segmented according to media (documents, authors, journals, keywords, subject matter) in different areas (Zupic y Cater, 2015). This visualization contrasted with the theoretical background to activate the variables set on a preliminary working hypothesis, that is, UTAUT2, colluding with the empirical analysis from the extracted samples from the analysis.

In chapters four and five, the factors directly impacting users towards usage and intention, for both platforms proposed, are presented considering a detailed analysis and critical review of the literature relative to VA's and P2P Bizum for payments. As such, the conceptual framework, model for assessment, hypothesis, and instrument of measurement for data compilation after filtering questionnaires, are included in the exposition. By applying SPSS AMOS version 27, the modeling equations are obtained. First, data processing and EFA (Exploratory Factorial Analysis) for inquiring the variables and feasibility of guidelines are agreeable and represented accordingly, via observed variables (sample questionnaire). After, the statistics and processing of the equations as part of the assessment model are applied in order to verify the utility of the model adequate to standard expectations for accuracy; if these are not measuring up to the standards of quality then they are discarded. Next step is CFA, the analysis factorial confirming the theory and model of assessment, and data validation.

Second, the presentation and assessment of the Structural Model, to follow through with the set of variables and preliminary hypotheses. By using Statistic adjustment and identifying the final structural model, after the adequate model for analysis is fit. All the guidelines for data analysis are set in to develop the results via a detailed conclusion, with plausible contributions and limitations, as well as, forecasting future lines of investigation, with regards to both, VA's, and P2P mobile payments.

Finally, chapter six includes results and findings study of the sample data. It ties up with theoretical contributions and open future line of research analysis.

Some of the contributions derived from the study open from the start by inquiring into the critical review of existing academic literature, explaining the technology of data and bibliometrics, and identifying those theories predominant around predictive AI and research. One line following from this extensive access to critical approaches is the imposition of a method for integrating theoretical approach and tool in a framework developed under the UTAUT2 variables and constructs; that is, offering a holistic understanding of the potential in better grasping adoption in VA's and P2P Bizum during the period of residential confinement, remote working, and other health-related restrictions during Covid-19. In Spain, the increased use of digital technologies to everyday common tasks developed exponentially. For this reason, the theoretical background covers additional social constructs to encompass the reality of technology change within an Extended Model and Framework of UTAUT2, based on empirical observations from varied contexts of application, as well and diverse technology environment. The information gathered for the assessment and presented via the discussion has value not only for private enterprise but also for policy informed decisions, in government, institutions and industry sectors; finally, the knowledge on technology adoption and variables impacting positive interaction with technology and digital devices will aid in closing the existing gap between digital access from social spectrums.

Keywords

Technological acceptance models, Behavioral intention, Web of Science, MAXQDA software, Bibliometrics, Visualization map, VOS viewer, TAM, UTAUT2; Peer-to-peer; mobile payment platform; Bizum; virtual assistants, technology implementation, artificial intelligence, Structural Equation Modeling.

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ABREVIATURAS

AV= Asistentes virtuales

BCT = tecnología blockchain

BI= Behavioral intention

CFA = análisis factorial confirmatorio / Analysis Factorial Confirming

CFI= goodness of fit index of adjustment contrast

CR= reliability

C-TAM-TPB = Combined TAM and TPB/ Combinación TAM y TPB

EE=Effort Expectancy/expectative del esfuerzo

EFA = análisis factorial exploratorio/ Exploratory Factorial Analysis

FC=Facilitating conditions/Condiciones facilitadoras

HB= Habit/Hábito

HM= Hedonic motivation/Motivación hedónica

IDT = Innovation Diffusion Theory/ teoría de la Difusión de la Innovación

IoT = Internet de las cosas

LS= mínimos cuadrados

MERS=Síndrome Respiratorio del Medio Oriente

ML= máxima verosimilitud

MM = Motivational Model/ Modelo Motivacional

MPCU = The Model of PC Utilization/ Modelo de Utilización PC

NFC= Near Field Communication

OMS= Organización Mundial de la Salud

PCLOSE= Close Fit

PE=Performance expectancy /Expectativa del desempeño

PEOU= Perceived Ease of Use

PI= Personal innovativeness

PLS = Partial Least Squares/ modelo mínimos cuadrados parciales

PR= Perceived risk

PSE= Perceived privacy risk

PU= Perceived Usefulness

P/V= Price/value/Precio/valor

P2P = persona a persona

RMSEA =square of residual approximate average

SARS= Respiratorio Agudo Severo

SEM= Structural Equation Modelling/Modelo ecuaciones estructurales

SCT = Social Cognitive Theory/ Teoría Cognitiva Social

SI= sistemas de información

SI= Social influence/Influencia Social

SPSS =Paquete Estadístico para las Ciencias Sociales

TAM = Technology Acceptance Model / Modelo de Adopción de Tecnología

TAM 2= Technology Acceptance Model 2/ Modelo de Adopción de Tecnología 2

TAM 3= Technology Acceptance Model 3/ Modelo de Adopción de Tecnología 3

TPB = The Theory of Planned Behaviour/ Teoría del Comportamiento Planeado

TRA = Theory of Reasoned Action/ Teoría de la Acción Razonada

TR= Trust

TTF= Task Technology Fit

UTAUT = Unified Theory of Acceptance and Use of Technology/ Teoría de Aceptación y

Uso de Tecnología

UTAUT 2 = Extending Theory Acceptance and Use Technology/ Teoría de Aceptación y Uso de Tecnología Extendida

VA's= Asistentes virtuales

WoS= Web of Science

Capítulo 1

Introducción

1. Introducción

Las tecnologías están cambiando a un ritmo tan rápido y de una manera tan impredecible, que la escala de su impacto está siendo de largo alcance y en todos los ámbitos de la sociedad. Tecnologías como la computación en la nube, inteligencia artificial, internet de las cosas o tecnología blockchain afectan a tareas habituales como realizar transferencias de dinero, enviar una fotografía, leer el QR de una carta de un restaurante o la declaración de la renta. Gracias a las aplicaciones móviles, los usuarios cada vez utilizan más la tecnología en sus actividades cotidianas. Como consecuencia las organizaciones, instituciones y empresas utilizan estas mismas aplicaciones para prestar sus servicios, procesos u ofrecer oportunidades comerciales, ya que la mayoría de las empresas y servicios están basados en tecnología. En consecuencia, las tecnologías emergentes de hoy en día tienen el potencial de formar parte de los consumidores y empresas.

Cuando los individuos se encuentran ante una nueva tecnología como la realidad virtual, 5G, la nube, inteligencia artificial, big data, internet de las cosas entre otros, recopilan y sintetizan la información sobre ella en el marco del sistema social en el que se encuentran. En este proceso, las creencias que sobre el uso de esa tecnología serán condicionantes para aceptar o rechazar la tecnología (Rogers, 1962).

La adopción de tecnología se define como la aceptación o el primer uso de una tecnología o producto emergente (Khasawneh, 2008). Desde la irrupción de la tecnología, campos como la psicología, sociología o los sistemas de la información han desarrollado numerosos modelos teóricos para predecir y explicar la aceptación la tecnología de la

información por parte de los usuarios (Venkatesh et al., 2003). Los estudios sobre la adopción de tecnología se han centrado durante décadas en comprender, predecir y explicar las variables que influyen en la intención y uso de la tecnología y en consecuencia en su aceptación o rechazo.

Estos estudios han llevado al desarrollo de modelos y de marcos conceptuales para intentar probar empíricamente los factores que influyen en la intención y uso de la tecnología (Gangwar et al., 2014). Estos modelos y teorías parten de la Teoría de la Difusión de la Innovación (IDT) (Rogers, 1962), teoría que proporciona un contexto en el que se puede examinar la aceptación y el impacto de la tecnología de la información a lo largo del tiempo (Dilon y Morris, 1996). Examinan los factores que influyen en la propagación o extensión de la tecnología. Además, describe los cinco atributos explicativos de por qué algunas innovaciones se adaptan de forma más rápida que otras: ventaja relativa, compatibilidad, complejidad, posibilidad de ensayo y posibilidad de observación. También establece que la adopción a largo plazo es diferente e incluso puede ser más importante que la adopción inicial (Rogers, 1962, 1983, 1995,2003).

Estos modelos y teorías ayudan a adoptar las innovaciones actuales, ya que la intención y utilización de la innovación y la tecnología de la información es predecible. Estos marcos ofrecen una perspectiva centrada en la comprensión de la tecnología, ya que los usuarios pueden formar diferentes percepciones hacia una tecnología, por un lado, les afecta la forma en que la utilizan, por otro lado, las posibilidades que ofrece la tecnología pueden mejorar tales percepciones y motivar acciones posteriores (Tarafdar et al., 2020).

Estos modelos, que se resumen los más destacados a continuación, se han aplicado en una variedad de contextos y entornos, ya que son la base teórica para la investigación empírica: La teoría de la Difusión de la Innovación (IDT) (Rogers, 1962,1983,1995,2003), la Teoría de la Acción Razonada (TRA) (Ajzen y Fishbein, 1980), la teoría Social Cognitiva (SCT) (Bandura,1986), el Modelo de Adopción de Tecnología (TAM) (Davis, 1989), la Teoría del Comportamiento Planeado (TPB) (Azjen,1991), el Modelo de Utilización PC (MCPU) (Thompson et al., 1991), el Modelo Motivacional (MM) (Davis et al., 1992) y la Combinación TAM y TPB (C-TAM-TPB) (Taylor y Todd, 1995), la Teoría de Aceptación y Uso de Tecnología (UTAUT) (Venkatesh et al., 2003) y la Teoría de Aceptación y Uso de Tecnología extendida (UTAUT2) (Venkatesh et al., 2012).

La enfermedad del coronavirus 2019, también conocida como la Covid-19, está relacionada con los virus que causan el Síndrome Respiratorio Agudo Severo (SARS) y Síndrome Respiratorio del Medio Oriente (MERS). El primer caso de la Covid-19 se informó el 31 de diciembre de 2019 y se encontró en Wuhan, provincia de Hubei, China. La Organización Mundial de la Salud (OMS) declaró la Covid-19 una pandemia el 11 de marzo de 2020 (OMS, 2020). Desde entonces, la Covid-19 ha transformado el mundo, con personas que se han movido hacia el uso de canales y negocios online. Estos cambios han impulsado una adopción digital más rápida.

Este uso creciente de la tecnología para la mayoría de las acciones cotidianas ha llevado a crear nuevos comportamientos digitales. Comportamientos humanos como comprar, trabajar, aprender, divertirse o entretenerse, que habitualmente se hacían de forma presencial cambiaron drásticamente a realizarse de forma online, lo que conllevó a

un cambio en el comportamiento de los consumidores, por ejemplo, en el comercio, con cambios en el consumidor desde el reconocimiento del problema hasta la búsqueda de información, la compra o la entrega. Este uso de la tecnología genera oportunidades de investigación desde una perspectiva diferente, aceleradas en parte por las tecnologías emergentes y la democratización de esta tecnología a toda la población.

Además, la pandemia de la Covid-19 ha interrumpido los hábitos y el comportamiento habitual de los consumidores. Los consumidores han aprendido nuevos hábitos relacionados con los avances tecnológicos, así como nuevas formas innovadoras para hacer frente a las limitaciones de trabajo, ocio, compra y educación motivados por la pandemia.

Aunque como consecuencia de esta inmersión se ha producido una mayor brecha digital entre los ciudadanos, bien por los que tienen acceso o no a los sistemas de información o bien por los que tienen una mayor adaptabilidad frente a los que tienen más dificultad para adaptarse a estas nuevas tecnologías. La historia muestra que las pandemias pueden catalizar un cambio enorme, transformando fundamentalmente la forma en que las personas dan sentido al mundo. Por lo que las tecnologías pueden ser catalizadores del cambio, no sólo por el papel que han desempeñado en la lucha contra la pandemia de la Covid-19, sino porque la pandemia podría normalizar de forma permanentemente el uso integral de las tecnologías digitales en la sociedad.

Este estudio ha seleccionado dos tecnologías emergentes, pago móvil peer to peer Bizum y asistentes virtuales para investigar el efecto de las construcciones UTAUT2 propuestas con el objeto de medir cuales son los factores que influyen en la intención de

usar estas tecnologías. Por lo que esta investigación proporciona una visión integral y una comprensión profunda de la intención de usar estas tecnologías basadas en las percepciones de los usuarios en España.

2. Justificación de la investigación

La relación entre los humanos y las tecnologías digitales se ha documentado ampliamente en las últimas décadas para intentar explicar el comportamiento de estos frente a las tecnologías, por lo que la investigación sobre adopción y difusión de tecnología es una corriente madura dentro de la literatura de los sistemas de información. Los investigadores están en una búsqueda continua para comprender los factores que influyen en la aceptación individual y el uso de la tecnología emergente (Hughes et al., 2029).

En la pandemia de la Covid-19, las tecnologías han tenido un gran crecimiento, que ha llevado a realizar una amplia investigación sobre estas tecnologías digitales, las poblaciones específicas que las han utilizado y los efectos que han producido estas tecnologías en los humanos (Vargo et al., 2021).

Estos cambios sin precedentes tanto en el comportamiento humano como en la difusión de tecnologías emergentes generan una oportunidad sin precedentes para que la comunidad investigadora estudie el comportamiento relacionado con la tecnología en la pandemia de la Covid-19 (Yan et al., 2021). Examinar el efecto de la pandemia en la aceptación de la tecnología es una forma de convertir esta interrupción motivada por la pandemia en una oportunidad transformadora.

Estas áreas de investigación, sobre la intención de usar la tecnología, en las compras, en el trabajo, en el ocio, redes sociales entre otros ha llevado a enriquecer la disciplina de comportamiento del consumidor, ya que ha supuesto un cambio de comportamiento en la forma de consumir originado principalmente por la rigidez de la ubicación. Esto ha llevado a que los consumidores hayan aprendido a improvisar de manera creativa e innovadora para hacer frente a estas situaciones (Sheth, 2020).

El uso de los asistentes virtuales en la actualidad se encuentra en una etapa de gran crecimiento y desarrollo, existiendo una previsión optimista de que continue con esta tendencia de crecimiento en el mercado. Aunque su uso sigue siendo muy limitado en cuanto a las tareas en las que se utiliza (Lopatovska et al., 2019).

Hasta el momento, hay pocas investigaciones científicas sobre estas tecnologías incluyendo el impacto de la Covid-19. Este estudio aborda este vacío de investigación fundamental y presenta los resultados empíricos sobre el uso de los asistentes virtuales y el P2P Bizum. Nuestro estudio pionero tiene como objetivo proporcionar información útil y aplicable en los sectores involucrados en su desarrollo o comercialización.

3. Preguntas y objetivos de la investigación

Las preguntas que nos planeamos en la investigación son:

- ¿cuáles son los factores que contribuyen a que los individuos adopten las tecnologías?
- ¿cuál es el modelo o teoría más apropiado que deberíamos seleccionar para estudiar las tecnologías actuales?
- ¿podemos aplicar este modelo o teoría y predecir la intención conductual de usar la tecnología en los asistentes virtuales y P2P Bizum?

El objetivo general fue identificar, comprender y estudiar los factores que influyen en la intención de uso de la tecnología durante la Covid-19, como objetivos específicos:

1. Realizar una revisión histórica de los modelos o teorías para seleccionar aquella que sea más adecuada para el estudio de la tecnología actual.
2. Seleccionar dos innovaciones tecnológicas, asistentes virtuales y P2P Bizum, para aplicar el modelo o teoría escogido.
3. Desarrollar un modelo predictivo que nos ayude a eliminar los obstáculos en la adopción de la tecnología.

Este conocimiento contribuirá a los esfuerzos que actualmente realizan las organizaciones, instituciones y empresas, para lograr la democratización de la tecnología.

A continuación, se describen las principales preguntas de investigación y objetivos por capítulos.

3.1. Preguntas y objetivos de la investigación Capítulo 2

Preguntas de investigación:

- ¿Cuáles son los modelos y teorías de adopción de tecnología que han intentado explicar los factores que condicionan la aceptación o rechazo de la tecnología a lo largo de los años?
- ¿Cuáles son los factores que contribuyen a que los individuos adopten esa tecnología?
- ¿Cuál modelo o teoría es más adecuado para predecir en las tecnologías emergentes?

Objetivos:

1. Realizar una revisión de literatura existente sobre las principales teorías en lo que atañe a sus bases teóricas y a sus principales constructos y describir y clasificar las variables que predicen el uso de aceptación o de rechazo de la tecnología.
2. Confirmar si estas teorías siguen siendo utilizadas en la actualidad, si han sido descartadas o están en desuso.
3. Investigar en qué áreas y en qué disciplinas de estudio se utilizan estas teorías y confirmar si se aplican para el estudio de la aceptación de las innovaciones tecnológicas emergentes.

3.2. Preguntas y objetivos de la investigación Capítulo 3

Preguntas de investigación:

- ¿Cuáles son las semejanzas y las diferencias en cuanto a cantidad, calidad y estructura de la producción científica de TAM/TAM2/TAM3 y la UTAUT/UTAUT2?
- ¿Cuáles son las principales áreas de investigación de TAM/TAM2/TAM3 y la UTAUT/UTAUT2?
- ¿Cuál de las dos, TAM/TAM2/TAM3 o la UTAUT/UTAUT2 tiene una mayor relevancia y aceptación entre la comunidad científica como modelo para estudiar la aceptación o rechazo de la tecnología actual?

Objetivos:

Identificar, visualizar y comparar la producción científica en cuanto a la cantidad, calidad y estructura a través de un análisis de sus principales ratios:

1. Áreas de investigación, publicaciones, revistas, tipos de documento e idiomas.
2. Analizar el comportamiento de la producción científica sobre los modelos de aceptación de la tecnología para evaluar el ritmo de crecimiento de la producción científica y sus tendencias (Modelo Price).
3. Identificación de los autores más especializados en el tema frente aquellos autores denominados transitorios o no especializados (Ley de Lotka).
4. Identificación de las revistas cuyas publicaciones constituyen el núcleo de la

disciplina (Modelo de Bradford).

5. Análisis de las citas, revistas, autores y documentos más citados.
6. Cooperación de los autores a través la herramienta VOSviewer.
7. Identificar las palabras claves a través la herramienta VOSviewer de los documentos analizados, permitiendo analizar el enfoque temático y las tendencias de investigación en la producción científica.

3.3. Preguntas y objetivos de la investigación Capítulo 4

Preguntas de investigación:

- ¿Cuáles son los factores que afectan a la intención de comportamiento en el uso de los asistentes virtuales?
- ¿En qué grado la confianza, riesgo de privacidad percibido e innovación personal pueden medir la intención y el uso de los asistentes virtuales?

Objetivos:

1) Explorar los factores incluidos en el modelo UTAUT2 que inciden directamente en el comportamiento de los usuarios para adoptar los asistentes virtuales.
2) Agregar nuevos factores al modelo UTAUT2 que impacten en la intención del comportamiento de los usuarios en torno a los asistentes virtuales y fortalecer el modelo.
3) Evaluar el modelo de intención conductual del usuario alineado con datos empíricos a través del modelado de ecuaciones estructurales.
4) Establecer un modelo predictivo.

3.4. Preguntas y objetivos de la investigación Capítulo 5

Preguntas de investigación:

- ¿Cuáles son los factores que inciden en la intención de usar la plataforma de pago móvil P2P Bizum?
- ¿Los factores de confianza, seguridad y riesgo percibido contribuyen en la intención conductual de adoptar la plataforma de pago móvil P2P Bizum?

Objetivos:

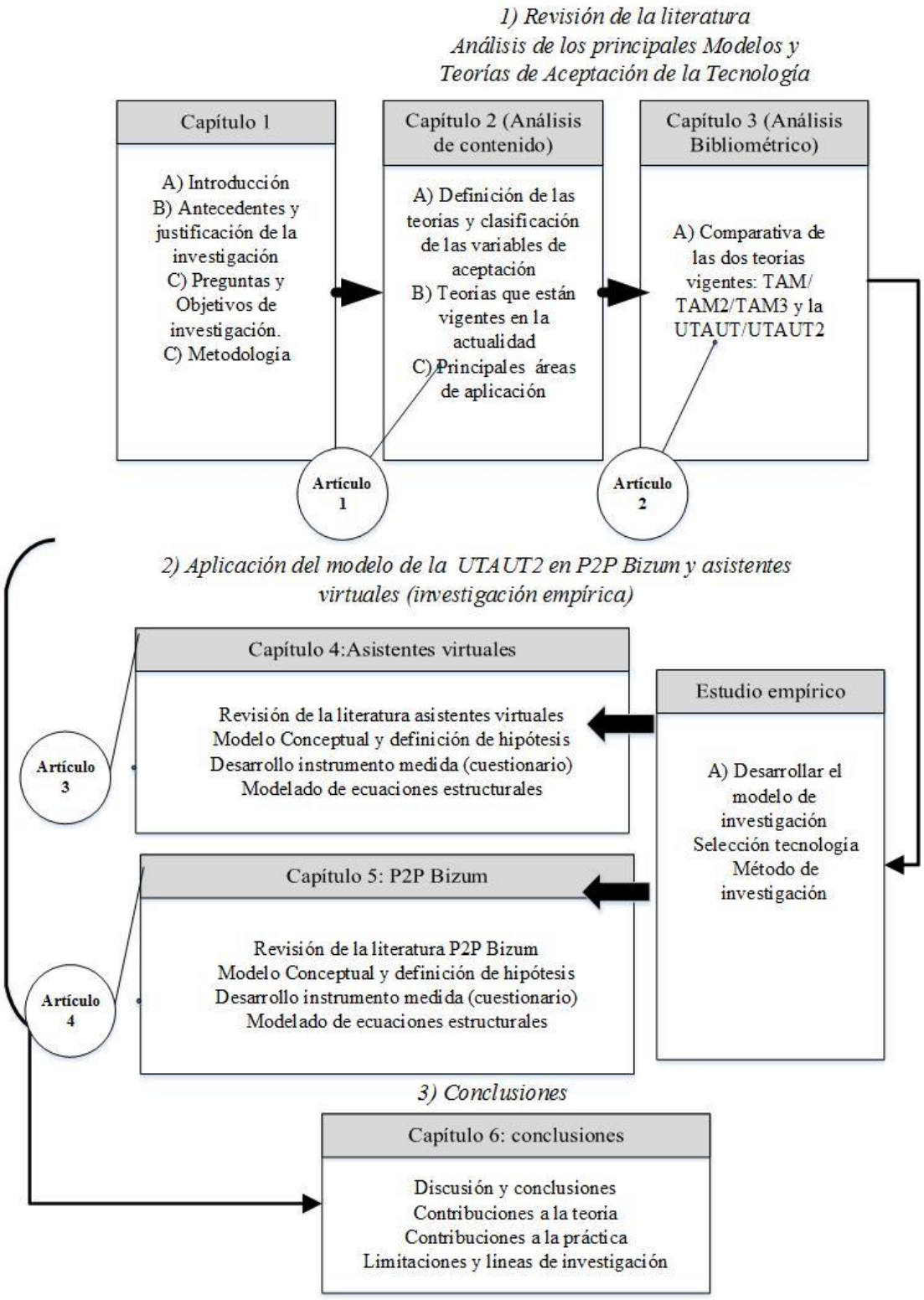
1) Explorar los factores incluidos en el modelo UTAUT2 que impactan directamente en la intención de comportamiento de los usuarios sobre la plataforma de pago móvil P2P Bizum.
2) Extender el modelo de la UTAUT2 con nuevos factores con el objeto de mejorar el modelo predictivo.
3) Realizar una investigación empírica para desarrollar un modelo predictivo.

4. Diseño y proceso de investigación

El diseño o proceso de investigación es un procedimiento general que consta de una serie de pasos y técnicas para llevar a cabo la investigación y que conduce a la finalización exitosa del estudio (Creswell, 2003). Es decir, es la descripción de cómo se llevará a cabo la investigación desde el inicio hasta la conclusión del estudio (Leedy y Ormrod, 2019).

En el diagrama de flujo de la Figura 1 se presentan las etapas que se han llevado a cabo para realizar el proceso de investigación. También se describen las publicaciones que han derivado de la investigación, su relación y correlación entre ellas.

Figura 1: Síntesis de la tesis doctoral y la interrelación y correlación existente entre los cuatro artículos publicados



Fuente: elaboración propia

5. Metodología de la investigación

La metodología es dar una idea clara sobre qué métodos o procesos se van a utilizar en la investigación, puede describirse como un método para recopilar datos y análisis para la utilización de técnicas y procedimientos en el diseño de la investigación. Se utiliza para distinguir entre métodos y resultados (Iacono et al., 2009). La metodología describe y explica los métodos y principios que se utilizan en la investigación; cómo los métodos de recopilación de datos, los materiales utilizados, las personas entrevistadas, las teorías seleccionadas, las técnicas de análisis de datos y la justificación de la selección de un método frente a otro (Walliman, 2000).

Según Gelo et al en 2008, la metodología es el estudio y la lógica de los métodos de investigación se refieren a los principios que rigen la actividad investigadora y se definen como un conjunto de reglas, principios y condiciones formales que fundamentan y guían la investigación científica y facilitará organizar y aumentar nuestro conocimiento sobre los fenómenos. Por lo que la metodología establece qué tipo de relación existe entre la observación, la teoría, las hipótesis y los métodos del investigador.

5.1. El paradigma de investigación

Los métodos de investigación se pueden describir, examinar y categorizar en diferentes niveles. El nivel más fundamental es el filosófico. Según la disciplina de la filosofía, el nivel filosófico de un método de investigación que se centra en los supuestos relacionados con las características más generales del mundo, dónde abarcan aspectos como la mente, la materia, la razón o las pruebas del conocimiento (Blackburn, 2005). En consecuencia,

cuando se utiliza un método de investigación específico, conscientemente o no, se están haciendo suposiciones sobre aspectos filosóficos. Estos aspectos en los que se categorizan los distintos métodos de investigación se denominan paradigmas. El concepto de 'paradigma' fue propuesto por primera vez por Thomas Kuhn en 1962. Se aplica cuando se reconoce que existe un alto nivel de consenso profesional dentro de comunidades particulares de científicos, sobre aspectos de creencias filosóficas, teorías, estándares para la investigación y hallazgos ejemplares. Un paradigma se refiere a teorías y escuelas de pensamiento sobre investigación que comparten un conjunto común de supuestos sobre la naturaleza de las ciencias sociales, en particular con respecto a la ontología ¿cuál es la esencia de un fenómeno?, la epistemología ¿cómo conocemos o llegamos a comprender un fenómeno? y la axiología ¿qué valores intervienen en la producción de conocimiento sobre un fenómeno? Aunque los académicos difieren en cuanto al número de paradigmas existen, sus nombres exactos y las relaciones entre ellos (Putnam, 1983). La mayoría de las investigaciones en las disciplinas de ciencias sociales o naturales depende de uno de los paradigmas filosóficos: positivista, interpretativo y crítico. Este sistema de tres clasificaciones es ampliamente aceptado en la investigación de SI, ya que cada enfoque tipifica una serie de formas de percibir el mundo para observar, medir y comprender la realidad social (Myers y Avison, 2002).

5.1.1. El paradigma positivista

El paradigma positivismo, a veces denominado, método o investigación científica (Mertens, 2007) refleja una filosofía determinista en la que las causas probablemente determinan los efectos o resultados (Creswell, 2003). Los positivistas tienen como objetivo probar una teoría o describir una experiencia a través de la observación y la

medición para predecir y controlar las fuerzas que le rodean. El positivismo fue reemplazado después de la Segunda Guerra Mundial por el pospositivismo (Mertens, 2007). Los pospositivistas parten del supuesto de que cualquier parte de la investigación está influenciada por una serie de teorías bien desarrolladas además de la que se está probando (Cook y Campbell, 1979). Las teorías se consideran provisionales y los nuevos conocimientos pueden cuestionar todo el marco teórico (Khun,1962). La investigación positivista está más en línea con métodos cuantitativos de recopilación y análisis de datos (Mertens, 2007).

5.1.2 Justificación del uso del paradigma positivista en la investigación

En esta investigación se utilizará el enfoque positivista ya que se va a probar una teoría existente (UTAUT2) para poder comprender el comportamiento individual y poder confirmar las hipótesis propuestas. Esta investigación mostrará los factores que influyen en la intención de aceptar la tecnología (asistentes virtuales y P2P Bizum). A través de la recopilación de datos y técnicas estadísticas, por lo que el enfoque positivista es el más apropiado. La confirmación de las hipótesis del modelo de la UTAUT2, más las propuestas de añadir otros factores al modelo, nos servirá para comprender la intención de usar estas tecnologías.

5.2. El enfoque de investigación

El enfoque del estudio es necesario para comprender cómo se ha llevado a cabo la investigación general y de forma específica sobre el tema seleccionado. El enfoque está vinculado con las preguntas de investigación de tal manera que se pueda sacar una conclusión efectiva. Existen dos tipos diferentes de enfoques de investigación, inductivo

y deductivo (Saunders et al., 2009). Estos enfoques tienen fines diferentes. El inductivo como desarrollo de la teoría y asociado a la investigación cualitativa y el deductivo como análisis de la teoría y asociado a la investigación cuantitativa (Abreu, 2014). El método de investigación inductivo se define como un enfoque de la investigación que comienza con la discusión de áreas más enfocadas y luego pasa a la discusión general, mientras que el enfoque deductivo comienza con la discusión de cosas generales y luego crea un vínculo entre estas cosas generales para desarrollar uno específico (Ghauri et al., 2020).

5.2.1. Enfoque deductivo

En el enfoque deductivo hay una teoría; luego se deduce una hipótesis predictiva que concreta esa teoría, posteriormente esa hipótesis se prueba en el mundo real y con el resultado, la teoría se descarta o se fortalece.

El enfoque deductivo son pasos inducidos por el investigador con el propósito de llenar la teoría con vacíos de conocimiento a través de las hipótesis, selección, análisis y validación (Ghauri et al., 2020). Uno de los temas principales en un enfoque deductivo es proporcionar explicaciones sobre ciertas características en ciertas situaciones, por lo que la recopilación de teorías es un paso imprescindible (Saunders et al., 2009).

Si bien un enfoque deductivo puede limitar el pensamiento divergente y la creatividad, es un método enfocado con un alcance claro (Ghauri et al., 2020).

5.2.2. Justificación del enfoque deductivo en la investigación

Esta investigación se basa en la aplicación del enfoque deductivo porque se lleva a cabo por un lado con una discusión general y luego pasa a aplicarse la teoría de la UTAUT2 manteniendo las preguntas de investigación enfocadas en los asistentes virtuales y en el P2P Bizum. El enfoque deductivo es el más adecuado porque la discusión de algunas áreas generales es esencial en esta investigación para llamar la atención con una fuerte discusión de fondo (Saunders et al., 2009).

Se presenta una discusión basada en la revisión de la literatura de la UTAUT2 y su uso en España. Por lo que el propósito del estudio es llenar un vacío de conocimiento en la teoría actual, ya que el entorno estudiado, durante la pandemia y en estas dos tecnologías no está explorado. En concreto, el modelo UTAUT2 se aplicará con el fin de conocer la intención de comportamiento de usar estas tecnologías, por lo que el modelo UTAUT2 se probará en un nuevo entorno, la Covid-19, para determinar su aplicabilidad; lo que a su vez tendrá implicaciones teóricas y prácticas. Para este análisis utilizamos un proceso deductivo de dos pasos: una revisión extensa de la literatura sobre los modelos y teorías de la tecnología de la información y luego el uso de criterios de selección específicos para identificar los constructos que han sido estudiados en otros modelos, teorías o investigaciones para ser aplicadas en estas tecnologías.

5.3. Método de investigación

5.3.1. Cuantitativo

La elección del método cuantitativo suele estar relacionada con la elección del enfoque, ya que los investigadores utilizan principalmente los métodos cuantitativos para los enfoques deductivos (Saunders et al., 2009).

La investigación cuantitativa se enfoca en recopilar datos numéricos y generalizarlos a través de una población para explicar un fenómeno en particular. Además, la metodología cuantitativa emplea modelos, hipótesis o teorías, que luego se prueban y explican la causalidad de los datos (Saunders et al., 2009). En esta investigación es necesaria la reducción de fenómenos a valores numéricos y así poder realizar análisis estadísticos (Gelo et al., 2008). La generación de estos datos numéricos puede ser útiles en su estado inicial o se tienen que transformar en estadísticas útiles, con el propósito de resolver un determinado problema de investigación (Bryman, 2003). Los métodos de investigación cuantitativa se aplican en situaciones en las que es necesario cuantificar parámetros definidos como opiniones, actitudes y comportamientos y/o cuando se generalizan muestras de grandes poblaciones (Saunders et al., 2009).

Los diseños de investigación dentro del enfoque cuantitativo incluyen diseños experimentales y no experimentales. Los diseños experimentales hacen inferencias causales sobre la relación entre una variable independiente y una o más dependientes. Se caracterizan por la manipulación directa de la variable independiente y por un control riguroso de las variables (Gelo et al., 2008).

5.3.2. Justificación del método cuantitativo en la investigación

La investigación cuantitativa en esta investigación permite la obtención y análisis de un gran número de datos numéricos medibles y generalizables. Esto contribuye a una mayor credibilidad de la investigación realizada.

Con el método cuantitativo se prueba la propuesta del modelo de investigación y se examina la relación entre la variable dependiente, que es la intención conductual y las variables independientes que son los factores que se han incluido en el modelo.

5.4. Diseño de la investigación

5.4.1. Descriptivo y explicativo

El estudio descriptivo es considerado como parte de una pieza o precursor de la investigación exploratoria, por lo que es necesario tener una imagen clara de los fenómenos antes de realizar un estudio exploratorio (Saunders et al., 2009). Este estudio muestra un perfil preciso de las personas, por lo que requiere recopilar mucha información sobre la situación que se va a estudiar. El estudio descriptivo es realizado con el fin de determinar y describir las características de los variables de la situación. Por lo tanto, este estudio pretende proporcionar al investigador un perfil o describir aspectos de los fenómenos siendo investigado en diferentes niveles, como individual, organizacional, orientada a la industria y otras perspectivas (Sekaran y Bougie, 2016).

Con el estudio exploratorio se busca la explicación de una situación o problema que se estudia y no es necesario que sea una relación causal y explique los patrones relacionados con el fenómeno estudiado. El estudio explicativo investiga la relación entre las variables del fenómeno para establecer relaciones causales entre variables (Saunders et al., 2009). Otros autores denominaron a este tipo de estudio como prueba de hipótesis. Las pruebas de hipótesis generalmente se llevan a cabo para explicar la naturaleza de las relaciones específicas, o indicar la diferencia entre grupos de variables independientes, así como explicar la varianza en las variables dependientes o para predecir resultados (Sekaran y Bougie, 2016).

5.4.2. Justificación del diseño de la investigación descriptivo y explicativo

El enfoque en esta tesis es descriptivo y explicativo ya que el objeto de la investigación es describir y determinar qué constructos del modelo teórico UTAUT2 y su extensión afecta a la intención de comportamiento de los asistentes virtuales y el P2P Bizum. Para esta tesis se elige un enfoque de investigación mixto, ya que las teorías se investigan a fondo. A su vez, esas teorías y marcos son la base del modelo conceptual UTAUT2. Se busca investigar las interrelaciones entre los principales constructos de UTAUT2 (expectativa del desempeño, expectativa del esfuerzo, influencia social, condiciones facilitadoras, etc.) para predecir la intención de comportamiento.

5.5. Recopilación datos

La recopilación de datos es una fase integral de la investigación porque la investigación en sí misma significa buscar y familiarizarse con diferentes fuentes para trabajar en un área seleccionada. Hay dos tipos de fuentes de datos denominadas fuente primaria y secundaria. La fuente primaria se basa en la recopilación de datos directamente de la fuente original y no incluye ningún intermediario del que recibir los datos. Un ejemplo de fuentes primarias serían las encuestas y entrevistas. La fuente secundaria, por otro lado, se basa en la recopilación de datos en fuentes que ya están presentes para ser explotadas. Estas fuentes están en forma de literatura relevante, estudios de casos, revistas, artículos, referencias web y libros.

5.5.1. Cuestionario

El cuestionario es un instrumento de medición, cuyo propósito es operacionalizar la demanda de información de los investigadores en un formato que permita la medición estadística. Los cuestionarios son un método apropiado para recopilar datos para la investigación explicativa. Una encuesta es un método de recopilación de datos, la cual, facilita la recopilación de datos de un gran grupo de personas rápidamente y a un coste comparativamente más bajo (Sanders et al., 2009).

5.5.2. Justificación del método de recopilación de datos utilizado en la investigación

Se ha seleccionado la encuesta, ya que el propósito de una encuesta es generalizar e inferir algunas características de los ciudadanos de la muestra a la población objeto de estudio, que es lo que se quiere hacer con el diseño del modelo predictivo.

Para realizar la encuesta, se han desarrollados dos instrumentos de medida, Se recogieron un total de 306 cuestionarios en la investigación de los asistentes virtuales y 334 cuestionarios en la investigación de P2P Bizum como datos primarios para esta fase.

Este cuestionario consta de dos secciones, la primera con información demográfica y uso de datos de estas tecnologías y la segunda con preguntas relacionadas con los factores que se miden el modelo conceptual propuesto. El cuestionario fue adaptado al contexto específico de la tecnología del instrumento propuesto por Venkatesh et al. (2012) así como otros autores académicos relevantes. Se utilizó preguntas de escala Likert de cinco puntos que van desde totalmente en desacuerdo hasta totalmente de acuerdo. Estos cuestionario fue realizado a través de un formulario de Google que se ha distribuido de forma online y presencial a través de un código QR, durante el primer trimestre de 2022. Previo al lanzamiento se desarrolló un piloto para verificar que las preguntas eran entendibles y que median el objeto de estudio.

5.6. Análisis de los datos

5.6.1. Técnicas de análisis

El Modelado de ecuaciones estructurales (SEM) es una técnica estadística integral que permite a los investigadores responder a un conjunto de preguntas interrelacionadas en un análisis sistemático y completo al modelar las relaciones entre múltiples construcciones teóricas independientes y dependientes de forma simultánea (Anderson y Gerbing 1988).

El uso de SEM permitirá analizar problemas de investigación complejos a partir de un análisis de fenómenos de causa efecto. El investigador puede construir modelos teóricos que verifica empíricamente y permiten comprender los fenómenos estudiados. SEM permitirá probar la estructura de covarianza de las variables observables con el uso de una estructura de modelo simplificada y sobre la base de los elementos formalizados de la teoría. Es decir, los modelos SEM son la síntesis del conocimiento teórico y los resultados empíricos son los fenómenos estudiados (Tarka, 2018).

Hay dos formas diferentes de realizar SEM; a través de un enfoque basado en covarianza que utiliza la máxima verosimilitud (ML) y un enfoque basado en la varianza que en su lugar utiliza funciones de mínimos cuadrados (LS) y se denomina modelo de ruta de mínimos cuadrados parciales (PLS) (Barclay, et al., 1995). El enfoque de SEM se conoce como modelado duro y su propósito es ser utilizado en pruebas de hipótesis nítidas y puras donde no hay casi interferencia estadística. Como resultado, el modelo ML es sensible a las desviaciones en los datos que surgen de los modelos del mundo real (Barclay et al., 1995).

Según los modelos SEM tienen tres características distintivas: estiman relaciones múltiples e interrelacionadas; pueden representar conceptos no observados en estas relaciones, incluida el error de medición y buscan analizar todo el conjunto de relaciones (Hair et al., 2013).

En general, los modelos de ecuaciones estructurales se visualizan gráficamente a través de los llamados diagramas de ruta, que trazan rutas entre variables en el modelo teórico elegido (Hox y Bechger, 1998). El análisis SEM habitualmente comienza dibujando un diagrama de ruta, que consiste en cuadros y círculos que a su vez están conectados por flechas. Según la definición original, las variables no medidas se representan mediante una elipse/círculo, mientras que las variables medidas se representan mediante cuadrados/rectángulos. Además, los caminos de una sola cabeza (que se visualizan a través de flechas) son relaciones casuales, mientras que los de dos cabezas especifican covarianza o correlación; menos una explicación casual. Desde una perspectiva estadística, los caminos de una sola cabeza representan coeficientes de regresión y los de dos cabezas representan covarianzas (Wright, 2012). Se han realizado más desarrollos del modelo para representar medias y varianzas también (McArdle, y Epstein, 1987).

SEM está compuesto por el modelo de medida y el modelo estructural. El modelo de medida mide las variables latentes o variables compuestas mientras que el modelo estructural prueba todas las dependencias hipotéticas basadas en el análisis de ruta. El proceso se puede conceptualizar en seis etapas principales (Hair et al., 2013).

Etapa 1: definición de constructos individuales.

Etapa 2: desarrollo del modelo de medición general.

Etapa 3: diseño de un estudio para producir resultados empíricos.

Etapa 4: evaluación de la validez del modelo de medición.

Etapa 5: especificación del modelo estructural.

Etapa 6: evaluación de la validez del modelo estructural.

A través de un procesamiento de los datos, se realiza el análisis factorial exploratorio (EFA) que indica si los constructos latentes y los indicadores propuestos miden lo que la teoría indica que deberían medir, se hace un análisis de confiabilidad y la medida de la bondad de ajuste, para ver la discrepancia entre los valores observados y los valores esperados en el modelo de estudio. A continuación, con el análisis factorial confirmatorio (CFA) se examinan los indicadores observados y los constructos latentes, a través de la validez convergente, la validez discriminante y la confiabilidad compuesta para obtener el mejor modelo de medida, posteriormente se realiza el modelado de las ecuaciones estructurales (SEM) y así evaluar las hipótesis entre los constructos latentes.

