Does the use of technology create technology engagement? Comparing three structural models

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Abstract

Purpose – Some aspects of technology behaviour remain unclear, such as the generation of technology use and engagement. So, this study aims to address the following question: does engagement with technology drive the use of technology?or does the use of technology create the engagement with technology?

Design/methodology/approach – Based on the uses and gratifications theory, this study compares three alternative competing models that explain technology behaviour on a sample of 715 individuals, using the selection criteria proposed by Mathieson. A comprehensive analysis and comparison of three structural competing models on technology behaviour, namely, "use-and-engagement", "use-to-engagement" and "engagement-to-use", are presented.

Findings – Findings show that the "use-and-engagement" model provides a better explanation of technology behaviour and is superior to predict technology behaviour, suggesting that both technology engagement and use could be considered as consequences.

Originality/value – This study's major contribution is the empirical examination of three structural competing models and the selection of the best explaining model of technology behaviour.

Keywords Behaviour, Technology, Engagement, Use, Structural models

Paper type Research paper

¿El uso de la tecnología crea implicacion con la tecnología? Comparando tres modelos estructurales

Resumen

Objetivo – Algunos aspectos del comportamiento tecnológico permanecen sin aclarar, como la creación del uso e implicación hacia la tecnología. Así que abordamos la siguiente pregunta: *¿La implicación con la tecnología impulse su uso?, o ¿es el uso de la tecnología el que impulse la implicación?.*

Metodología – Basándonos en la Teoría de los Usos y Gratificaciones se han comparado tres modelos alternativos que compiten entre sí para explicar el comportamiento tecnológico, en una muestra de 715 individuos utilizando el criterio de selección propuesto por Mathieson. Se presenta un análisis y una comparación exhaustive de tres modelos estructurales competitivos sobre el comportamiento tecnológico, que son "*uso-e-implicación*", "*uso-para-la implicación*" e "*implicación-para-el uso*".

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Resultados – Los resultados muestran que el modelo "*uso-e-implicación*" proporciona la mejor explicación del comportamiento tecnológico y es superior para predecir el comportamiento tecnológico, lo que sugiere que tanto la implicación como el uso de la tecnología podrían considerarse como consecuencias.

Originalidad – Nuestra principal contribución es el análisis empírico de tres modelos estructurales competitivos y la selección del mejor de ellos para explicar el comportamiento tecnológico.

Palabras clave Comportamiento, Tecnología, Implicación, Uso, Modelos estructurales

Tipo de artículo Trabajo de investigación

技术的使用是否创造了技术参与？比较三种结构模型

摘要

目的 – 技术行为的某些方面仍然不清楚，例如技术使用和参与的产生。因此，我们意在解决以下问题：对技术的参与是否推动了技术的使用,还是技术的使用创造了技术的参与？

方法 – 基于"使用与满足"理论，我们使用马蒂森提出的选择标准，在715人的样本上比较了三种解释技术行为的替代竞争模型。即我们对三个关于技术行为的结构性竞争模型，"使用和参与"、"使用到参与"和"参与到使用"进行了综合的分析和比较。

研究结果 – 研究结果显示，"使用和参与"模型更好的解释了技术行为，并且其优于预测技术行为，这表明技术参与和使用都可以被认为是后果。

独创性 – 我们的主要贡献是对三个结构性竞争模型进行了实证检验，并选择了对技术行为的最佳解释模型。

关键词 行为, 技术, 参与, 使用, 结构模型

文章类型 研究型论文

1. Introduction

With the emergence of new technologies, such as augmented reality, wearable technologies, smartphones or 3D printing, it is important to understand what factors motivate individuals to use them and what factors engage them with technologies. Similarly, individuals are used to an abundance of technologies, being technology part of the consumers' daily routines; and accordingly, a great number of the studies about technology behaviour examine the variables that influence technology use (Rauschnabel, 2018; Ray *et al.*, 2019) and technology engagement (Skadberg and Kimmel, 2004), while various conceptual models about technology behaviour have been proposed. In fact, there are many theories that explore the use and adoption of technologies. The technology acceptance model (Davis, 1989) explains the adoption of technologies and has been widely applied in acceptance behaviour of a broad range of information technologies. Likewise, the unified theory of acceptance and technology-use model (Venkatesh *et al.*, 2003) is a behavioural-based model developed to unify the multiple existing theories about technology adoption and acceptance that has been validated and applied to investigate the adoption and use of technology. Conversely, the uses and gratifications theory (Katz *et al.*, 1974) provides an explanation of why individuals use technology, based on the main gratifications derived from its use, being a useful theoretical framework to understand the relationships between psychological motivations and technology behaviour. In addition, numerous studies have attempted to examine the determinants of individual's adoption and use of technologies, comparing different theories and conceptual models (Hung and Chang, 2005).