SEM se puede realizar con distintos programas como LISREL, EQS y AMOS.

5.6.2. Justificación del de la técnica de análisis utilizado en la investigación

Dada la naturaleza compleja del modelo UTAUT2, se utilizó el modelo de ecuaciones estructurales como modelo para la evaluación del modelo conceptual, así como para el análisis de los datos de la muestra.

El programa utilizado fue AMOS versión 27 para realizar el análisis SEM. En el análisis descriptivo de los datos se utilizó el programa SPSS, versión 27, para describir las características de los datos de los usuarios de la investigación.

5.7. Muestreo

Para recopilar los datos de una encuesta se puede utilizar dos enfoques de muestreo diferentes, muestreo probabilístico y muestreo no probabilístico. El muestreo probabilístico significa que un encuestado tiene una probabilidad fija de pertenecer a una muestra, en cambio, el método no probabilístico no tiene una probabilidad conocida de que un encuestado forme parte de la muestra (Saunders et al., 2009). Con el muestreo probabilístico nos aseguramos de que toda la población esté representada por los resultados. Sin embargo, el muestreo no probabilístico no busca necesariamente representar a toda la población, ya que el autor utiliza métodos subjetivos como la experiencia personal, la conveniencia, el juicio de expertos, etc. para seleccionar la muestra de población pudiendo generalizar los resultados de la muestra no probabilística (Saunders et al., 2009).

5.7.1. Técnica de muestreo

El muestreo de conveniencia o muestreo aleatorio es una técnica de muestreo no probabilístico en la que se recopilan datos de los miembros de la población que cumplan ciertos criterios prácticos, como fácil accesibilidad, proximidad geográfica, disponibilidad en un momento dado, o la voluntad de participar y por lo tanto es una población a las que es fácil acceder por parte del investigador (Saunders et al., 2009).

Se recomienda utilizar el muestreo por conveniencia en estudios en los que existe una restricción de tiempo para recopilar los datos, ya que la recopilación de datos se puede lograr rápidamente (Saunders et al., 2009).

El muestreo probabilístico conlleva el uso de una muestra aleatoria de la población objetivo por lo que permite generalizar los resultados a toda la población objetivo. (Hair et al., 2013).

Este método depende en parte de la viabilidad y la sensibilidad de los datos recopilados, con el objetivo de responder a las preguntas de investigación de un estudio (Saunders, 2009).

5.7.2. Justificación del método muestreo de datos utilizado en la investigación

En esta tesis, el objetivo fue investigar qué factores influyen en la intención de comportamiento. Por lo tanto, se eligió un enfoque no probabilístico junto con una estrategia de muestreo por conveniencia. Se eligió el enfoque no probabilístico debido a la accesibilidad de los usuarios, mientras que la estrategia de muestreo por conveniencia se eligió debido a su aplicabilidad común en este tipo de estudios y la eficiencia de tiempo. Este método de muestreo se ha elegido por el tiempo limitado para recopilar los datos primarios y también para garantizar que se haya alcanzado el tamaño de la muestra que permiten probar las hipótesis planteadas. Aunque, el muestreo de conveniencia puede llevar a un exceso o defecto de representación de grupos particulares dentro de la muestra (Saunders et al., 2009), en este estudio al no enfocarse en investigar el efecto de las variables individuales como la edad, el género o la experiencia no existiría este exceso ni defecto en la representación.

5.8. Ética de la investigación

Esta investigación implicó una serie de consideraciones éticas. Por un lado, el uso de las revistas, artículos, libros y fuentes web para realizar el estudio se han referenciado siguiendo las normas académicas establecidas. Y, por otro lado, la recopilación de datos, al ser un cuestionario autoadministrado vía web y no solicitar datos personales identificativos de los participantes los datos que se han recogido han sido totalmente anónimos y únicamente se han utilizado para fines académicos.

6. Estructura de la tesis

A continuación, en la tabla 1 se detalla la estructura de la tesis:

Tabla 1: Fases de la estructura de la investigación incluyendo los artículos publicados

Fase investigación	Estructura del capítulo	Artículo	Descripción
Fase 1: definir contexto de investigación	Capítulo 1: Introducción		✓ Introducción ✓ Justificación de la investigación ✓ Preguntas de investigación ✓ Objetivos de la investigación ✓ Diseño de la investigación ✓ Metodología de la investigación
Fase 2: estudio teórico	Capítulo 2: Análisis de las Teorías y Modelos de Aceptación de Tecnología	Artículo 1	✓ Teoría de la Acción Razonada ✓ Teoría del Comportamiento Planeado ✓ Teoría de la Difusión de la Innovación ✓ Modelo de Aceptación de Tecnología ✓ Teoría Cognitiva Social ✓ Modelo combinado TAM-TPB ✓ Teoría Unificada de Aceptación y Uso de la Tecnología ✓ Teoría Unificada de Aceptación y Uso de la Tecnología extendida 2
	Capítulo 3- Análisis bibliométrico de las principales Teorías y Modelos de Aceptación de Tecnología	Artículo 2	✓ Modelo de Aceptación de Tecnología ✓ Modelo de Aceptación de Tecnología 2 ✓ Modelo de Aceptación de Tecnología 3 ✓ Teoría Unificada de Aceptación y Uso de la Tecnología ✓ Teoría Unificada de Aceptación y Uso de la Tecnología extendida 2
Fase 3: estudio empírico	Capítulo 4- Creación de un modelo predictivo basado en la UTAUT2:	Artículo 3	✓ Fundamentos teóricos de la inteligencia artificial y asistentes virtuales ✓ Selección de los constructos y sus relaciones ✓ Desarrollo de un modelo conceptual

	Inteligencia artificial		✓ Definición y recogida de datos: cuestionario ✓ Evaluación del modelo de medida y estructural ✓ Análisis estadístico ✓ Formulación del modelo final ✓ Discusión y conclusiones
Fase 3: estudio empírico	Capítulo 5- Creación de un modelo predictivo Basado en la UTAUT2: Método de pago P2P	Artículo 4	✓ Fundamentos teóricos de los pagos P2P Bizum ✓ Selección de los constructos y sus relaciones ✓ Desarrollo de un modelo conceptual ✓ Definición y recogida de datos: cuestionario ✓ Evaluación del modelo de medida y estructural ✓ Análisis estadístico ✓ Formulación del modelo final ✓ Discusión y conclusiones
Fase 4: conclusiones	Capítulo 5: Discusión y conclusiones		✓ Discusión y respuesta las preguntas de investigación ✓ Conclusiones ✓ Contribuciones de investigación ✓ Limitaciones y futuras líneas de investigación

Fuente: elaboración propia

Capítulo 2

¿Por qué los usuarios aceptan la tecnología de la información? Descripción y uso de las teorías y de los modelos de su aceptación

Why do users accept the information technology? Description and use of theories and models of their acceptance

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WHY DO USERS ACCEPT THE INFORMATION TECHNOLOGY? DESCRIPTION AND USE OF THEORIES AND MODELS OF THEIR ACCEPTANCE

¿Por qué los usuarios aceptan la tecnología de la información? Descripción y uso de las teorías y de los modelos de su aceptación

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KEYWORDS

Technological acceptance models
Behavioral intention
Behavior of use
TAM
UTAUT 2
Web of Science
MAXQDA software

ABSTRACT

The objective of this research is to understand, predict and explain what factors influence organizations and induce individuals to accept technology. Through the methodology of content analysis and based on the Web of Science database and through the MAXQDA software, this document analyzes and reviews the ten most important theories and models of technology acceptance used in recent years. This review offers a holistic view that will help future researchers to select the most appropriate theories to apply to their field of study.

PALABRAS CLAVE

Modelos de aceptación tecnológica
Intención de comportamiento
Comportamiento de uso
TAM
UTAUT 2
Web of Science
MAXQDA software

RESUMEN

El objetivo de esta investigación es comprender, predecir y explicar qué factores influyen en las organizaciones e inducen a los individuos a aceptar la tecnología. A través de la metodología del análisis de contenido y partiendo de la base de datos Web of Science y a través del software MAXQDA, este documento analiza y revisa las diez teorías y modelos de aceptación de tecnología más importantes y utilizadas a lo largo de los últimos años. Esta revisión ofrece una visión holística que servirá para que futuros investigadores puedan seleccionar las teorías más apropiadas para aplicarlas a su ámbito de estudio.

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1. Introduction

The recent expansion of Information Technologies and Telecommunications has greatly impacted human life in many aspects and it is characterized for it speed evolution in new areas of application. Devices that changed social interactions, modes of communication and labor approaches to work life, are not reduced to tablets, smartphones & social media networks, but there are many other areas to account for digital transformation (Mishra, 2012). Technology adoption defines acceptance and first access to use of a given technological device and novel products (Khasawneh, 2008). Studies that pinpoint adoption in the technology industry, evolved around understanding, predicting and providing a rationale for the variables that can be accounted for having an impact on behavior at the level of individual adoption, as well as, from an institutional standpoint. This approach shed light from a framework and conceptual model, that is developing on the variables that incidentally affect adoption from a behavioral standpoint (Gangwar et al., 2014). The key variables around new technologies and adoption rates contributed in modeling an explanatory framework for predicting attitudes, including rejection from the side of users. Considered as a main factor for success, user acceptance is key for a preliminary assessment in market implantation (Dillon et al., 1996; Phan et al., 2011). From a user standpoint, any new information that is being retrieved from a new technology, virtual reality, 5G, Cloud computing, AI, Big Data, Internet of Things, among others, when users are presented with a new development, their analysis and overall perception relies on previous knowledge arising from a predominant worldview, which is entangled in their social sphere. It is a process, elaborating a ground from acceptance based on previous beliefs; whether these are conditioning or irrelevant for acceptance, there are many variables - from a theoretical standpoint - that Information Technologies have been assessing for the last years.

2. Objectives

For the present study, we set out a chronological review of those theories and models of technology adoption that identified factors conditioning technology acceptance over the years; with the objective of answering recurring questions around technological innovation: what factors contribute to individuals adopting that technology? Will individuals adopt that technology? The approach that has been carried out to answer these questions consists of a synthesis of ten framework models developed over the years to understand the acceptance or rejection of technology. In general, these questions are based on the perceptions that individuals generate about different aspects related to the use of technology or innovation. From this overall aim, there are three specific objectives laid out as follows:

1. The first objective is to carry out a review of the existing literature on the main theories regarding their theoretical bases and their main constructs and to describe and classify the variables that predict the use of acceptance or rejection of technology.
2. The second objective is to confirm if these theories are still used today or if they have been rejected.
3. The third objective is to investigate the areas and disciplines of study that have been used to record any applications to the study of the acceptance of emerging technological innovations, and whether there are any triggers for negative perception and rejected adoption.

3. Methodology

Considering the scope of our analysis, the bottom-line approach anchors in literature review reporting on scientific, field related studies, that refer to technology adoption, based on the application of content analysis technique (Bardin, 1996). Thematic content analysis narrows down to specific terms and concepts relevant to our focus on adoption. Additionally, the technique is established on set lists of frequencies, search for words in context, and thematic identification and classification (Abela, 2002). The following stages have been established for the process of building a systematic approach, based on the work of Gough et al. (2017), see Figure 11:

1. The theories that are being reviewed in base to three levelers, follow the set stands for research by:
    - Relevant authors that covered the proposed area of study: Alexandre et al., 2018; Amsterdamska et al., 1986; Alomary et al., 2015; Legris et al., 2018; Taherdoost, 2018; Tarhini et al., 2015; Venkatesh et al., 2012; Yousafzai et al., 2007.
    - Amount of references, ranking its relevancy in the field: IDT: 133.477; TRA: 277.861; TPB: 538.621; SCT: 790.826; TAM: 563.951; MCPU: 19.493; MM: 516.922; TAM-TPB: 25.708; UTAUT: 225.272; UTAUT 2: 48.112.
    - Secondary sources pointing to its relevance and weight within the Information Technologies Scholar community: IDT: 2.131; TRA: 7.798; TPB: 18.559; SCT: 22.603; TAM: 21.089; MCPU: 370; MM: 15.058; TAM-TPB: 362; UTAUT: 7.092; UTAUT 2: 1.151.
2. A selected base for bibliography: Web of Science Core Collection, including the Journal Citation Report (JCR), which represents a trusted source for quality, ranked, references and it's highly regarded within the institutions overseeing research quality.

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3. A set keyword for listing theories: "Innovation Diffusion Theory; IDT", "Theory of Reasoned Action; TRA", "Theory of Planned Behavior; TPB", "Social Cognitive theory; SCT", "Technology Acceptance Model; TAM ","Model of PC Utilization; MPCU", "Motivational Model; MM", "Combined TAM-TPB", "Theory Acceptance and Use Technology; UTAUT", "Extending Theory Acceptance and Use Technology; UTAUT 2".
4. An applied methodology using practical criteria for selecting specialized sources: first, via a chronological framework 1962-2021; second, a base of documents filtered from a narrow frame establishing sources for 2018-2021. The selected date agrees with common standard of Internet of Things within consumer demographics, as well as other technologies accessing a universal access to consumer market: cloud to the edge, chatbots, and autonomous vehicles (Gartner, 2018); last, considering technological change as a threshold to "Open Access" source: AI platforms and Business Analytics; these are laid out by following the Theory, documents, sequence: IDT: 573; TRA: 873; TPB: 3.321; SCT: 7.174; TAM: 1.810; MCPU: 75; MM: 2.502; TAM-TPB: 50; UTAUT: 1.245; UTAUT 2: 614.
5. Accomplishing a review via MAXQDA, a tool for content analysis that account for the selected terms for analysis in a registry along with a given context. This system allows selecting words that are processed within a transcription of a sentence, textual fragment, a piece of discourse, which in turn, yields a thematic regrouping (MAXQDA,2020).
6. A synthesis of results in report form of the review, after a quantitative measure of words along with the grouping of thematic nodes as extracted from the analysis.

4. Theories and models: historic overview

In this section, the results obtained from first phase in the analysis have been showcased, according to the studies and theories reviewed.

4.1. Innovation Diffusion Theory (IDT)

The origin of the *Diffusion of Innovation* theory was raised by a French sociologist, Gabriel Tarde, in 1903, and became popular in its elaboration, by Everett Rogers, in 1962. Rogers explained how individuals or groups adopt an innovation, and, also, defined the *Diffusion of innovation* as the process by which an innovation in the sphere of ideas, products, practices, and philosophy, is communicated through certain channels in a specified frame of time, between the members of a defined social system within the scope of the innovation (Rogers, 1962, 1983, 1995). The acceptance or rejection of an innovation necessarily goes through five stages: awareness, interest, decision, implementation, and adoption and, as a result, Rogers framed users as innovators, early adopters, early majority, majority late, and stragglers (2003). In addition, the author introduced five explanatory attributes that explain the pace of innovation, whereas some adapt more quickly than others: relative advantage, compatibility, complexity, testability, and observability (see Table 1 and Figure 2).

Table 1. Standard Constructs (IDT)

Constructs	Definition
Relative advantage	Rate of innovation to improve an idea, practice, or the objective for integration.
Compatibility	Rate of conformity for an innovation to be perceived along its value, from gained value to potential future value from user needs foreseen.
Complexity	Rate of difficulty relative to the know-how, skill and perception of usage around innovation.
Trialability	Rate of experimentation around innovation from potential users.
Observability	Rate of visibility of results derived from innovation in a specific context.

Source: adapted from Rogers (2003)

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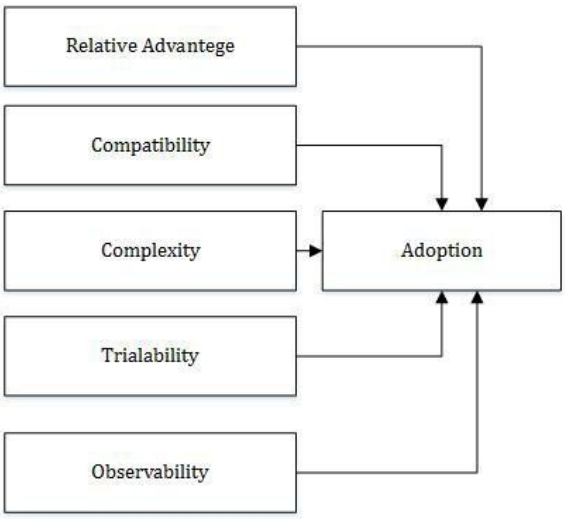
Figure 2. Innovation Diffusion Theory (IDT)



Source: Adapted from Rogers (2003)

4.2. The Theory of Reasoned Action (TRA)

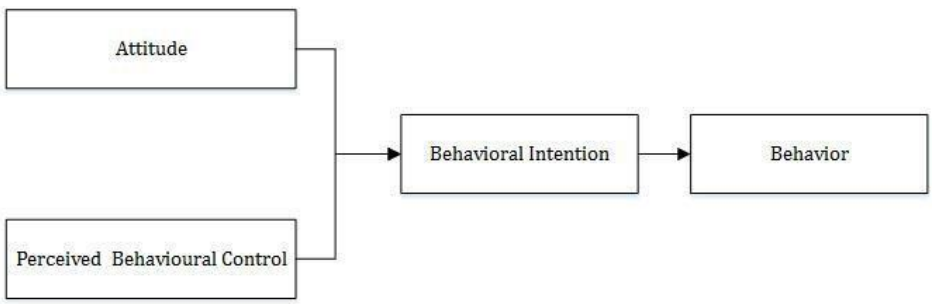
The Theory of Reasoned Action (TRA) is a model developed from psychology by Fishbein and Ajzen, in 1975, and, Ajzen and Fishbein, in 1980. It defines that the behavior of an individual is determined by her behavioral intention in order to perform the specified behavior; this basis provides the most accurate prediction of the behavior (Fishbein and Ajzen, 1975). Behavioral intention is influenced by two factors: first, attitude, a previous conditioning toward the behavior and subjective norms. The Theory of Reasoned Action describes how the behavioral intention will carry out a certain action as a result of attitude, not only towards the behavior but, also, towards the influence of subjective norms. Therefore, the intention to perform or to reject a behavior is an action prior to the behavior itself. This attitude will be conditioned by beliefs and by the evaluation, an individual assessment of the behavioral results; that is, a person will have a positive attitude towards that behavior if the individual thinks that the results of performing a specific action will be positive; instead, a person will have a negative attitude toward that behavior if he/she believes it will have a negative outcome (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980). The constructs determining behavioral intentions' rates of influence, are described below (see Table 2 and Figure 3).

Table 2. Constructs in TRA

Constructs	Definition
Attitude	It is a judgement scaled from two poles (negative to positive) towards a set behavior.
Subjective Norms	Social pressure exerted on individual and decision-makers in order to carry out an intention of behavior. It arises as a perception of others around a set behavior.
Behavioral intention	A cognitive representation for envisioning a specific behavior that is preset to a known behavior, by preceding it.
Behavior	A set action.

Source: adapted from Fishbein & Ajzen (1975) and Ajzen & Fishbein (1980).

Figure 3. Theory of Reasoned Action (TRA)



Source: Adapted from Fishbein & Ajzen (1975) and Ajzen & Fishbein (1980).

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4.3. The Theory of Planned Behaviour (TPB)

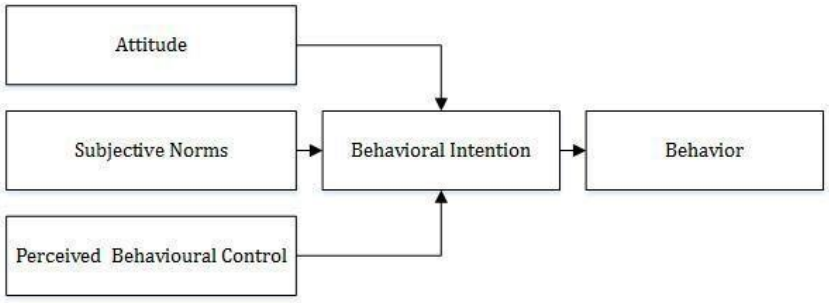
The Theory of Planned Behavior TPB (Ajzen, 1985, 1988, 1991) is an extension of TRA, by establishing an overpass to an underlying limitation: those behaviors over which people do not have complete control. The actual behavior from TPB depends, both, on the attitude towards the behavior, and, the subjective norms that incorporate a third construct, which is perceived as behavioral control, and it is described as perceived difficulty for an isolated behavior. This control of perceived behavior influences not only behavioral intent, but also actual behavior. The TPB has the ability to assess an individual's behavioral intention, based on his/her attitude, social pressure, and intentional motivation for targeted activities or for voluntary actions, see table 3 and figure 4 (Ajzen, 1985,1988,1991).

Table 3. Additional construct defined in TPB

Construct	Definition
Perceived Behavioural Control	A perception of the rate of difficulty in order to carry out a behavior from a set environment.

Source: adapted from Ajzen (1985,1988, 1991).

Figure 4. Theory of Planned Behaviour (TPB)



Source: adapted from Ajzen (1985,1988,1991).

4.4. Social Cognitive Theory (SCT)

The Social Cognitive Theory is developed from the Theory of Social Learning (Miller and Dollar, 1941). SCT describes human behavior, with the objective of understanding, changing, as well as, predicting its outcomes (Bandura, 1986). From this broad perspective, behavior is consistent with learning and must be analyzed cognitively, that is, based on the information we receive from learning and previous experiences, since these will influence reinforcements and expectations, including behavioral action. These previous experiences will determine whether a person engages in a specific behavior and the reasons why a subject will engage. According to SCT, learning occurs in a specific social context, with dynamic and reciprocal interactions of people, behaviors and in a set environment. It includes the concept of self-efficacy, defined as a personal judgment about one's own ability to organize and carry out the actions necessary to achieve certain types of outcomes. This self-assessment is not based on skills, but rather on capacities that can be developed with a skill-set (Bandura, 1986). The SCT (see table 4 and figure 5) was not specifically designed to predict technology acceptance behaviors, but rather to provide information on the effect of individual characteristics, for self-efficacy, as a set of preliminary perceptions, linking to acceptance in outcomes, such as, acceptance of technology (Bandura, 1986).

Table 4. Constructs from SCT

Constructs	Definition
Personal factors (knowledge, expectations, attitude)	Individual traits associated with humans (knowledge, expectations, and attitude).
External factors (social influences, community access, links and influences)	Areas of influences from other than internal, personal, factors. These variables are from a set environment acting from physical realm, as well as social.
Behavioural factors (skills, experience, self-efficacy)	Individual traits associated with humans (skills, experience, self-efficacy).

Source: adapted from Bandura (1986).

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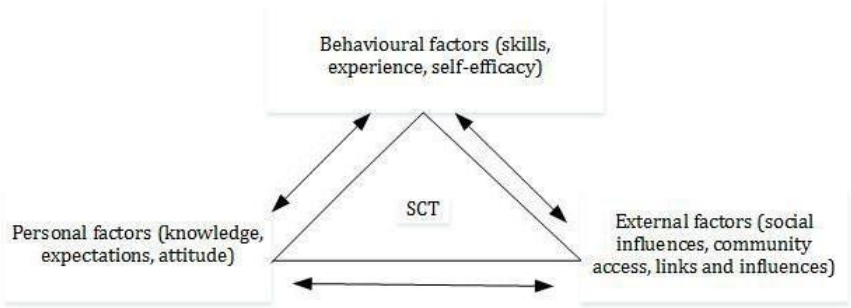
Figure 5. Social Cognitive Theory (SCT)



Source: adapted from Bandura (1986).

4.5. Technology Acceptance Model (TAM)

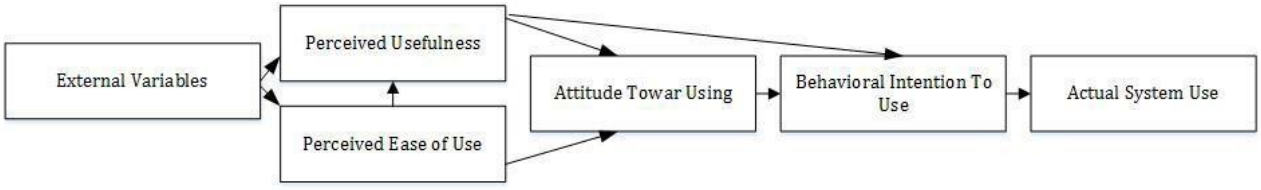
The Technology Acceptance Model (TAM) (Davis et al., 1989), is based on TRA, and it has been the most widely used approach to study technology adoption (Davis, 1989). It was developed to predict users' acceptance of information systems in organizations by analyzing the impact of external factors on internal beliefs, attitudes and intentions. This model holds that behavioral intention, in addition to being determined by attitude toward behavior, is, also, directly influenced by perceived usefulness and perceived ease of use, usage variables that are, in turn, influenced by other pre-existing factors (Davis et al., 1989). These two variables, received usefulness and perceived easy of use, are incorporated into the model, mainly because they are relevant to the acceptance of technology. TAM (see table 5 and figure 6) considers the attitude towards the use of technology and perceived usefulness, as being directly related to intention, prior to use of the technology. Therefore, the perceived usefulness constitutes a cognitive determinant of the behavioral intention, while attitude represents an affective component (Davis et al., 1989).

Table 5. Constructs from TAM

Constructs	Definition
Perceived Usefulness	Rate for individual usage of a specific system for perceived performance.
Perceived Ease of Use	Rate for individual usage of a specific system for non-added effort.

Source: adapted from Davis et al. (1989).

Figura 6. Technology Acceptance Model (TAM)



Source: adapted from Davis et al. (1989).

4.6. The Model of PC Utilization (MPCU)

Based on Theory of Human Behavior (Triandis 1977), the Model of PC Utilization MPCU was developed by Thompson et al. (1991). It differs in some features from Theory of Reasoned Action, considering that differentiates between cognitive and affective elements within attitude. According to MPCU, a behavior is determined by personal attitudes –what is projected as desired outcomes, a string of social norms judgements on what it is required, and their habits, what they usually do– , as well as, a set of expected consequences of their behavior. This model measures the degree of use of a PC (computer) by a worker when its use is not mandatory within an organization, and the assignment of value is individual, depending solely on the user.

Aligned with this theory is the standard ground for PC use as likely influenced by factors, ranging from affect to norm, and habits. The user's feelings towards PC use, or affect, are linked to the workplaces' social norms about PC use. Standard habits related to its use, arise from consequences, previous experiences with a PC, and extend from the conditions that are actively playing out in the workplace. With these varying factors around usage, some of the constructs determining acceptance are described, as follows (see table 6 and figure 7):

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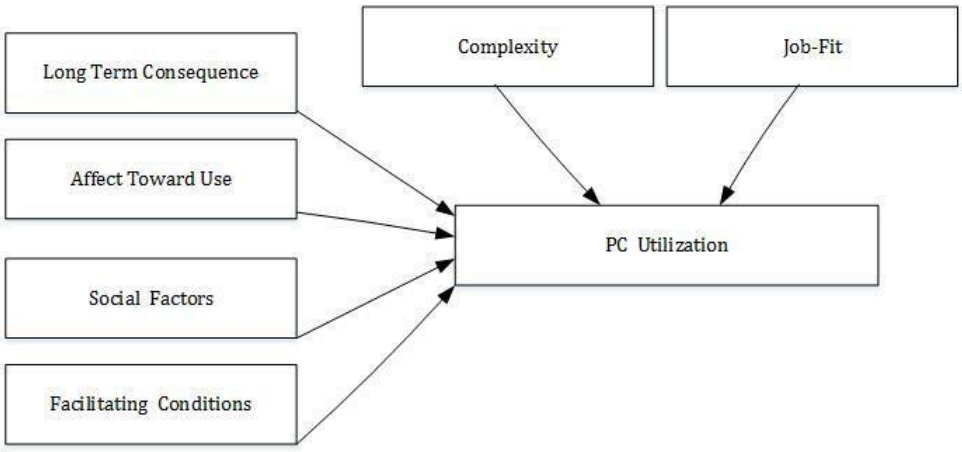
Table 6. Constructs as defined in PC (MCPU) theory

Constructs	Definition
Job-Fit	Rate for an individual usage of a specific technology for overall performance at work.
Complexity	Rate of innovation perceived for its relative difficult in added knowledge and skills for it use.
Long Term Consequence	Results oriented to future reward.
Affect Toward Use	Feeling of enjoyment, cheerfulness, pleasure, anxiety, displeasure or dislike, associated with a specific action/behavior.
Social Factors	Internalization of subjective elements within a set group or tribe. Interpersonal agreement specific to individual behavior in similar social settings.
Facilitating Conditions	Providing technical support to PC users as a particular facilitating condition for system usage.

Source: adapted from Thompson et al. (1991).

Figure 7. The Model of PC Utilization (MPCU)



Source: adapted from Thompson et al. (1991).

4.7. Motivational Model (MM)

Motivation theory has relied on previous Psychology research to explain behavior. This model was proposed by Davis et al. (1992) in which they considered two factors as variables for a common ground: the intrinsic motivation of carrying out an activity for an inherent satisfaction rather than for any consequence or benefit derived from its execution. When a person is intrinsically motivated, they move to act for the sake of pleasure or for the challenge that the activity provokes, in favor of any expectation for personal rewards, incentives or any extrinsic motivation confirming that the behavior is driven by perceived value and its derived benefits (see table 7 and figure 8).

Tabla 7. Constructs in Motivational Model (MM)

Constructs	**Definition**
Intrinsic motivation	The completion of an activity for its inherent satisfaction over its consequences or benefits derived from the execution
Extrinsic motivation	A behavior promoted based on perceived value and derived benefits.

Source: adapted from Davis et al. (1992).

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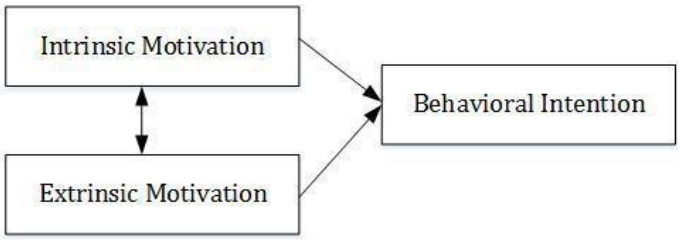
Figure 8. Motivational Model (MM)



Source: adapted from Davis et al. (1992).

4.8. Combined TAM and TPB (C-TAM-TPB)

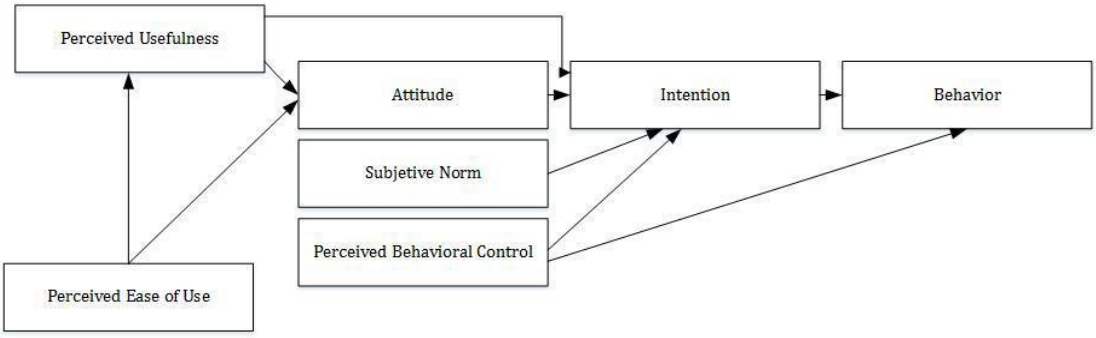
The theory that combines the *Technology Acceptance Model* (TAM) with *Planned Behavior Model* (TPB) is known by a combination of TAM and TPB acronym: C-TAM-TPB. It builds on previous studies by Madden et al. (1992) and was developed by Taylor and Todd (1995). This model is used to predict usage for people who have never used technology before and, also, for those who have used it and are familiar with it. The objective of the model was to incorporate the normative or social aspects and elements of control of the perceived behavior of the TPB, into TAM. Considered a hybrid model, the combined TBP TAM framework (see table 8 and figure 9) explains perceived usefulness and attitude towards use as factors conditioning behavioral intention, which, in turn, is influenced by subjective norm and inherent control (Taylor and Todd, 1995).

Table 8. Constructs in C-TAM-TPB

Constructs	Definition
Attitude	Assessment performed on technology by an individual.
Subjective Norm	Individual opinions (communal opinions) that effectuate a shift within a result.
Perceived Behavioral Control	It is linked to perception on the accessibility of resources and opportunity that are required for carrying out a specific behavior.
Perceived Ease of Use	Rate for individual usage of a specific system for non-added effort.
Perceived Usefulness	A subjective probability activated by users around a performance system; It will increase productivity at the organization level.

Source: adapted from Taylor & Todd (1995)

Figure 9. Combined TAM and TPB (C-TAM-TPB)



Source: adapted from Taylor & Todd (1995).

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

The *Unified Theory of Technology Acceptance and Use* UTAUT was developed in 2003 to predict user adoption of information technology in a business context (Venkatesh et al.). UTAUT integrated eight previous relevant theories: *Innovation Diffusion Theory* (IDT), *Reasoned Action Theory* (TRA), *Planned Behavior Theory* (TPB), *Social Cognitive Theory* (SCT), *Technology Adoption Model* (TAM), *PC Utilization Model* (MPCU), *Motivational Model* (MM) and *Combination* TAM and TPB (C-TAM-TPB). In the UTAUT acceptance model, four main constructs are defined: performance expectation, effort expectation, social influence and facilitating conditions, which are the factors that determine the adoption of technology by the user; user's behavior depends on his/her intention and technology usage, and it impacts all four factors mentioned, PE, EE, SI, FC. The UTAUT model (see table 9 and

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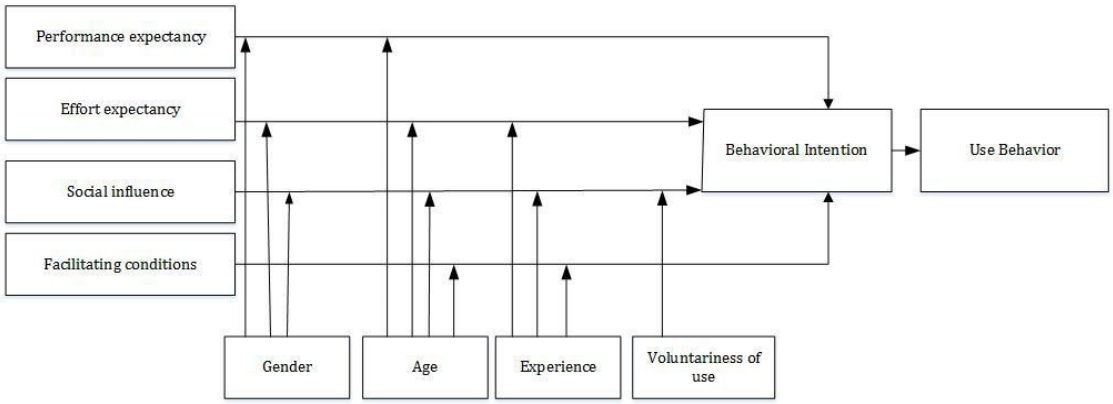
figure 10) considers variables from bands across identity variables, gender, age, experience, and voluntary use to modulate the influence of the four constructs along with behavioral intention and use of technology (Venkatesh et al., 2003).

Table 9. Constructs defined in UTAUT

Constructs	Definition
Performance expectancy	Rate of perception that an individual sees as adjuvant to improved performance and usage in the workplace.
Effort expectancy	Degree of difficulty associated to system usage.
Social influence	Rate of perception that an individual associates with prestige around the use of the new system.
Facilitating conditions	Rate of perception that an individual associates with an organizational structure and technical infrastructure backing up system usage.

Source: adapted from Venkatesh et al. (2003).

Figure 10. Modelo UTAUT



Source: adapted from Venkatesh et al. (2003).

4.10. Extending Theory Acceptance and Use Technology (UTAUT 2)

Since UTAUT arises for a context generic for organizations, Venkatesh et al. (2012) developed UTAUT 2, to include three new constructs: hedonic motivation, price/value and habit, factors oriented towards the acceptance of technology within an evolved framework to input consumers' behaviour. (see table 10 and figure 11).

Tabla 10. Constructs in UTAUT 2 model

Constructs	**Definition**
Hedonic motivation	Enjoyment and pleasure derived from technology use.
Price value	A cognitive reward at consumer, marketplace, level, for added benefits as these arise from some platforms, associated with its cost.
Habit	Rate for individuals measuring everyday behaviors, automated into learning.

Source : adapted from Venkatesh et al. (2012).

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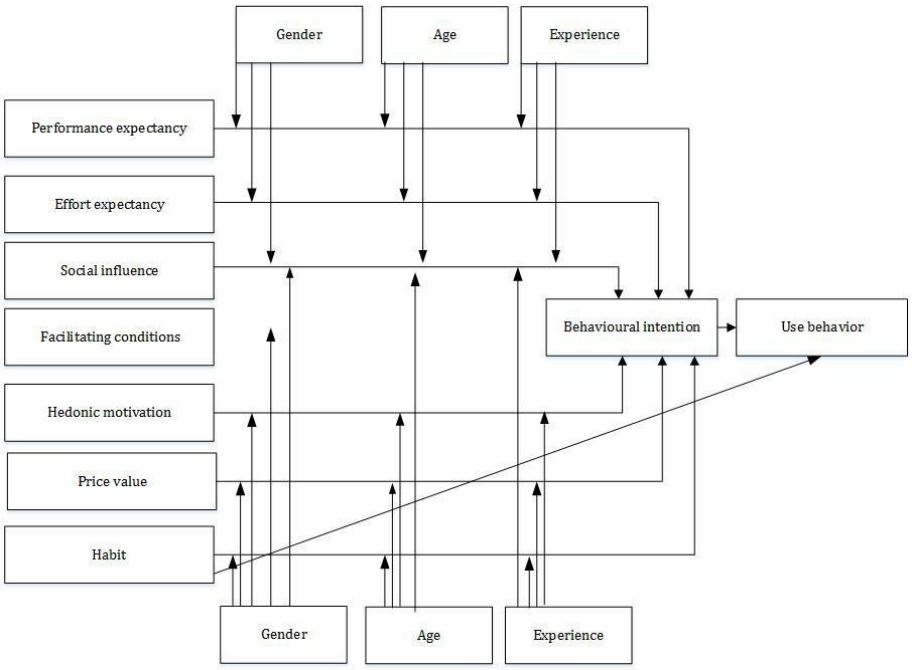
Figure 11. UTAUT 2 Model



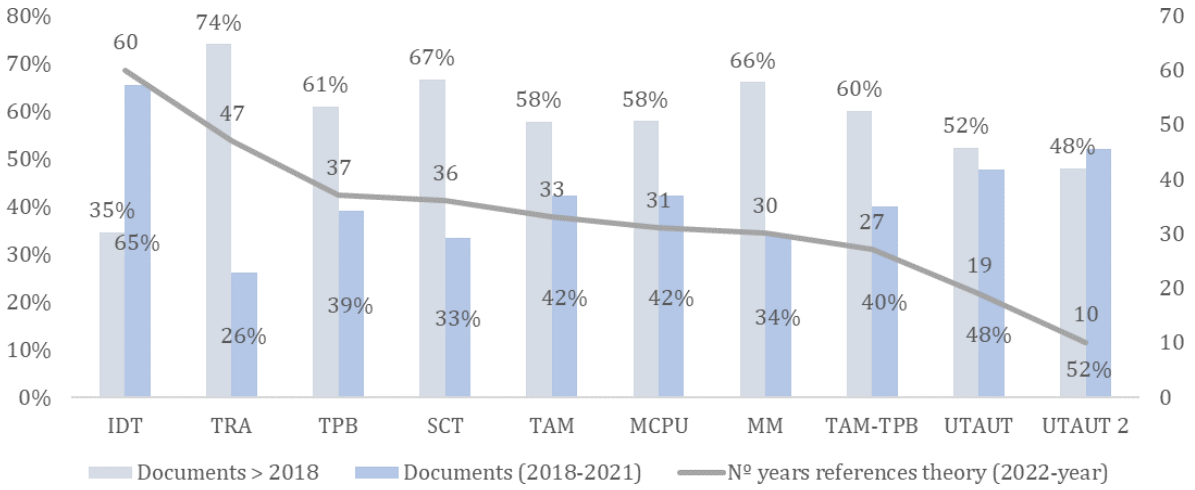
Source: adapted from Venkatesh et al. (2012).

5. Results

From a progression in history line up contrasting models and it relevancy, Figure 13 showcases the three variables activated for this analysis, namely: the number of years that the theory had links and references (2022-year); the number of documents produced from 2018-2021; and, the percentage of total production.

The percentage of qualitative research production for the years 2018-2021 versus the total production is represented in descending order: IDT: 65,5%; UTAUT 2: 52,0%; UTAUT: 47,7%; TAM: 42,3%; MCPU: 42,2%; TAM-TPB: 40,1%; TPB: 39,1%; MM: 34,0%; SCT: 33,5%; TRA: 26,0%.

Figura 13. Theories and models: historic overview



5.1. Thematic areas of study from the theories and models

The results of the analysis are presented as overview of the field in which the theoretical approaches are applied along with main topics from each model. These results, shown in tables 11-22, below, tackle the analysis of main areas of content as it relates to themes extracted from the relevant theories in technology, as stated third objective, to link behavioral intention to Technology Acceptance models.

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Table 11. Thematic areas of study from the theories and models

Application areas	Thematic
Innovation Diffusion Theory (IDT)	
Business Economics, Computer Science, Environmental Sciences Ecology, Science Technology, Engineering, Information Science Library Science, Education Educational Research, Social Sciences, Public Administration.	Absorptive-capacity, banking, business, challenges, cloud computing, commerce, covid-19, drivers, e-business, education, electric vehicles, energy, facebook, food, ict, internet, internet banking, policy, services, social media, transformation, university.
Theory of Reasoned Action (TRA)	
Business Economics, Psychology, Philosophy, Computer Science, Social Sciences, Education Educational Research, Environmental Sciences Ecology, Science Technology Other Topics, Public Environmental Occupational Health.	Health; self-efficacy; physical; perceptions; determinants; attitude; metaanalysis;decision-making;beliefs;information;management;adoption;consumption;covid-19;information-technology;risk;care;user; technology; trust.
Theory of Planned Behavior (TPB)	
Business Economics, Environmental Sciences Ecology, Psychology, Science Technology, Public Environmental Occupational Health, Engineering, Social Sciences, Education Educational Research, Computer Science.	Adolescents, adults, children, mothers, parents, pregnancy, nurses, college students, covid-19, pandemic, vaccination, csr, social identity, sustainable consumption, ecotourism, education, e-health, entrepreneurship, entrepreneurship education, environment, collectivism, environmental sustainability, renewable energy, exercise, farmers, food, food safety, food waste, consumption, health, health education, higher-education, physical activity, policy, public transport, buying behavior, purchase intention, autonomous vehicles, internet
Social Cognitive Theory (SCT)	
Psychology, Business Economics, Education Educational Research, Neurosciences Neurology, Psychiatry, Public Environmental Occupational Health, Social Sciences, Computer Science, Sciences Ecology.	Care, covid-19, diet, health, ehealth, nutrition, obesity, pandemic, consumption, cooperation, culture, race, education, emotional intelligence, exercise, family, job-satisfaction, career, language, music, neuroscience, physical activity, power, psychosis, resilience, schizophrenia, self-efficacy, self-esteem, self-management, social media, technology, television, artificial intelligence, information-technology, internet, mobile phone.
Technology Acceptance Model (TAM)	
Computer Science, Business Economics, Engineering, Education Educational Research, Information Science Library Science, Science Technology, Environmental Sciences Ecology, Social Sciences, Psychology.	Apps, artificial intelligence, assistive technology, augmented reality, blockchain, classroom, cloud computing, e-commerce, computer-technology, digital divide, digital health, digital technology, digital transformation, e-health, e-learning, fintech, gamification, human-robot interaction, internet, internet banking, internet of things, machine learning, mobile applications, mobile devices, smart home, social media.
The Model of PC Utilization	
Engineering, Health Care Sciences Services, Energy Fuels, Chemistry, Oncology, General Internal Medicine, Environmental Sciences Ecology, Thermodynamics, Computer Science.	Consultation, health-care, management, model, optimization, quality, services, simulation, system.

Source: adapted from WoS & MAXQDA (2022).

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Table 11. Thematic areas of study from the theories and models (continuation)

Application areas	Thematic
Motivational Model (MM)	
Psychology, Education Educational Research, Business Economics, Neurosciences Neurology, Public Environmental Occupational Health, Social Sciences, Psychiatry, Computer Science, Environmental Sciences Ecology.	Academic-achievement, academic-performance, adolescent, adults, alcohol use, efficacy, stress, suicide, effort, emotion, intelligence, physical activity, power, primary care, psychological needs, psychometric properties, quality-of-life, social support, sport, strategies, video games, classroom, gamification, college-students, social media.
Combined TAM and TPB	
Business Economics, Computer Science, Engineering, Environmental Sciences Ecology, Science Technology, Information Science Library, Education, Transportation, Social Sciences.	Covid-19, e-government, electronic commerce, higher-education, information, information-technology, integration, internet, internet banking, sharing economy.
Unified Theory of Acceptance and Use of Technology (UTAUT)	
Business Economics, Computer Science, Information Science Library, Education, Engineering, Science Technology, Environmental Sciences Ecology, Social Sciences, Health Care.	Assistive technology, augmented reality, automated vehicles, banking, big data, blended learning, blockchain, covid-19, e-commerce, e-government, e-health, e-learning, e-commerce, electronic health records, facebook, gamification, gratifications, ict, internet, internet banking, internet of things, mobile applications, banking, higher education, mobile health, mobile learning, mobile phone, sharing economy, smartwatch, social commerce, social media, telehealth, telemedicine, tourism, virtual reality.
Extending Theory Acceptance and Use Technology (UTAUT 2)	
Business Economics, Computer Science, Information Science, Library Science, Education, Social Sciences, Science Technology, Engineering, Environmental Sciences Ecology, Health Care Sciences Services.	Apps, artificial intelligence, augmented reality, commerce, culture, e-commerce, e-government, mobile learning, education, ict, internet, internet banking, internet of things, ehealth, mobile payment, privacy, sharing economy, smartphones, telemedicine, tourism, virtual reality.

Source: adapted from WoS & MAXQDA (2022).

6. Discussion

Below is a summary of the theories in chronological order, year, author and main determinants that predict the adoption of technology by individuals or organizations (see table 11). From our three-fold objective, stated as an overview of the theories or models used to explain and predict the use of technology, a definition set for predictive variables or constructs, we proceed to link concepts relevant to the theoretical frameworks, presented in table 11 for a global scope and snapshot summary and to provide understanding from its chronological evolution.

The second objective set out was an analysis in order to look closer at technology usage and whether the relevant theories are underlying or, whether they lost ground for application. The results confirm that all theories are still valid and remain a relatively valuable source in the field. Taking into account that the average number of years that theories undergo generational phasing, is around 32 years, then our scope for research and analysis on technology acceptance is justified on the weight and concepts laid out in more recent studies, by maintaining a scope around four years of production over total length of historic progression. It is shown that the IDT and UTAUT 2 theories have had a higher number of references by looking closely at the greater production in the last four years: 65% for IDT and 52% in UTAUT 2. Under this light, the fact that the researched technology is currently available overlaps with the impact of Covid-19 for wide access, resulting in an overall transformation of digital technologies and touching upon many sectors and across regions, with an international lens. Its global impact and speed in disseminating new technologies accessible to users underlies an added interest in studying the technology acceptance, from an academic viewpoint. The TRA model remains at the lowest point in the scale of production, which can be explained for three reasons, consider that it was first laid out as a theory 47 years ago and it wasn't developed in the field of technology; for these reasons, its scope is very limited for integrating concepts at play with behavioral intention.

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Table 12. Theories and models, overview of historic progression

Theories/Models	**Year**	**Author**	**Constructs and factors for Adoption Technology**
Innovation Diffusion Theory	1962 1983 1995 2003	Rogers	Relative Advantage, Compatibility, Complexity, Trialability and Observability.
Theory of Reasoned Action	1975 1980	Fishbein y Ajzen Ajzen y Fishbein	Attitude, Subjective norms, Behavioral intention, Behavior.
Theory of Planned Behaviour	1985 1988 1991	Ajzen	Attitude, Subjective norms, Perceived behavioral control, Behavioral intention, Behavior.
Social Cognitive theory	1986	Bandura	Behavioural factors, Personal factors and External factors.
Technology Acceptance Model	1989	Davis	Perceived Usefulness, Perceived Ease of Use
Model of PC Utilization, MPCU	1991	Thompson, Higgins y Howell.	Job-Fit, Complexity, Long Term Consequence, Affect Toward Use, Social Factors, Facilitating Conditions.
Motivational Model	1992	Davis, Bagozzi y Warshaw.	Intrinsic motivation, Extrinsic motivation.
Combined TAM-TPB	1995	Taylor y Todd	Attitude, Subjective Norm, Perceived Behavioral Control, Perceived Ease of Use, Perceived Usefulness.
Theory Acceptance and Use Technology	2003	Venkatesh, Morris, Davis y Davis.	Performance expectancy, Effort expectancy, Social influence, Facilitating conditions.
Extending Theory Acceptance and Use Technology	2012	Venkatesh, Thong y Xu.	Performance expectancy, Effort expectancy, Social influence, Facilitating conditions, Hedonic motivation, Price value, Habit.

The third objective for the present study, to deepen insight through an analysis of content that can be activated within the areas and themes common to diverse areas of investigation, is presented in the summary, in table 12. Although we depart from the acknowledgment around theories that are still valid, if we pursue a more in-detail analysis from the perspective of their application to technological field, then, the conclusions vary since only four theories are widely used across technological fields: IDT, TAM, UTAUT and UTAUT 2. Those framework models are applied to the study of technology acceptance in areas that overlap with very diverse fields of knowledge & specialization: artificial intelligence, mobile applications, assistive technology, augmented reality, block chain, distance classroom, autonomous vehicles, the cloud, electronic commerce, computational analysis, digital transformation, e-health, e-learning, financial technology, gamification, robots, internet2, internet banking, IoT, machine learning, SEM, smart home, social networks, virtual reality and mobile devices. The TRA, TPB and MM theories relied more in psycho-social factors, such as fear, stress, and personal identity, versus other theories that tend to focus on motivational studies, learning and ergonomics. Thus, our confirmation to provide a background context built in theories that are studying emerging technologies, from IDT, TAM, UTAUT and UTAUT 2 thresholds and concepts.

7. Conclusion

Considering that these models are similar in their presentation of behavior and usage, but differ in their account and conceptual angle, our review defined two sets of models and theoretical frameworks from their application: (1) models that are mainly applied in the field of technology; (2) models that are applied in social and psychological contexts and aren't fully validating for an explanation of technology acceptance. Starting with the Web of Science database that we based our data set analysis and keeping some of the limitations in the framework in sight, then the results can be extended to other databases that were not previously researched, for instance, Scopus and Google Scholar. Additionally, other theories that were not showcased in our study will provide another avenue for understanding user intention from a consumer behavioral standpoint. Finally, a possible field for future research could be delimited around those constructs that the authors have added over the years, from the theoretical perspective, in order to improve the predictive model in their studies.

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Capítulo 3

Los modelos TAM frente a los UTAUT: Estudio comparativo de la producción científica y análisis bibliométrico

TAM versus UTAUT models: A contrasting study of scholarly production and its bibliometric analysis

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TAM VERSUS UTAUT MODELS: A CONTRASTING STUDY OF SCHOLARLY PRODUCTION AND ITS BIBLIOMETRIC ANALYSIS

LOS MODELOS TAM FRENTE A LOS UTAUT: ESTUDIO COMPARATIVO DE LA PRODUCCIÓN CIENTÍFICA Y ANÁLISIS BIBIOMÉTRICO

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KEYWORDS

Models and frameworks in Technology Adoption
Bibliometrics
TAM
UTAUT 2
Web of Science (WoS)
Visualization map
VOSviewer

ABSTRACT

The objective of this research is to review and compare the TAM/TAM2/TAM3 and the UTAUT/UTAUT2 through a bibliometric approach to determine which is the most appropriate model to study new technologies. Data was obtained from the Web of Science database. 2,450 publications were examined, related to TAM/TAM2/TAM3 and 5,145 publications of UTAUT/UTAUT2 during the period 2016-2021. The findings confirm that UTAUT/UTAUT2 is being used by more and more researchers. This review offers a holistic view that will help future researchers to select the most appropriate models in their disciplines of study.

PALABRAS CLAVE

Modelos de Aceptación Tecnológica
Análisis Bibliométrico
TAM
UTAUT 2
Web of Science (WoS)
Mapa de visualización
VOSviewer

RESUMEN

El objetivo de esta investigación es revisar y comparar a través de un enfoque bibliométrico la TAM/TAM2/TAM3 y la UTAUT/UTAUT2 para determinar cuál es el modelo más adecuado para estudiar las nuevas tecnologías. Los datos se obtuvieron de la base de datos Web of Science. Se examinaron 2.450 publicaciones, relacionadas con TAM/TAM2/TAM3 y 5.145 publicaciones de la UTAUT/UTAUT2 durante el período 2016-2021. Los hallazgos confirman que cada vez más investigadores utilizan la UTAUT/UTAUT2. Esta revisión ofrece una visión holística que servirá para que futuros investigadores puedan seleccionar los modelos más apropiados en sus disciplinas de estudio.

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Introduction

Technology Adoption as a phenomenon has been studied via several models and theoretical filters in order to explore the enviroment around technology acceptance and its use. Some of the approaches were focused in the process, by looking in detph into adoption; other approaches applied existing theories around behavioralism or were created for the sole purpose of narrowing down adoption as a single event. These theories encompassed a extended model and framework overtime: TAM (Davis, 1989), updated TAM2 (Venkatesh & Davis, 2000) and TAM3 (Venkatesh & Bala, 2008); UTAUT (Venkatesh et al., 2003), updated UTAUT2 (Venkatesh et al., 2012).

As part of theories and explanatory models, these working theories will provide a set of variables for defining a specific phenomenon, versus a framework model that accounts for a system, theory and phenomena, by describing known properties or infered characteristics to be used in studies thereof. Aditionally, a model applies to any abstract representation extracted from a segment of the real world, presented with the purpose of explaining, undertanding, predicting and controlling any phenomena in the light of investigation (Burch, 2003).

According to TAM (Davis, 1989) behaviroual intention is determining human behaviour in base to the emotional component, guiding attitude towards a specific behaviour. This cognitive approach into the conditining factors of behaviour led into variables in usage that are induced from its utility perceived and easy of use, as relating to external factors, such as beliefs, attitudes linked to intention (Davis et al., 1989). TAM is athe basic model that will be undertook by Venkatesh & Davis (2000), for an extended framework TAM2, which integrates variables from a social and oraganizational onset. The third upgrade into an extended and encompassing framework of this model TAM3 (Venkatesh & Bala, 2008) goes into a set of precedents to factor in the easy of use as perceived within a community, as well as, its perceived enjoyment and usability.

UTAUT (Venkatesh et al. 2003) is an extended theoretical approached that has been validated in different areas with the aim of approaching factors determining behavioral intention within organizations fro the use of technology. It aligns with at least eight previous theories that were mainstream in order to explain any technological related factor within a specific time-frame, by means of identifying 32 constructs that provided a set of four variables: *Performance expectation*, *Effort Expectation*, *Social Influences* and *Facilitating Conditions*, as main variables to predict user intention and behaviroul use. In order to adapt this theory to end-user, UTAUT2 added three constructs for analysis: *Hedonic Motivation*, *Price-value* and *Habit* (Venkatesh et al., 2012).

These theories present a robust model that is reliable and it had been consistently applied in looking for the factors impacting behaviour and usage for technology around varied enviroments:

- TAM/TAM2/TAM3: mobile / e-payments (Zhong & Moon, 2021); mobile / e-learning (Alfadda & Mahdi, 2021); health (Rajak & Shaw, 2021), artificial intelligence (Iqbal & Sidhu, 2022), mobile platforms (Song, et al., 2021) etc.
- UTAUT/UTAUT2: mobile / e-payments (Suo et al., 2022); mobile / e-learning (Alghaziet al., 2021); health (Arfi et al., 2021), artificial intelligence (Balakrishnan et al., 2022), mobile aplications (Puriwat & Tripopsakul, 2021) etc.

This bibliometric approach to the analysis of variables incresed over the years due to accesibilty and readily avalaible software for contrasting data, providing a scientific range for great volumen of data, and leading into high impact research (Donthu et al., 2021).

2. Objetives

We are taking into consideration that new technology is subject to constant evolution, in order to explain its use from a user perspective side. This area remains a niche with current updates being brought up to light by scholars and research community. With this botton line, an approach to technology adoption is accountable to biometric standards taken from indexed resources in Web of Science, via main reviews and journals to describe, explain and assess the models TAM/TAM2/TAM3 y UTAUT/UTAUT2. Some of the questions and objectives that will be tackled, are listed in advance:

- Which similarities and differences in quantity, quality and structure are relevant to scientific approaches from the angle of TAM and UTAUT, including all the extensions in the frameworks (TAM2/TAM3 & UTAUT2)?
- What are the main areas for investigation within the scientific community?
- Which theoretical approach and models are presently most relevant and have a wider acceptance to provide a model that underlies to rejection theory or adoption in technology?

In order to provide answers, the path of inquire will set around these objectives:

- To identify, visualize and contrast scholarly published articles to account for research standards of quantity, quality, and structure by presenting an analisys and main ratios:
    - Research Areas, Publisher, Journal, Document Type and Language.
    - Using PRICE model in order to analyze behavior within production in areas of research specific to adoption that evaluate any growing rate for its own trends of analysis.

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- Identifying LOTKA'S law and authors with a high index ration in order to establish guidelines across the discipline for those authors transitioning or non-specialized/
- Identifying BRATFORDS'S model for those articles and studies that are central and relevant to several technology disciplines.
- Providing analysis for quotations, authors and journals highlighted.
- By collaborating authors as part of the VoS viewer tool.
- Identifying key terms in VoS viewer within articles and content provided for analysis, in order to offer a thematic approach to research trends that is organized guiding a scholarly approach.

3. Critical studies overview

In this section, the focus will be on the models and theories that underline the study, taking into consideration the proposed model for assesment.

3.1. Technology Adoption models (TAM/TAM2/TAM3)

The *Technology Acceptance Model* (TAM) was the first model to mention psychological factors that affect the technology adoption, and it was developed by Davis, in 1989, departing from the *Theory of Reasoned Action* (TRA) and *Theory of Planned Behavior* (TPB). TAM analyzes user behavior taking their attitudes as a key variable, in order to predict and explain the use of technology and analyze why people accept information systems or not. This model indicates that the user's motivation to select a techology system depends on three factors: *perceived ease of use*, *perceived usefulness*, and attitude, a factor that is considered essential as determinant in predicting whether the user will utilize it or not. *Perceived usefulness* and *ease of use* are specified as the main factors affecting attitude, which is connected to relationships between beliefs, attitudes, intention and behavior. All other external factors are assumed to influence intention and attitude indirectly, through *perceived usefulness* and *ease of use*. For this reason, an individuals' actual behavior is conditioned by behavioral intention, which is determined by attitude and subjective norms, and, in turn, conected to core beliefs and other external factors. *Perceived usefulness* is the individual's belief about how a particular system will improve their performance on a task, while *perceived ease of use* is the extent to which the user believes that using that technology will be effortless. In this way, *perceived usefulness* and *perceived ease of use* constitute cognitive determinants of behavioral intention, while attitude represents the affective component (Davis et al., 1989).

The model TAM2 (Venkatesh & Davis, 2000) incorporates two groups of constructions into the original set: *social influences* (image and subjective norms) and *cognitive influences* (the relevance of the task, the quality of the result and the possibility of demonstrating the result); There are two added moderating factors: *experience* and *willingness of use*. Subjective norms influence not only the *perceived usefulness* but, also, the *intention to use*.

The model TAM3 (Venkatesh & Bala, 2008) incorporates a set of antecedents for the perceived *ease of use*: *self-efficacy*, *anxiety*, "*playfulness1*", as well as, those user associations to a external control. Additionally, the authors propose two factors interrelated with the system in itself: *perceived enjoyment* and *perceived usability*.

3.2. Unified Theory of Aceptance and Use of Technology (UTAUT) and extension Theory (UTAUT2)

The *Unified Theory of Acceptance and Use of Technology* UTAUT (Venkatesh et al., 2003) was developed to analyze, collect and synthesize various prevalent technology adoption theories, through a review of eight of the most outstanding theoretical models: the *Innovation Diffusion Theory* (IDT) (Rogers, 1961); *Reasoned Action Theory* (TRA) (Ajzen & Fishbein, 1980); *Planned Behavior Theory* (TPB) (Azjen, 1991), *Social Cognitive Theory* (SCT) (Bandura, 1986), *Technology Adoption Model* (TAM) (Davis, 1989); *PC utilization model* (MPCU) (Thompson et al., 1991); *Motivational Model* (MM) and the *Combination TAM and TPB* (C- TAM- TPB) (Taylor & Todd, 1995). There are thirty-two constructs standing to the essential model, reviewed from a a unified perspective, via a *Unified Theory of Acceptance and Use of Technology* (UTAUT) (Venkatesh et al., 2003), with the aim of explaining behavior from an organizational side accounting for technology use and adoption. The four main constructs defined as part of the extended, unified, model are: *Performance Expectation*, which is the degree to which the use of a technology will provide benefits to users in carrying out certain activities; *Effort Expectation*, which is the degree of ease associated with the use of the system; *Social Influence*, which is the measure that users perceive that other notable and relevant users in the community (for example, family members, friends, or colleagues) believe in their use of any given technology; *Facilitating conditions*, which are the users' perceptions of resources and the support available to perform a behavior. Last, there are four moderators to contrast the analysis: age, gender, experience and willingness of use. Venkatesh et al., (2012), add three newly introduced factors that further describe the context of the consumer, *Hedonic Motivation* that is the fun or pleasure derived from the use of technology, *price-value* that is the cognitive compensation of consumers between the perceived benefits of applications and the cost

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of using them, and *habit*, which is the extent to which individuals tend to perform behaviors automatically due to learning.

3.3. Bibliometrics

The growing number of reviews in research literature produced in recent years is linked with analysis and bibliometric standars for establishing data pools within the scholar community. Quantitative methods are based in perfomance indicators and mathematical models, that allow, in one hand, to examine the material from a retrospective point of view and provide an advancement aligned with research progression; in the other hand, it allows evaluating the potential for a given theme in featuring a line of development that is productive for research or whether is obsolete (White & McCain, 1989).

Known assesments for analysis and a bibliometric approach are contrasting production analysis versus structure models. Quantity and quality indexes examining contributions in a specific field (Cobo et al., 2011) are descriptive and mainly based on bibliometrics. The second type of assesments contribute with a scientific-base, mapping the connections within the levelers in the data-set; and, these are more likely to be structural (Donthu et al., 2020).

Quantity indicators are measuring productivity around terms and keywords measured to an autor, journal or institution (Durieux & Gevenois, 2010; Tan et al., 2009).

Quality indicators are most commonly used to measure the frequency of citations linking a platform, author and periodical journal, as these appear in other platforms (Durieux & Gevenois, 2010).

Structural indicators measuring the links brigdging publishing areas, authors and knowledge data-bases, are associated with analysis and with constructionism in social networks, known as *sociograms* (Rueda et al., 2007).

Many areas of study and fields interelated via bibliometric analysis are based in TAM/TAM2/TAM3/UTAUT/ UTAUT2; these trace down patterns in knowldedge areas (Alturas, 2021; Al-Emran & Granić, 2021; Taneja & Bharti, 2021; Wang et al., 2021; Xu et al., 2021).

4. Methodology

The methodology carried out was developed in three stages, after scrutinizing data-bases: first, data collection; second, processing via analitic units; and, third, data-visualization for analysis by providing maps. The program IBM SPPS Statistics 27 was used to perform the descriptive analysis, count the frequency of citations and keywords, and, generate the citation matrix (journals/documents/authors), as well as, a matrix of keyword co-occurrences using the VoS viewer software (Van Eck and Waltman, 2010).

4.1. Selection and data analysis

In order to obtain quality data, Web of Science (WOS) is a recognized database, akcnowledged by the scientific community as a digital platform for indexed literature and bibliometrics, which provides metadata for standard analysis. (Gaviria-Marin et al., 2019). Since it covers a wide range of disciplines, metadata will yield a high-quality range of information for any analitical undertake.

The parameters applied to article searches are described below:

1. TAM: Web of Science Core Collection; topic: Technology Adoption Model; open access Timespan: 2016-2021 (March, 12); Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, 2.
2. UTAUT/UTAUT2: Web of Science Core Collection; topic: utaut2 OR utaut 2 OR extending unified theory acceptance use of technology, or unified theory acceptance use of technology, or theory acceptance and use of technology. Timespan: 2016-2021 (March, 12); Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, 2.

Two different data sets were created:

1. TAM/TAM2/TAM3 research article bibliographic records. As a result, a total of 2,450 documents were included in this data set;
2. UTAUT/UTAUT2 bibliographic records with a data set of 5,145 documents.

The retrieved documents were downloaded in plain text format and analyzed well along.

4.2. Selection and units for processing analysis

After obtaining citation sources of documents, authors and journals, the units basis for citation analysis were: sources cited, references cited, and authors cited, while the units for basis in co-occurrences for the analysis, were the keywords provided by the authors of the documents.

Basis for analysis. The keywords, and descriptors, with which the scientific production is indexed were chosen from the retrieved documents. The first database, researched data, included records from two types of keywords: a) Author keywords (AKW), provided by the authors themselves; and b) Keywords Plus (KW+), automatically extracted by WoS from the frequency of appearance of the words in the titles of the references of the cited articles.

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The automatically extracted keywords are less specific and understandable than the words provided by the authors for keytags (Zhang et al., 2016). For the purpose of our study, the AKW's selected were provided by the authors.

4.3. Map Visualizations of units and processing

The bibliometric software used is VoSviewer (Van Eck & Waltman, 2010). Through the visualization of distance-based bibliometric networks, thousands of nodes are taken to perform the analysis of imported data. This tool works, on the one hand, with different units of analysis, such as authors, organizations, countries, documents, journals, keywords, and citations, and, on the other hand, with units of measurement, such as co-authorship, co-ocurrences, citations, and co-citations. The maps are elaborated following these three techniques:

1) the *association strength* normalization technique consists in measuring the similarity of the co-citation and co-occurrence values of the analyzed units, considering s*trength of association* (FA) in the similarity index, shaping a matrix of normalized co-occurrences. The FA index is based on the normalization of the intensity for pairs of units associated in the analysis; the weight of each co-citation, and the co-occurrence of keywords, were obtained according with this mapping method (Van Eck & Waltman, 2010).

2) The *visualization of similarities,* VoS mapping technique, consists in executing different clustering algorithms to position and classify the co-citations of journals, documents and authors; the co-occurrences of keywords, in similar groups yields a cluster, which is a set of closely related nodes aligned to a type of link. Each node being analyzed is assigned to a cluster (Van Eck & Waltman, 2010).

3) the *grouping technique* consists in representing the different groups in tags; a map for visualizing different units where represented areas using circles, nodes, and labels, are connected by links or lines. The size of the nodes in the co-citation analysis represents the normalized number of citations received for each item, and the thickness of the lines represents the strength of the links. The link and the proximity between two items identify the relationship of citation, or co-occurrence in this method, between two units of analysis. The color of the nodes is random and it indicates the group with which each item is associated (Van Eck & Waltman, 2010).

4.4. Bibliometrics

With the acceptance of bibliometrics as a science-base discipline, the legal side evolved to show the progression and elaborate laws that protect the handling of privacy, confidentiality, etc. As relating to data and information. The search for statistically regular behaviors over time in the different elements related to the production and consumption of scientific information, as well as global explanations for the observed phenomena, are achieved through the formulation of bibliometric laws. Three primary laws to be known and pertinent in this research are the laws of Price, Lotka, and Batford.

4.4.1. Price Law: the law of exponential growth in scientific information

Price's Law models the relationship between production and time. Price found that the growth of scientific information was exponential and occurred at such a rapid rate that every 10-15 years the existing global information doubled (Price, 1963).

4.4.2. Lotka's law: the law of productivity in scientific authors

Lotka's law is the non-linear regression model that relates the number of authors to their productivity: "The number of authors, An, who publish n papers on a subject is inversely proportional to the number of articles squared". This premise stated that a small number of authors concentrate the largest volume of scientific production, specialized authors who lead scientific production and the rest, which represents the vast majority of authors, have low productivity, since they are researchers in passing or transient condition (Lotka, 1926).

4.4.3. Bradford's law: the law of dispersion in scientific literature

Bradford's Law of Dispersion establishes that

> *if scientific journals are ordered in a decreasing sequence of productivity of articles on a specific field, they can be divided into a nucleus of journals that deal in particular with the subject, a Bradford nucleus, and various groups or zones containing approximately the same number of articles as the core, where the number of journals in the core and in successive zones is in a 1: n: n2 ratio*. (Bradford, 1934)

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5. Results

5.1. Quantity levelers

The contributions of the research components in a set field are examined: authors, institutions, countries, languages, journals, among others. This quantity-based analysis, which is descriptive in nature, is the hallmark of bibliometric studies (Donthu et al., 2020).

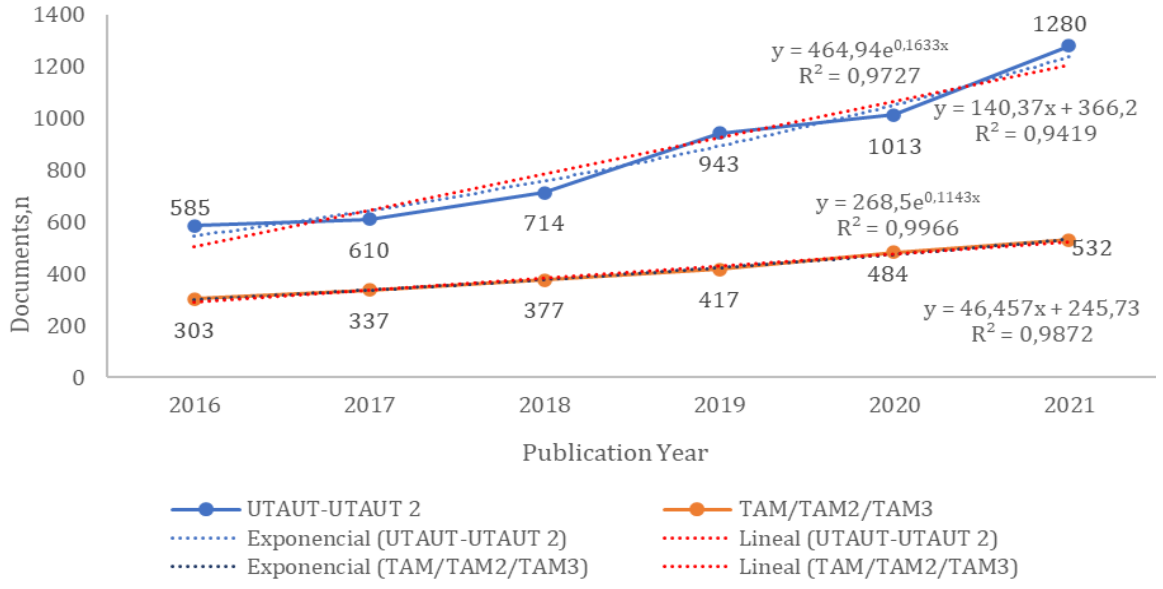
5.1.1. Amount of publications by year

The dissemination of research papers over set periods of time reveals the pace of development of a specific field (Donthu et al., 2021a). The state of scientific development derives to obsolescence of scientific literatura over time. In other words, there is a strong tendency in many disciplines for scientific publications to stop being researched relatively quickly, since in areas with a high level of production, the documents are replaced by others with newer information, in other cases, the information is valid, but there is a decreasing interest in these fields of knowledge. Each discipline undergoes its own evolution, passing through various stages: first, precursors, that would be the first publications in a field of research; second, exponential growth when a field becomes a research front; last, a linear growth that is the moment that it slows down publications and its primary purpose is to review and archive knowledge (Ardanuy, 2012).

A total of 2,450 records were retrieved for the TAM/TAM2/TAM3 search, while 5,145 records were retrieved for the UTAUT/UTAUT 2 search for the period 2016-2021. Graph 1 shows the growth of articles through Price's Law to model the relationship between production and time. In the case of the TAM/TAM2/TAM3, the correlation index R^2 = 0.9727 obtained means that 0.027% of the variance is not explained in the exponential fit, compared to 0.058% not explained in the linear fit. According to the curve, the theories continue to be a front of scientific interest since it continues in a growth stage by having an exponential growth. In the case of UTAUT/UTAUT2, the correlation index R^2 = 0.9966 obtained assumes that 0.003% of the variance is not explained in the exponential fit, compared to 0.013% not explained in the linear fit. Observing the curve and the value of the indexes, the current growth would be exponential, so it continues in the growth stage, being a set of theories of interest within the scientific community. The regression line confirms that the growth pattern is consistent along the line, in both fields of investigation.

As shown in the graphic below, the growth of articles using these theories has been steadily increasing over the years. Although the research articles linked to a second search, UTAUT/UTAUT2, grew at a faster pace than the first one, TAM/TAM2/TAM3.

Graphic visualization 1. – Rate of growth in production (Price's model)



Source: Garcia de Blanes et al., 2022

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5.1.2. Amount of publications by author

Upon distributing the documents by the number of authors, it was observed that in the 2,450 documents of TAM/TAM2/TAM3, there are a total of 6,584 authors, a number of authors that is quite high compared to the total number of works produced, which makes an average of 2.69 articles/author. Of these 6,584 authors, 5,879 authors have produced a single document; 678 authors two documents, and 27 authors => 3 documents. In the UTAUT/UTAUT2, there are a total of 12,889 authors; this number of authors is quite high compared to the total number of works produced 5,145, which makes an average of 2.51 authors/article. Of these authors, 10,954 authors have produced a single document; 1,844 authors two documents and 91 authors => 3 documents.

Next, it is observed and shown in table 1, the 6 most productive authors in TAM/TAM2/TAM3: Al-emran M with 23; Al-rahmi WM with 17 and Salloum SA with 15 documents; in the UTAUT/UTAUT2 area: Dwivedi YK with 38, Rana NP with 35 and Oliveira T with 33 documents.

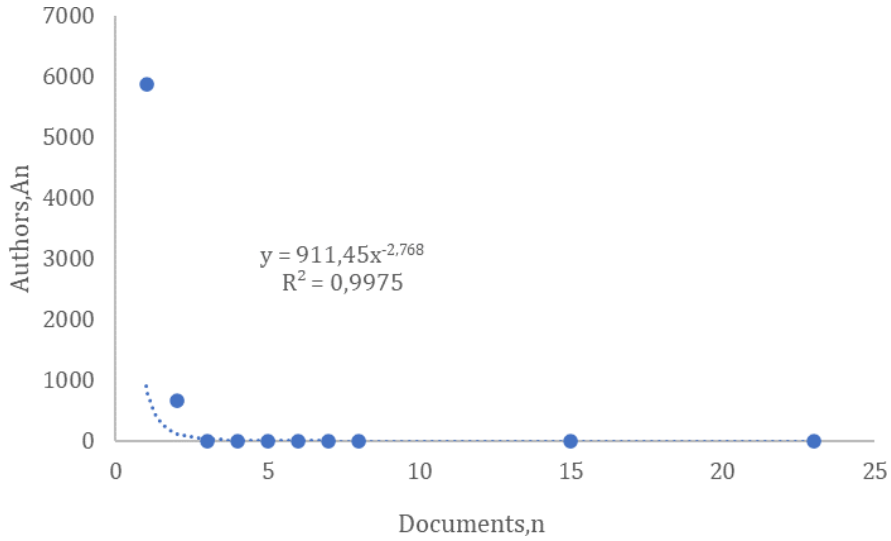
Table 1. Top Autores

TAM/TAM2/TAM3			UTAUT-UTAUT 2		
Authors	**Record Count**	**% Total**	**Authors**	**Record Count**	**% Total**
Al-emran M	23	0,9%	Dwivedi YK	38	0,7%
Al-rahmi WM	17	0,7%	Rana NP	35	0,7%
Salloum SA	15	0,6%	Oliveira T	33	0,6%
Teo T	15	0,6%	Al-rahmi WM	21	0,4%
Garcia-penalvo FJ	12	0,5%	Chatterjee S	17	0,3%
Mensah IK	11	0,4%	Kim S	17	0,3%
		3,80%			**3,13%**

Source: García de Blanes et al., 2022

The productivity of the authors is going to be measured through Lotka's law. From the analysis in TAM/TAM2/TAM3, graph. 2 displays the coefficient of determination is R2 = 99.75%; in UTAUT/UTAUT2 the coefficient of R2 = 99.7% (see graph 3). Therefore, Lotka's Law is fulfilled. This great dispersion of the field can be explained either by the multidisciplinary approaches, or by the possibility of applying this model to different contexts.

Graphic 2. Productivity within authors TAM/TAM1/TAM2 (Lotka's law)



Source: Garcia de Blanes et al., 2022

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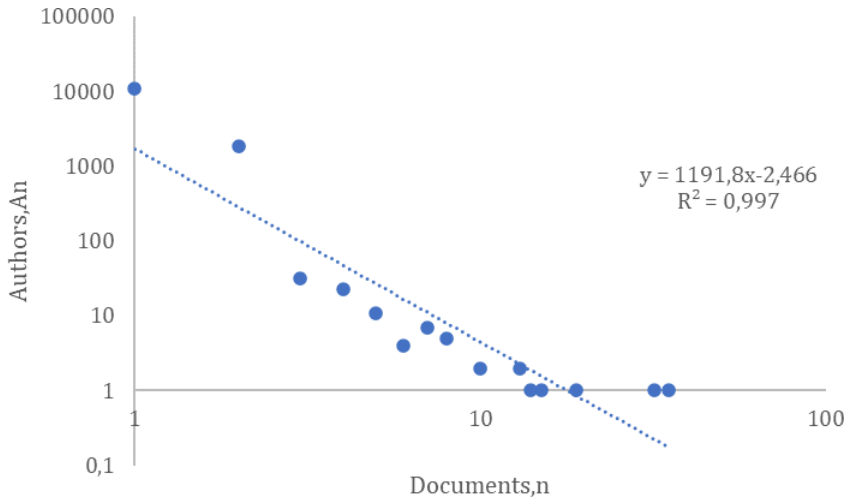
Graphic 3. Productivity within authors UTAUT/UTAUT2 (Lotka's law)



Source: Garcia de Blanes et al., 2022

5.1.3. Amount of publications by journal and publisher

In both cases of study, appear the same five main publishers but table 2 pointed at the different order by varying status. These publishers account for 56.07% of the publications in TAM/TAM2/TAM3 and 61.87% in UTAUT-UTAUT 2. The publisher with the largest number of publications, Elsevier, has a 12.08% (294 documents) of the total publications in TAM/TAM2/TAM3, and in the case of UTAUT-UTAUT2, a 17.24% (887 documents) over all publications. The Dutch publisher Elsevier, one of the largest scientific publishers in the world, features products such as the *Lancet,* the *Cell* journals in the ScienceDirect collection of electronic journals and the Scopus Citation Database.

Some journals published substantially more articles on topics related to the theories than others. For instance, the chart below (table 3) shows the 6 main journals with the largest number of articles on TAM/TAM2/TAM3 and UTAUT-UTAUT 2. The number of articles and the total percentage of production are shown as well. The journal with the most publications on both theories is the *Journal of Sustainability*, in the *Open Access Interdisciplinary* journal, published by MDPI.

Table 2. Top Publishing organizations

TAM/TAM2/TAM3			UTAUT-UTAUT 2		
Publisher	# Documents	% total	Publishers	# Documents	% total
Elsevier	296	12,08%	Elsevier	887	17,24%
IEEE	255	10,40%	Emerald Group Publishing	665	12,93%
Springer Nature	249	10,16%	Springer Nature	570	11,08%
Emerald Group Publishing	212	8,65%	Taylor & Francis	447	8,69%
Taylor & Francis	194	7,92%	IEEE	342	6,65%
Mdpi	168	6,86%	Mdpi	272	5,29%
		56,07%			61,87%

Source: Garcia de Blanes et al., 2022

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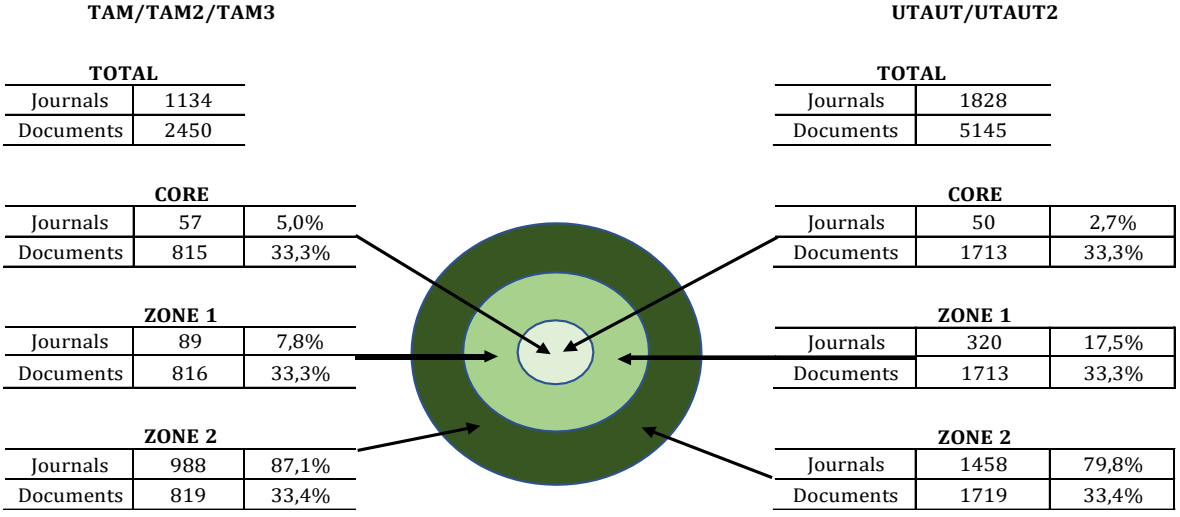
Table 3. Top Journals

TAM/TAM2/TAM3			UTAUT-UTAUT 2		
Publisher	# Documents	% total	Publishers	# Documents	% total
SUSTAINABILITY	81	3,3%	SUSTAINABILITY	135	2,6%
EDUCATION AND INFORMATION TECHNOLOGIES	53	2,2%	COMPUTERS IN HUMAN BEHAVIOR	112	2,2%
COMPUTERS IN HUMAN BEHAVIOR	46	1,9%	INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT	62	1,2%
IEEE ACCESS	32	1,3%	EDUCATION AND INFORMATION TECHNOLOGIES	62	1,2%
JOURNAL OF ASIAN FINANCE ECONOMICS AND BUSINESS	23	0,9%	BEHAVIOUR & INFORMATION TECHNOLOGY	55	1,1%
INTERACTIVE LEARNING ENVIRONMENTS	23	0,9%	JOURNAL OF MEDICAL INTERNET RESEARCH	47	1,0%
		10,5%			10,2%

Source: Garcia de Blanes et al., 2022

Next, the dispersion of production by journals is shown in Figure 1. For this analysis, the first set, TAM/TAM2/TAM3, results in 57 journals core to Bradford's method showing those authors with highest concentration of publications by having the largest number of publications. In the UTAUT/UTAUT2 set, the core is made up of 50 journals. In both cases, the Bradford Mathematical Model of production dispersion is fulfilled.