However, there is scarce research evaluating different structural competing models of technology behaviour. Further, to the authors' knowledge there is a lack of empirical research applying the criteria proposed by Mathieson (1991) to develop such comparison. In this context, the main goal of this research is to examine the strength of three alternative

competing models to measure and explain technology behaviour. More precisely, this study compares three alternative competing models that explain technology behaviour, to select the best explaining structural model, following the criteria proposed by Mathieson (1991). First model, labelled "engagement-and-use" suggests that both use and engagement with technology are influenced by different motivations, while the second model, labelled "use-to-engagement", supports that technology use is an antecedent or prerequisite for technology engagement and finally the model "engagement-to-use" considers that technology engagement precedes technology use. These competing models will be examined and compared in terms of overall model fit, explanatory power and path coefficients to determine which one is the best to explain and predict the engagement and behavioural use of technology. So, the major contribution of this study is empirically testing three alternative structural competing models to decide which one could be considered the structural model with greater explanatory power.

Some interesting managerial and theoretical implications could be derived from our study. On one hand, this study provides marketing scholars with a practical method to compare and analyse different structural models, allowing the selection of the model with greater explanatory power. On the other hand, this research reports that different motivations such as information search, social interaction, entertainment and type of content influence the individuals' use and engagement with technology, and that these motivations drive users' technology use and technology engagement simultaneously.

Finally, this paper is structured as follows. First, the literature foundations are reviewed in Section 2, followed by the research hypotheses development in Subsection 2.3. Then, we present the methodology of the research in Section 4. Finally, the results are discussed in Section 6, followed by conclusions, managerial implications and study limitations.

2. Theoretical foundations

2.1 Uses and gratifications theory

The uses and gratifications theory, proposed by Katz *et al.* (1974) is a useful theoretical framework to understand the relationship between psychological motives and technology use and behaviour. The uses and gratifications theory was first developed in the field of communication, until Rosengren *et al.* (1985) expanded the application of the theory to new technologies such as satellite, internet or interactive television. Subsequently, this theory was focussed on explaining individuals' use and acceptance of diverse technologies using extrinsic and intrinsic motivations (Luo and Remus, 2014) and assuming that both hedonic and utilitarian motivations influence the individual's adoption of technologies, as well as social motivations (Florenthal, 2019). This theory has been widely used to understand the use of new technologies (Rauschnabel, 2018; Ray *et al.*, 2019) and has become increasingly relevant as a theoretical framework in research on the motivations to use and adopt different technologies (Ray *et al.*, 2019). More precisely, the uses and gratifications approach has been applied to technologies such as the use of internet (Kaur *et al.*, 2020), Web or social media (Dolan *et al.*, 2016; Sun *et al.*, 2017; Rathnayake and Winter, 2018; Lin *et al.*, 2019; Zong *et al.*, 2019), mobile applications and mobile games (Lin *et al.*, 2016; Abassi *et al.*, 2022), mobile payment services (Alhassan *et al.*, 2020), virtual reality (Ball *et al.*, 2021) or video streaming technologies (Camilleri and Falzon, 2021).