Figure 1: Dispersion of production (Bradford model)



Source: Garcia de Blanes et al., 2022

5.1.4. Amount of publications by countries

When performing the analysis by country, as shown in Table 4, in the case of TAM/TAM2/TAM3, Peoples R. CHINA is the country with the highest production with 354 documents (10.8%), and, in UTAUT/UTAU2, it is USA with 853 documents (11.6%). In the case of TAM/TAM2/TAM3, in descending order, the contribution by country would be: USA, Malaysia, Taiwan, and Indonesia. In UTAUT/UTAUT2: Peoples R. China, Malasya, Taiwan, and Great Britain.

Next, by applying a regional filter to look into geographical regions, results highligh Asia (China / Malasya / Taiwan / Indonesia) as the area with the highest production, since it represents 28.3% with 926 documents for the TAM/TAM2/TAM 3 search, and 21.3% with 1,560 documents in UTAUT/UTAUT2.

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Table 4. Top publicacions by country

TAM/TAM2/TAM3			UTAUT-UTAUT 2		
Countries/Regions	Record Count	% of Total	Countries/Regions	Record Count	% of Total
PEOPLES R. CHINA	354	10,8%	USA	853	11,6%
USA	250	7,6%	PEOPLES R. CHINA	786	10,7%
MALAYSIA	233	7,1%	MALAYSIA	423	5,8%
TAIWAN	176	5,4%	TAIWAN	351	4,8%
INDONESIA	163	5,0%	ENGLAND	332	4,5%
		35,97%			37,40%

Source: Garcia de Blanes et al., 2022

5.1.5. Amount of publicacions by language

The most used language of publication for scientific dissemination is *English*, in the case of TAM/TAM2/TAM3 with 97.31% (2,384 of the documents); in the case of UTAUT /UTAUT2 a 98.40% (5,061 of the documents). In both cases, *Spanish* is second language, with *Portuguese* and *Chinese-Mandarin* third language of production, in both cases TAM/TAM2/TAM3 and UTAUT-UTAUT2, respectively.

Table 5. Top publicacions by language

TAM/TAM2/TAM3			UTAUT-UTAUT 2		
Language	Record Count	% of total	Language	Record Count	% of total
English	2.384	97,3%	English	5.061	98,4%
Spanish	31	1,3%	Spanish	28	0,5%
Portuguese	14	0,6%	Chinese-Mandarin	13	0,3%

Source: Garcia de Blanes et al., 2022

5.1.6. Amount of publications by entry format

The most frequent type of document presents the studies in the form of articles for periodical publications: in the TAM/TAM2/TAM3 search area, a total of 4081 documents, and UTAUT_UTAUT2 documented with 1820 items (table 6). The second most followed document, by far, is “Papers” or presentations from Cogress Proceedings.

Table 6. Top Publications by format

TAM/TAM2/TAM3			UTAUT-UTAUT 2		
Document Types	Record Count	% total	Document Types	Record Count	% total
Articles	4081	73,62%	Articles	1820	71,50%
Proceedings Papers	894	16,13%	Proceedings Papers	574	22,60%
Early Access	253	4,56%	Early Access	78	3,10%
Review Articles	174	3,14%	Review Articles	58	2,30%
		97,45%			99,50%

Source: Garcia de Blanes et al., 2022

5.1.7. Amount of publications by institution

From an institutional level, the organizations with the highest number of publications, as shown in Table 7, are the the UNIVERSITI TEKNOLOGI MALAYSIA, one of the main public research universities in Malaysia, with 45 publications in the TAM/TAM1/TAM2; in the UTAUT-UTAUT 2 the LEAGUE OF EUROPEAN RESEARCH

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UNIVERSITIES LERU gathers 96 publications from an association formed by twenty-three research-intensive universities.

Table 7. Top Instituciones

Affiliations	Record Count	% total	Affiliations	Record Count	% total
UNIVERSITI TEKNOLOGI MALAYSIA	45	1,8%	LEAGUE OF EUROPEAN RESEARCH UNIVERSITIES LERU	96	1,9%
UNIVERSITAS BINA NUSANTARA	28	1,1%	STATE UNIVERSITY SYSTEM OF FLORIDA	71	1,4%
UNIVERSITI SAINS MALAYSIA	27	1,1%	UNIVERSITI TEKNOLOGI MALAYSIA	66	1,3%
LEAGUE OF EUROPEAN RESEARCH UNIVERSITIES LERU	26	1,1%	CHINESE ACADEMY OF SCIENCES	54	1,1%
KING SAUD UNIVERSITY	24	1,0%	UNIVERSITI SAINS MALAYSIA	53	1,0%
EGYPTIAN KNOWLEDGE BANK EKB	23	0,9%	UNIVERSITI MALAYA	51	1,0%
		7,06%			7,60%

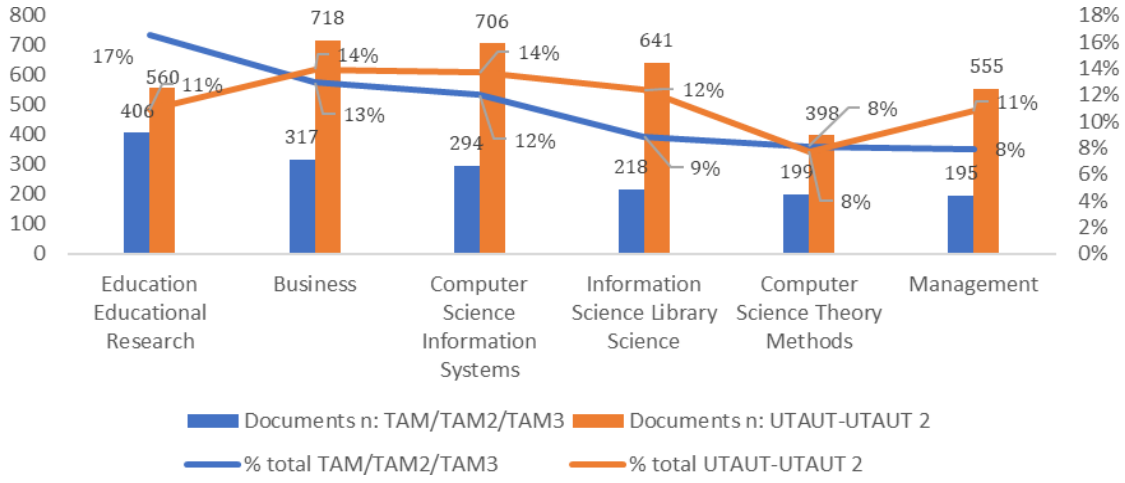
Source: Garcia de Blanes et al., 2022

5.1.8. Amount of publications by category

The scientific production as filtered by research area or discipline is shown next (Graph 4). In TAM/TAM2/TAM3, the category with the highest production is Education; Educational research presents a 17% with 406 documents. Other categories in descending order are: Computer Science Information Systems 12% (294 documents), Information Science Library Science 9% (218 documents), Computer Science Theory Methods 8% (199 documents), and Management 11% (195 documents).

In the second area of search, UTAUT/UTAUT2, the categories varied with the highest production in Business with 14% (718 documents), Computer Science Information Systems with 14% (706 documents), Information Science Library Science with 12% (641 documents), Education Educational Research with 11% (560 documents), Management with 11% (555 documents), and Computer Science Theory Methods with 8% (398 documents).

Graphic visualization 4- Top 6 theme-areas



Source: Garcia de Blanes et al., 2022

5.2. Quality markers

Research citations on both set of theories were compared to gain insight into the different types of research being conducted. As it is shown next (in table 8) the descriptive statistics of the citations points to a large number of

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citations, which is indicative of the relevance of both research domains. The number of citations and means of productions is much higher in UTAUT/UTAUT2 than in TAM/TAM2/TAM3.

Table 8. #References

TAM/TAM2/TAM3			UTAUT-UTAUT 2		
References	# documentos	Media / citations	references	Record Count	% of Total
25,138	2,450	10,2	345,100	5,145	67,07

Source: Garcia de Blanes et al., 2022

5.2.1. Amount of author references

The most cited authors out of 10 in the higher rank, are: Mostafa Al-emran who received the highest citation count (458 citations), with Timothy Teo having the highest average citation count (75.3) in TAM/TAM2/TAM3. In the UTAUT-UTAUT2 areas, Yogesh k. Dwivedi, who received the highest citation count (2,135 citations), along with Marc Clement, with the highest citation average (204).

Table 9. Top referenced authors

Model	Author	Documents	Citation	Media / Citation
TAM/TAM2/TAM3	al-emran, mostafa	23	458	19,9
	tarhini, ali	4	301	75,3
	teo, timothy	15	249	16,6
	garcia-penalvo, francisco j.	8	229	28,6
	carlos sanchez-prieto, jose	7	227	32,4
	sharma, sujeet kumar	4	223	55,8
	olmos-miguelanez, susana	5	222	44,4
	salloum, said a.	15	184	12,3
	mezhuyev, vitaliy	5	183	36,6
	kamaludin, adzhar	3	167	55,7
	Total	89	2443	
UTAUT-UTAUT2	dwivedi, yogesh k.	35	2.135	61,0
	rana, nripendra p.	32	2.070	64,7
	alalwan, ali abdallah	13	1.108	85,2
	williams, michael d.	8	976	122,0
	tarhini, ali	13	646	49,7
	clement, marc	3	612	204,0
	al-rahmi, waleed mugahed	19	450	23,7
	wamba, samuel fosso	10	424	42,4
	lal, banita	3	415	138,3
	jeyaraj, anand	4	407	101,8
	Total	140	9243	

Source: Garcia de Blanes et al., 2022

5.2.2. Amount of Journal references

Considering the top 10 journals with the highest number of citations, *Computers in Human Behavior*, with 3,298 citations within TAM/TAM2/TAM3, is the journal with the highest number of citations although it is not the highest in terms of average, occupying fourth place in the top 10 citations. As for UTAUT/UTAUT2, it is the journal *Sustainability* with 10,505 citations that has the highest number of citations, lowering in the average index to rank eighth in the top 10.

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Table 10. Top Referenced Journals

	Journal	# Documents	#Citations	Average Citations
TAM/TAM2/TAM3	COMPUTERS IN HUMAN BEHAVIOR	46	3,298	71,7
	INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT	11	822	74,7
	COMPUTERS & EDUCATION	11	811	73,7
	SUSTAINABILITY	81	700	8,6
	TELEMATICS AND INFORMATICS	18	601	33,4
	JOURNAL OF RETAILING AND CONSUMER SERVICES	17	543	31,9
	IEEE ACCESS	32	538	16,8
	TECHNOLOGY IN SOCIETY	18	501	27,8
	EDUCATION AND INFORMATION TECHNOLOGIES	53	495	9,3
	TRANSPORTATION RESEARCH PART C-EMERGING TECHNOLOGIES	4	465	116,3
	Total	291	8774	
UTAUT/ UTAUT2	SUSTAINABILITY	135	10.505	77,8
	COMPUTERS IN HUMAN BEHAVIOR	112	9.685	86,5
	INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT	62	7.367	118,8
	BEHAVIOUR & INFORMATION TECHNOLOGY	55	4.973	90,4
	INFORMATION TECHNOLOGY & PEOPLE	47	4.615	98,2
	INFORMATION SYSTEMS FRONTIERS	47	4.499	95,7
	JOURNAL OF RETAILING AND CONSUMER SERVICES	47	4.431	94,3
	TECHNOLOGY IN SOCIETY	47	4.406	93,7
	EDUCATION AND INFORMATION TECHNOLOGIES	62	4.364	70,4
	JOURNAL OF MEDICAL INTERNET RESEARCH	52	3.644	70,1
	Total	666	58489	

Source: Garcia de Blanes et al., 2022

5.2.3. Amount of referenced documents

A higher count in articles reveals the profile of a research domain along with a historical perspective of a research domain. The ten most cited documents for both sets of theories are shown below (table 11).

Table 11. Top referenced documents

Model	Documents	Citation
	Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model	317
	The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education	271
	Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors	259
	Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA	243
	Understanding the Blockchain technology adoption in supply chains-Indian context	193

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TAM/TAM2/TAM3	Understanding consumer intention to participate in online travel community and effects on consumer intention to purchase travel online and WOM: An integration of innovation diffusion theory and TAM with trust	175
	Investigating the influence of the most commonly used external variables of TAM on students' Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) of e-portfolios	172
	Exploring the Implications of Virtual Reality Technology in Tourism Marketing: An Integrated Research Framework	168
	A SEM-neural network approach for predicting antecedents of m-commerce acceptance	163
	Consumer adoption of mobile banking in Jordan Examining the role of usefulness, ease of use, perceived risk and self-efficacy	162
	Total	2123
UTAUT/UTAUT2	Factors Impacting Mobile Banking in India: Empirical Approach Extending UTAUT2 with Perceived Value and Trust	256
	Foresight for online shopping behavior: a study of attribution for what next syndrome	251
	An empirical analysis of factors predicting the behavioral intention to adopt Internet shopping technology among non-shoppers in a developing country context: Does gender matter?	234
	Background and outcomes of internet usage within organisations in Yemen: An extension of the Unified Theory of Acceptance and Use of Technology (UTAUT) model	227
	The role of elaboration likelihood model in consumer behaviour research and its extension to new technologies: A review and future research agenda	218
	Social media and disaster management: Case of the north and south Kivu regions in the Democratic Republic of the Congo	218
	Gender and age: Do they really moderate mobile tourism shopping behavior?	217
	Electronic medical record systems: decision support examination framework for individual, security and privacy concerns using multi-perspective analysis	216
	Being Useful: How Information Systems Professionals Influence the Use of Information Systems in Enterprises	213
	Factors That Influence the Adoption of Enterprise Architecture by Public Sector Organizations: An Empirical Study	207
	Total	2257

Source: Garcia de Blanes et al., 2022

5.2.4. Amount of references by institutions

Table 10 shows the most cited organizations. In TAM/TAM2/TAM3 it is "Univ. Teknol Malaysia" that received the highest citation count (705 citations). On the other hand, in LA UTAUT-UTAUT2 it is "Swansea Univ." that received the highest citation count (1,908 citations).

Table 12. Top referenced institutions

Model	Organization	Documents	Citations	Media / Citation
TAM/TAM2/TAM3	Univ. teknol malaysia	42	705	16.8
	swansea univ.	10	497	49.7
	sultan qaboos univ.	13	420	32.3
	Univ. granada	9	416	46,2
	Univ. salamanca	18	403	22,4
	Univ. ghent	6	364	60,7
	king saud univ.	24	355	14,8
	king abdulaziz univ.	20	349	17,5
	Univ. oslo	4	337	84,3

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	Univ. hong kong	8	332	41,5
	Total	154	4,178	
UTAUT-UTAUT 2	swansea univ.	43	1,908	44.4
	Univ. nova lisboa	34	1,192	35.1
	al balqa appl univ.	20	1,158	57.9
	hong kong polytech univ.	29	835	28.8
	sultan qaboos univ.	28	834	29.8
	Univ. arkansas	13	825	63.5
	Univ. malaya	49	797	16.3
	brunel univ. london	18	787	43.7
	Univ. teknol malaysia	54	777	14.4
	swansea univ. bay campus	8	754	94.3
	Total	296	9,867	

Source: Garcia de Blanes et al., 2022

5.3. Structure markers

5.3.1. Co-authoring/colaborations mapping

Through the co-authorship networks we can see the existing relationships between the scientific producers who have made a joint publication of the results of their research. The proportion of works can be counted and those individuals who have published the most jointly can be identified.

Analyzing the collaboration networks in the scientific production of the TAM/TAM2/TAM3, the equation used the analysis of co-authorship/ authors integrated from VoSviewer, with a minimum number of documents per autor equaling 2. The total number of documents that have been selected is 705. The map shows the ten main clusters with 113 connections. Each circle representing a node signals a researcher, the proximity of one node to another, shows the co-authorship relationship between the researchers; the colors indicate the groups of researchers that are related to each other. The three most collaborative authors are: Mostafa Al-emran with 18, Said a Salloum, with 14 and Timothy Teo, with 11 collaborations (see graph. 5).

In the UTAUT/UTAUT2 the equation used analysis of co-authorship/ authors integrated from VoSviewer with a ainimum number of documents per autor equaling 2. The total number of documents that have been selected is 246. The twenty-four main clusters with 533 connections are shown on the map. Each node represents a researcher, the proximity of one node to another shows the co-authorship relationship between the researchers, while the colors indicate the groups of researchers that are related to each other. The three most collaborative authors are: Yogesh k dwivedi, with 33, Nripendra p. Rana with 38, and Waleed Mugahed Al-rahmi, with 26 contributions (see graph. 6).

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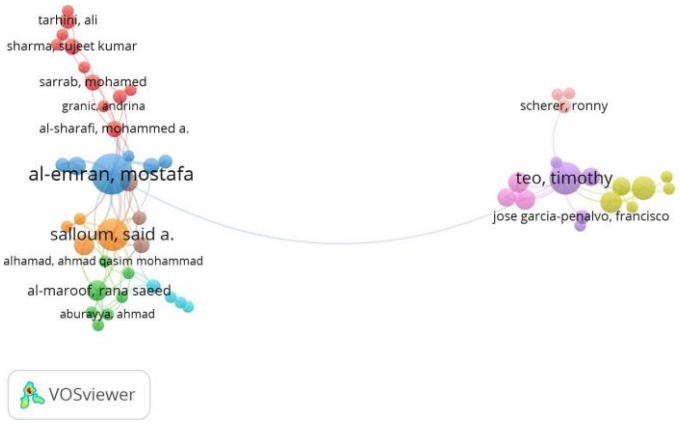
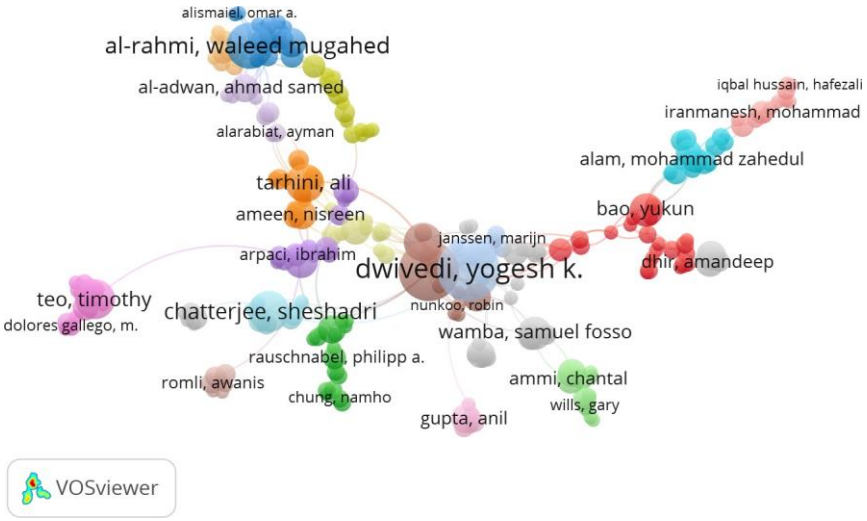
Graphic visualization 5. Co-authoring map (TAM/TAM2/TAM3)



Source: Garcia de Blanes et al., 2022

Graphic visualization 6. Co-authoring map (UTAUT/UTAUT2)



Source: Garcia de Blanes et al., 2022

5.3.2. Co-authoring/collaboration between countries map

The map shows the visualization of collaboration between countries. The circles represent the different countries and its size the number of published documents. The strength of co-authorship is reflected in the proximity of one country to another. The countries that are located far from each other, will have a lower co-authorship relationship, while closeness will show a greater strength of collaboration (co-authorship). The clusters are differentiated by colors, which indicate the countries that are relatively related to each other.

Analyzing the collaboration networks in the scientific production of the TAM/TAM2/TAM3, the equation used analysis of co-authorship/countries integrated from VoSviewer. Minimum number of documents per country=5. The total number of countries that have been selected is 69. The nine main clusters with 420 connections are shown on the map. Each node represents a country, and the proximity of one node to another shows the co-authorship relationship between countries; the colors indicate the groupings of countries that are related to each other. The three most collaborative countries are: Peoples R China with 370 documents and 175 connections. It is followed by the USA with 250 documents and 164 connections, and, third, Malasya with 23 documents and 133 connections (see graph. 7).

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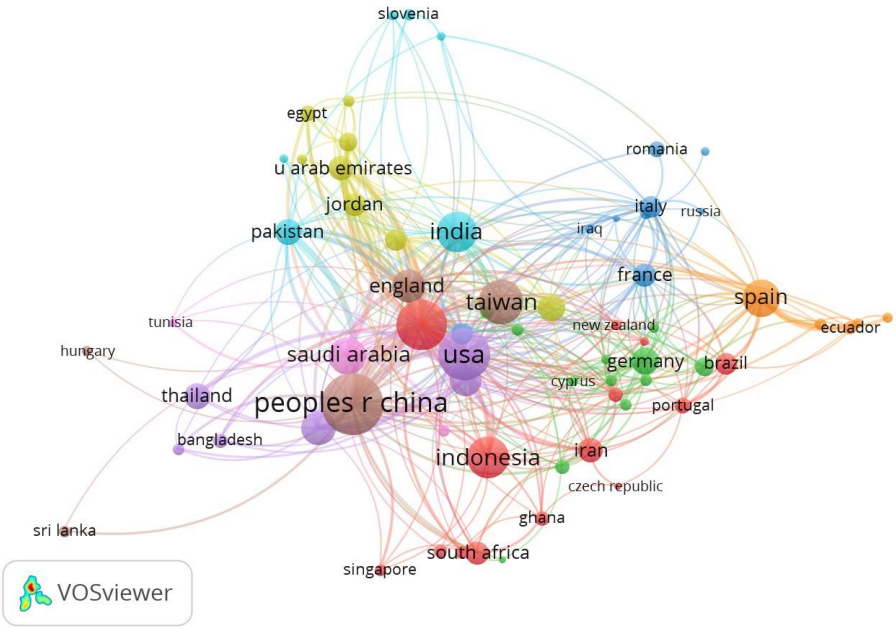
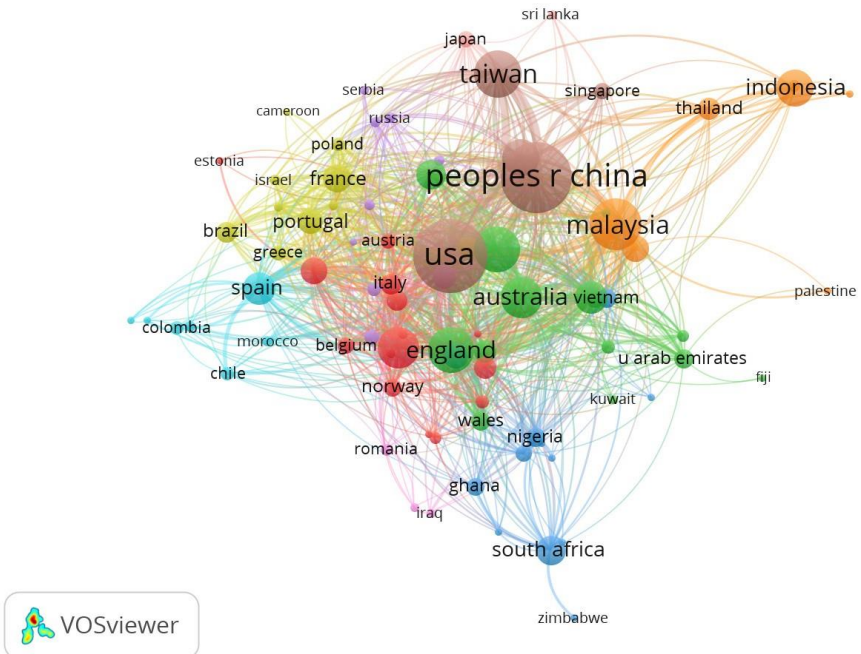
In the UTAUT/UTAUT2 the equation used analysis of co-authorship/countries integrated from VoSviewer. With the minimum number of documents per country set at 5, the total number of countries that have been selected is 80. The top ten clusters with 925 connections are shown on the map. Each node represents a country and the proximity of one node to another, shows the co-authorship relationship between countries; the colors indicate the groupings of countries that are related to each other. The three most collaborative countries are: USA with 821 documents and 565 connections. It is followed by Peoples R. China with 762 documents and 494 connections; third place is for England with 318 documents and 360 connections (see graph. 8).

Graphic visualization 7. Co-authoring & regions map (TAM/TAM2/TAM3)



Source: Garcia de Blanes et al., 2022

Graphic visualization 8. Co-authoring & regions map (UTAUT/UTAUT2)



Source: Garcia de Blanes et al., 2022

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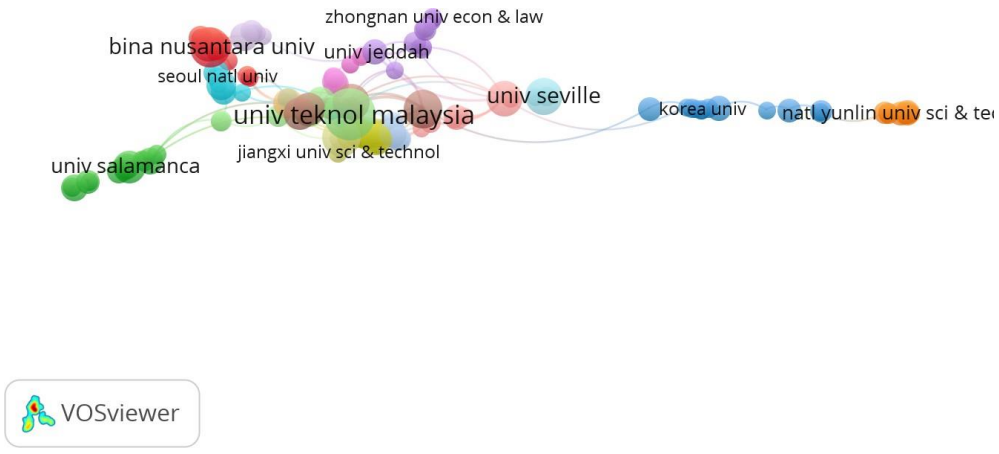
5.3.3. Co-authoring/collaboration institutional map

The map shows the visualization of the collaboration between institutions. The nodes for the different organizations point at the size, to highlight contrast between organizations by the number of published documents. The strength of collaboration is reflected in the proximity of one institution to another. Organizations that are located far from each other will have a lower co-authoring relationship, while closeness will show a greater strength of collaboration (co-authoring). The clusters are differentiated by colors, which indicate the organizations that are relatively linked to each other.

Analyzing the collaboration networks in the scientific production of the TAM/TAM2/TAM3, the equation used analysis of co-authorship/organizations integrated from VoSviewer. The minimum number of documents per organization is 5 and the total number of organizations that have been selected is 166. The sixteen main clusters with 227 connections are shown on the map. Each node represents an organization, the proximity of one node to another shows the co-authorship relationship between organizations, the colors indicate the groupings of organizations that are related to each other. The three most collaborative organizations are: Unive Teknol Malasya with 42 documents and 38 connections. It is followed by King Saud Univ. with 24 documents and 24 connections and the third Univ Sharjah with 11 documents and 22 connections.

Analyzing the collaboration networks in the scientific production of the TAM/TAM2/TAM3, the equation used analysis of co-authorship/organizations integrated from VoSviewer. Minimum number of documents per organization set at 5 with the number of organizations selected totaling 166. The sixteen main clusters with 227 connections are shown on the map. Each node represents an organization, the proximity of one node to another shows the co-authorship relationship between organizations, the colors indicate the groupings of organizations that are related to each other. The three most collaborative organizations are: Univ. Teknol Malasya with 42 documents and 38 connections. It is followed by King Saud Univ. with 24 documents and 24 connections, and, third, Univ. Sharjah with 11 documents and 22 connections.

Graphic visualization 9. Co-authoring institutions map (TAM/TAM2/TAM3)



Source: Garcia de Blanes et al., 2022

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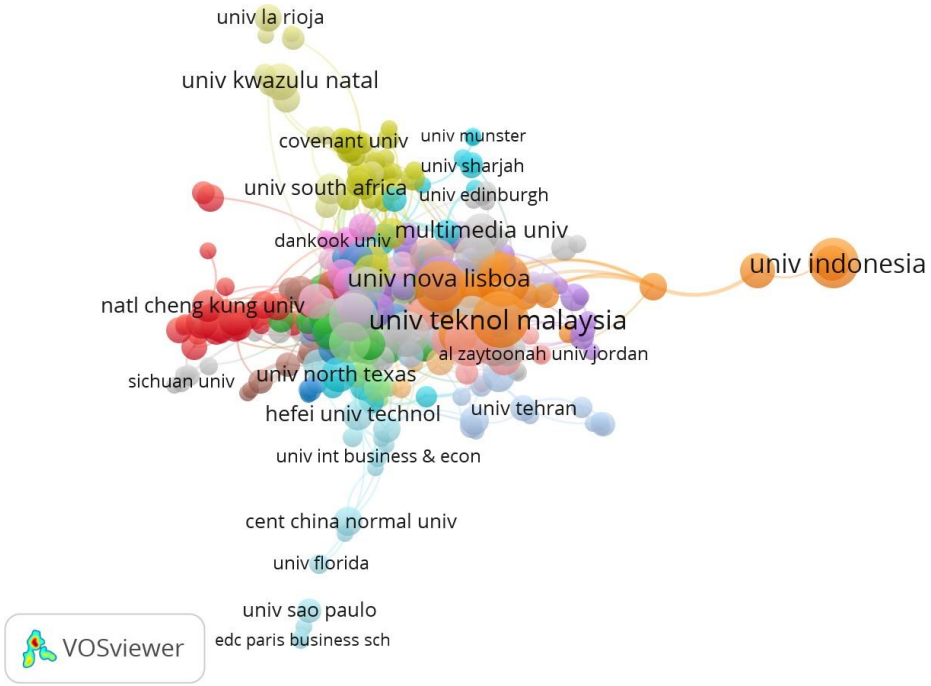
Graphic visualization 10. Co-authoring institutions map (UTAUT/UTAUT2)



Source: Garcia de Blanes et al., 2022

5.3.1. Keywords/co-ocurrence / keyword clusters

The objective of this dedicated search is to create a map for the co-ocurrency of keywords delimiting the scope of the search to the bibliographic data-set extracted from Web Of Science. Analyzing the collaborative networks in the scientific production of the TAM/TAM2/TAM3, the equation used the analysis of co-occurrence/ author keywords integrated from VoSviewer. The set minimum number repeated keywords, 10, and total number of keywords equals 129. The top nine clusters with 1,892 connections are shown on the map. Each node represents a keyword, with the proximity of nodes showing co-ocurrence for keywords. The colors indicate the groups of keywords that are related to each other (see graph. 11).

In the UTAUT/UTAUT2 the equation used analysis of co-occurrence/ author keywords integrated from VoSviewer. The set minimum number of repeated keywords, 10, while number of keywords totals 279. The top nine clusters with 5,524 connections are shown on the map. Each node represents a keyword and concurrence of keywords is shown by the proximity of nodes. The colors indicate the groups of keywords that are related to each other (see graph. 12).

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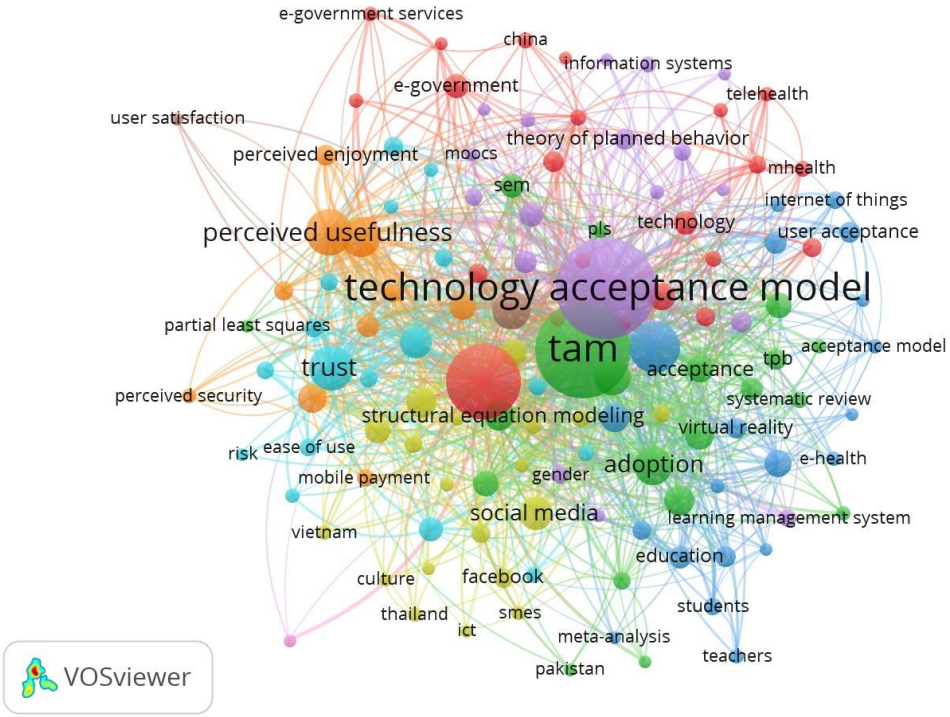
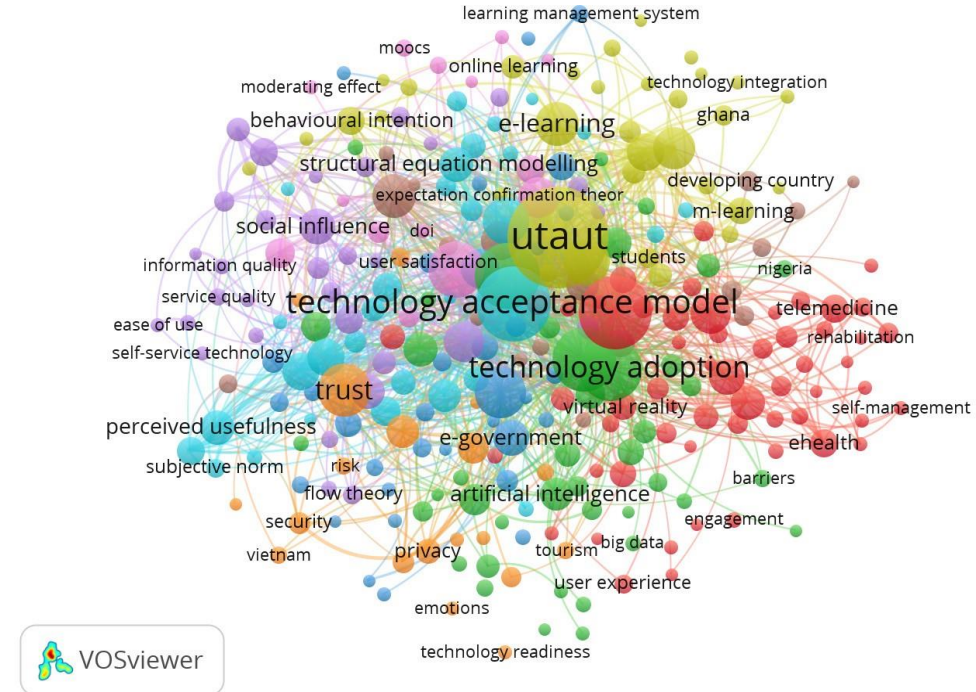
Graphic visualization 11. Co-ocurrences keyword map (TAM/TAM2/TAM3)



Source: Garcia de Blanes et al., 2022

Graphic visualization 12. Co-ocurrences keyword map (UTAUT/UTAUT2)



Source: Garcia de Blanes et al., 2022

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The analysis of the co-occurrence of words and descriptors yielded different groupings to reflect different approaches and changing trends in investigation, which sheds light on subjects and themes prevalent in the studies:

Table 13. Keywords theme-areas (TAM/TAM2/TAM3)

Cluster	Keywords	#occurrences	Theme areas
Red 1	covid-19	43	Present day and current news, studies trending on development of platforms, COVID19, etc.
	gamification	24	
	smartphone	22	
	Tele-medicine	18	
	mobile apps	17	
Green 2	augmented reality	44	Studies in Technology Adoption for emergent Information Technologies.
	virtual reality	28	
	internet of things	19	
	e-health	12	
	artificial intelligence	11	
Orange 3	trust	120	Studies of variable models for Technology Adoption in diverse contexts
	security	22	
	satisfaction	22	
	usefulness	19	
	privacy	19	
Yellow 4	adoption	90	Education (Technology Adoption in education)
	e-learning	82	
	higher education	54	
	mobile learning	40	
	blended learning	12	
Purple 5	technology acceptance model	593	Evolution of theories and model frameworks for Technology Adoption.
	theory of planned behavior	25	
	innovation diffusion theory	11	
	unified theory of acceptance and use of technology	10	
	theory of reasoned action	10	
Light blue 6	perceived usefulness	125	Analysis of perceptions and usage in Technology Adoption.
	perceived ease of use	92	
	perceived risk	49	
	perceived enjoyment	27	
	perceived security	13	
blue 7	social media	66	Analysis of social media and Business Applications.
	facebook	24	
	information technology	21	
	smes	12	
	social commerce	10	

Source: Garcia de Blanes et al., 2022

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Table 14. Keywords theme-areas (UTAUT/UTAUT2)

Cluster	Keywords	#occurrences	Theme areas
Red 1	mhealth	69	Studies relative to Technology Adoption in medical equipment.
	ehealth	44	
	telemedicine	44	
	e-health	26	
	mobile health	24	
Green 2	artificial intelligence	61	Studies relative to Technology Adoption in emergent information technology.
	e-commerce	58	
	cloud computing	54	
	mobile payment	50	
	blockchain	32	
Blue 3	social influence	76	Studies relative to aditional variables to models in Technology Adoption.
	continuance intention	67	
	performance expectancy	45	
	satisfaction	45	
	effort expectancy	34	
Yellow 4	mobile learning	119	Education (Technology Adoption in Education).
	e-learning	108	
	higher education	104	
	online learning	33	
	blended learning	27	
Purple 5	technology acceptance model	311	Theories evolution and models of Technology Adoption.
	theory of planned behavior	122	
	theory of planned behaviour	62	
	innovation diffusion theory	36	
	theory of reasoned action	36	
Orange 6	trust	156	Studies relative to aditional variables in diverse contexts of Technology Adoption.
	privacy	37	
	security	29	
	risk	19	
	intrinsic motivation	13	
Light blue 7	knowledge sharing	24	Studies relative to Technology Adoption in diverse contexts (circular economy, share economy, recycling).
	developing country	24	
	knowledge management	23	
	sharing economy	20	
	wearable technology	19	

Source: García de Blanes et al., 2022

6. Discussion

Since the contrast analysis of diverse angles pointed to strenght areas to focus on both sets of theories, this contrasted framework of characteristics and guidelines, as shown below (see table 15), added a distinctive filter, a nuanced view of technology adoption from an academic, scholarly approach, a highly specialized community, fluent in analysis of sources and text references. Research from bibliometrics provides an enriched outlook into differences in organizational practices and disciplines, and a systematic line of research, into trends for analysis, at a time when the eclosion of data tools for business analysis is becoming prevalent, widely accesible, and with an expansive wave for integrations in consumer technology.

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Table 15: Summary of TAM/TAM2/TAM3 and UTAUT/UTAUT2

Features for criteria in bibliographic searches	TAM/TAM2/TAM3	UTAUT/UTAUT2
Year production	Lower number of publications. Currently the pace of Studies continues to grow exponentially.	Higher number of publications. Currently the pace of Studies continues to grow exponentially.
Author production	More likely colaboration with authors (2,69 authors/document). More authors transient & less specialization (27).	Less likely colaboration with authors (2,51 authors/document). More authors specialized & less transient (27).
Journal and Press Data bases production	Top 5 publishers, have less production (56,07%) Bradford applies (nucleo: 57, zone 1: 89, zone 2: 988 revistas).	Top 5 publishers, have more of the total production (61,87%) Bradford model applies (nucleo: 50, zone 1: 320, zone 2: 1,458 revistas)
Country of production	Top 5 countries: Peoples R. China, USA, Malasya & Taiwan. Different country: Indonesia.	Top 5 countries: Peoples R. China, USA, Malasya y Taiwan. Different country: Great Britain.
Language production	Top 3 languages: English & Spanish. Differing language: Portuguese.	Top 3 languages: English & Spanish. Differing language: Chinese
Production according to type of publications	Top publication type, similar for both areas. Articles (73,62%). Second: Proceedings Paper (16,13%)	Top publication type, similar for both areas. Articles (71,50%) Second: Proceedings Papers (22,60%)
Institutional production	Fragmented references to institutions in this field, caused in part, by core evolution and cross-disciplinary approaches.	Fragmented references to institutions in this field, caused, in part, by core evolution and cross-disciplinary approaches.
Production for Categories	Colliding: Education, Educational Research, Computer Science Information Systems, Information Science Library Science Computer Science & Management.	Colliding: Education, Educational Research, Computer Science Information Systems, Information Science Library Science Computer Science & Management.
Number of citations	Less references.	More references per theory.
Number of citations per autor	Less references by author.	More references per author.
Number of citations per journal	Less references by journal.	Major number received for citations per journal.
Number of citations per document	Less references by document count.	More references per document.
Number of citations per institución	Less references per institution.	More references per institution.
Co-authoring/colaboration map	Less references in co-autoring.	Less references in co-authoring.
Co-authoring/colaboration institutional map	Less references in colaborations with other institutions.	Less references in colaborations with other institutions.
Keywords pattern/co-ocurrence keywords	keywords: mental health; artificial intelligence; social influence; mobile learning; trust; knowledge sharing	keywords: covid-19; augmented reality; trust; adoption technology acceptance model; perceived usefulness; social media
Theme and subject matters	Differents Theme and subject matters: 1) Present day and current news, studies trending on development of platforms, COVID19, etc. 2) Analysis of perceptions and usage in Technology Adoption. 3) Analysis of social media and Business Applications.	Differents Theme and subject matters: 1) Studies relative to Technology Adoption in medical equipment. 2) Studies relative to aditional variables in diverse contexts of Technology Adoption. 3) Studies relative to Technology Adoption in diverse contexts (circular economy, share economy, recycling).

Source: García de Blanes et al., 2022

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7. Conclusions

TAM/TAM2/TAM3 and UTAUT/UTAUT2 are rapidly growing and widely adopted theories accross research fields in recent years. This study aimed to present in detail the current state of research on both theories, TAM & UTAUT standard, through bibliometric analysis and bibliometric mapping. Through different bibliometric techniques, *Price's Law*, *Lotka's Law*, and *Bradford Model* among others, these theoretical frameworks were accounted from its main characteristics and patterns, in order to depict a global frame of the estate of research; thus, for a better understanding of the current situation around Technology Adoption. Additionally, scientific mapping analysis of the collaborations by countries, authors, and organizations and coexisting keywords provided further analysis from a historical perspective. Research in both sets of theories appears in its mature stage, and continue to grow. Accordingly, this methodological approach helped reveal details of the theoretical basis of the area under study and provided a scope for emerging trends that are taking place in the technology field. From a bibliometric documented approach, UTAUT/UTAUT2 is the most relevant theory in terms of publications, citations and emerging themes, although both sets of theories are currently in use.

Finally, among the limitations found throughout the study, an inherent difficulty in selecting information for applying filters is first and most noticeable hurdle; eventhough the bibliometric data's preliminary cleaning, by elimination of duplicates and error entries, any error will affect the overall count in the final analysis that, if carried out to data exploration, will compromise the process of filtering; such as, it is noted in filtering by keywords.

Regarding future research prospects, the method of analysis translates to other databases, such as, Scopus, or Google Scholar, with the aim of bringing light to specific areas of study within technology (artificial intelligence, mobile learning, payment platforms, etc.), from a bibliometric analysis to further provide contexts of application. This study contributted to an essential understanding of both theory sets, via bibliometrics, by sinthetizing tools and know-how that can help future scholars in establishing a comprehensive bottom ground for research studies.

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Capítulo 4

Aplicación y extensión del modelo de la UTAUT2 para determinar los factores que influyen en la intención de comportamiento en el uso de la inteligencia artificial asistentes virtuales

Application and extension of the UTAUT2 model for determining behavioral intention factors in use of the artificial intelligence virtual assistants

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Application and extension of the UTAUT2 model for determining behavioral intention factors in use of the artificial intelligence virtual assistants

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Virtual Assistants, also known as conversational artificial intelligence, are transforming the reality around us. These virtual assistants have challenged our daily lives by assisting us in the different dimensions of our lives, such as health, entertainment, home, and education, among others. The main purpose of this study is to develop and empirically test a model to predict factors that affect users' behavioral intentions when they use intelligent virtual assistants. As a theoretical basis for investigating behavioral intention of using virtual assistants from the consumers' perspective, researchers employed the extended Unified Theory of Acceptance and Use of Technology (UTAUT2). For this research paper, seven variables were analyzed: performance expectancy, effort expectancy, facilitating conditions, social influence, hedonic motivation, habit, and price/value. In order to improve consumer behavior prediction, three additional factors were included in the study: perceived privacy risk, trust, and personal innovativeness. Researchers carried out an online survey with 304 responses. The obtained sample was analyzed with Structural Equation Modeling (SEM) through IBM SPSS V. 27.0 and AMOS V 27.0. The main study results reveal that factors, such as *habit, trust*, and *personal innovation*, have a significant impact on the adoption of virtual assistants. However, on the other side, *performance expectancy, effort expectancy, facilitating conditions, social influence, hedonic motivation, price/value*, and *perceived privacy risk* were not significant factors in the users' intention to adopt this service. This research paper examines the effect of personal innovation, security, and trust variables in relation to the use of virtual assistants. It contributes to a more holistic understanding of the adoption of these intelligent devices and tries to fill the knowledge gap on this topic, as it is an emerging technology. This investigation also provides relevant information on how to successfully implement these technologies.

KEYWORDS

virtual assistants, UTAUT2, users' behavioral intentions, technology implementation, artificial intelligence

Introduction

The most recent developments around digital technologies open new possibilities in the Human-to-machine interaction (Dix, 2017). Virtual assistants (VAs) are remarkable for their functionalities by providing close to real conversations with humans using interfaces, and by representing a human-like image that simulates social skills recreating personable qualities that interact with humans *via* imitation. Some human abilities that are commonly recreated or represented as communicative traits include speech recognition, feedback loop, and interacting with the tool of the exchange in a conversation (Cassell, 2000). Some known VAs in everyday activities, Alexa, Siri, Cortana, and Bixby, complete essential tasks: starting phone calls, reporting weather, processing math and calculations, playing music lists, and many more (Chattaraman et al., 2019; Robinson et al., 2019). Artificial Intelligence (AI) is providing the tools for VAs to offer advanced voice interfaces, and to allow users to carry an interaction *via* internet connection by using real speech. These VA platforms are integrated in consumer devices *via* smartphones and tablets, as well as *via* platforms for home entertainment, incorporating speakers, bots, and messenger platforms (Guzman, 2019). Workplace environment interfaces can include: functions *via* chatbots, graphic design, speech recognition, media publishing, video editing, and accounting, etc., and can be found in VAs. The most recent dissemination from devices powered by AI and integrated business software into market technology will provide a bottom line 4.2 billion devices, which is estimated to double in number to 8.4 billion in 2024 (Statista, 2022).

In this context, scholars in the Information Technologies area have created a framework of the UTAUT2 theory (Venkatesh et al., 2012), where any empirical information and collected data can be studied to apply in different fields with varying angles within the technology realm (Venkatesh et al., 2016). This approach, and growing interest in VAs, provides field research to understand factors that lead to VAs adoption. This growing interest on studying factors from a consumer decision-making side creates a number of rationales that allow for insightful predictions within the adoption segment (Yang and Lee, 2019; Hasan et al., 2021; Pitardi and Marriott, 2021). It seems that there are not enough studies framing the factors that are influencing, or directly or indirectly changing, everyday needs and expectations in order to evolve according to users' needs. This became apparent mainly after many changes drastically affected our standard of living and interactions, as those that occurred in Spain during and after the last global pandemic caused by COVID-19.

The model UTAUT2 is the base framework, with an emphasis on *Perceived Privacy Risk* and *Perceived Trust* as constructs taken into consideration. As a result, the theoretical model is improved by adding *Personal Innovation* to the seminal notions developed by Dinev and Hart (2006) for an integrated framework. The following research questions and objectives lead the study.

Research questions:

- What are the factors impacting behavioral intention in the process of use for VAs?
- What degree of trust, perceived privacy risk, and personal innovation can be measured from VA usage?

Objectives:

- To explore the factors included in the model UTAUT2 directly impacting user behavior around VAs.
- To add rationales from the model UTAUT2 impacting user behavior around VAs.
- To evaluate the model of behavioral user intention aligned with empirical data in correlation with guiding variables.
- To establish a preliminary guideline from intention to usage for plausible advances around this area.

The study is presented in 6 sections. Section 1 is the Introduction. Section 2 sets a Theoretical framework, before introducing the hypothesis linked to relevant variables from the theories applied in Section 3, Selected variables for the study. Next, Section 4, Methodology, sets research standards, including methods, data collection, and data analysis. In Section 5 presents results and discussion. In Section 6, Conclusions and implocations are explained, prior to Section 7, Limitations and future research which provides the scope and closing remarks.

Theoretical framework

Virtual assistants

The use of artificial intelligence is being developed in line with the improvement of technology and tasks relating to AI implementations (Saad et al., 2017; Yang and Lee, 2019; Lopatovska et al., 2021). AI implementation in VA consumer devices, also called voice assisted tools, revolves around integrated data in IoT applications. These communicate with users, *via* speech, text, facial recognition, and gestures (Laranjo et al., 2018) to allow user interaction *via* natural language (Stieglitz et al., 2018). These devices are designed to provide a similar-to-human environment, having improved voice activated technology from the previous generation of devices; and due to the additional learning capability from input for a better performance, this technology has advanced a step further in its potential for personalization (Bawack et al., 2021; Vimalkumar et al., 2021). In general, the latest generation of voice assisted devices offers better-quality tools for services providing added space for personalization with regard to previous interactions (McLean and Osei-Frimpong, 2019;

Pantano and Pizzi, 2020). Accordingly, digital adaptations in voice assisted devices extend on the expectation for performance and productivity in the workplace, so their link to hedonic pleasure and utility derived from usage has an impact on the balance that its users attain in their personal lives (Mishra et al., 2021; Jain et al., 2022). Popular personal assistant devices in the present-day marketplace, such as, Siri, Alexa, Cortana, and Bixby, are integrating common every day-use devices in consumer technology, such as speakers, autonomous vehicles and mobile devices, by integrating voice recognition into AI, so users interact with smartphones from a creative, novel, and more immediate interface. In recent years, VAs with integrated AI functionalities have been a leading trend in consumer technology due to the potential benefits derived from personalization, both in the workplace and in the home, and for the ease of use and added capabilities, which, in turn, create a positive feeling around VAs (Moriuchi, 2019).

UTAUT2

The analysis of factors in technology adoption are core to research studies in the field for a great number of authors. The UTAUT model was derived *via* an evolved model from at least eight developments from different fields of study, pinning down technological change and adoption: Innovation Diffusion Theory IDT (Rogers, 1961); Theory of Reasoned Action TRA (Ajzen and Fishbein, 1980); Theory of Planned Behavior TPB (Ajzen, 1991); Social Cognitive Theory SCT (Bandura, 1986); Technology Acceptance Model TAM (Davis, 1989); Model of PC Utilization MPCU (Thompson et al., 1991); Motivational Model MM (Davis et al., 1992); C-TAM; Combined TAM-TPB (Taylor and Todd, 1995). The main value of this model arises from bringing a historic light in technology use by working around a set of constructs; that is, concepts that encapsulate what is central to the effects of technology use from a user's intention perspective (Yu, 2012). The UTAUT model centered on four constructs: *Performance Expectancy, Effort Expectancy, Social Influence*, and *Facilitating Conditions* with moderating demographic inputs: gender, age, level of expertise (experience), and perceived usefulness (Venkatesh et al., 2003). From these eight variables, a wrapping theory with their activated items from constructs, are presented in Table 1.

With UTAUT's underlying theoretical context, Venkatesh et al. (2012) provided a seminal framework to focus on the consumer viewpoint for an extended version UTAUT2, which aggregated three factors for considerations: *Hedonic Motivation, Price/value*, and *Habit*. This allows for a predictive capability built-into the model that substantially increases its potential for estimating user adoption up to 74% (Venkatesh et al., 2016). The applicable dimension of the theoretical approach had been well-established as a general framework within the technology industry. The large number of studies produced are evidence

TABLE 1 Core constructs of UTAUT.

Constructs	Variables	Model contributing to constructs
Performance expectancy	Perceived usefulness	Technology Acceptance Model (TAM) 1–3; Combined TAM-TPB (Theory of Planned Behavior)
	Extrinsic motivation	Motivation Model (MM)
	Job-fit	Model of PC Utilization (MPCU)
	Relative advantage	Innovation Diffusion Theory (IDT)
	Outcome expectations	Social Cognition Theory (SCT)
Effort expectancy	Perceived ease of use	TAM 1–3
	Complexity	MPCU
Social influence	Subjective norms	TRA, TAM2, TPB/ DTPB, and combined TAM-TPB
	Social factors	MPCU
	Image	DOI
Facilitating conditions	Perceived behavioral control	TPB/DTPB and combined TAM-TPB
	Facilitating conditions	MPCU
	Compatibility	DOI

Created using source data from Venkatesh et al. (2003).

of a model that is fruitful for analysis in the new technologies' adoption areas and within innovative approaches, and as part of varying cultural and social contexts, gives us an enhanced framework for adoption (Šumak and Šorgo, 2016). Some fields of practical application and user, behavioral, and standard approach are often used for virtual classroom and learning (Dizon, 2021); banking and finances (Khan and Rabbani, 2021), and ecommerce (Biduski et al., 2020).

Scientific research regarding virtual assistants

Many studies have approached user intention, as well as the factors for adoption in VA. Lu et al. (2021) focused on the context of Tourism and Hospitality from a defined consumer approach for long term integration of AI and robotics into common transactions around services for hotels, restaurants, airlines, and retail shop networks. From the analysis of lever factors, the variables that are rated as directly correlated to adoption, are: *PE, Intrinsic Motivation, (ergonomics), Social Influence, Facilitating Conditions*, and *Emotions*. Related to Tourism and Hospitality, the travel segment inspired another

study focusing on devices for Intelligent Travel Assistants as these relate to eight variables impacting adoption, which are: *ease of use, trust, enjoyment, design, usefulness, quality, safety,* and *empathy*. External factors are showing an overall influence, such as, *usage, trust, hedonic motivation*, and *design*, to be followed by *utility, quality*, and *empathy*. In the institutional context and within organizations, the approach to study technology and VA adoption is taken from a task-oriented, work-environment approach. Some of the factors determining how satisfactory work conditions for a person can be, stem from technology use, as it is impacting productivity and level of tasks completion (Marikyan et al., 2022). In this context, the results point at *Performance Expectancy, Perceived Enjoyment, Social Presence*, and *Trust*, as positive factors directly impacting productivity and commitment from workers. Research conducted by McLean and Osei-Frimpong (2019), combined the theoretical underpinnings of Uses and Gratifications Theory (U&GT) with technological theories to obtain a clearer understanding of user motivations in their intent and use of voice assistants around the home. This research establishes a moderating role for the *Perceived Privacy Risks* that can diminish and negatively influence the use of voice assistants in the home. The results indicate the importance of the benefits that these devices grant us, since it will motivate the use of a voice assistant at home. Yang and Lee (2019) explain the intent and use of VA devices through *Perceived Utility, Perceived Enjoyment*, and product design-related, ergonomic, features. The results show that the *Perceived Usefulness* and *Enjoyment* have a significant impact on users' intention. From a hedonic value perspective, the content quality, which is also a functional attribute of VA devices, as well as visual appeal, positively affect *Perceived Enjoyment*.

UTAUT 2 has been used in diverse fields from widespread contexts. Vimalkumar et al. (2021) analyzed the factors that motivate people to use voice assistants for the home, adding other variables to the original set: *Perceived Privacy concerns*, *Perceived Privacy Risk*, and *Perceived Trust*. In the Kessler and Martin (2017) research, they identify the perceptions and determinants of potential future users linking to VA technology by adding the variables *Data Security, Compatibility*, and *Relationship* with the device to the framework model. Kalinić et al. (2019) analyzes the disposition of customers to use smart speakers for online purchases, adding the *Perceived Risk* variable to the model (Malarvizhi et al., 2022). Almahri et al. (2020) examines the factors that can deter or facilitate the acceptance and use of chatbots by university/college students in post-secondary education. Gansser and Reich (2021) analyzes factors influencing the use of VAs in a daily life environment in three segments of mobility, home, and health, adding the variables *wellbeing* and *health, convenience, comfort, sustainability, safety* and *security*, and *Personal Innovation*. Schmitz et al. (2022) investigated patients' intention in order to take advantage of virtual medical appointments by adding *Perceived Security*, and *Perceived Product Advantage* to the user intention model of variable analysis.

Selected variables for the study

Performance expectancy

The PE has been defined as "the degree to which the use of a technology will provide benefits to consumers in carrying out certain activities" (Venkatesh et al., 2003, p. 447). Therefore, it denotes the degree to which an individual perceives that virtual assistant can facilitate greater performance and productivity. Being a relatively recent technology, one foreseeable barrier was set at the possibility of visualizing potential for added tasks within the VA platform. The effect of this variable, on the attitude toward the use of technology, has been well-documented in previous literature on virtual assistants (Cyr et al., 2007; Hassanein and Head, 2007; Moriuchi, 2019; Ye et al., 2020). From this perspective, PE reflects the extrinsic degree of motivation or the expected result of the use. Previous research has seen this variable for its influence on the adoption of VA (McLean and Osei-Frimpong, 2019; Wagner et al., 2019; Koon et al., 2020; Vimalkumar et al., 2021). Therefore, based on this, the following hypothesis is proposed:

H1: PE positively and directly influences user's intention to use VA.

Effort expectancy

EE is "the degree of ease associated with using the system" (Venkatesh et al., 2003, p. 450). In context it refers to the perceived ease in VAs usage. This factor is considered a fundamental predictor of technology adoption in research settings (Wirtz et al., 2019). When interacting with AI-based VAs, EE will appear to be implicit in most cases, being a barrier if they are not provided to the level expected by consumers (Wirtz et al., 2018, 2019) or require a high effort, since VAs have to allow consumers to execute tasks with minimal effort (McLean and Osei-Frimpong, 2019). The objective is therefore to have users achieve a positive perception regarding the "degree of ease" (Venkatesh et al., 2012), Previously it has been shown that confidence in one's own abilities to deal with technical systems has a significant influence, directly impacting the intention to use them (Fridin and Belokopytov, 2014). Previous research has studied this variable to understand its influence on VAs' adoption (Chopra, 2019; Zaharia and Würfel, 2020; Mishra et al., 2021; Moriuchi et al., 2021). Therefore, based on this it is hypothesized that:

H2: EE positively and directly influences user's intention to use VA.

Social influence

SI is "the extent to which consumers perceive their significant others (like family and friends) believe they should use a particular technology" (Venkatesh et al., 2003, p. 451). In the context of the study, it is the degree to which an individual believes that important people support their use of VAs for their daily tasks. The SI based variable models an individual's beliefs and behavior through the interactional mechanisms of compliance, internalization, and identification (Moriuchi, 2021). Previous studies have provided empirical support that evidences the impact of SI on the use of technology in different contexts (Moriuchi, 2021). They have also studied this variable to examine its influence on the adoption of VAs (Chopra, 2019; Zaharia and Würfel, 2020; Mishra et al., 2021; Moriuchi et al., 2021). In this context our proposed hypothesis is the following:

H3: SI positively and directly influences user's intention to use VA.

Facilitating conditions

Facilitating conditions are "consumers' perceptions of the resources and support available to perform a behavior" (Venkatesh et al., 2003, p, 453). Underlying this perception, there is the idea of acceptance; an information system depends on a preliminary assessment of one's own ability to master the new technology (Wong et al., 2020). Users need to perceive the presence of a solid support infrastructure that facilitates the learning and usage of the technology, so the usefulness of a technological device will be executed under the premise that facilitating conditions are actively working on a given environment (Canziani and MacSween, 2021). This scenario is particularly true in the context of AI-based technology, whether for individual or organizational use; it is necessary to have infrastructure that facilitates use (Grover et al., 2020). Vimalkumar et al. (2021) confirmed the positive influence of *facilitating conditions* on consumer adoption of digital voice assistants. In addition, previous research analyzed FC from the standpoint of influence on adoption, specifically, VAs (Gunasinghe et al., 2020; O'Connell et al., 2021; Al Shamsi et al., 2022) where the findings point at confirming the presence of this variable, thus:

H4: FC positively and directly influences user's intention to use VA.

Hedonic motivation

HM is "the fun element, joy, or pleasure derived from the use of a particular technology without any specific additional benefit" (Venkatesh et al., 2012, pp. 157–178). Some authors state that HM is a key factor in consumer behavior (Holbrook and Hirschman, 1982), and that aspect linked to the fun and pleasure derived from usage, can be seen as crucial when evaluating, in advance, acceptance and technology use (Childers et al., 2001; Brown and Venkatesh, 2005). The greater the fun and pleasure elements anticipated from the use of a technology, the more likely consumers are to accept it. Understanding *hedonic motivation* for technology use relies on the assumption that arousal inherently makes people excited and more willing to accept and use something new—a natural tendency to initiate actions, that makes individuals, joyful, positive, and helpful. Previous research has analyzed this variable in experiences and VA adoption (Gunasinghe et al., 2020; O'Connell et al., 2021; Al Shamsi et al., 2022), and it has established that:

H5: HM positively and directly influences user's intention to use VA.

Price/value

PV has been defined as "consumers' cognitive trade-off between the perceived benefits of apps and the cost of using them" (Venkatesh et al., 2012, pp. 157–178). Therefore, PV is a measure of the net benefit obtained by using a technology. In fact, people are always out to maximize net profit. This implies that, if the adoption and use of technology generate positive gains, individuals will accept the cost of it. Previous studies have confirmed the effect that price/value has on technology adoption, a process that is enhancing in itself, and as such, provides a positive feeling and impact on users (Moorthy et al., 2019; Palau-Saumell et al., 2019). In addition, the studies confirm that price/value and behavioral intention are closely related in positively improving intentional behavior and adoption due to the novel perception that it increases satisfaction (Moorthy et al., 2019; Palau-Saumell et al., 2019). Based on this variable and similar experiences in technology adoption for VAs (Ashfaq et al., 2021; Ling et al., 2021; Twum et al., 2021), the general conception is toward seeing:

H6: PV positively and directly influences user's intention to use VA.

Habit

The HB is "the extent to which individuals tend to perform behaviors automatically due to learning" (Venkatesh et al., 2012, p. 157–178). As a consequence of repeated performance, when people internalize habits, they may not think about, realize, or

evaluate the reasons for their actions (Mittal, 1988; Ouellette and Wood, 1998). In the context of VAs based on machine learning, habit allows the formation of a symbiotic relationship between the user and the technology (Jacucci et al., 2014). Hence, habit is not only an explanation of daily routines (Yen and Wu, 2016), but also an important factor that will determine the degree of user engagement with this type of technology (Perez-Vega et al., 2021). Previous research has analyzed this variable to study its influence on the adoption of VA (Kessler and Martin, 2017; Gunasinghe et al., 2020; Twum et al., 2021). Therefore, based on this the following hypothesis is suggested:

H7: HB positively and directly influences user's intention to use VA.

Perceived privacy risk

Perceived Privacy Risk indicates the degree of perceived certainty of consumers that their personal information is shared with an information system (Lee et al., 2021). Therefore, privacy implies not being subjected to unwanted intrusions (Merriam-Webster and Springfield, 2005), such as wiretapping, the exploitation of security vulnerabilities and user identity theft (Chung et al., 2017). VAs cause a growing concern about privacy and security that are impediments to their use and adoption (Saura et al., 2021; Vimalkumar et al., 2021). Since VAs need to collect sensitive and private data for proper operation, security issues are raised for, and this fact entails a barrier to, their full adoption (Pitardi and Marriott, 2021). Previous research has examined how privacy concerns influence consumer responses in a variety of settings (Pizzi and Scarpi, 2020). These studies provide evidence that privacy concerns can act as an inhibitor (Nepomuceno et al., 2014). Thus, based on previous research and following its impact on adoption around VAs, our hypothesis is the following:

H8: Perceived Privacy Risk negatively and directly influences user's intention to use VA.

Trust

Trust is generally conceived as a multidimensional concept that reflects perceptions of competence, integrity, and benevolence of another entity (Mayer et al., 1995). *TR* has been recognized as a key influencer of human-machine interactions (McLean et al., 2020). It builds on your perception of trustworthiness, which is enhanced by having faith in your interactions (Hengstler et al., 2016). *TR* is one of the most important elements to overcoming uncertainty (Yang and Lee, 2019). When technology is emerging, users often feel uncertain due to a lack of information. However, when users have a pre-existing feeling of trust toward a specific technology, a brand, or rely on referrals, this uncertainty can be eliminated.

TR has been extensively researched in the VA field (Kuberkar and Singhal, 2020; Pitardi and Marriott, 2021; Vimalkumar et al., 2021). Previous research on *TR* highlights the role of technical features of websites and technology, such as ease of navigation, visuals, and ease of search, as signals that convey trustworthiness (Corritore et al., 2003). Prior research has analyzed this variable to study its influence on the adoption of VA (Kasilingam, 2020). Therefore, based on this our hypothesis is the following:

H9: TR positively and directly influences user's intention to use VA.

Personal innovativeness

This is the area of adaptation to technology with a higher interest from a behavioral intention standpoint—for individuals to display a high degree of adoption of new products within a set user-base or a specific community (Juaneda-Ayensa et al., 2016; Getnet et al., 2019). In the area of VA adoption, innovation is measured in terms of function, hedonic motivation, and cognitive motivation. The effect of such variables toward adoption in VA has been studied in previous research to present a thesis for positive rate with an effect on adoption. Previous research recognizes this variable for its influence on the adoption of VA (Kasilingam, 2020; Hasan et al., 2021; Winkler, 2021). In this context, the last hypothesis is:

H10: PI positively and directly influences user's intention to use VA.

Figure 1 presents the developed research model.

Methodology

Plan-design for data

The developed questionnaire for an effective market survey consists of two parts: (1) the instrument proposed by Venkatesh et al. (2012) to the context of Virtual Assistants with 24 questions that measure the 7 constructs of the UTAUT2; and (2) the questions of scholarly articles were adapted with 12 questions that measure the three factors added to the model. In addition, sociodemographic information is collected for contrasting data (Tables 2, 3). The 5-point Likert scale method is used, ranging from 1 (totally disagree) to 5 (totally agree). This scale avoids cognitive biases and the confusion of the respondents. In addition, it provides quality data, and it is recommended by researchers (Revilla et al., 2014). The structural equation model (SEM) was used for the analysis of the results, since it allows testing all the relationships between the observed and latent variables simultaneously, by combining multiple regression with factor analysis and provides general adjustment statistics (Iacobucci, 2010). In addition, it is capable of considering the

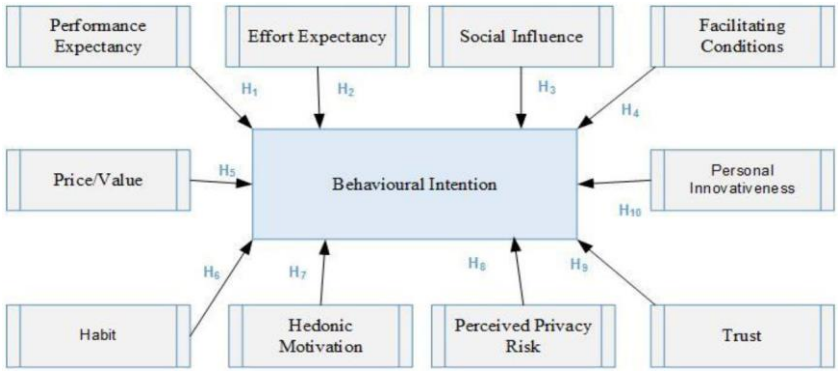

FIGURE 1
The research model.

TABLE 2 Variables for analysis.

ID	Constructs	Items	Source
1	Performance expectancy	4	Venkatesh et al., 2003
2	Effort expectancy	4	
3	Social influence	3	
4	Facilitating conditions	4	
5	Hedonic motivation	4	
6	Price/value	3	Venkatesh et al., 2012
7	Habit	3	
8	Perceived privacy risk	4	Featherman and Pavlou, 2003
9	Trust	3	Lu et al., 2011
10	Personal innovativeness	4	Agarwal and Prasad, 1998; Thakur and Srivastava, 2014
11	Behavioral intention	3	Venkatesh et al., 2003

measurement error with the observed variables (Hair et al., 2006).

Data collection

After completing the pilot test to clarify phrasing and eliminate items that were not identifiable in the questionnaire, the empirical data was obtained from the questionnaire and executed through a Google form that was *distributed online and in person, via* door-to-door survey to individuals in post-secondary campuses and in other urban districts, by using a QR code; it was implemented during the first quarter of 2022. Non-probabilistic convenience sampling was used. Three hundred and six responses were obtained. A first descriptive analysis using IBM SPPS Statistics 27 examined the data for missing pieces of information, uncommitted responses, outliers, and for data leveling. There were no missing data in the set. Thus, in Table 4 a descriptive sociodemographic data of the sample is presented.

Data analysis

Modeling analysis: Framework

Prior to the estimation analysis of the models the Mardia coefficient was calculated, which showed the multivariate non-normality of the data obtained, since it should not exceed the value 70. The results show a Kurtosis = 221.443 and a critical region = 29.693; however, considering that the skewness coefficients were <3 and the kurtosis coefficients <10, the maximum likelihood procedure was continued. A confirmatory factor analysis CFA test was performed using SPSS 27 and AMOS 27 tools to verify the measurement model by examining convergent validity, discriminant validity, and internal consistency of the constructs. To estimate convergent validity, the following were measured: the reliability of the measurement item (factor load), the reliability of each construct CR, and the average variance extracted AVE (Anderson and Gerbing, 1988). The values of the standardized factor loadings ranged between 0.588 and 0.933, which is higher than the required value of 0.50 (Gefen et al., 2000). Meanwhile, the composite reliability values demonstrated internal consistency of the latent constructs with values above the threshold of 0.70 (Heinzl et al., 2011). Finally, the values of the average variance extracted AVE, which are a measure of the variation explained by the latent variable to the random measurement error, ranged between 0.557 for *performance expectation* and 0.81 for *social influence*, above the lower stipulated limit of 0.50 (Fornell and Larcker, 1981). Therefore, all the predictors in this study, as can be seen in Table 5, are highly reliable, and the convergent validity results suggest that the latent constructs are good within the observed variables, since

TABLE 3 Survey questions.

Constructs	Items	Question
Performance expectancy	PE1	Voice assisted devices appear useful for everyday common tasks...
	PE2	Voice assisted devices supplemented options for completing tasks that are essential to me...
	PE3	Voice assisted devices aided in completing tasks faster...
	PE4	Voice assisted devices increased productivity for...
Effort expectancy	EE1	In order to learn new information, voice assisted devices provided an easier means to...
	EE2	My interaction with voice assisted devices features a clear sound and easy to understand speech...
	EE3	I find that voice assisted devices are easy to use...
	EE4	It is easy for me to feel competent around voice assisted devices...
Social influence	SI1	People that are close to me consider that using voice assisted devices is...
	SI2	People that affect my everyday life and have an effect on my personal choices, consider that I should use voice assisted devices...
	SI3	People with opinions that are valuable to me have a preference for voice assisted devices...
Facilitating conditions	FC1	I have access to the necessary resources in order to be able to use voice assisted devices...
	FC2	I have the basic level of skill in order to be able to use voice assisted devices...
	FC3	Voice assisted devices are compatible with other devices that I already use...
	FC4	I am able to get online support for any difficulty arising during times when I use voice assisted devices...
Hedonic motivation	HM1	Using voice assisted devices is fun...
	HM2	Using voice assisted devices is enjoyable...
	HM3	Using voice assisted devices is entertaining...
Price/value	PV1	Voice assisted devices are reasonably priced...
	PV2	I am willing to pay for using platforms associates with the use of voice assisted devices...
	PV3	The cost for services added to voice assisted devices is manageable and it fits with added benefits...
Habit	HB1	Using voice assisted devices is fun...
	HB2	Using voice assisted devices is enjoyable...
	HB3	Using voice assisted devices is entertaining...
Trust	TR1	Voice assisted devices are trustworthy...
	TR2	I trust voice assisted devices for their ability to perform its functions...
	TR3	Voice assisted devices are capable of performing assigned tasks...
	TR4	Voice assisted devices in still trust in me...
Perceived privacy risk	PSE1	I have concerns about personal data protection and privacy whenever I use voice assisted devices...
	PSE2	I have concerns for security and data protection whenever I use Voice assisted devices...
	PSE3	I have concerns around privacy associated with the systems' use around voice assisted devices...
	PSE4	I have concerns around security issues associated with the systems' use around voice assisted devices...
Personal innovativeness	PI1	I like experimenting with voice assisted devices...
	PI2	I am generally an early user among colleagues and active user of voice assisted devices...
	PI3	Generally, I am hesitant to try the new voice assisted devices...
	PI4	I would seek new ways and experiment with voice assisted devices...
Behavioral intention	BI1	I intent to use voice assisted devices in the future...
	BI2	I will continue to use voice assisted devices regularly in my everyday life...
	BI3	My plan is to continue on using voice assisted devices often...

they are correlated with each other within the bottom-line model.

For the evaluation of discriminant validity, Heterotrait-Monotrait (Henseler et al., 2015) is used as an estimator of the correlation between two latent variables. According to this indicator, the coefficients must be below 0.90, in all cases they offered levels below 0.90, as can be seen in Table 6, which confirms the discriminant validity of all the latent used variables. For this, the construct measured items were required and they did not interlink with other concepts.

The general fit of the measurement model (Figure 2) to assess quality was performed through the evaluation of four goodness-of-fit indicators: the divided chi-square fit index PCMIN/DF, comparative goodness-of-fit index CFI, root of the

TABLE 4 Survey feature profile.

Variable	Description	Frequency	Percentage %
Gender	Female	189	61.8
	Male	117	38.2
	Prior to 1965	19	6.2
Year of birth	1965–1979	35	11.4
	1980–1999	90	29.4
	After 2000	162	52.9
Level of education	Elementary school	0	0.30
	Higher secondary school	5	1.6
	Bachelor	147	48
	High education	154	50.3
Use virtual assistants	Yes	230	75.2
	No	76	24.8
Frequency use virtual assistants (Last month)	0	63	20.6
	1–10	172	56.2
	11–20	36	11.7
	over 21x	35	11.5
Use of virtual assistants as only option	Yes	62	20.3
	No	244	79.7

residual root mean square of approximation RMSEA, and p of Close Fit (PCLOSE). The measurement model is considered sufficiently adjusted when these measurements are <3, ≥0.95, ≥0.90, ≤0.06 (Hair et al., 2006). The results: (PCMIN/DF 2.154, CFI 0.896, RMSA 0.050). This confirms that the measurement model has a high goodness of fit to (level) the data.

Structural model assessment

Data set sample validation

With the aim of validating the adequacy of samples collected, Hoelter's N critical index was applied with a significance level of 0.05, equivalent to 95% confidence (Hoelter, 1983; Bollen and Liang, 1988). The appropriate threshold for a good fit is 200, and values below 75 are considered unacceptable (75 ≤ value < 200; acceptable ≥ 200) (Wan, 2002; Garson, 2014). The size of the sample with 230 questionnaires is acceptable, since the Holter analysis concluded that the minimum size necessary for the sample would have been 117 questionnaires for a 95% reliability.

Framework–model analysis

Four common measures of model fit were used to assess the overall goodness of fit of the model. The results of the proposed research model showed an adequate fit: (PCMIN/DF 2.154, CFI 0.896, RMSA 0.050). The next step in evaluating the structural model (Figure 3) is to measure the explanatory power of the dependent variable measured as R-squared R^2. This is used as a measure of the explanatory power of the model ensemble and describes how much of the dependent variable is explained by the independent variables in the model. R^2 values range from 0 to 1. Values closer to 1 are indicative of more significant explanatory power, and values >0.9 are indicative of model overfitting that could cause inaccurate results. Behavioral user intention was found to have an R^2 of 0.898, indicating that 89.8% of the variable was explained by the independent variables in the model. That is, the model elucidated an 89.8% for measuring the behavioral intention in the realm of VAs.

One final step entails evaluating the chain relation in the cause linking constructs *via* the structural model (Hair et al., 2010). The relation between independent variables and dependable prove a median, average beta coefficient (β), the statistics T and the value of p. The SEM results in Table 7 display the guidelines H7, H9, H10, as significant, vs. *habit, trust* and *personal innovation* as being significantly correlated with user intention in VA's. Also, we consider *habit* ($\beta = 0.408$, $p < 0.001$) a good predictor, being followed by *trust* ($\beta = 0.291$, $p < 0.001$), and in last place, lowered score for *personal innovativeness* ($\beta = 0.267$, $p < 0.001$). The guidelines H1, H2, H3, H4, H5, H6, and H8, *performance expectancy* ($\beta = 0{,}136$, $p > 0.1$), *effort expectancy* ($\beta = -0.141$, $p > 0.1$), *social influence* ($\beta = -0.008$, $p > 0.1$), *facilitating conditions* ($\beta = 0.170$, $p > 0.1$), *hedonic motivation* ($\beta = 0.049$, $p > 0.1$), *price/value* ($\beta = -0{,}76$, $p > 0.1$) and *perceived privacy risk* ($\beta = 0.002$, $p > 0.1$) user intent does not represent a meaningful thrust in the context of a Spanish VAs user-base.

TABLE 5 Results for the measurement model.

Constructs	Items	Standard loadings	CR	AVE
Performance expectancy	PE1	0.864	0.833	0.557
	PE2	0.652		
	PE3	0.715		
	PE4	0.74		
Effort expectancy	EE1	0.868	0.914	0.727
	EE2	0.77		
	EE3	0.887		
	EE4	0.88		
Social influence	SI1	0.875	0.927	0.81
	SI2	0.933		
	SI3	0.89		
Facilitating conditions	FC1	0.866	0.888	0.669
	FC2	0.901		
	FC3	0.853		
	FC4	0.62		
Hedonic motivation	HM1	0.907	0.91	0.77
	HM2	0.9		
	HM3	0.824		
Price/value	PV1	0.853	0.922	0.798
	PV2	0.94		
	PV3	0.885		
Habit	HB1	0.872	0.842	0.646
	HB2	0.614		
	HB3	0.894		
Trust	TR1	0.77	0.863	0.612
	TR2	0.79		
	TR3	0.774		
	TR4	0.796		
Perceived privacy risk	PSE1	0.889	0.863	0.765
	PSE2	0.933		
	PSE3	0.685		
	PSE4	0.588		
Personal innovativeness	PI1	0.737	0.855	0.597
	PI2	0.697		
	PI3	0.805		
	PI4	0.842		
Behavioral intention	BI1	0.84	0.894	0.738
	BI2	0.82		
	BI3	0.91		

Results and discussion

What are the factors impacting users' intention and VAs usage? The model framework UTAUT2 establishes an empirical base for several constructs and suggests that behavioral user intention responds to *habit, trust*, and *personal innovation*. The model assigns 89.8% of predictability to user intention.

From the model analysis it is established that PE (H1), doesn't impact intention of usage. Despite a number of studies pointing at PE and benefit perceived in VAs toward higher adoption rate (Fan et al., 2022) for providing a pleasurable experience (Tsay and Patterson, 2018), that in turn will add to intention of use and to adoption rates (Almaiah et al., 2019), for the present case scenario didn't show a significant impact toward

TABLE 6 Ratio heterotrait–monotrait.

	PE	EE	SI	FC	HM	PV	HB	PI	PSE	TR	BI
PE											
EE	0.544										
SI	0.67	0.29									
FC	0.434	0.873	0.229								
HM	0.562	0.725	0.336	0.732							
PV	0.399	0.319	0.341	0.323	0.44						
HB	0.785	0.425	0.629	0.339	0.441	0.59					
PI	0.61	0.256	0.549	0.182	0.4	0.39	0.675				
SS	0.2	0.097	0.164	0.06	0.068	0.21	0.142	0.215			
T	0.611	0.634	0.429	0.611	0.593	0.47	0.556	0.593	0		
B	0.796	0.534	0.582	0.494	0.59	0.48	0.83	0.788	0.104	0.78	

an increase in user perception or an improved expectation for performance. This bottom line is backed up by the referenced studies (Khalid et al., 2021; Pitchay et al., 2021). From a user skill consideration of VAs usage and adoption, most participants in the 52% spectrum were millennials and digital natives, so, functioning and display of simple commands, searches, and chat natural to the interface did not require any upgrades for the users' technical knowledge (Melián-González et al., 2021). Thus, this factor is irrelevant to EE by minimizing setting up and action-tasks specific to VA usage. Ease of use as a non-relevant factor has been established in several studies (Wirtz et al., 2018, 2019; Zarouali et al., 2018; Balakrishnan and Dwivedi, 2021; Lv et al., 2021; Aw et al., 2022; Moussawi et al., 2022).

Aligned with ease-of-use factors arising from SI, we can take into account that colleagues and close individuals provide a referential standard from a common core belief and a similar mindset toward technology adoption. For the geographical scope of the study, Spain's population without wider access to technology will not have an impact in usage. Presence on apps and smart platforms of VAs, such as Alexa, Siri, and Cortana, extends to 16.9% of the total population in Spain (Survey in TIC Hogares, 2020). For use of VAs, specific targets show a 9.4% frequent use, several times a day, while a 6.1% use them once a day (Statista, 2022). This low rate of penetration clearly links to a lower degree of influence within a network, as shown by previous research (Hu et al., 2019).