This theory states that the main gratifications obtained through the use of technology are the need to search for information, to interact socially and the need for entertainment (Katz *et al.*, 1974). Further, this theory posits that individuals actively select and use technology in a goal-directed manner to achieve desired gratifications. Further, this theory assumes that individuals actively use communication media to satisfy some needs (Katz *et al.*, 1974), and authors like McQuail (1983) highlight four individuals' gratifications that

result from communication media use, namely, information, integration, social interaction and entertainment. Similarly, Sundar and Limperos (2013) extended the uses and gratifications framework to new media technologies and found that individuals using emergent media possibly create such new gratifications as modality, agency, interactivity and navigability. In the context of the use of internet, different authors have examined the motivations and gratifications obtained from its use based on the uses and gratifications perspective (Lin *et al.*, 2019; Zong *et al.*, 2019). Ultimately, the uses and gratifications theory has been applied to examine all kinds of online media, making it an adequate theory to the study of emerging technologies (Taherdoost, 2018).

2.2 Concept of user engagement

According to Agarwal and Karahanna (2000), the term engagement could be defined as an intrinsic motivation, which involves high levels of concentration, meaning that the individual acts with complete focus and full consciousness on the activities performed. Interestingly, engagement has been related to various concepts beyond the notion of involvement (Azer *et al.*, 2021), being understood as a context-dependant, multidimensional variable. More precisely, it can be stated that user engagement comprises both psychological and behavioural elements (Brodie *et al.*, 2019). On one side, psychological engagement arises in interactive user experiences with a focal object and can be understood as a psychological process (Bowden, 2009). Likewise, behavioural engagement could be defined as the individual's manifestations towards a focal object (Van Doorn *et al.*, 2010).

More precisely, the term technology engagement could be conceptualised as a state of focussed immersion and deep involvement with a highly enjoyable experience that takes place when the individual is interacting with any technology with full immersion (Agarwal and Karahanna, 2000). Similarly, user engagement can be understood as the quality of the experience characterised by the depth of the cognitive, affective and behavioural investment when interacting with digital technologies and media (O'Brien, 2016). Finally, more recent studies highlight that technologies could be applied by companies to engage consumers during all the stages of the customer experience (Flavián *et al.*, 2021).

2.3 Research hypotheses development

2.3.1 Information search motivation. Based on the uses and gratifications theory (Katz *et al.*, 1974), one of the main gratifications obtained by the use of technology is information. More precisely, the information search motivation – meaning the procurement of information and finding out about updated events – is strongly related with the use of technologies. So, one of the primary motives and reasons for using technology is the search of information. In fact, technology has modified the access, production and circulation of information (Flavián and Gurrea, 2007). Likewise, prior research on the use of internet highlights that information seeking is one of the major motivations for the use of this specific technology (Lou *et al.*, 2011). Further, some studies highlight that technology and the internet have increased the speed of information, reduced the cost of the distribution of information and created an opportunity to establish a more direct contact with users (Flavián and Gurrea, 2007). Similarly, digital technologies provide great possibilities for the search of specific information (Flavián and Gurrea, 2007). Therefore, we assume that one of the motives for using and engaging with technology may be informational. Hence, the following hypotheses are presented:

H1. The information search motivation has a positive influence on the engagement with technology.

H2. The information search motivation has a positive influence on the use of technology.

2.3.2 Social interaction motivation. The term socialisation or social interaction could be defined as gaining insight into the circumstances of others, identifying with other individuals and achieving sense of belonging.

According to the uses and gratifications theory social, interaction is one of the gratifications derived from the use of technology (Katz *et al.*, 1974), being an important determinant of the uses of various technologies (Rauschnabel, 2018). In this vein, authors like Gan and Li (2018) note that social interaction refers to the use of a technology to interact and connect with others, and authors like Liu and Shih (2021) define social gratification as the individual satisfaction with social interactions.

Likewise, Stafford *et al.* (2004) showed that individuals could gain many gratifications derived from technology use such as connecting with friends, peers and society, meaning as social connection anywhere and anytime. Therefore, social gratification or the need of social interaction is one of the major reasons for using technology (Rauschnabel, 2018; Hwang *et al.*, 2014). Further, Hwang *et al.* (2014) reported that the willingness to connect with others, as well as the need to express one's opinions are important motivations for the use of technology. One example could be the use of online networking platforms that allows individuals to connect with others (Lou *et al.*, 2011) and the exchange of contents and information (Hwang *et al.*, 2014), thus meeting social needs. Accordingly, we assume that one of the motives of engaging with technology may be social:

H3. The social interaction motivation has a positive influence on the engagement with technology.