FC (H4) did not affect usage or behavioral intent, considering that individuals have the necessary skill and ability in order to use VAs without additional technical support. Then, *facilitating conditions* are not essential contributing causes used to deter or favor user intention as shown in scholarly research (Alalwan et al., 2017), bearing in mind that ease of use specific to assistant devices does not imply a need for structural support to install the platform or to use the application.

VA adoption is not impacted by a *hedonic motivation*, seeing that the most common tasks, searches, and easy questions, are accessible *via* these assistants to most Spanish users according to an AIMC Study (2021). The distribution of tasks in this category presents the areas of interactions that are most common—searches/questions, weather/traffic report, music streaming and internet radio, alerts, calendar reminders, to-do-lists, call display, newscasts, messaging, central control for home appliances, shopping/online orders/meal delivery providers—a landscape of everyday applications that aligns with previous research (Laumer et al., 2019; McLean and Osei-Frimpong, 2019; McLean et al., 2021).

Price/value (H6) is not a significant factor due to an added advantage originating in zero cost for installation and from the perception of affordability to access technology assisting devices, such as, central speakers.

Contrary to *price/value* as it relates to ease of use, *habit* (H7) has a significant effect over intention of use in the VAs segment. As part of social psychology, habits include learned actions, mnemonic rules, and repetition of sequences from experiences in the same way specific actions create a consistent, recurrent, and pattern in results (Verplanken and Faes, 1999). Therefore, an automated action will be completed with the expectation of a known incentive. The more an action yields a specific result, associated to a benefit, the more this link forms between action and reward, thus carrying a behavior over time and without added effort (Lally and Gardner, 2013). From this perspective, the younger generation, having breath from a digital environment where they depend on mobile devices and apps for most of their everyday tasks, are inherently competent and naturally fall in the path of automation when using VAs. By integrating the string of tasks listed as simple access to assistants, these devices become integrated, as well as contributing to the development of digital skills of VA (Kessler and Martin, 2017; Gunasinghe et al., 2020). This positive influence stands against

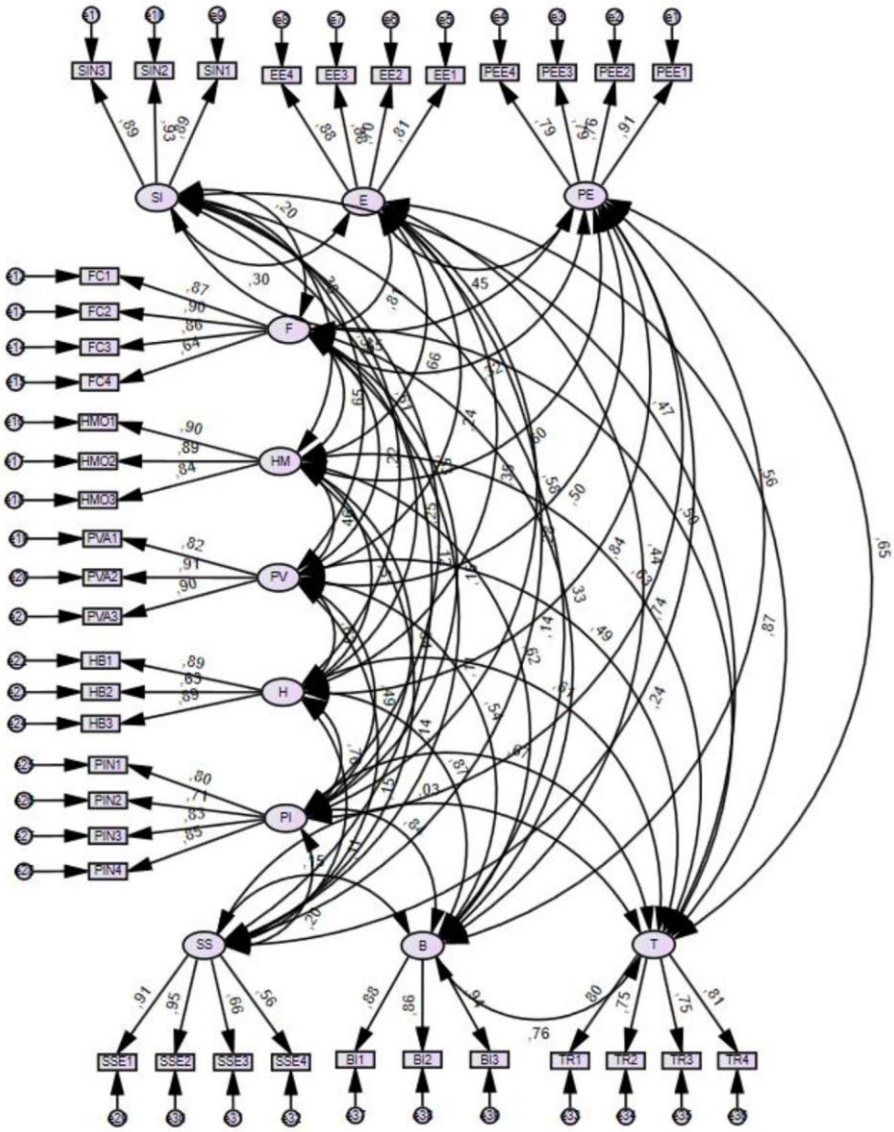

FIGURE 2
Measurement model.

other scholars' analysis with negative findings around the impact of HB in usage (He et al., 2022).

Our framework and data analysis supported that *privacy risks* (H9) do not impact user intention. In the VAs' area, the risks associated with security and privacy are aligned with third-party access to unauthorized, restricted information bands, and consequent data-breaches around personal information in the system (Han and Yang, 2018). One added benefit of a VA is listening to and storing requests; however, the security layer provides a perception risk in a manner that is not entangled with "trustworthiness" or "authorized access." Additionally, the compilation of personal information entrusted into the privacy of the system would not add a layer of risk when the service provider stores information according to set standards for security. This could be detrimental to the overall factors impacting adoption, but it is not a barrier in the use of an assistant device; the added risk is powerful among perceived situation or potential risks, but it isn't perceived or felt as such by users during their interactions who relied on the ease of use and its practicality.

This gap existing between the will to shield or share data is measured by trust. *Trust* (H9) changes toward the service and the provider of a platform. The service provided is established between individuals at the time of performing a task when the

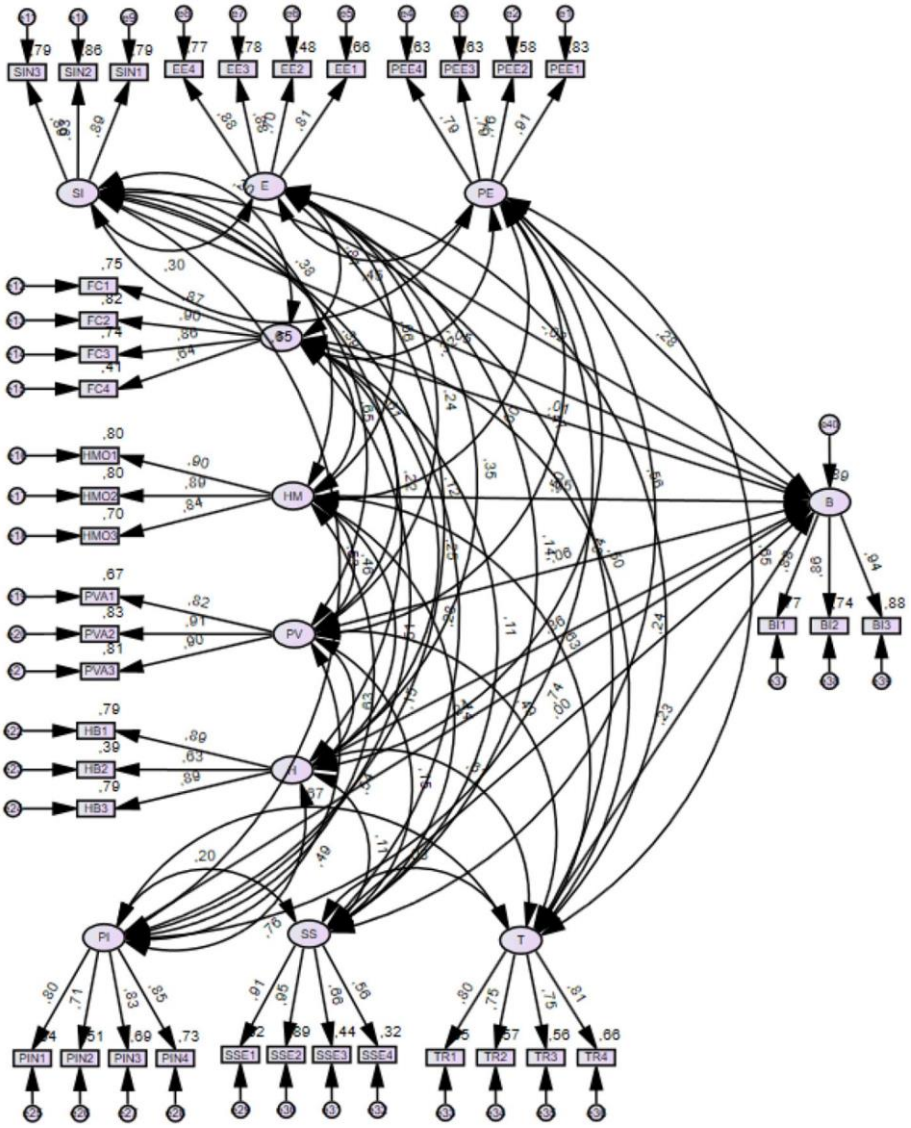

FIGURE 3
Final structural-model.

expectation is placed on the system responding to the present interaction and communicating the results fast and efficiently, in a reliable manner. On one hand, trust in the service provider links to credibility and established reputation. Some technology platforms providing service access to servers are Amazon, Google, and Apple—companies with a long-known trajectory and degree of trust that will eliminate initial user resistance toward enrolling in one of these service provider platforms. On the other hand, lack of trust will yield a lower adoption rate in the specific segment of VAs, due to underlying risks to privacy and trust, conducive to technology distrust (Cho et al., 2020; Zierau et al., 2020); accordingly, design of interface should be sensitive to this layer of risk and trust (Cho et al., 2020; Chen et al., 2021). Consistent with this line of thought, trust is a known factor in studies for user acceptance of VAs (Kuberkar and Singhal, 2020; Pitardi and Marriott, 2021; Vimalkumar et al., 2021).

Personal innovation influences behavioral intention, and for many researchers working in this variable, it is most promising in arising technologies, since leading into a role within a known process will cause an evolution into more immediate acceptance than other individuals that are lacking involvement with new technologies. This assertion reinforces the belief that innovative people are capable of remaining optimistic and positive when confronted with new technology developments (Dabholkar and Bagozzi, 2002). This is consistent with preliminary standards

TABLE 7 Results.

Guidelines	β	*t*-value	*p*-value	Decision
H1: Performance expectancy → Behavioral intention	0.136	1.368	0.171	Unsupported
H2: Effort expectancy → Behavioral intention	−0.141	−1.230	0.219	Unsupported
H3: Social influence → Behavioral intention	−0.008	−0.150	0.881	Unsupported
H4: Facilitating conditions → Behavioral intention	0.170	1.522	0.128	Unsupported
H5: Price/Value → Behavioral intention	−0.76	−1.461	0.144	Unsupported
H6: Habit → Behavioral intention	0.408	4.177	***	Supported
H7: Hedonic motivation → Behavioral intention	0.049	0.720	0.471	Unsupported
H8: Perceived privacy risk → Behavioral intention	0.002	0.573	0.958	Unsupported
H9: Trust → Behavioral intention	0.291	0.052	***	Supported
H10: Personal innovativeness → Behavioral intention	0.267	3.751	***	Supported

Measurement correlation-values: ***$p < 0.001$.

confirming PI as having a high degree of influence in a user's intention (Kasilingam, 2020).

Conclusions and implications

After the pandemic COVID-19 virus, many geographical areas showed an increase in VAs usage. There are few studies for reference after the global health crisis, and this model for analysis and study aims at filling this gap in the research of factors influencing introduction of new devices for virtual assistants. From a quantitative standpoint, there is a new methodology showing user intention around VAs' use and adoption in Spain. An underlying factor contributing to this context, arose from previous studies; based on AI introduction and a wide, all encompassing approach, to technology adoption (Wirtz et al., 2018, 2019); these changes have widened the scope in the theory and framework for analysis, to apply new filters for assessment of *trust, privacy risk*, and *personal innovation* in VAs. The information provided toward personal user experience can provide guidance for any development in the technological areas of health, business, home smart-systems (energy, security), and personalized bots-assistant companion. Considering that expanded use of the VA in these varied facets from industry to household, involve a massive potential for growth, this theoretical contribution and data analysis brings new light into personal innovation as a seminal variable for an integrated framework, with a focus on the interdependency of technology use and its context, limited to a national framework, the Spanish territory.

The above considerations are relative to the degree of technology development, skill, and competence around technology use as well as individual perceptions on the new applications (Alalwan et al., 2018). For the time-period framework, narrowed down to the years of global pandemic and defined by a health regulated environment, the study contributes data foreshadowing the novel role of consumer devices within a Spanish demographic, targeting device usage in diverse areas of daily life, from entertainment and home assistance to deliveries (Guzman, 2019). A second aspect under consideration is the effect of technology innovations as part of a context sensitive to added security and perceived risks; whether these devices make life easy without an added cost to privacy is a variable that opens a holistic sense into understanding the use of VAs as this field is evolving along AI. Personal innovation gains an edge for an integrated framework with essential notions established from behavioral intention. This notion is proposed by Dinev and Hart (2006) and proves to be productive in creating a cohesive base for analysis in line with a set of variables. In the area of VAs, personal innovation creates a filter valuable to system designers and business developers working in Vas as a means for retrofitting from clients, and to account for adoption with, an in-depth outlook into systems for prospecting of features and improvement processes (Kabra et al., 2017; Khalilzadeh et al., 2017). This is a valuable lesson obtained from the survey: it is important to have a customer centric approach, a user focus, along with a reputation for trustworthiness and low risk in bringing new features and generating innovations for an overall positive adoption rate. The information arising from the results represents a practical contribution looking forward into systems design and for businesses working in VA platforms. The data contrasted with an aligned set of variables will not only bring main factors that are relevant to user design to the discussion, but also highlight the need to integrate new features for increased trust, low risk, and greater innovation around digital assistants.

Limitations and future research

There are some limitations of the present study even after reaching our set of objectives. Mainly, the results should be taken with caution for the limited scope of demographic

data and only applied to the Spanish population. The same guidelines for ten factors of users' intention, can be extended for a cross-sectional approach to other geographical areas. Also, a cross-sectional study can be developed—an analytical approach from variables representing a synchronic set of standards for the data compiled in a specific timeframe—involving subjects and survey respondents' opinion evolution over time. Thus, results of the present analysis show that, indeed, *trust* leads to adoption, whereas *privacy risk* does not. Even though these factors are not new for studying users' adoption of the technological devices and smart technology, the context of application of the two factors leads researchers to open new paths for studies of continued use of VAs.

Finally, it could be appropriate to integrate new factors to the scope of variables and set of constructs, such as ergonomics, for dismantling an embedded bias around physical characteristics and their relation to mind processes, as these link to non-humans (for a technological viewpoint) with the aim of adding a layer of humanization to the process. This tendency to provide an animal form is known as anthropomorphism, which in turn, results in additional trust and satisfaction from a user, and even security, offering a more nuanced base for filtering of a subjective process. Prospective areas of development may bring a new insight on the link from intention to usage. Also, it may consider including other moderating variables for a study, such as gender, age, experience, and needs/desirable outcomes from use.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the patients/participants or patients/participants legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

MG: hypothesis proposal, data analysis, and manuscript preparation. JS: data collection. AA: manuscript revision. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Capítulo 5

¿Cuáles son los principales factores para utilizar la plataforma española de pago móvil peer-to-peer Bizum? Un análisis aplicando el modelo UTAUT2.

What are the leading factors for using Spanish peer-to-peer mobile payment platform Bizum? The applied analysis of the UTAUT2 model.

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What are the leading factors for using Spanish peer-to-peer mobile payment platform Bizum? The applied analysis of the UTAUT2 model

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ABSTRACT

The main goal of this paper is to determine the underlying factors that drive the adoption of the Bizum mobile peer-to-peer payment system by users. It is empirically proven that factors included in the extended Unified Theory of Acceptance and Use of Technology (UTAUT2) model are precursors of the mobile payment adoption.The proposed model modifies the set of constructs by adding trust, security, and perceived risk. The sampleconsist of 334 Bizum platform users who are mainly young people between 18 and 22 years old. Obtained datawas analyzed by a Structural Equation Modeling (SEM) through Confirmatory Factor Analysis (CFA). The results show that the strongest predictor for adopting to use Bizum mobile payment platform is habit, with 75 % of acceptance of young online banking users. But habit and social influence factors show 82.5 % of intention of use among young users. In contrary, performance expectancy, effort expectancy, facilitating conditions, price-value, hedonic motivation, trust, security, and perceived risk do not influence the intention to use this platform. Banks, financial entities, as well as banking platform developers, can benefit from the results of this study by under- standing the factors that influence users to use these platforms and consequently successfully implement them.

1. Introduction

Digital banking is a widely used expression for any application of technology that aids in completing financial operations and banking transactions, in a more efficient manner than traditional banking (Sardana and Singhania, 2018). As such, an encompassing perspective for the term *financial operations* electronic-digital tools, internet banking, and mobile, are all areas within digital access. Specifically, mobile technologies evolved from analog connection to broadband and wireless to ease client access to varied services for different financial services and banking needs (Yao and Zhong, 2011). Essentially, clients that access their bank for basic everyday services (accessing tellers, paying bills, money orders, opening bank accounts, deposits, loan payments, access to bank statements and related transactions), they do so instantly, by interacting via mobile devices (cellular phone and tablets) to an omni-present platform (Kwateng et al., 2019; Laukkanen, 2016; Baptista and Oliveira, 2015). Digital forms of payment were first introduced as an effective means to complete common *digital banking* operations (Aladwani, 2003; Leong et al., 2020). The mobile digital payments system comprises financial activities including services that require connecting bands in mobile operating frequencies, commonly used for digital handheld assistants, cellphone technology, and, for any communication between devices sharing data in an open network (NFC) (Alkhowaiter, 2020; Patil et al., 2020); additionally, payment modalities using encrypted network, such as, e-wallet and cryptocurrency for payments alternative modes to issued currency that more recently are replacing credit and cash as more traditional payment methods. In summary, all these modes of technology used in banking operations for every day, common banking, including authorizing transactions, allow a far-reaching integration across-systems and payment platforms into financial transactions, from a *digital banking* perspective (Srivastava et al., 2010). The mobile technology for peer-to-peer (P2P) systems, payments from person-to-person, are far more flexible for trading goods and services, exchanges from providers and customers in a shared common platform at any time; namely, as services agreed between users, the channels for transferring money alternates varied technological platforms via mobile, online banking, internet banking and online-social network platforms. All these devices require mobile technology in order to complete digital online payments.

From this perspective the adoption ratio, a 3.6 % is established on the

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assumption of a growing value per transaction of 644€ globally. Also, Pricewaterhouse Cooper reported that digital-based payments reached 3 billion transactions worldwide in 2021, with an estimation for future around the number of transactions at 30 billion in digital payment transactions. On basis of the PWC (PriceWaterhouseCoopers) 2022 report, in years 2020–2025 the percentage of electronic digital payments will grow to 82 % averaging 1.8 billion transactions; in 2025–2030, growth estimated to 61 % surpassing 1.8 billion operations.Across different areas, Asian-Pacific region will lead the adoption with a 76 % growth estimated for years 2025–2030, followed by African countries, 64 %, and European area 39 %. North-America's adoption, including USA and Canada, will grow moderately, at 35 % (PwC (PriceWaterhouseCoopers), 2022).

Considering that knowledge across fields in Psychology, Sociology, Information Technologies have accounted for a shift in user technology adoption from diverse theories and model frameworks in UTAUT, for the study, these premises from Venkatesh et al. (2003) are applied. Their model is based on a commitment to integrate, by unifying some pre-established models; since this integration allowed to account on previous models, they draw a line of continuity in acceptance of new technologies based on users' perception. By being applied in corporate understanding of technological change for organizations, the model was applied considering four main factors affecting technological integration: *Performance Expectancy, Effort Expectancy, Facilitating Conditions,* and *Social Influence*. Rooting in large acceptance and longtime popularity, by having been linked to many sectors, a second extension to this framework was developed in 2012 (UTAUT2) with three added factors: *Hedonic Motivation*, *Price/Value*, and *Habits*, as they are directly linked to consumer behavior. Extension theory took on the new variables by adjusting the model in order to evaluate the adoption-technology from the users' perspective.

Additional estimates on the speed of penetration and rate of adoption in digital banking, payment platforms, and the high complexity of factors in the usage, as well as, adoption rates – from previous barriers to online banking and digital payments – will provide a focus on academic research and industry sectors alike (Kwateng et al., 2019; Merhi et al., 2019; Gharaibeh et al., 2018; Alalwan et al., 2018; Tamilmani et al., 2019; Putri, 2018; Shaw and Sergueeva, 2019; Soodan and Rana, 2020; Purwanto and Loisa, 2020; Widyanto et al., 2020; Widodo et al., 2019; Shaw and Sergueeva, 2019; Chen et al., 2019a,b; Suo et al., 2022; Saura et al., 2021). The present study is based on a framework for adoption in model UTAUT2 for an evaluation and consideration of determinant factors, as these relate to P2P mobile payment platforms. Therefore, social and individual constructs mediating a user's disposition into acceptance, such as, Trust, Security, and Perceived Risk, become prevalent factors in the selection of new platforms.

A vacuum in academic research relating technology usage and P2P adoption has been prevalent after the years of Global Health Emergency during Covid-19 pandemic. The framework presented in this study for anchoring Bizum, a P2P system widely used in Spain, revolves around user intention and it is aimed at reporting on an exploding technology.

The following research questions and objectives lead the study. Research questions:

1) What are the factors that affect behavioral intention in the process of using a mobile payment platform Bizum?
2) What aspects of trust, security and perceived risk can be assessed upon adopting mobile payment platform Bizum?

1.1. Objectives

1) To explore the factors included in the model UTAUT2 directly impacting user behavior around mobile payment platform Bizum.
2) To add rationales from the model UTAUT2 impacting user behavior around mobile payment platform Bizum.
3) To evaluate the model of behavioral user intention aligned with empirical data in correlation with guiding variables.
4) To establish a preliminary guideline, from intention to usage, for plausible advances around this area. One expected outcome arising from the review consisted in contributing to literature around the identified factors~~-~~ Trust, Security, and Perceived Risk~~-~~ , which have established a line of continuation for usability assigned to P2P, as an adequate model of analysis: a predicting model for evaluation in intention around digital payment systems.

After the introduction, the core analysis follows from a literature review to frame the model of assessment and its variables; a conceptual framework guided by hypothesis for adoption. The main corpus of data, process of compilation and data analysis, is provided in section three, via modeling equations. Next, the results and discussion with data showcases. Section five is for conclusions and contributions from the study and final section, pointing at plausible future lines of research and managerial outlook.

2. Preliminary thesis and previews academic studies

2.1. P2P Mobile pay – Bizum

A P2P *Peer-to-peer digital payments* platform is a type of digital transaction that allows to transfer funds between people at two ends, by connecting to their bank account or credit card via mobile application or online (Thompson, 2019; Ramos de Luna et al., 2019). Often considered as an easier method of payment, faster and convenient, it is easy to configure since the two users are registered for the purpose of obtaining an account number in order to link a bank account or credit card account with the application. It is a fast portal for the connection where transfer happens in a few seconds and few click for completing the transaction, after the user has selected a recipient, entered an amount, and submitted the payment (Bizum, 2022). For this reason, digital payments are broadly accepted and its popularity rage among friends, relatives, and colleagues (Fuscaldo, 2019). Many platforms for P2P are supported by non-financial entities, including Paypal, SquareCash, Venmo, Bizum, Apple Pay, Google Pay, etc.

Bizum is a Spanish-based entity created in 2016 after a collaborative partnership from banks in Spain, with the aim of establishing an agile system that serves both individuals, and traditional brick & mortar commerce. This payment platform allows the transfer of funds from a recipient end to users by sharing a mobile number. When a user needs to send funds, the system notifies it with a text message to verify the connection; this code is needed to complete a safe transaction via the mobile platform. Once the transfer is completed, the recipient can deposit the funds instantly. From the moment a transfer is completed, the cash amount is showing at the end's recipients account holder, and the transaction is recorded so it can be later retrieved from a Bizum data sheet. The novel financial platform is gaining traction from recent peak in access from individuals and business users into Digital payments and mobile access to platforms during the years of global pandemic outbreak, Corona-virus19. Access to Bizum in 2021 accounted for 18 million registered users, and it is expected to reach 23 million in 2022, which entails a 48.6 % of the total Spanish population. The goal for the present year (2022) is to complete 800 million transactions from individuals and to surpass the 20 million transactions for e-commerce users.

2.2. UTAUT2

The Unified Theory of Technology Acceptance and Use UTAUT was developed in 2003 to predict user adoption of information technology in a business context (Venkatesh et al., 2003). UTAUT integrated eight previous relevant theories, which are the following: Innovation Diffusion Theory IDT (Rogers, 1961); Theory of Reasoned Action TRA (Ajzen

and Fishbein, 1980); Theory of Planned Behavior TPB (Azjen, 1991); Social Cognitive Theory SCT (Bandura, 1986); Technology Acceptance Model TAM (Davis, 1989); Model of PC Utilization MPCU (Thompson et al., 1991); Motivational Model MM (Davis et al., 1992); C-TAM;Model Combined with TPB (Taylor and Todd, 1995).

For a systematic approach, within a model design previewing research models from UTAUT acceptance model, four main constructs are defined: performance expectation, effort expectation, social influence and facilitating conditions, which are the factors that determine technology adoption; user's behavior depends on his/her intention and on technology usage, and it impacts all four factors mentioned, PE, EE, SI, FC. The UTAUT model considers variables from bands across personal identity variables, gender, age, experience, and voluntary use to modulate the influence of the four constructs along with behavioral intention and use of technology (Venkatesh et al., 2003).

Since UTAUT arises for a context generic for organizations, Venkatesh et al. (2012) developed UTAUT2, to include three new constructs: hedonic motivation, price/value and habit, factors oriented towards the acceptance of technology within an evolved framework to key in consumers'behavior (Fig. 1).

2.3. Research on mobile payments and UTAUT2

Since it first appeared in 2012, research around *Theory Acceptance and Use Technology* (Venkatesh et al., 2012) has shown a proven valid method to underpin technological innovation in several areas, across field domains and contexts. Some of the advantages noted in this study are: an encompassing approach from a consumer viewpoint in the process of technology adoption, from both theoretical frameworks, UTAUT and UTAUT2; a higher prospecting power into determining outcomes for adoption, from a UTAUT2 angle to leverage sources and explanatory variables, up to a 74 %; opening views to a paradigm flexible enough to integrate constructs, which by means of an augmented insight into behavioral basis, increases the user intention predicting model (Migliore et al., 2022). These essential guidelines open a path for understanding emergent technologies from a developmental stage based on the theoretical framework. It features a model of analysis that is reliable, trusted and greatly used. Into the context of technology systems and platforms for mobile payments, many scholars adopt this underlying framework (Liébana-Cabanillas et al., 2021; Balakrishnan and Shuib, 2021; Penney et al., 2021; Pratama and Renny, 2022; Widyanto et al., 2021, etc.).

Often scholars have cross referenced the model UTAUT2 along with other theories depending on their field of research. Tamilmani et al. (2021) investigate their own approach for an extension theory providing an outlook into at least sixty thematic areas and find five constructs common to any differing approach, including: trust, perceived risk, self-efficacy, attitude, and personal innovation. After accessing up to 377 articles, and synthetizing a total of 25 articles, Al-Saedi and Al-Emran (2021) obtain a filter for the model common variables predicting user adoption, to highlight perceived risk and trust as the highest ranking. Based in 57 TAM/UTAUT/UTAUT2 studies that focus on mobile payment systems, Harris et al. (2019) suggest for a renewed approach into technology adoption regarding mobile payment systems that new opportunities are opening from a perspective that grasps personal use in countries with robust financial systems where risk perceived and trust remain prior elements before security and privacy.

Next, focusing on contexts that are filtered from studies using an ample scope for their approach to mobile P2P, Al-Okaily et al. (2022) undertake mobile payments and technology adoption in Jordan by extending UTAUT2 constructs to variables such as conscience, trust, security and privacy. From this taxing filter, the results are favoring Price-value and social influences as main factors determining use of mobile for payments, as well as performance expectations, conscience, and trust. Some other variables added to the tandem in Widodo, are perceived risk and trust (Widodo et al., 2019). For these authors, habit is more prevalent than intent in a behavioral user approach to adoption in Indonesia, and, social influences, performance expectation, hedonic motivation, and perceived risk will not affect user intention significantly.

More recently, some of the variables activated from these critical UTAUT/UTAUT2 studies are included along many of the scholarly research approaches being undertook to present day: trust (Penney et al., 2021; Pratama and Renny, 2022; Widyanto et al., 2021), security (Chauhan et al., 2022; Pratama and Renny, 2022; Widyanto et al., 2021)

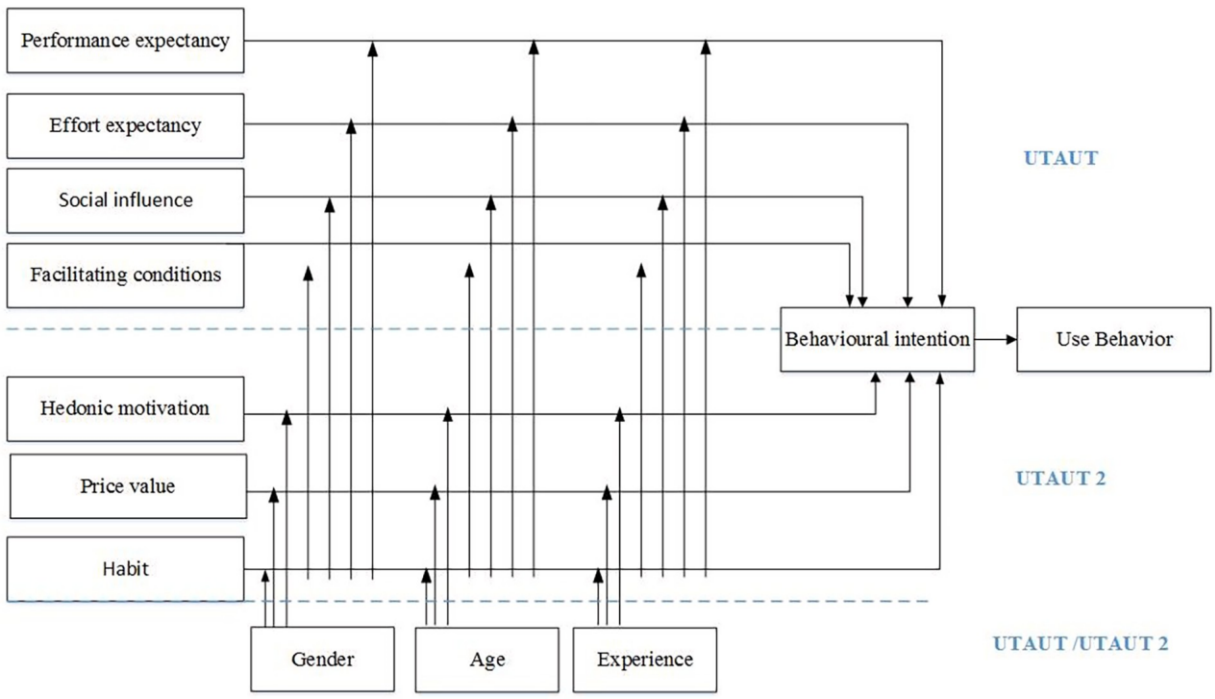

Fig. 1. Extending Theory Acceptance and Use Technology (UTAUT2).
Source: Adapted Venkatesh et al. (2012).

and perceived risk (Penney et al., 2021; Chauhan et al., 2022; Pratama and Renny, 2022; Widyanto et al., 2021).

2.4. SEM structural equations modeling

SEM model is based in Variances (VB-SEM), originating from a prevalent theory on dependency relations. It is conceptualized from a systematic integration of relationships to justify a given range of phenomenon that, in turn, provides an explanation for differentiating variables that are acting vs factors and variables that result from a dependent link. The aim of the explanation model is the theory; the framework for a theoretical justification starts from the assumption by which SEM's is confirming its guidelines and rationale for the sake of providing a theoretical framework, above the confirmation of empirical results. A researcher examining relations and variants from a theoretical viewpoint to proof its validity from a conceptual standpoint (Hair, 2009). As a result, SEP provided a background, a conceptual framework for contrasting theoretical grounds against facts (empirical data sets) (Haenlein and Kaplan, 2004). This provides versatility of approaches for research areas coming from Social Studies, Education, Behavioral Sciences, in order to approach a causal chain supported by this theory (Gefen et al., 2000; Haenlein and Kaplan, 2004; Statsoft, 2013). The final recommendation to support any analysis on market penetration arising from SEM tools is to rely on a consistent theoretical standpoint (Hair et al., 2014).

2.5. Thesis: guidelines for the analysis

Based on the previous section, pointing at relevant literature on the topic, the present study brings light further on our objective: to aim research and analysis in the proposed areas under three variables, trust, security and perceived risk, all of these variables departing from current models as part of UTAUT2 framework.

2.5.1. Performance Expectancy ➔ Behavioral Intention

What is the P*erformance Expectancy* (PE)? This key metric indicates the individual perception previous to using a new system to assess the degree in which work performance will be improved (Venkatesh et al., 2003). In the context of banking system, the degree of expectation in the improvement of online internet banking tools for an additional benefit as part of banking operations (Raza et al., 2019). These benefits include an added comfort to effectuate payments, a more immediate response and efficient service for the overall service provided by mobile and online banking (Khan et al., 2022; Zhou et al., 2010). For this reason, authors that consider PE for its impact arising from the intent of behavior, weighed this factor higher (Baptista and Oliveira, 2015; Basri, 2018). In fact, when PE applied to mobile payments specifically, the adoption rate is higher as directly linked to the functionality of the services for the transaction (Gupta and Arora, 2017; Hongxia et al., 2011; Yu, 2012; Chong, 2013; Yang, 2010). Considering some of these findings, the thesis that is being pursued from the analysis, follows, a first guideline:

H1. *: PE positively and directly influences user's intention of using Bizum P2P system.*

2.5.2. Effort Expectancy ➔ Behavioral Intention

What is *Effort expectancy* (EE)? In the context of any system, this key metric provides a grade to the easiness of use; for an easier usability associated with online banking, there is a higher probability of adoption from clients in their regular banking transactions (Venkatesh et al., 2003). There is a positive impact associated with a grade of EE that results in the intent from a behavioral standpoint on the part of users, who may be considering mobile banking (Giovanis et al., 2019; Gupta et al., 2019; Iqbal et al., 2022;). Following with a previous line ofadoption of new services in mobile payments, on one hand, some authors see this expectation from a positive light towards mobile payment system adoption (Alalwan et al., 2017; Abu-Taieh et al., 2022; Shaikh et al., 2021), while others see it as one key dominant factor for adoption (Bailey et al., 2017; Kadim and Sunardi, 2022; Tan et al., 2014; Wulandari, 2017). Therefore, based on this, the following hypothesis is proposed:

H2. : EE positively and directly influences user's intention for using Bizum P2P system.

2.5.3. Social Influence ➔ Behavioral Intention

Social Influence (SI) includes the perception from an individual around social network value arising from the connection to other individuals that can be influenced for adoption of a new system (Venkatesh et al., 2003). The information and stimulate set around a circle of people that are influencing clients, contributes to the sense of a role defined as contributing towards understanding and knowledge of their use of internet banking and mobile payments (Alalwan et al., 2016). Several studies presented this thesis on SI as directly linked with behavioral intention to adopt services as part of online & mobile banking; as such, social influence defines intention and usability of the new system (Bhatiasevi, 2016; Tan and Lau, 2016; Kishore and Sequeira, 2016; Mahfuz et al., 2016). In addition, there are analysis that are pointing at SI as the most significant factor impacting usage in mobile and online banking (Alalwan et al., 2016; Fedorko et al., 2021; Yu, 2012). As such analysis is streamlined with literature around adoption for online & mobile, it follows that SI favorably conditions the adoptionof new services and technology. (Marpaung et al., 2021; Migliore et al., 2022; Suo et al., 2022; Nur and Panggabean, 2021). Therefore, based on this, the following hypothesis is proposed:

H3. *: SI positively and directly influences user's intention for using Bizum P2P system.*

2.5.4. Facilitating Conditions ➔ Behavioral Intention

Facilitating Conditions (FC) account for the set of expectations that an individual has on a given technical and organizational structure to back up the system use (Venkatesh et al., 2003). In the existing literature on mobile banking, FC represent individual perceptions on existing infrastructure, both, form a technical and organizational standpoint, in order to validate the mobile banking system (Albashrawi et al., 2017). Considering that mobile banking services rely on resources availability, as well as know-how and a number of set parameters in the structural system, arranging conditions have influence on a person's decision to use mobile banking (Afshan and Sharif, 2016; Thaker et al., 2021; Wu et al., 2021). In the mobile payments' ecosystem, FC are taking into a mix of significant value for the consideration into adoption of mobile payment from the consumer side (Baptista and Oliveira, 2015; Chauhan et al., 2022; Teo et al., 2015). Therefore, based on this, the following hypothesis is proposed:

H4. *: FC positively and directly influences user's intention for using Bizum P2P system.*

2.5.5. Price/Value ➔ Behavioral Intention

Price/Value (PV) revolves around the perception on the consumer side relative to the benefits perceived as technology application in connection to cost of use (Venkatesh et al., 2012). This pre-conception grows from the underlying consumer belief that technology has a high cost (Luarn and Lin, 2005). As part of the final price, subscription fee, device cost and Internet user fees, add to the overall application (Wei et al., 2021) The price/value, in the context of studies on mobile payment systems, includes perceived price, a prior estimation on value, as a negative influence initially impacting adoption (Bhatiasevi and Yoopetch, 2015; Giovanis et al., 2019; Gupta et al., 2019; Wu et al., 2021). Therefore, based on this, the following hypothesis is proposed:

H5. *: PV negatively and directly influences user's intention for using Bizum*

P2P system.