H4. The social interaction motivation has a positive influence on the use of technology.

2.3.3 Entertainment motivation. One of the motivational factors influencing the individual's use or technology is related with the enjoyment, entertainment, pleasure and inherent satisfaction (Lim *et al.*, 2013). According to McQuail (1983), the concept of entertainment is related to the extent to which one activity fulfils the individual's needs for enjoyment, escapism and hedonistic pleasure. So, entertainment derived from technology use means that the use of technology is enjoyable, fun and entertaining. More precisely, the entertaining gratification represents the extent to which the use of a technology is enjoyable and fun and relates to the ability of a technology to fulfil the user needs of pleasure, escapism or emotional release (Dolan *et al.*, 2016; Gan and Li, 2018). In fact, there are technologies and systems intended to provide users with a sense of enjoyment, entertainment and a break from productive tasks (Abassi *et al.*, 2022), such as internet, game consoles, cable TV, computer games and so on (Rauterberg, 2004). Similarly, the concept of enjoyment in human-technology interactions could be defined as the degree to which the use of a technology system is perceived as pleasant by the user (Davis *et al.*, 1992).

The uses and gratifications theory posits that entertainment is an intrinsic motivation related with the playfulness and fun derived from the technology behavioural usage (Katz *et al.*, 1974). Similarly, previous studies show that individuals experience hedonic value and gratification when they develop leisure activities through technology (Jung *et al.*, 2009). Further, more recent studies highlight that entertainment, enjoyment and relaxation are major motivations technology behaviour (Hwang *et al.*, 2014), while other authors report the hedonic value as one strong variable influencing and determining the technology use (Li *et al.*, 2015; Abassi *et al.*, 2022).

Liwewise, authors such as Kang and Atkin (1999) have pointed out the relevance of entertainment motivation as one of the main reasons that drives the use of services on the internet. Therefore, we can state that technology is used for entertainment.

In addition, considering that individuals tend to use technologies for entertainment, we can assume that they may engage with technologies for entertainment purposes. Interestingly, recent research notes that as customers become more habituated to use specific technologies, their initial delight is expected to decrease, and in turn, fostering long-term customer engagement with technologies will require companies' continuous learning and innovation (Hollebeek *et al.*, 2019). Finally, the following hypotheses are proposed:

H5. The entertainment motivation has a positive influence on the engagement with technology.

H6. The entertainment motivation has a positive influence on the use of technology.

2.3.4 Type of content. There content gratification related to the technology use identified in the uses and gratifications theory (Katz *et al.*, 1974) refers to user satisfaction with information content (Liu and Shih, 2021). Likewise, the uses and gratifications theory aims to identify needs that can be fulfilled by the use of and engagement with a particular content (Florenthal, 2019); and in turn, in the present study, we have included the type of content as a factor influencing technology behaviour.

The use of technology and technology engagement may be influenced by the type of content delivered, by the credibility, relevance and trustworthiness of contents provided (De Wulf *et al.*, 2006), as well as by the availability and diversity of contents. In fact, prior studies indicate that the quality and type of content strongly influence the adoption of technology (Jarvenpaa and Todd, 1997). Further, today, and because of emergence of new technologies, it is common that individuals play an active role in the creation of contents and some studies indicate that nowadays individuals create and share their own-generated content through social networking (Hill, 2017).

Following Csikszentmihalyi (1993), the type of content is a reason for engagement because when content is attractive and rewarding, the individual will be immersed and concentrated in it. Therefore, we can assume that the type of content may engage the individual with technology and drive technology use. Later, other studies reported that content has shown to be the most influencing factor on cognitive engagement, absorption and level of concentration (Chung and Tan, 2004). Consequently, a repeated and boring content will make individuals to a poor engagement, while an interesting and exciting content may create higher levels of engagement (Kim *et al.*, 2010). Similarly, individuals actively select the technology and engage in content that gratifies them the most and that helps them to achieve their goals (Florenthal, 2019). Additionally, previous studies report that technology influences cognitive engagement of individuals (Skadberg and Kimmel, 2004).

So, considering the influence of the type of content in the use and engagement with technology, we propose these research hypotheses:

H7. The type of content has a positive influence on the engagement with technology.

H8. The type of content has a positive influence on the use of technology.

3. Alternative competing models to explain technology behaviour

According to Mathieson (1991), different conceptual models could be compared following three criteria. First criterium examines how well the conceptual models explain and predict

the use and engagement with technology. More precisely, we will examine whether the factors of each model largely account for the observed variance. So, comparing the model's respective levels of variance provides evidence of the superiority of the models. Secondly, we will examine the value of the information provided by the alternative models (Mathieson, 1991). That is, under the assumption that the comparison should not be biased to favour one model over the others, we will analyse the empirical evidence on which variables have a stronger influence on behavioural usage and engagement. Accordingly, the path coefficients between variables and their significance could be examined, as well as the model fits. Last criterion for model comparison is the cost of each model because it is important that models provide valuable information at low cost and with minimum effort. Finally, it should be noted that the selection of the wrong structural model would convey a loss of explanatory power.

3.1 Proposal of three alternative competing models

The three alternative competing models empirically tested and examined in this study capture the relationships among information search, social interaction, entertainment, type of content, technology use and engagement with technology. Overall, the primary difference among these three competing models is the role played by use and engagement. More precisely, the three competing models test whether use and engagement are both consequences of the main motivations to use technologies (Model A) or whether these factors are antecedents (Models B and C). Therefore, these three alternative competing models aim to explain technology behaviour.

3.1.1 Model A: technology engagement and use as consequences. This model considers both engagement with technology and technology usage as consequences of the different motivations. For this reason, it could be considered as a direct impact model because it posits that each one of the motivational factors directly influences both technology use and engagement, showing a direct effect (Figure 1). So, according to this model, technology engagement and use are equally influenced by the different motivations, being considered as dependent variables. In other words, this model holds that cognitive engagement with technology and technology behavioural use are jointly created by different motivations on equal footing.

3.1.2 Model B: "use-to-engagement model" (use as an antecedent). Model B consists of the original proposed relationships of the uses and gratifications theory (Katz *et al.*, 1974); but, in addition, we have incorporated engagement as a potential consequence of the use of technology, as well as the type of content as a potential variable influencing the use of technology. That is, according to prior studies that indicate usage is one of the primary determinants of engagement with technology (Sharafi *et al.*, 2006), we assume that to be engaged with technologies, the individual needs to use them. That is, this model proposes that technology use is an antecedent or prerequisite for technology engagement, suggesting that technology usage does not require a cognitive engagement. So, only technology use is considered as the major predictor directly influencing technology engagement. Consequently, Model B could be labelled "use-to-engagement" because only technology use has a direct impact on technology engagement, while the motivational factors have an indirect impact on engagement with technology.

3.1.3 Model C: engagement-to-use model (engagement as an antecedent). Model C, labelled "engagement-to-use" proposes that technology engagement precedes or is a prerequisite of technology use, suggesting that technology usage requires certain level of cognitive engagement. This model is based on the flow theory proposed by