2.5.6. Habits ➔ Behavioral Intention

Social norms are *Habits* (HB) measured as part of the individual drive to follow behaviors, habits ingrained in learning tasks (Venkatesh et al., 2012). From an Information Systems angle, the underlying prediction proves that this habit has a significant impact in emotional link to real use. Considering that there is a previous know-how of the product, these intrinsic learned facts become habit (Johora and May, 2015). Information and product knowledge in order to follow up with an expected behavior, in turn, increased its perceived value (Cheng et al., 2009). In the context of mobile systems, habit represents a tangible determining factor towards usage (Zhang et al., 2018). According with studies on mobile payment adoption the trend is to underlie habit and social norm as positive factors (Handayanto and Ambarwati, 2022; Hasyim, 2022; Pasaribu and Rabbani, 2022; Zain and Susanto, 2022). Therefore, based on this, the following hypothesis is proposed:

H6. *: HB positively and directly influences user's intention for using Bizum P2P system.*

2.5.7. Hedonic Motivation ➔ Behavioral Intention

Hedonic Motivation (HM) is understood as the pleasure or reward derived for technology use (Venkatesh et al., 2012). Specifically, in the context of mobile banking this degree of pleasurable feeling in users derives from mobile banking use. Mobile banking showcases a modern technology in relation to lifestyles and actual value of the people portraying this edge to consumers (Gan et al., 2006; Celik, 2008; Lin and Hsieh, 2011; Riffai et al., 2012). From this angle, factoring in users' feelings such as pleasure, cheerfulness, and happiness when using technology, the attached behavior supports its utility and added perceived value (Cheng et al., 2006; Turel et al., 2007). In mobile payments, HM will impact use of the technology, thus being accounted as factor in adoption (Sharif and Raza, 2017; Hwang and Kim, 2007; Akhlaq and Ahmed, 2013; Zain and Susanto, 2022), since a user's perceptions on technology are not linked to anxiety, worriedness or preoccupations, which, also, have an impact for the risks perceived in the use of mobile payment services (Alalwan et al., 2018); HM has a direct impact on the use of mobile payments (Koenig-Lewis et al., 2015) and will significantly impact user intention in mobile payments (Alalwan et al., 2018; Hasyim, 2022; Handayanto and Ambarwati, 2022). Therefore, based on this, the following hypothesis is proposed:

H7. *: HM positively and directly influences user's intention for using Bizum P2P system.*

2.5.8. Trust ➔ Behavioral Intention

Trust (TR) is a subjective believe for a part taking stand on requirements and obligations. In the area pertaining financial transactions when users are more exposed to risk arising from uncertainty and lack of control, trust is of great relevance (Lu et al., 2011; Zhou, 2013; Slade et al., 2015, 2015b; Ben Arfi et al., 2021). From this onset of perceived risk factors, trust is also a defining factor for success affecting a new system of information (Alalwan et al., 2016; Pham and Ho, 2014). In base with standing literature, perceived trust confirmed its relevance as a main factor positively influencing the adoption in electronic payments (Chong et al., 2012; Das¸tan and Gürler, 2016; Giovannini et al., 2015; Nelloh et al., 2019; Tossy, 2014; Williams et al., 2015; Changchit et al., 2020). Additional bibliography outlined trust as the most influential factor interacting with behavioral intention for usage in mobile payments (Penney et al., 2021; Sankaran and Chakraborty, 2021). Therefore, based on this, the following hypothesis is proposed:

H8. *: TR positively and directly influences user's intention for using Bizum P2P system.*

2.5.9. Perceived Security ➔ Behavioral Intention

Perceived Security (PS) is the perception that user upholds in front of a potential risk when completing banking operations; the degree of security that a client user assesses in selecting a secure payment mode (Khalilzadeh et al., 2017). Security is an important factor within methods of payment either in mobile banking or online banking, with a significant impact affecting behavioral intention (Aladwani, 2001; Parasuraman et al., 2005; Shen et al., 2010; Yoon, 2010). Several authors have shown that security associated with a mobile device payment mode has a positive impact from first drives in behavioral motivations to adopt mobile banking (Merhi et al., 2019; Akhter et al., 2020). Security level as perceived by consumer, will attract more consumer interest towards adoption (Alaeddin et al., 2018). In base with research conducive to security of information encryption, (Alshare and Mousa, 2014; Oliveira et al., 2014; Widyanto et al., 2021; Arfi et al., 2021) and safety in data privacy (Morosan and DeFranco, 2016; Ribeiro-Navarrete et al., 2021) both, security and safety have a positive impact in user mobile payments. Therefore, based on this, the following hypothesis is proposed:

H9. *: Security positively and directly influences user's intention for using Bizum P2P system.*

2.5.10. Perceived Risk ➔ Behavioral Intention

Perceived Risk (PR) defines as potential lost in result-oriented search upon implementation of a new technology (Lee and Song, 2013). It is the clients' perception around security and reliability in institutional networks, such as, guarantees, policy framework and regulatory environment for mobile payments (Zhou, 2011). Security is weighted a relevant factor for the protection of clients because of uncertainty and risks inherent, to create a feeling of trust among client-users of mobile payment (Xin et al., 2015). Users will bring added security to platforms aligned with continued utilization (McKnight et al., 2002; Kim et al., 2010). In the context of mobile payments, perceived risk will arise as critical factor negatively impacting adoption for this payment mode (Pheeraphuttharangkoon, 2015; Purwanto et al., 2020; Merhi et al., 2020; Slade et al., 2015). Therefore, based on this, the following hypothesis is proposed:

H10. *: PR negatively and directly influences user's intention for using Bizum P2P.*

Following all previous bases and guidelines for a user's intent analysis, as shown from UTAUT2 model, the independent variables being considered for this study's adoption analysis, PE, EE, SI, PM. FC, CV, Trust, Security and Perceived Risk, are mediating factors, as opposed to behavioral motivators (Fig. 2) acting upon user intent, which are linked to dependable variables.

3. Methodology

In the Methodology section, a standard norm for analysis, collection of data, and scope, are presented.

3.1. Plan-design for data

Based on a two-part questionnaire, first for demographic information and data use disclosure, aligned with eight items; second, it includes matters related to factors measuring the supported concepts, prorated in 38 items of inquiry around ten base-assumptions. The questionnaire is adapted from the context of P2P Bizum system aligned with the analysis tool introduced by Venkatesh et al. (2012) for seven of the UTAUT 2 concepts. Three remaining concepts of analysis are adapted from relevant questions that are main for the purpose of this study. The question rated in a scale from 1 to 5, "totally disagree" to "totally agree", from Likert scale, is preferred for avoiding cognitive bias around 5-point question, as well as minimizing confusion for the surveyed. The five-point standard is recommended for yielding higher quality metrics

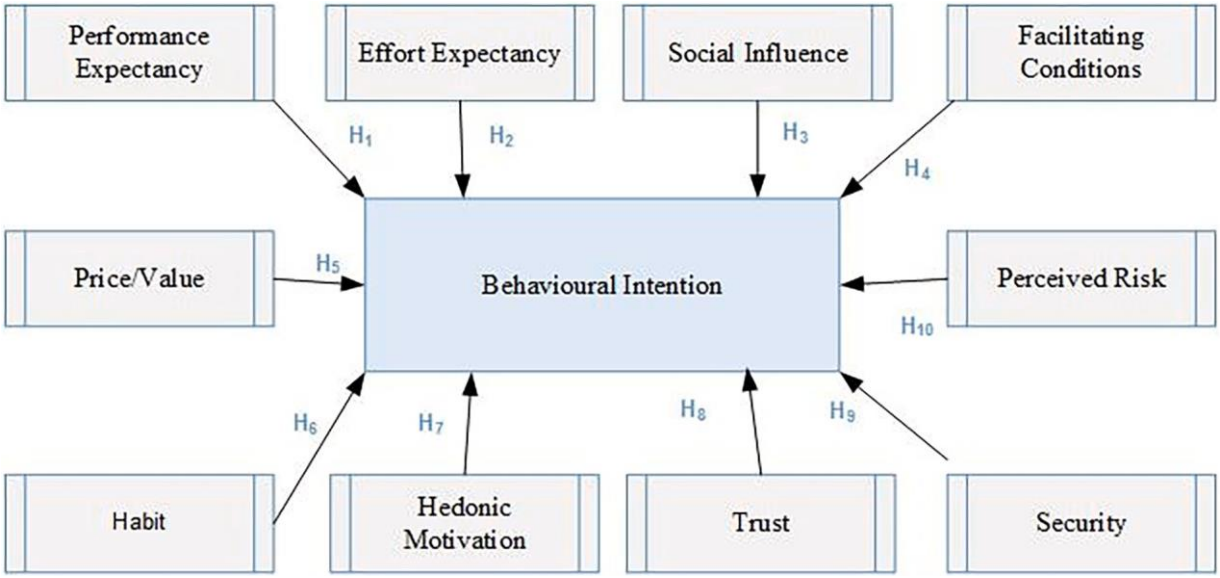

Fig. 2. Proposed model for analysis.
Source: authors, 2022.

(Revilla et al., 2014; Babakus and Mangold, 1992). The number of items for surveying and variables taken into consideration are displayed in Table 1.

3.2. Data collection

Empirical data obtained after the distribution of the questionnaire, was collected from the online Google tool, and in-person via QR code, during the period of January to March 2022. The number of total entries was 334 filled replies. The modality of survey selected was non-probabilistic, for an adequate mode of recollection for the purpose of the survey. The presentation of the analysis, in Table 2, displays the frequency of user demographic band to represent across segments and features average users from the mobile and online banking realms.

3.3. Scope of the sample

One key aspect to consider from a SEM point of view is the scope of the sample; there is not a conclusive standard for a preferred analysis, nor a specific number of responses expected from SEM (Kline, 2011). From a dissimilar standard around variable criteria, some data analysts prefer a minimum entry of 200 cases (Catena Martínez et al., 2003; Hair et al., 2014; Stevens, 2009), while, from parameters standpoint, filtered around concepts/items, the preferred standard is at 100 cases for models

Table 1
Exhibit: variables for analysis.

id	Constructs	Items	Source
1	Performance expectancy	4	Venkatesh et al., 2003
2	Effort expectancy	4	
3	Social influence	4	
4	Facilitating conditions	4	Venkatesh et al., 2012
6	Price/value	3	
7	Habit	3	
8	Trust	4	Lee and Song, 2013, Gefen et al., 2003; Beldad et al., 2010; Hanif and Lallie, 2021.
9	Perceived security	3	Wang et al., 2019; Hanif and Lallie, 2021; Cocosila and Trabelsi, 2016
10	Perceived risk	3	Featherman and Pavlou, 2003

Source: authors, 2022.

Table 2
Surveys: feature profile.

Variable		Frequency	Percentage
Gender	Female	108	64.7 %
	Male	196	35.5 %
	Prior to 1965	6	2.0 %
Age	1965–1979	14	4.6 %
	1980–1999	85	28.0 %
	After 2000	199	65.5 %
Level of education	Elementary School	1	0.3 %
	Higher Secondary School	2	0.7 %
	Bachelor	110	36.2 %
	High Education	191	62.8 %
Use Bank Online	Yes	301	99.0 %
	No	3	1.0 %
Frequency use bank online	0	13	4.3 %
	1–10	184	60.5 %
	11–20	78	25.7 %
	Over 21×	29	9.5 %
Use Bizum System	Yes	304	100.0 %
Frequency use Bizum System	0	15	4.9 %
	1–10	169	55.6 %
	11–20	86	28.3 %
	over 21×	29	11.23 %
Use of Bizum as only option	Yes	130	42.8 %
	No	174	57.2 %

Source: authors, 2022.

with 5 or fewer items, with each of them containing three indicators and affinity levelers over 0.60 (Hair et al., 2014). Some authors stick to a 5 cases per parameter for an adequate sample in AFC (Worthington and Whittaker, 2006). In the case per variable scenario, the expectation is for the sum of all variables included plus the total itemized concepts. From this consistent with the base approach, an adequate sample will present 8 cases for the total items, variables observed and latent ones (Catena Martínez et al., 2003). Additionally, the preference is for 15 cases per item or included variable to obtain a wide representation (Hair et al., 2014). For the present analysis, which follows David Sopper standard, this questionnaire had 40 items observed, 10 latent concepts for parameters, a 0.25 grade of scope and statistics with a potential 0.8 leveler for a 0.05 probability, requiring an entry survey with at least 290 responses.

3.4. Data analysis

3.4.1. Modeling analysis: framework

For technological specific system/user-base adoption analysis, and with the aim of reviewing its suitability in base to the presented framework, as recommended by Anderson and Gerbing (1988), the study is laid in two phases: first, review of the model for data-analysis, and second, assessment of the structural model. From this twofold analysis, after a first filter is applied to data, the results will be accounted according to a modeling-filter, to be validated under SEM.

3.4.2. Introduction: data analysis

The first step towards filtering data, is a demographic approach from a social angle, activating intention and usage, and transferring raw information from the excel sheet to the selected platform, IBM SPPS Statistics 27. By processing the identified variables, the filtering data process during digitation, will purge extreme and abnormal values, while validating previously selected constructs for rating. Out of this preliminary process, 28 responses are left out for lack of relevance/opinion towards 2P2 Bizum payment system. At this stage, not any lacking, uncompromised or abnormal values are to be found. This univariant leveling process of cleaning and filtering data applied under the Kolmogorov test, in order to lay a distribution for the bottom-line, allowed to apply a leveler between a data set against a proposed framework. With a significant overall value under 0.05 points to an abnormal distribution; over 0.05 puts values into the normality threshold. From this standard test, the present data set obtained for the 2P2 Bizum analysis, did not reach the significant 0.05 value, a threshold for considering any data set.

3.4.3. Introduction: filtering modeling

This model for filtering data was assessed via an internal reliability analysis method, convergence validity and discriminatory validity. The Confirmatory Factor Analysis (CFA) was performed with the AMOS 27, a platform that introduced an index in the order of rights adjustment, which, had not been performed will not allow to modify the model for filtering for best extraction model.

3.4.3.1. Psychometric basis and data validation. For the psychometric basis and data validation, a standard base need to be shown. For this, previous to an analysis in the estimation of models, the Mardia average is calculated; this presents us with a normalcy screen test via a multivariant approach from obtained responses, showing a Mardia average required to be present under a 70-point value. The results are standard with a Curtosis = 256.24 and critical band = 54.50; however, considering that asymmetric standards stand at 3, and that curtosis variants remain under 10, the procedure to filter data and analysis is deemed to showcase a valid analysis for standards of reliability.

Variant Convergence evaluates the maximum degree for selected items to be highlighted via latent concepts from the framework by trying out the constructs that need disaggregation, depending on reliability (CR), item reliability (algorithmic potential value), and average variable extracted (AVE). There is acceptance of framework concepts present in CV anytime that CR surpasses the standard 0.70 (Heinzl et al., 2011); in addition, AVE is over 0.50 (Hair, 2009) and the averaged variables relating to the concepts have an established value over 0.70, or at least of 0.50 (Hair, 2009). All the variables rated in the average equation AVE are above the threshold 0.50 for our case study; also, CR average values are above 0.70. Having eliminated 14 entries for low latency, cross-sectional latencies and for optimizing analysis towards data validation, the overall results support CV scale. Finally, Alfa Cronbach is not included for lack of CR, arising from different values assigned to different items (Chin, 1998). The following Table 3 shows the variables AVE and CR.

Variant convergence works to verify that items for a latent construct

Table 3
Algorithmic potential value.

Constructs	Items	Standard loadings	CR	AVE
Performance expectancy	PEE2	0.78	0.736	0.583
	PEE4	0.74		
Effort expectancy	EE1	0.77	0.815	0.526
	EE2	0.73		
	EE3	0.75		
	EE4	0.65		
Social influence	SI1	0.87	0.895	0.74
	SI2	0.84		
	SI3	0.87		
Facilitating conditions	FC1	0.75	0.764	0.619
	FC2	0.82		
Hedonic motivation	HM1	0.88	0.837	0.635
	HM2	0.67		
	HM3	0.83		
Price/Value	PVA2	0.90	0.898	0.815
	PVA3	0.91		
Habit	HBT1	0.83	0.767	0.623
	HBT3	0.75		
Trust	TR3	0.62	0.7	0.544
	TR4	0.84		
Perceived security	PSE1	0.90	0.867	0.765
	PSE2	0.84		
Perceived risk	PRI1	0.77	0.832	0.622
	PRI2	0.81		
	PRI3	0.79		
Behavioral intention	BI1	0.64	0.827	0.619
	BI2	0.82		
	BI3	0.88		

Source: authors, 2022.

are not linked, as required, and that these remain unchained to any other construct. First step is Fornell & Larcker test by which a contrast in the square root of AVE to any provided variable runs a value (Barclay et al., 1995). In order to obtain a feasible variant necessarily the value obtained is higher than its correlation values to other constructs (Fornell and Larcker, 1981; Hair et al., 2016). Sectional values measured across, also need to show a higher value in columns and rows (Henseler et al., 2009). For each construct, a value for AVE (shown in bold in Table 4) was over the values of correlations; so, this attests a necessary degree in AVE. The ratio will validate constructs for each factor, considering that the scale assesses models in a hierarchical relationship, by graded levelers. According to the items, the quotients under 1 point, for a conservative standard approach, around 0.90. By adding into the equation factors of Trust and Perception of Risk, which are values above 1, it is shown a correlation for the two items leveled within the same construct (see Table 5); for the present study the factors are omitted as it is seen in Table 6. After this adjustment to variants measured under 0.90 to follow the standard HTMT criteria, survey, and data analysis yield values for validation of the assessment of latent variables and constructs, leveled via AVE. Then, both, AVE and CR remain verifiable.

3.4.3.2. Adjustment of grading model. Once the estimated model for assessment for the quality of variables in data is provided, then a statistic goodness of fit is required for the adjustment: index of adjustment chi-square divided (CMIN/DF), goodness of fit index of adjustment contrast (CFI), square of residual approximate average (RMSEA) and p, a Close Fit (PCLOSE). Table 7 shows the adjustments, as follows:

Correlations and framework chains are represented in Fig. 3.

3.5. Structural assessment model

The evaluation of the framework will follow over the next sections to assess modeling validity and research guides.

Table 4
Model for values: reliability and variant convergence (Fornell & Larcker Test).

	PE	EE	SI	FC	HM	PV	HB	TR	PS	PR	BI
PE	**0.763**										
EE	0.337***	**0.757**									
SI	0.658***	0.362***	**0.86**								
FC	0.262**	0.859***	0.304***	**0.786**							
HM	0.534***	0.226**	0.388***	0.137†	**0.86**						
PV	0.369***	−0.046	0.211**	−0.043	0.259***	**0.903**					
HB	0.547***	0.377***	0.450***	0.443***	0.268***	0.227**	**0.79**				
TR	0.455***	0.503***	0.508***	0.531***	0.356***	0.212**	0.693***	**0.737**			
PS	0.390***	0.485***	0.411***	0.497***	0.318***	0.182**	0.664***	1.025***	**0.875**		
PR	−0.071	−0.230**	−0.071	−0.234**	0.081	0.191**	−0.215**	−0.325***	−0.365***	**0.789**	
BI	0.508***	0.335***	0.473***	0.405***	0.290***	0.185**	0.899***	0.588***	0.544***	−0.177*	**0.857**

Square root of average variant in sectional representation is shown in bold. Elements outside the sectional divide represent a shared variance.
Significance of Correlations: † $p < 0.100$; * $p < 0.050$; ** $p < 0.010$; *** $p < 0.001$.
Source: authors, 2022.

Table 5
Ratio Heterotrait-Monotrait (initial).

	PE	EE	SI	FC	HM	PV	HB	TR	PS	PR	BI
PE											
EE	0.348										
SI	0.657	0.39									
FC	0.272	0.898	0.303								
HM	0.567	0.33	0.47	0.266							
PV	0.37	0.023	0.217	0.042	0.27						
HB	0.545	0.432	0.442	0.438	0.358	0.22					
TR	0.465	0.533	0.532	0.547	0.461	0.21	0.724				
PS	0.397	0.497	0.413	0.501	0.397	0.18	0.657				
PR	0.071	0.231	0.076	0.237	0.041	0.2	0.222		0.383		
BI	0.505	0.483	0.467	0.504	0.376	0.18	0.924	0.677	0.624	0.27	

Thresholds are 0.850 for strict and 0.900 for liberal discriminant validity (Henseler et al., 2015).
Source: authors, 2022

3.5.1. Assessment of validation

Once the assessment of the model and the applied equations are completed, the sample needs to be validated; for that purpose, N de Hoelter critical index is applied showing a significant level in the value 0.05, equivalent to 95 % trust (Hoelter, 1983; Bollen and Liang, 1988). Software applied for the assessment is proprietary AMOS 27. The proper threshold for bottom-line adjustments stands at 200, and values under 75 are rejected. (75 ≤ value <200; acceptable ≥200) (Garson, 2014; Wan, 2002). The scope of the sample with 304 surveys is acceptable according to Holters procedure; the minimum threshold for a valid sample remains 243 questionnaires for an overall 95 % reliability.

3.5.2. Modeling assessment

The model presents four standard levelers acceptable for adjustment of the framework, with the intent of assessing the richness of the general framework. This framework rendered similar results to the confirmation model by complying with its requirements for adjustments (CMIN 0,817, CFI 0,945, RMSA 0,932, PClose 0,944). The results led evidence that the model complies with data validation needs. Finally, with the objective in sight of predicting user intent of P2P adoption, the R^2 is a quotient that needs to be obtained; the coefficient is 0.825, translates into user adoption estimated at 82.5 %.

Additionally, the chain relation between concepts in the framework will be provided, followed by inter-dependable variables and dependable ones, for providing a Beta β quotient and *p* value. Based on a first approach to the analysis, the seven guidelines proposed as factors impacting user intent, by inquiring into the Bizum P2P system. The preliminary items taken from SEM (Table 8) will show that guidelines 3 and 7, factors significantly impacting adoption. The resulting guideline, as shown, expects that habit and social influence alike, will link to further utilization of P2P mobile payments. From the ratios, it follows that habit is a strong predictor, over user intent for adoption (β = 0,665, $p < 0,001$), followed by social influence (β = 0,087, $p < 0,050$); the

Table 7
Goodness of fit adjustment for final modeling.

	CMIN/DF	CFI	RMSEA	PCLOSE
Values researched	1.435	0.978	0.038	0.98
Desired values	Between 1 and 3	>0.95	<0.06	>0.05
Interpretation	Adjustment data excellence	Adjustment contrast excellence	Error approximation to zero, almost excellent data modeling	Adjustment excellence

Source: authors, 2022.

Table 6
Ratio Heterotrait-Monotrait (final).

	PE	EE	SI	FC	HM	PV	HB	PS	PR	BI
PE										
EE	0.347									
SI	0.657	0.365								
FC	0.272	0.86	0.303							
HM	0.532	0.23	0.393	0.15						
PV	0.37	0.04	0.217	0.042	0.263					
HB	0.545	0.381	0.442	0.438	0.266	0.22				
PS	0.397	0.49	0.413	0.501	0.314	0.18	0.657			
PR	0.071	0.232	0.076	0.237	0.079	0.2	0.222	0.383		
BI	0.531	0.339	0.478	0.405	0.305	0.19	0.9	0.556	0.182	

Thresholds are 0.850 for strict and 0.900 for liberal discriminant validity (Henseler et al., 2015).
Source: authors, 2022.

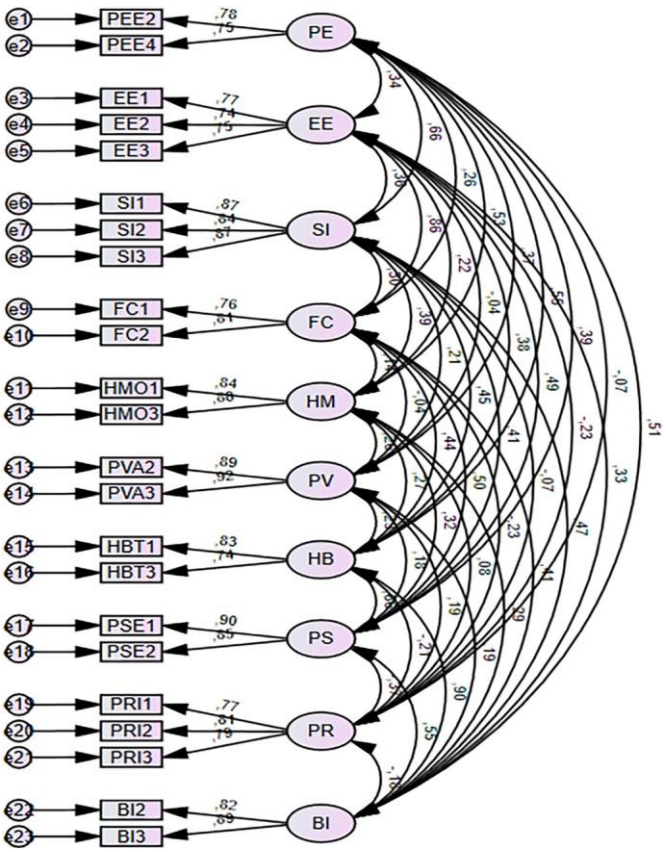

Fig. 3. Final grade/ratios model.
Source: authors, 2022.

Table 8
Framework equations applied model resulting from UTAUT2.

Guidelines	β	t value	*p* value	Decision
H1: Performance Expectancy➔Behavioral Intention	—0.051	—0.634	0.526	Unsupported
H2: Effort Expectancy➔Behavioral Intention	—0.04	—0.351	0.726	Unsupported
H3: Social Influence➔Behavioral Intention	0.087	1.666	0.096	Supported al 90 %
H4: Facilitating Conditions➔Behavioral Intention	0.05	0.43	0.668	Unsupported
H5: Hedonic Motivation➔Behavioral Intention	0.057	1.189	0.235	Unsupported
H6: Price Value➔Behavioral Intention	—0.013	—0.314	0.754	Unsupported
H7: Habit➔Behavioral Intention	0.665	8.238	***	Supported

Measurement correlation-values: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$.
Source: authors, 2022.

degree of reliability lies at 90 % for this last factor, considering that *p* value is in a scale 0,05-0,01. Other guidelines result in values less significant for measuring a user's intent in mobile payment systems adoption are the following: "Performance Expectation" (β = 0,051, $p > 0.100$); "Effort Expectation" (β = 0,04, $p > 0,100$); "Facilitating Conditions" (β = 0,05, $p > 0,100$); "Hedonic Motivation" (β = 0,057, $p > 0,100$); and "Price/Value" (β = 0,013, $p > 0,100$).

Next, a second inquiry, central to the study, poses the question: How are other factors that rely on emotional values, such as, trust, security, and perceived risk, impacting user intent and adoption of P2P systems? These guidelines are graded based on three constructs grounding the research and the results, as shown below. The feature SEM values, as compiled, are security (H8) at β = —0.099, $p > 0.100$; and risk perception (H10) at β —0.016, $p > 0,100$ (See Table 9).

Correlations and framework chains are represented in Fig. 4.

4. Results and discussion

Since a main objective set a need of delimiting those factors relevant to behavioral intention for Bizum P2P, the ground for research around the Model UTAUT2 is set around the above depicted guidelines for measuring a rate in the areas of *Trust*, *Security* and *Perceived Risk*.

Whereas factors like *Habit* and *Social Influence* are significantly impacting *Behavioral Intention*, only *Habit* is strongly impacting P2P adoption. To this bottom line considerations relative to duties and stipulations around usage, in the context of financial operations, other considerations relative to development and specific tech insights for Spain, are individual perceptions, skill and experience; these are highlighted, also, as relevant from a socio-geographical context for the study.

There is a noticeable change in habits associated with payment modes in Spain after the global health pandemic crisis of Covid-19. Resulting from this shift, cash transactions are left as second choice after debit transactions. *Banco de España* in a report published in 2021 presented this data supporting the shift towards credit/debit, interact methods of payment, up to 36 % Spanish population declared this option as their preferred method of payment for daily transactions. Most significantly, a 61.2 % of the population responded to have modified habits as a result of the restrictions and protective measurements imposed by health authorities during the period of confinement and emergency health alert, as well as commercial outlets favoring interact payments, with a 2.5 % of the citizens reporting completely deflect cash for sanitary causes and risk of infection. Mainly the trend will continue, since a high percentage, according to the study (Gavilan, 2022), will continue to maintain the new norm for no cash transactions after pandemic restrictions revert (69.1 % and 61.3 % as recorded for individuals and businesses). Since recommendations remain a cautionary measure in favor of alternative payments methods not involving cash handling or small change for most of the areas under influence of Health Authorities, there is an evident shift on modes of transactions and interacting with money in Spanish territories.

According to a report tool for innovation in finances, *Barometro*, this percentage increased with more people using mobile platforms for payments up to 58.22 % from a pre-pandemic level, 55.66 %. This percentage continue to increase during second wave and well into 2020, to reach a 63.22 %. This resulted in a banking system use increase parallel to a greater number of users selecting P2P platforms and options for online. As such, Bizum P2P for personal money orders and non-commercial transactions (individuals), increased its rate of use from 62.79 % to 75.26 %, with the higher lapse growth after a second wave, from 65.93 % (Barómetro de Innovación Financiera *2021, 2022*; Saura et al., 2022). For a great area of Spanish population, P2P systems

Table 9
Results model for structural equations added variables.

Guidelines	β	t value	*p* value	Decision
H8: Trust ➔Behavioral Intention	–	–	–	–
H9: Security ➔Behavioral Intention	—0.099	—1.441	0.000	Unsupported
H10: Perceived risk➔Behavioral Intention	—0.016	—0.378	0.272	Unsupported

Measurement correlation-values: † $p < 0.100$ * $p < 0.050$ ** $p < 0.010$ *** $p < 0.001$.
Source: authors, 2022.

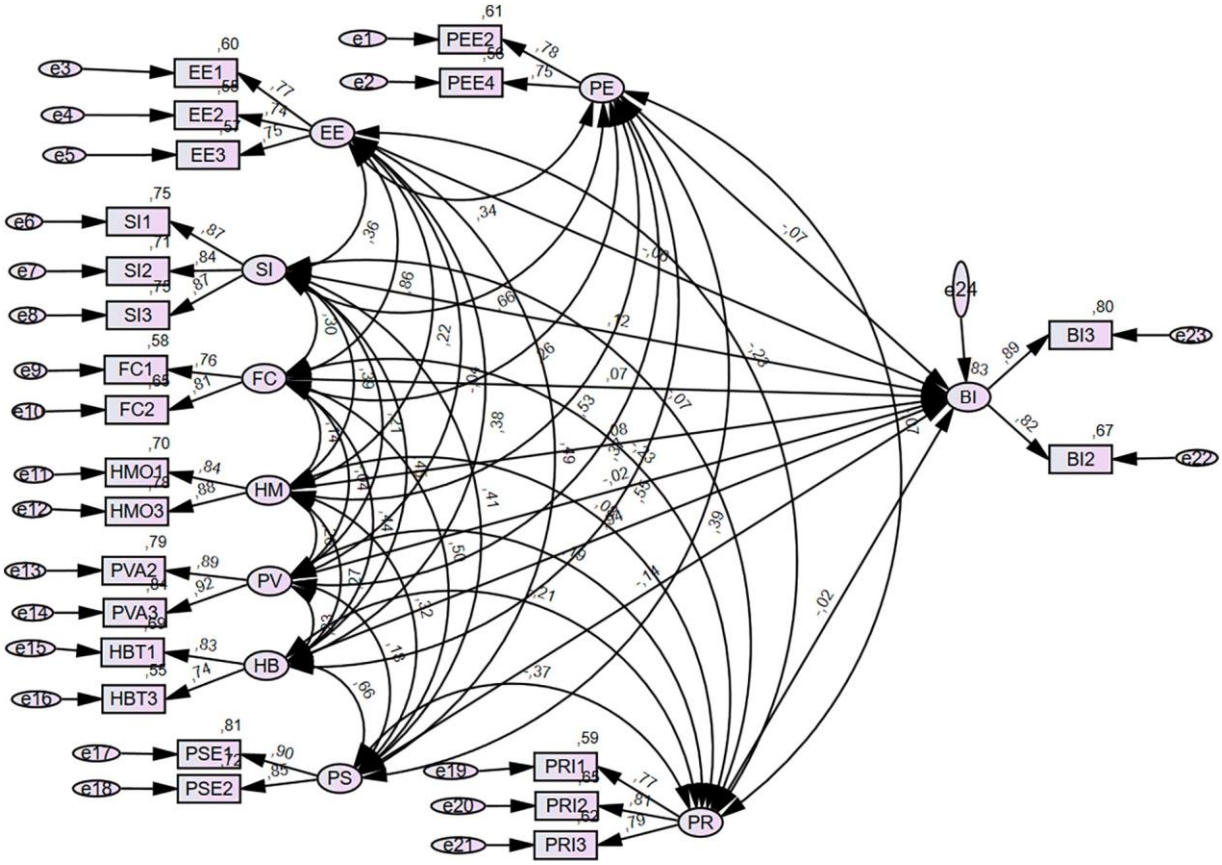

Fig. 4. Final structural-model.
Source: authors, 2022.

represent a convenient method of payment even if the resort to adoption was fueled by factors out of their control. One factor to consider in consolidating new systems to replace cash payments, arising from sector's aim at digitization for banking services and remote working tools during the pandemic closures. This reflected in the closing of physical in-location offices, around 50 % offices from 2008 to 2020, and up to 20 % decrease in bank teller spots; the consequence most obvious for closures linked to less accessible via convenient points of access to cash, in turn, resulted in a change in behaviors.

Habits are developed at the time when behaviors become recurrent; that is why later, behaviors respond to automatic stimulae and result from a controlled environment. Habits affect directly user intention without resulting from a rational process. Even though researchers have pointed to rational process in decision making, regarding user intention in use of P2P mobile (Hu et al., 2021; Jegerson and Hussain, 2022; Liu et al., 2022;). Theories in habits and user behavioral intention establish that set behaviors become repetition in order to form a habit, with rational processes being external to this process (Aarts and Dijksterhuis, 2000). For the study, users integrate P2P to daily routines, so after repeated use and continued money transfers via mobile, this routine becomes habit around patterns in money management. With increased use and frequency of payments, P2P users adapt to the technology to form a habit overtime. Habit represents a determining factor into building a use around P2Ps.

A set of habits can be activated as a variable for the study of leading factors into technology acceptance (Suo et al., 2022; Penney et al., 2021; Pasaribu and Rabbani, 2022), for a new approach into factors, thus, considering this variable irrelevant to user intention (Marpaung et al., 2021; Martinez and McAndrews, 2022).

Social Influences significantly impact user intent around family values, colleagues, and behavior expectation related areas ($\beta = 0.087$, $p < 0.050$). Overall findings reported for young respondents linked user intention with family opinion based on Spanish lifestyle and level of dependence as part of a family unit for living.

Some critical studies on social influence found that these variables are a factor actively influencing user intention (Suo et al., 2022; Nur and Panggabean, 2021; Penney et al., 2021; Migliore et al., 2022) versus scholars reporting that SI are not relevant (Hasyim, 2022; Kadir and Ismail, 2022; Pratama and Renny, 2022; Tang et al., 2021). For the objective of the present study, positive experiences linked to P2P mobile are shared within a network of friends and acquaintances, a milieu that in turn, favorably impacts an expanded use in each market segment.

Performance Expectation leads towards consumer decision making in payment choices based on the degree of accessibility via mobile technology (Madan and Yadav, 2016; Moorthy et al., 2020). For the present study, this factor yielded β=0.051, and $p > 0.100$; PE was not determinant even though there is an underlying link to user intent from a behavioral standpoint in adopting mobile technology (Abdullah Omran et al., 2017). This is consistent with previous scholarly reported results in critical studies (Hasyim et al.; 2022; Kurniadi and Hendityasari, 2021; Sankaran and Chakraborty, 2021: Maharani, 2021; Pasaribu and Rabbani, 2022; Kadim and Sunardi, 2022).

Effort expectation ($\beta = 0.04$, $p > 0.100$) does not predict user intent in P2P technology due to previous knowledge and experience, since most of the participants are knowledgeable and standard users of electronic payment systems. Mobile payment technology is immediate and accessible in contrast to other methods of payment like credit cards and cash; for these users, the new technology appears as a reasonable option that can be integrated with traditional methods of payment, as it has been reported in previous scholarly literature (Suo et al., 2022; Winata and Tjokrosaputro, 2022; Nur and Panggabean, 2021).

Facilitating Conditions appear as non-conditioning for behavioral

adoption of P2P systems due to extended usage of mobile (β= 0.05, $p > 0.100$). Mobile users were already familiarized with their devices and did not need assistance for effectuating a payment via their device/platform. P2P technology seems intuitive and easy to use, with Bizum illustrating everyday transactions via platform payments and other banking transactions. This easy handling makes other additional support unnecessary and irrelevant towards user adoption; as such, *Effort Expectancy* cannot be accounted as an intrinsic motivation in decision making from a user's intent standpoint. This has been pointed out in previous studies (Suo et al., 2022; Martinez and McAndrews, 2022; Marpaung et al., 2021; Pasaribu and Rabbani, 2022; Penney et al., 2021; Pratama and Renny, 2022).

Hedonic Motivation (β=0.057, $p > 0.100$) and Price/value chain (β 0.013, $p > 0.100$), were not accounted as significant values in user intent towards P2P systems utilization. On the one hand, *Price/value* had no impact in adding a cost to the device use; on the other hand, linking value to hedonic motivation, highlighted that there is a lack of positive perception attaching the transaction for any user will be automatically completing a payment transaction, which decreased their assets. Then, HM becomes irrelevant as shown in previous studies (Suo et al., 2022; Al-Sabaawi et al., 2021; Maharani, 2021; Penney et al., 2021), along with PV (Kurniadi and Hendityasari, 2021; Maharani, 2021; Rabaa'i, 2021).

Security (β = —0.099, $p > 0.100$) and Risk perception (β = —0.016, $p > 0.100$) are not influencing factors significant to adoption, since major financial institutions are main providers of services for mobile payment. Bizum users are backed up by Spanish major players in Banks. Underlining this sense of security regulations from relevant European Commission for encryption technology in Credit/Debit card terminals, is placed accordingly since issuing a Payment Services Directive in 2019 (PSD2). With the aim of improving security and reinforce protective measures, this policy framework establishes guidelines for protecting bank users, including up to 50 euros maximum loss resulting from fraud and unauthorized transactions. This resolution is valid for claims within a maximum 15-day period after irregular use of payment or fraud detected in credit/debit cards. Additionally, a two-step verification process became standard for added security (2FA), to obtain proof of identity by means of checking on a set of information from personal profile: mobile phone number, credit/debit card or digital signature (known elements); password, pin number, digital trace (inherent elements). Therefore, *Security* and *Risk Perceived* are not determining user intention and these variables, stay unaccounted.

Another factor to account for security and perceived risk as non-determinant variables for technology use in Spain, is habit, considered independent from any rational line of mental processes that could lead to a specific technology use, upon implantation of the new system. Usage and rationalization would not explain alone adoption built into habit. Then, security (Pratama and Renny, 2022) and perceived risk remain prevalent to account for P2P usage in Spain (Al-Sabaawi et al., 2021; Belanche et al., 2022; Pratama and Renny, 2022; Widyanto et al., 2021).

In sum, after obtaining guidelines for the study and analysis of factors in adoption of mobile P2P, for a total 82.5 % user-base, there are two standing variables predicting Behavioral Intention: *Habit* and *Social influence*. This outcome validates a higher percentage after the preliminary presuppose around 74 % estimated in line with UTAUT2 framework in Venkatesh et al. (2016).

5. Conclusions

User behaviors around payment methods evolved prominently during the last global pandemic outbreak from 2020 and onwards. Bank digitization adapted fast to the renewed environment imposed by confinement and curfew restrictions, a background conditioned by health restrictions that facilitated the changes in selected methods of payment, introducing new technologies. There are several studies contrasting opinions around preferred methods for payment, and these noted a change in habits arising from this environment. In fact, many conventional uses and social interactions linking to money operations and exchange, even everyday transactions like splitting the check in a restaurant or funding a giftset from a group, mobile payment established itself as the preferred platform becoming a common, regular, option to be prompted among diverse methods of payment available. Considering the framework and guidelines for analysis presented as hypothesis for adoption, the changes in *Behavioral Intention* that are significant, arise from two well-defined predictors, *Habit* and *Social influence*, for a total percentage user –base of 82.5 %. Other variables that were included as part of the motivation/behavioral framework in P2P mobile adoption, *PE, EE, FC, PV, HM, Trust, Security,* and *Perceived Risk,* were not significant.

Finally, the theoretical framework underlying the data analysis allowed a systematic approach by using concepts and measuring variables, since it underlines the predominance of Covid-19 as an external factor considerably affecting habits in Spain with regards to Bizum platform and the use of other P2P mobile platforms. *Habit* is significantly relevant, one variable above others impacting adoption. For future adoption analysis, the range of factors taken in consideration may potentially vary to narrow the variables that are directly linked and most significant, this shift resulting from societal changes derived from pandemic virus. Setting a framework that aligns with UTAUT2, as pointed at the beginning of this study, adds a nuanced picture to technology adoption, in line with previous standards, by adding new data to the research on cognitive behaviors around information systems and mobile technology.

Additionally, studies linking technology acceptance in P2P mobile to attitude and intention (Daragmeh et al., 2021; To and Trinh, 2021; Srivastava and Singh, 2022) show that unlike other areas of technology directly linking a behavioral approach to user impact, these fields of study underpin the effect from the M-learning environment (Cao & Nguyen, 2022), Ai (Robinson et al., 2022), e-commerce (Chen et al., 2022), and validate this approach to habit. Our study represents one of the first research to validate such an influence on P2P and validate this approach to habit. Our study represents one of the first research to validate such an influence on P2P mobile payments, as the hypothesis suggest that habit has a more significant impact than attitude on users' behavioral intention towards P2P mobile payments.

5.1. Theoretical contributions

Contributions to the theoretical ground in this area of UTAUT2 research, arise from an integrated model suggested as a holistic understanding for adoption, around the overall P2P mobile systems, after Pandemic crisis. In Spain, specifically, considering a growing industry, previous studies are limited for similar undertakings and data analysis. By extending the presented model from UTAUT2 to assess common variables aligned with constructs from the theory, including trust, security and perceived risk, the study aligns with a known set that has been empirically validated. In line with a high predictive strength connected to user intention, the same method and variables will apply in a wider segment for technology systems within the mobile payment technology, NFC, QR, and B2B. As seen, habit stands as the variable most revealing around behavioral user intention, and habit can be a focus for research aligned in the technology adoption environment. The proposed method and chain of hypothesis are cohesive with habit leading towards P2P in the described user environment, a main factor considering that consumer behavior appears from a rational process. In retrospect, the evolution of technology and user adoption rounds to our objective, namely, presenting a complete analysis and methodological framework that weight in habit in an adoption framework, delimited by social influences, from a positive light.

5.2. Managerial implications

Some of the results derived from the study, also, align with expectations from P2P users and network service providers, developing application systems. One implication linking design towards technology implementation will set a redesign feedback loop that connects with users' common needs and expectations. From this potential upgrade towards a future in applications perspective, it is suggested to:

1) Easy payment systems into social interactions by means of sharing recommendations and/or product/service satisfaction surveys. This will add visibility and access to consumer demographic bands previously unreached.
2) Consider P2P providers via mobile platform since it will help identify and evaluate those elements interacting with routines and habits around consumers' interests. One plausible path is offering a simplified mobile payment system for users to be able to experiment its benefits and the ability to adapt it to their needs.
3) Avoid commission sales for financial services, as providers of technology and methods of payments in the P2P; for added security and trust built into the P2P system, incentives can be offered.
4) Demonstrate the utility and ease of use of these technology-based tools.

5.3. Limitations and future research directions

The sample for this study is laid transverse from a short time frame and, for this nature, user perceptions are prompt to varying and evolving over time in the specific utilization of P2P system with new knowledge and improved skills. A longitudinal study is feasible in order to obtain a more reliable base with predictors for specific demographic bands.

One limitation associated with a delimited geographical scope surfaces from plausible future lines of investigation, considering that the findings and outcomes are applicable only to the setting described. However, since the insights, by means of contrasted studies and segmented findings by geographical areas, can be activated to other cultural settings, the showcased theoretical ground proves to bring up those variables that are relevant into a geographically delimited technology market, for confirmation or rejection, as these tie in a specific set of devices and P2P systems. In this sense, survey participants are bounded to a Spanish network of interactions that will differ from different geographic areas and regions.

The applicable demographic band in the survey needs to bring a cautionary note into the report and assessment, considering that most of the respondents are in the 18–22 years old (65.5 %), a digital native generation that relies on mobile use for a great part of their routines and habits. This consideration opens a new avenue for enquiry, in order to focus on an older population and their use of technology systems for payment.

Finally, considering the scope around a unique application, Bizum P2P, and extending the number of platforms surveyed will allow assessment on a cross-sectional board to analyze Google Pay, Apple, Pay Cash, and Paypal. Additional bands for criteria will narrow age, income level, and urban/rural population. In terms of P2P mobile adoption within Spain, a future study around a vertical-segmented view, will lead to identifying changes in user intent and mobile adoption for the Spanish population.

Declaration of competing interest

We confirm that neither the manuscript, nor any parts of its content are currently under consideration or published in another journal, and there are no conflicts of interest. Also, this research hasn´t received any grant.

Data availability

Data will be made available on request.

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Capítulo 6

Conclusiones

1. Conclusiones y respuesta a las preguntas de investigación

Esta investigación surgió por la necesidad de dar respuesta a las preguntas recurrentes en cualquier innovación tecnológica ¿cuáles son los factores que contribuyen a que los individuos adopten las tecnologías? ¿cuál es el modelo o teoría más apropiado que deberíamos seleccionar para estudiar la aceptación o rechazo de estas tecnologías? ¿podemos aplicar este modelo o teoría y predecir la intención conductual de usar la tecnología? Se planteó como objetivo general identificar, comprender y estudiar los factores que influyen en la intención de uso de la tecnología durante la Covid-19, como objetivos específicos 1) realizar una revisión histórica de los modelos y teorías para seleccionar aquella teoría o modelos que sean más adecuados para el estudio de la tecnología actual 2) seleccionar dos innovaciones tecnológicas, asistentes virtuales y P2P Bizum, para aplicar el modelo o teoría escogido 3) desarrollar un modelo predictivo que nos ayude a eliminar los obstáculos en la aceptación y adopción de la tecnología.

Se ha dado respuesta a la primera pregunta ¿cuál es el modelo o teoría más apropiado que deberíamos seleccionar para estudiar las tecnologías actuales? A través de una revisión de la literatura, se han utilizado dos enfoques híbridos, el análisis de contenido y el enfoque bibliométrico, se ha conseguido realizar un análisis exhaustivo sobre los diferente modelos y teorías desarrollados a lo largo de los años que explican la aceptación de la tecnología. Para realizar este estudio se extrajo la información de la base de datos de Web of Science seleccionado un conjunto de metadatos que han sido posteriormente analizados.

En este análisis de contenido se ha explorado y descrito las principales teorías y modelos que se utilizan para intentar explicar y predecir el uso de la tecnología: la Teoría de la Difusión de la Innovación (IDT), la Teoría de la Acción Razonada (TRA), la Teoría del Comportamiento Planeado (TPB), la Teoría Social Cognitiva (SCT), el Modelo de Adopción de Tecnología (TAM), el Modelo de Adopción de Tecnología (TAM 2), el Modelo de Adopción de Tecnología 3 (TAM 3), el Modelo de Utilización del PC (MCP), el modelo de utilización del PC (MPCU), el Modelo Motivacional (MM), el Modelo Combinado TAM-TPB (C-TAM-TPB), la Teoría Unificada de Aceptación y Uso de Tecnología (UTAUT) y la Teoría de Aceptación y Uso de la Tecnología extendida (UTAUT2). A continuación, se han definido las principales variables conceptuales, así como el ámbito de actuación y el número de artículos de investigación de cada teoría. Los resultados confirman que todas las teorías siguen vigentes y son una fuente de investigación para la comunidad científica.

El estudio también nos muestra que estas teorías y modelos son similares en su estructura, pero diferentes en su explicación del comportamiento y uso de la tecnología. Algunas teorías provienen de la sociología (IDT), la psicología social (TRA) o teorías psicosociales (SCT y TPB), cambia el enfoque utilizado ya que algunos intentan explicar los comportamientos humanos (TRA y TPB), la influencia de las organizaciones en la aceptación y no en el individuo (DOI), pronosticar un comportamiento (SCT y TPB) o conocer las creencias de la tecnología (TAM, UTAUT Y UTAUT2).

Con el foco en los últimos cuatro años 2018-2021. Los resultados muestran que las teorías IDT y UTAUT/UTAUT2 han tenido una mayor producción en este periodo que en el histórico: un 65% en el caso de IDT y un 52% en la UTAUT/UTAUT2, esto podría deberse al interés y la preocupación que suscita en los investigadores la aceptación de la tecnología como consecuencia de la trasformación digital de muchos países, sectores y empresas como consecuencia de la Covid-19. Las tres teorías con una mayor producción son: IDT, teoría sociológica con 573 investigaciones, TAM/TAM2/TAM3 con 3.422 investigaciones y la UTAUT/UTAUT2 con 1.859 investigaciones, estas dos últimas teorías se desarrollaron específicamente para predecir y explicar el comportamiento de los humanos frente a la tecnología.

Por lo que los resultados confirman que, aunque todas las teorías siguen vigentes y son utilizada por los investigadores, las que se utilizan para estudiar específicamente la tecnología emergente son IDT, TAM/TAM2/TAM3 y la UTAUT/UTAUT2.

Estas tres teorías en la actualidad se aplican en el ámbito digital con el estudio de la aceptación de la inteligencia artificial, aplicaciones móviles, tecnología de asistencia, realidad aumentada, blockchain, classroom, vehículos autónomos, la nube, comercio electrónico, tecnología computacional y plataformas diversas como e-salud o e-learning entre otras.

Para realizar el análisis bibliométrico se han seleccionado dos teorías, su elección ha sido justificada por lo datos resultantes del análisis de contenido, ya que se han seleccionado las que tienen un mayor número de publicaciones en el periodo de la Covid-

19, la TAM/TAM2/TAM3 con 3.422 documentos y la UTAUT/UTAUT2 con 1.859.

A través de este análisis, se han elaborado indicadores y modelos matemáticos con los que se ha examinado retrospectivamente como se ha llevado a cabo el avance de investigación de estas dos teorías, su desarrollo, obsolescencia y dispersión, y por último evaluar el potencial del tema investigado mediante el análisis de las tendencias (White y McCain, 1989), con el objeto de seleccionar la teoría más relevante para realizar el análisis empírico.

En la TAM/TAM2/TAM3, las ratios muestran que en la producción científica hay una mayor colaboración entre los autores (2,69 autores por documento), pero más autores transitorios y menos especializados. Se cumple el modelo de Bradford (núcleo-57, zona 1- 89, zona 2-988 revistas). Pero tienen un menor número de citas, autores, instituciones y mapas de colaboraciones que en la UTAUT/UTAUT2.

En la UTAUT/UTAUT2, las ratios muestran que en la producción científica hay una menor colaboración entre los autores (2,51 autores por documento), pero más autores especializados y menos transitorios. Se cumple el modelo de Bradford (núcleo-50, zona 1-320, zona 2-1458 revistas) y se confirma que tiene un mayor número de citas, autores, instituciones y mapas de colaboraciones que la TAM/TAM2/TAM3.

Los resultados son relevadores ya que muestran que la teoría de la UTAUT/UTAUT2 es más robusta y se aplica más frecuentemente para el estudio de toda la tecnología emergente, esto se ha confirmado con las ratios de estructura, contenido y calidad y

también con un análisis semántico de secuencias de palabras que nos ha permitido analizar la temática y las tendencias de investigación. Esto es coherente y coincidente con los resultados del primer análisis de contenido, ante estas evidencias empíricas, se decidió seguir la investigación con la teoría UTAUT/UTAUT2. Al estar la UTAUT orientada al contexto de las organizaciones, Venkatesh et al. (2012) desarrollaron la UTAUT2 incluyendo tres nuevos constructos: la motivación hedónica, precio/valor y el hábito, factores orientados hacia la aceptación de la tecnología por parte de los consumidores. Como nuestro estudio está basado en los consumidores se seleccionó la teoría de la UTAUT2 para el estudio empírico.

Las dos tecnologías digitales para la aplicación de la UTAUT2 fueron los asistentes virtuales y el P2P Bizum, denominadas también Industria 4.0, por su novedad y porque han logrado que con su impacto proporcionen un beneficio para la sociedad, supongan una nueva revolución tecnológica, pero también porque existe un vacío de conocimiento y por lo tanto una necesidad de estudiar el impacto de la Covid-19 en España en estas dos tecnologías.

Los asistentes virtuales y la aplicación P2P Bizum se han vuelto cada vez más populares y han tenido un gran desarrollo durante la pandemia. Al estar confinados y disponer más tiempo los asistentes virtuales han ayudado a tareas de entretenimiento como escuchar música, dar información, resolver dudas y en algunos casos simplemente como compañía ante la soledad del encierro. En el caso de P2P Bizum su uso se ha popularizado por la velocidad, conveniencia, eficiencia y seguridad de los pagos como protección frente a la pandemia.

Por lo que, para responder a las siguientes preguntas de investigación, ¿cuáles son los factores que contribuyen a que los individuos adopten las tecnologías? ¿podemos aplicar este modelo o teoría y predecir la intención conductual de usar la tecnología? ¿En qué medida el modelo de la UTAUT2 predice la intención de usar los asistentes virtuales y P2P Bizum? Se ha realizado la última parte de esta investigación, y después de hacer una extensa revisión de la literatura de ambas tecnologías, se han definido dos mapas conceptuales que sustentan las hipótesis para dibujar las relaciones de las variables estudiadas con la intención de usar la tecnología con el objeto de determinar cuáles son los factores que influyen en la intención del usuario de usar los asistentes virtuales y P2P Bizum. De este modo se diseñan sendos modelos predictivos para predecir la intención conductual. Se aplicó la teoría de la UTAUT2 con los factores a) Expectativa del desempeño b) Expectativa del esfuerzo 3) Influencia social c) Condiciones facilitadoras d) Influencia social 2) Precio-valor y f) Hábito. Para los asistentes virtuales se han añadido los factores de confianza, innovación personal y percepción de riesgo de privacidad. Para P2P Bizum se han añadido los factores de confianza, seguridad y riesgo percibido. Esta extensión del modelo ha quedado justificada a lo largo de las definiciones de las hipótesis, ya que las variables seleccionadas han sido probadas empíricamente en otros entornos y contextos con resultados satisfactorios. El objeto de extender el modelo es fortalecer nuestro modelo e incrementar su predicción, objetivo que se ha cumplido en el análisis empírico de los asistentes virtuales, por lo que se ha aplicado y extendido el modelo de la UTAUT2 con éxito.

Se probó empíricamente los factores propuestos con el modelado de ecuaciones estructurales y se confirmó que la intención de comportamiento en el caso de los

asistentes virtuales está influenciada por el hábito, la confianza y la innovación personal y explican el 89.3% del modelo, por lo que se puede afirmar que el modelo propuesto tiene una alta capacidad predictiva. En el caso del P2P Bizum el modelo propuesto explica la intención de comportamiento de los usuarios de utilizar el pago móvil P2P en un 82,5% únicamente con dos variables, el hábito y la influencia social por lo que también tiene una alta capacidad predictiva. Los resultados también indican que el hábito es el predictor más fuerte de la intención de usar ambas aplicaciones.

El hallazgo del factor hábito como dominante respecto a otros factores, nos indican que el hábito destaca como el mejor predictor. Si tenemos en cuenta las teorías de la psicológica, los hábitos se definen como las asociaciones cognitivas entre los comportamientos de los usuarios y los contextos desencadenantes del usuario, por lo que se separa los hábitos de los propios comportamientos habituales. Las fortalezas de estas asociaciones se acumulan a través de repeticiones de conductas dependientes del contexto y, a su vez, aumentan la probabilidad de que la conducta se realice en el mismo contexto (Marien et al. 2019). Por lo que el entorno de la Covid-19 podría haber ayudado a la formación de este hábito, ya que para inducir un hábito debe estar conectado con señales ambientales (Renfree et al. 2016), como ha sido el caso de la tecnología con su uso en la pandemia.

En los hábitos los estímulos desencadenan directamente respuestas. Por lo que los vínculos estímulo-respuesta se establecen a través del aprendizaje instrumental de un comportamiento específico que guie (conectarse a teams) se expresa en respuesta a una señal específica (acceder a la lección) y se refuerza con un resultado positivo (aprender).

Estos estímulos-respuestas han sido continuos y únicos en la pandemia, por ejemplo, como se ha descrito anteriormente para recibir las clases desde casa. Esto hace que el papel del incentivo disminuya gradualmente con la práctica, lo que conllevará que el comportamiento sea independiente del valor anticipado de sus consecuencias (Marien et al. 2019). Por lo que los resultados de esta investigación confirman la importancia del hábito en la tecnología, que tendrá un gran impacto en la vida humana.

La Covid-19, ha influido en la creación de hábitos en el uso de los asistentes virtuales y P2P Bizum; por lo tanto, ese hallazgo debe investigarse más a fondo y considerar su inclusión en diferentes estudios relacionados con la aceptación y el uso de una tecnología. El siguiente paso sería ayudar a consolidar ese hábito cuando la pandemia finalice para consolidarlo.

La UTAUT2 predice el 74% por ciento de la variación en la intención de comportamiento de los consumidores (Venkatesh et al., 2016), por lo que se puede confirmar que los modelos desarrollados en esta investigación pueden predecir y pronosticar la intención de usar los asistentes virtuales en un 89,3% y el P2P Bizum en un 82,5%, por lo que mejoran el modelo original propuesto por Venkatesh et al. (2016).

Se ha confirmado en esta investigación que el comportamiento de los usuarios con los asistentes virtuales y los medios de pago P2P Bizum se han visto modificados por el impacto de la Covid-19, por un lado la digitalización bancaria ha avanzado rápidamente en parte por la obligatoriedad en la normativa de salud impuesta en España para utilizar los medios de pago en un primer momento obligatorios y en la actualidad como métodos

preferenciales y por otro lado el uso de los asistentes virtuales se ha incrementado considerablemente, aunque todavía como nos indican los ratios expuestos en el estudio está en una etapa de difusión temprana.

Aunque la Covid-19 ha democratizado la tecnología en diferentes países, también existe una mayor brecha digital, que se ha confirmado entro otras observaciones con la baja penetración de respuesta de rangos de edad de población mayor en los cuestionarios, ya que para medir la variable hábito era necesario que fueran consumidores, por lo que trabajar en la inclusión para que la revolución Industrial 4.0 afecte a toda la sociedad y no únicamente a subconjuntos es una necesidad para las organizaciones, instituciones y empresas.

2.1. Contribuciones a la teoría

En primer lugar, se ha realizado una descripción general de los modelos y teorías que intentan explicar el comportamiento humano frente a la adopción de la tecnología. Esto ha permitido una mejor comprensión en este campo, ya que muchos estudios han utilizado estos marcos tradicionales para llevar a cabo sus investigaciones y el resto combina modelos anteriores o añade nuevos constructos a los modelos desarrollados, por lo que esta comprensión completa desde estos modelos con el enfoque de los actuales sistemas de información aporta valor a la teoría. Además, esta revisión prepara el terreno para la próxima ola de investigación, sintetizando las principales lagunas en el conocimiento y analizando las tendencias emergentes de los estudios incluyendo el impacto de la Covid-19.

El análisis de los asistentes virtuales ha contribuido a la teórica desde tres vertientes: un nuevo contexto, un nuevo modelo con nuevos constructos y nuevos resultados. Se han proporcionado nuevos conocimientos cuantitativos sobre los antecedentes de la intención de usar los asistentes virtuales en España. Ampliando los estudios previos sobre la adopción de tecnología basada en inteligencia artificial, en específico en los asistentes virtuales. Se ha evaluado empíricamente nuevos factores que se han añadido al modelo: la confianza, el riesgo de privacidad y la innovación personal proporcionando información orientada a la experiencia personal del usuario en la adopción de esta tecnología que podría ayudar a comprender las intenciones de los usuarios y ser extrapolada al desarrollo de futuras aplicaciones en ámbitos tan diversos como la salud, negocios, robótica o comercio, entre otros muchos, debido al crecimiento exponencial esperado de esta tecnología en los próximos años. Los resultados y su discusión nos hacen comprender el impacto que ha tenido la Covid-19.

En el análisis del P2P Bizum, en primer lugar ha contribuido a la teórica ya que tiene como objetivo proporcionar una comprensión holística y completa sobre la adopción de pagos móviles. En segundo lugar, se centra en el contexto de España, donde es escasa la literatura que aplica y evalúa empíricamente el modelo UTAUT2 en P2P Bizum durante la pandemia. En tercer lugar, nuestro estudio presenta una extensión del modelo UTAUT2 al evaluar otros constructos adicionales como la confianza, seguridad y riesgo percibido que hacen fortalecer el modelo y por último los resultados con un alto poder predictivo sobre la intención de uso.

Los hallazgos sugieren que UTAUT2 podría mejorarse, al menos en lo que respecta a los asistentes virtuales, al incluir dos factores la confianza y la innovación personal, que se validaron en esta investigación, proporcionando nueva evidencia para contribuir al desarrollo de la teoría de la UTAUT2.

La utilización de las ecuaciones estructurales, en concreto el análisis factorial confirmatorio (AFC) fue clave para identificar un modelo que se ajustara a los datos, por lo que proporcionó un información muy valiosa, que confirmó que había menos factores de los que se habían hipotetizado, por lo que contribuyó a la parsimonia del modelo y fue fundamental para conducir a un modelo ajustado.

2.2. Contribuciones a la práctica

Para las organizaciones, instituciones, empresas o profesionales, esta investigación ayuda a conocer los factores que influyen los usuarios cuando utilizan un sistema de información, les ayudará a superar obstáculos y en mejorar los métodos para diseñar, evaluar y predecir la respuesta de los usuarios a las nuevas tecnologías. Es conveniente que los tomadores de decisiones conozcan los problemas que influyen en la decisión de los usuarios de utilizar un sistema en particular para que puedan tenerlos en cuenta durante la fase de desarrollo ya que les ayudará en mejorar la prestación de servicios desarrollados con tecnología. También se les ha facilitados recomendaciones y acciones en los asistentes virtuales y en el P2P Bizum con el fin de mejorar la adopción de la tecnología de la información.

Esta investigación refleja el comportamiento de los usuarios durante la Covid-19, por lo que se contribuye a la literatura al proponer un marco de contingencia que estudie específicamente el escenario de la Covid-19. En concreto, tales proposiciones son importante no sólo para los investigadores de tecnología, sino para la comunidad empresarial ya que permite comprender el cambio de actitud de las personas sobre la tecnología durante la Covid-19, y esto les puede ayudar por un lado a los investigadores en sus futuras áreas de investigación y formulación de estrategias y por otro lado en las organizaciones es una oportunidad conocer estos factores para capitalizar dicho cambio.

Para los usuarios y proveedores de los sistemas de pago P2P. Los resultados de la investigación de este estudio también tienen algunas implicaciones ya que deben rediseñarse estos sistemas continuamente para que sea útil en la vida diaria de los usuarios. Además, se realizan las siguientes recomendaciones: a) es importante tener una mayor interacción social, y retroalimentación de opiniones, para fomentar la comunicación y ayudar a superar la barrera para los no adoptantes b) las organizaciones, instituciones y entidades empresariales deben identificar y medir los elementos que afectan a la creación de rutinas y hábitos c) deben realizarse estudios de mercado a poblaciones específicas, para intentar comprender cuáles son los obstáculos de utilizar las aplicaciones.

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2.3. Limitaciones y futuras líneas de investigaciones

Aunque se lograron los objetivos principales de esta investigación, todavía existen algunas limitaciones del estudio.

En la revisión de la literatura, tanto en el análisis de contenido y en el enfoque bibliométrico, se puede destacar la dificultad a la hora de seleccionar la información y aplicar los filtros, y aunque se han tratado cuidadosamente los datos bibliométricos, como la eliminación de entradas duplicadas y erróneas, cualquier error puede afectar al análisis que se realice con dichos datos. Otra limitación es que se ha utilizado la base de datos Web of Science dejando fuera otras, como Scopus o Google Scholar, por lo que, aunque estaba base de datos, es razonable pensar que incluye las principales contribuciones que se habían publicado en los temas relacionados con la tecnología, es posible que algunos artículos relevantes no se hayan incluido en la muestra, por lo que en próximas investigaciones, se podría ver si se han quedado excluidos algunos que se han publicado en otras bases de datos y podrían ser relevantes,

En el análisis bibliométrico, en los indicadores de citación y los mapas de cocitación podría haber un sesgo parcial, porque estas metodologías analizan los trabajos que han sido citados con una mayor frecuencia para evaluar cuales tiene un mayor impacto en un área de conocimiento, pero en la práctica, los artículos y referencias más citados suelen ser los más antiguos, por lo que esta tendencia genera un sesgo temporal. Esta limitación se ha visto parcialmente corregida en los ratios analizados ya que se ha incluido, el análisis semántico de las palabras, por lo que tiene un enfoque más cuantitativo y evalúa las tendencias actuales.

Respecto a la investigación empírica de los asistentes virtuales y P2P Bizum no está exenta de limitaciones y necesidad de futuras investigaciones, por lo tanto, los resultados de este estudio deben interpretarse con precaución, por los siguientes motivos:

La investigación se centró en de España y los resultados son representativos del país. Por lo que está asociado a un contexto cultural y a una situación de la pandemia en particular, ya que cada país adoptó las medidas que consideró oportunas, extrapolarlo a otros contextos sería interesante para poder confirmar los resultados del modelo propuesto.

Este estudio está restringido en el tiempo, ya que tiene en cuenta la intención de aceptación de la tecnología de los asistentes virtuales y el P2P Bizum en un marco de tiempo determinado, por lo que fue realizado de forma transversal en un periodo breve y representa una instantánea en el tiempo ya que la información se recopiló una única vez. Esto sugiere que las percepciones hacia el uso de servicio de los asistentes virtuales y el pago móvil P2P Bizum pueden cambiar a lo largo del tiempo, ya que la población estudiada puede haber adquirido más experiencia con el tiempo por lo que un estudio longitudinal se podrían obtener más hallazgos específicos de un grupo concreto.

Los estudios futuros podrían abordar la relación entre intención y uso. No se utilizaron variables moderadoras como el género, la edad, nivel de renta, estudios y diferencias de poblaciones (rurales y urbanas). Y aunque algunos de estos moderados se recogieron en los cuestionarios de la investigación, se podrían analizar para ver si existen diferencias de las intenciones conductuales. Por lo tanto, un estudio futuro podría incluir estos

moderadores para obtener información desde otras perspectivas sobre las intenciones de uso de uso de los asistentes virtuales y el pago con móvil P2P Bizum en España con el fin de confirmar el resultado del estudio en toda la población.

También hay que tener en cuenta que los participantes de los cuestionarios hay bastantes población joven, ya que uno de los criterios era que fueran usuarios de la tecnología, por lo que es una muestra mucho más alcanzable que otros rangos de edad que han sido eliminados de la muestra por no cumplir el criterio de uso, por lo que una de las características de estos jóvenes son nativos digitales y dependientes del uso del móvil para sus tareas cotidianos por lo que habría que ser cauto para extrapolar estos resultados a la población mayor. Por lo que una posible línea de investigación futura sería realizar el mismo estudio en este rango de edad.

En los asistentes virtuales, sería conveniente incorporar nuevos factores como el antropomorfismo ya que tendemos a atribuir características físicas y mentales a agentes no humanos (es decir, tecnológicos) con el fin de percibir una mayor humanización. Esta propensión, llamada antropomorfismo, contribuye a que el usuario desarrolle sentimientos de confianza, satisfacción o seguridad por lo que incluirlo como antecedente de estos tres factores que se han analizado en el estudio podría aportar nuevos resultados.

En el análisis del método de pago P2P Bizum, este estudio se centra en el estudio de una aplicación de pago P2P Bizum, que podría ser ampliado en un futuro con otras aplicaciones P2P como Google Pay, Apple Pay Cash y PayPal.

Chapter 6

Conclusions

1. Conclusions and final remarks to research questions

This research springs from the need to answer reoccurring questions when confronted with an environment of thriving technological innovation: what are the factors that contribute to consumers in technology adoption? what is the most appropriate model or theory that we should select to study the acceptance or rejection of these technologies? Can we apply a model or theory and predict the behavioral intention to use a device or emergent technology? A main objective is to identify, understand and study the factors that influence the intention to use technology during Covid-19, as it relates to the objectives arising from the research sample 1) to carry out a historical review of the models and theories to select the theory or models that are most suitable for the study of current technology 2) to select two technological innovations, virtual assistants and P2P Bizum, that apply as part of the proposed framework 3) to develop a predictive model that helps in eliminating barriers to acceptance and adoption of technology.

The first question answered whether there is an appropriate model or theory more suitable to the context we select to study novel technologies, matter for the purpose of a literature review. Two hybrid approaches have been used, content analysis and bibliometric approach; these lines open a critical area to carry out an exhaustive analysis on the different models and theories developed over the years that explain the acceptance of technology. To carry out this study, information extracted from the Web of Science database, is selected via a set of metadata that has been subsequently analyzed.

In this content analysis, the main theories and models used to try to explain and predict the use of technology have been explored and described: the Diffusion of Innovation Theory (RTD), the Theory of Reasoned Action (ART), the Theory of Planned Behavior (TPB), the Social Cognitive Theory (SCT), the Technology Adoption Model (TAM), the Technology Adoption Model (TAM 2), Technology Adoption Model 3 (TAM 3), PC Utilization Model (MCP), PC Utilization Model (MPCU), Motivational Model (MM), Combined Model TAM-TPB (C-TAM-TPB), Unified Technology Acceptance and Use Theory (UTAUT) and Extended Technology Acceptance and Use Theory (UTAUT2). Next, the main conceptual variables have been defined, as well as the scope of action and the number of research articles of each theory. The results confirm that all theories are still valid and are a source of research for the scientific community.

The study also shows us that these theories and models are similar in structure, but different in their explanation of technology behavior and use. Some theories come from Sociology (IDT), Social Psychology (ART) or Psychosocial Theories (SCT and TPB), change the approach used as some try to explain human behaviors (ART and TPB), the influence of organizations on acceptance and not on the individual (DOI), predict a behavior (SCT and TPB) or know the beliefs around technology (TAM, UTAUT AND UTAUT2).

With the focus on the last four years 2018-2021. The results show that the RTD and UTAUT/UTAUT2 theories have had a higher production in this period than in the historical one: 65% in the case of RTD and 52% in UTAUT/UTAUT2, this could be due to the interest and concern that researchers arouse in the acceptance of technology as a result of the digital transformation of many countries, sectors and companies as a result of Covid-19. The three theories with the highest production are: RTD, sociological theory with 573 investigations, TAM/TAM2/TAM3 with 3,422 investigations and UTAUT/UTAUT2 with 1,859 investigations, these last two theories were developed specifically to predict and explain the behavior of humans in the face of technology.

So, the results confirm that, although all theories are still valid and are used by researchers, those used to specifically study emerging technology are IDT, TAM/TAM2/TAM3 and UTAUT/UTAUT2.

These three theories are currently applied in the digital field with the study of the acceptance of artificial intelligence, mobile applications, assistive technology, augmented reality, blockchain, classroom, autonomous vehicles, the cloud, e-commerce, computer technology, digital transformation, and diverse platforms such as e-health or e-learning among others.

To carry out the bibliometric analysis, two theories have been selected, their choice has been justified by the resulting data, since those with the highest number of publications in the Covid-19 period have been selected, the TAM/TAM2/TAM3 with 3,422 documents and the UTAUT/UTAUT2 with 1,859. In order to select a suitable

theory for empirical analysis, the indicators and mathematical models applied, have been examined retrospectively. From this analytical standpoint the research progresses in a critical line of enquiry, to amalgamate in these two frameworks, not only the theories but also their development, obsolescence, and dispersion, and to include an evaluation of the potential for an added trend analysis (White and McCain, 1989).

In the TAM/TAM2/TAM3, the ratios show that in scientific production there is greater collaboration between authors (2.69 authors/document), but more transient and less specialized authors. The Bradford model (core-57, zon to 1- 89, zonto 2-988 journals) is fulfilled. But they have fewer citations, authors, institutions, and maps of collaborations than in UTAUT/UTAUT2.

In UTAUT/UTAUT2, the ratios show that in scientific production there is less collaboration between authors (2.51 authors/document), but more specialized authors and less transient. The Bradford model is fulfilled (nucleus-50, zone at 1-320, zone 2-1458 journals) and, as such, it confirmed a higher number of citations, authors, institutions and collaboration maps than the TAM/TAM2/TAM3.

UTAUT / UTAUT2 theory aligns with results from a more robust set of analysis conducted on emerging technologies; this has been confirmed with the ratios of structure, content, and quality as well as with a semantic analysis of sequences of words that led to analyze a framed theme and research trends. This is consistent with the results of the first content analysis, given this empirical evidence, it was decided to continue the research with the UTAUT/UTAUT2 theory. As UTAUT is oriented to the context of

organizations, Venkatesh et al. (2012) developed UTAUT2 including three new constructs: hedonic motivation, price/value and habit, factors oriented towards the acceptance of technology by consumers. As our study is based on consumers, UTAUT2 theoretical framework comes out as providing more insights in line with an empirical study.

The two digital technologies for the application of UTAUT2, virtual assistants and P2P Bizum, also known within the industry 4.0 environment, not only in edge of innovation, but, also, for the achievements and impact provided to benefit society. This presupposes an upgrade or technological revolution but remains problematic considering digital network and accessibility gap. It arises an obvious need to over-reach for a more encompassing study of the impact of Covid-19 in Spain from the use and implementation of the new technologies and devices.

Virtual assistants and the P2P Bizum application have become increasingly popular and have had a great development during the pandemic. Being confined and having more time, virtual assistants have aided entertainment tasks such as listening to music, information prompts, solving technical issues, and, in some cases, simply for companies, businesses, and individuals, before isolation and other related with preventive health issues arising from confinement. In particular, in the case of P2P Bizum, its use has become prevalent due to speed of transaction, convenience, efficiency, and security of payments as protection against the pandemic.

After making an extensive review of the literature of both technologies, two conceptual maps are defining from preliminary hypotheses and drawing on the relationships of the variables aligned with user intention. To answer the following research questions from this light:

- ✓ What are the factors that influence the user's intention to use virtual assistants and P2P Bizum.
- ✓ What are the factors that contribute to individuals adopting technologies?
- ✓ Can we apply this model or theory and predict behavioral intent to use technology?
- ✓ To what extent does the UTAUT2 model predict the intention to use P2P Bizum and virtual assistants?

In this way, two predictive models are designed so that they can predict behavioral intention. The theory of UTAUT2 was applied with the factors a) Performance expectation b) Expectation of effort 3) Social influence c) Facilitating conditions d) Social influence 2) Price-value and f) Habit. For virtual assistants, the factors of trust, personal innovation and perception of privacy risk have been added. For P2P Bizum the factors of trust, security and perceived risk were added. This extension of the model has been justified throughout the definitions of the hypotheses since the selected variables have been empirically tested in other environments and contexts with satisfactory results. The purpose of extending the model is to strengthen our model and increase its prediction, an objective achieved via a critical approach into the UTAUT2 model.

The proposed factors, empirically tested with the modeling of structural equations, confirm several variables affecting user intention in the case of virtual assistants: first, habit, followed by confidence and personal innovation. Overall, the ratio achieved in the survey, an 89.3%, re-affirms that the proposed model has a high predictive capacity. In the case of P2P Bizum, the proposed model explains the behavioral intention of users to use P2P mobile payment by 82.5% with only two variables: habit and social influence to be accounted for, so with a similar high predictive capacity. The results also indicate that habit is the strongest predictor of behavioral intent to use both apps.

One of the variables in the model, created a niche for a predominant factor, habit, as dominant with respect to other factors. This indicates that habit stands out as the best predictor. If we take into account the theories of psychology, habit being a cognitive set where associations between behaviors are triggering varying contexts, so the habits are separated from the habitual behaviors themselves. The strength of these associations accumulates through repetitions of context-dependent behaviors and, in turn, increase the likelihood that the behavior will occur in the same context (Marien et al. 2019). Therefore, in the context of Covid-19, the formation of a habit to use a new technology, is conditioned, since to induce a habit, it must be connected with environmental signals (Renfree et al. 2016), as has been the case with technology with its use in the pandemic.

Following with habits, stimuli directly trigger responses. So, stimulus-response links are established through instrumental learning of a specific guiding behavior (connecting to teams) is expressed in response to a specific cue (accessing the lesson) and reinforced with a positive outcome (learn). These stimuli-responses have been continuous and

unique in the pandemic, for example, as described in the setting for remote learning and online education tools. This causes the role of the incentive to gradually diminish with practice, which will mean that the behavior is independent of the anticipated value of its consequences (Marien et al. 2019). The results of this line of analysis confirm the importance of habit in technology, which has had a great impact on human life. Covid-19 influenced the use of new applications in virtual assistants and P2P Bizum. Therefore, this area of investigation is fruitful for the inclusion of wide array of matters in studies related to acceptance and technology use. The next step will help consolidate the validity of habit when the pandemic ends to make it a permanent stream of insight.

It has been confirmed that the behavior of users with virtual assistants and P2P Bizum payment methods have been modified by the impact of the Covid-19, on the one hand banking digitalization has advanced rapidly in part due to the obligation in the health regulations imposed in Spain to use the means of payment at first mandatory and currently as preferential methods and on the other hand the use of virtual assistants has increased considerably, although still as indicated by the ratios exposed in the study is in an early dissemination stage. UTAUT2 predicts 74% percent of the variation in consumer behavioral intent (Venkatesh et al., 2016), so it can be confirmed that the models developed in this research can predict and forecast the intention to use virtual assistants by 89.3% and Bizum P2P by 82.5%, improving the original model proposed by Venkatesh et al. (2016).

It can be said that Covid-19 democratized technology in different countries, but there is still a great digital divide, which has been confirmed in the low penetration for an older

age band surveyed in the questionnaires, since to measure the habit variable it was necessary that they were consumers. In this regard, applying an additional filter on inclusion considering that the Industrial 4.0 revolution affects the whole society and not only subsets; this makes it a necessity for inclusive thinking as part of organizations, institutions, and companies.

2.1. Contributions to theory

For providing a human behavior versus technology adoption overview, the models and theories presented frame the guidelines encapsulating constructs. This has allowed a better understanding of a critical field, since many studies have used traditional frameworks to carry out their research and others combine previous models or simply add new constructs; a complete view and understanding from the proposed models, the approach to current information systems adds value to the theory. In addition, this review paves the way for the next wave of research, synthesizing the main gaps in knowledge and analyzing emerging trends from studies including the impact of Covid-19.

In the analysis of virtual assistants, he has contributed to the theory from three aspects: a new context, a new model with new constructs and results. New quantitative insights have been provided on the background to behavioral intention and use of virtual assistants in Spain, expanding on previous studies on technology adoption based on artificial intelligence, specifically in virtual assistants. It has empirically evaluated new factors that have been added to the model: trust, privacy risk and personal innovation providing information oriented to the personal experience of the user towards adoption that could support understand a basic approach to intent that could be extrapolated to the

development of future applications in areas as diverse as health, business, robotics or e-commerce, due to its exponential growth. The results and their discussion help us to understand the impact of Covid-19. In the analysis of P2P Bizum has contributed to the theory as it aims to provide a holistic and comprehensive understanding on the adoption of mobile payment platforms.

Finally, a focus on the context of Spain, where there is little appearance of critical literature, provides a perspective into a new area of application that empirically evaluates the UTAUT2 model in P2P Bizum during the pandemic. For this reason, our study presents an extension of the UTAUT2 model by evaluating other additional constructs such as trust, security and perceived risk that strengthen the model and finally with the high prediction of the model in the intention of use.

The conclusions in the analysis suggest that UTAUT 2 provides a bottom-line framework for an improved analysis, as far as virtual assistants are concerned, by including two factors trust and personal innovation, which were validated with the data, providing new evidence to contribute to the development of UTAUT2 theory. The use of structural equations, in particular confirmatory factor analysis (CFA) was key to identifying a model that fit the data, so it provided very valuable information, which confirmed that there were fewer factors than had been hypothesized, thus contributing to a sober line to follow within the model that is fundamental to lead to a fitted model.

2.2. Contributions to practice

For organizations, institutions, companies or professionals, this research helps to know the factors that influence users when using an information system. It will help them overcome obstacles and improve methods to design, evaluate and predict the response of users to new technologies. It is necessary outcome for decision-makers to have knowledge of the problems that influence users in their use and adoption of technology systems so that these can be taken into account during an earlier phase in product development, as it will help them improve the delivery of services developed with technology. Our discussion and analysis concluded with additional recommendations and actions for virtual assistants and for P2P Bizum, in order to improve the process of information technology development.

This research reflects the behavior of users during Covid-19, so it contributes to the literature by proposing a contingency framework that specifically studies the Covid-19 scenario. In particular, the bases are important not only for technology researchers, but for the business community since it opens the discussion to an in-depth understanding of the factors affecting change in people's attitudes about technology during Covid-19, and this can help researchers in extending future research areas and to formulate their strategy. On the other hand, in organizations, it presents an opportunity to recognize these factors and capitalize on this change. For users and providers of P2P payment systems, the results of this study also have implications, as these systems must be continually redesigned to be useful in users' daily lives. In addition, some of the following recommendations were made a) it is important to have greater social interaction, and feedback of opinions, to encourage communication and help overcome the barrier for non-adopters b)

organizations, institutions and business entities must identify and measure the elements that affect the creation of routines and habits c) market studies should be carried out on specific populations, to try to understand what are the barriers in using the applications.

2.3. Limitations and future lines of research

Although the main objectives of this research were achieved, there are still some limitations, mainly arising from the noise and filters in databases. For the literature review, both in the content analysis and in the bibliometric approach, the difficulty in selecting information and applying filters highlights duplicates and redundancy. Although the data from a bibliometric approach to sources have been carefully handled, the elimination of duplicate and erroneous entries, can carry errors affecting the analysis even when performed from a critical standpoint. Another limitation linked to Web of Science database is the scope of the research that has left out Scopus and Google Scholar which may return additional contributions to literature. It is reasonable to think that it includes the main contributions that had been published in the topics related to technology, and less plausible that some articles have not been included in the sample; in future research, it could be added, provided that the scope of the research widens in time and resources.

In the bibliometric analysis, citation indicators and co-citation maps there could be a partial bias, because these methodologies analyze works that have been cited with greater frequency to evaluate which have a higher impact on an area of knowledge, but on the practical side, the most cited articles and references are usually dating to far back in time research, so this trend generates a temporal bias. This limitation has been partially corrected in the ratios analyzed since the semantic analysis of the words has been

included, so it has a more quantitative approach and evaluates current trends.

Regarding the empirical research of virtual assistants and P2P, Bizum is not exempt from limitations and the need for future research, therefore, the results of this study should be interpreted without caution, for the following reasons:

1) The research is focused on Spain and the results are representative of this country alone. As it is associated with a cultural context and a specific set of constrains arising from pandemic, a global health crisis, that entailed diverse measures depending on national governments, it is considered appropriate, to extrapolate it to contexts that are outside this geographical area in order to confirm and contrast results via the proposed model.

2) This study is restricted in time, since it takes into account user intention in technology acceptance within devices and platforms relative to virtual assistants and P2P Bizum; so it was carried out transversally in a short period of time and represents a snapshot in time since the information was collected at once. This suggests that perceptions towards the service use of virtual assistants and Bizum P2P mobile payment may change over time, as the population studied may have gained more experience, so a longitudinal study could obtain more group-specific findings.

Future studies could address the relationship between intention and usage. Moderating variables such as gender, age, income level, studies and population differences (rural and

urban) were not used. And although some of these moderates were collected in the research questionnaires, they could be analyzed to see if there are differences in behavioral intentions. Therefore, opening a line for future studies that include these moderators to obtain information from other perspectives within Spain, in order to confirm the result of the analysis to the entire population.

It is also relevant to consider that the participants of the questionnaires are quite young people, since one of the criteria was that they were users of technology, so it is a much more achievable sample than other age ranges that have been eliminated from the sample for not meeting the criterion of use. Being digital natives, a younger generation of consumers are highly dependent on the use of mobile phones for daily tasks, so we should be cautious to extrapolate these results to an older population. A possible line of future research would be to conduct the same study at this age of population.

In the analysis of a P2P platform for payment, this study focuses on the study of a Bizum P2P payment application, which could be expanded in the future with other P2P applications such as Google Pay, Apple Pay Cash and PayPal. It would be convenient to incorporate new factors such as anthropomorphism since we tend to attribute physical and mental characteristics to non-human (that is, technological) agents in order to perceive greater humanization. This propensity, called anthropomorphism, helps the user develop feelings of trust, satisfaction, and security, so this renewed landscape will open the field of Information Technologies to innovative approaches and renewed frameworks.

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Aplicación de la Teoría Unificada de Aceptación y Uso de la Tecnología Extendida (UTAUT 2) para estimar la intención de uso de la tecnología. Desarrollo de un modelo predictivo para la plataforma de pago móvil peer-to-peer y los asistentes virtuales

María García de Blanes Sebastián