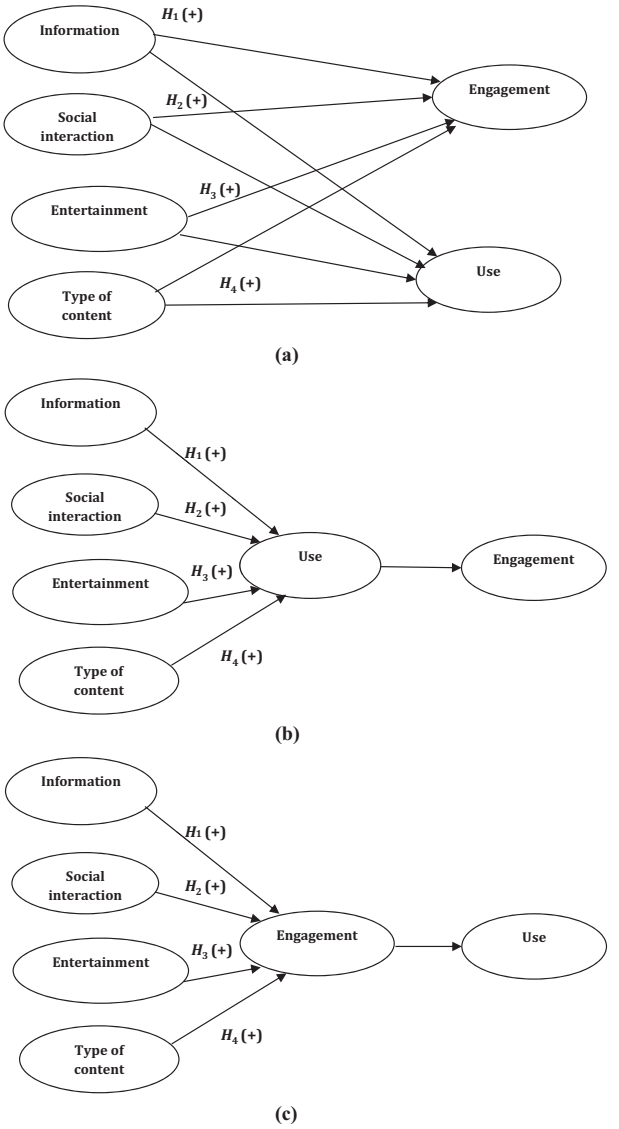

Figure 1.
Conceptual proposed models

Notes: (a) Model A "engagement-and-use"; (b) Model B "use-to-engagement"; (c) Model C "engagement-to-use"

Csikszentmihalyi (1993) who showed that when individuals are cognitively engaged with a certain experience or activity they tend to continue that experience, but when they are not engaged, they try to escape from it (Sharafi *et al.*, 2006). Therefore, the cognitive engagement increases the use intensiveness.

For this reason, this model builds on the basis of technology behaviour as a cognitive process that may or may not engender subsequent technology usage. In other words, the technology use does not arise until the individual has cognitive engagement with technology. So, in Model C, we propose that the extent to which an individual engages with technology influences the use of technology. Model C hypothesises that engagement with technology has a direct positive impact on technology use, and in turn, engagement is hypothesised to influence technology use directly.

4. Methodology

4.1 Variables and scale development

The instrument used in this study comprised question items based on previous research. Respondents were asked to indicate their agreement and disagreement with several statements using a five-point Likert-type scale ranging from 1 = "*strongly disagree*" to 5 = "*strongly agree*". The information search motivation was measured adopting a four-item scale from Baldus *et al.* (2015). The social interaction through technology was examined adapting four items proposed by Hollebeek (2011) and from Baldus *et al.* (2015). The entertainment motivation was gauged with a four-item scale adopted from Novak *et al.* (2000) and Koufaris (2002), while the type of content was examined using a three-item scale proposed by De Wulf *et al.* (2006). For measuring the user *engagement* with technology, we included a three-item scale proposed by Koufaris (2002) and by Sharafi *et al.* (2006). Finally, the *use* of technology was measured through a three-item scale adopted from Davis (1989).

4.2 Sampling and fieldwork

Data for the research were collected through a self-administered questionnaire among individuals residing in Spain. Data were obtained in September 2017 on a random basis.

We selected millennials as the population under research for the present research because including different age groups would make the analysis more complex because different age user groups may have different motivations and technology behaviour. Further, according to previous literature, the main factor differentiating millennials from other age groups is the core role of technology in their daily routines because they have grown up and have been immersed in technology all their lives (Howe and Strauss, 2003), thus being heavy users of technology. So, a pre-screening question was included in the questionnaire, including participants who were 20–30 years old. Therefore, the research target population are individuals who belong to the millennial cohort.

Participants were contacted at different university campus and in commercial institutions through a survey and using a self-administered questionnaire that was also available online. The self-administered questionnaire allows participants to complete a survey instrument on their own; however, the questionnaire was also administered on a face-to-face basis to ensure high-survey participation.

The questionnaire comprised two sections: the first section included variables related with the use and engagement with technology that participants were asked to rate using a five-point Likert-type scale, while the second section gathered socio-economic and demographic characteristics of the participants. Finally, a total amount of 909 questionnaires were collected, obtaining 715 valid questionnaires, thus representing a sampling error of $\pm 3.32\%$, with a confidence level of 95.5%.

5. Results

5.1 Measurement model

By means of confirmatory factor anális, the measurement model identifies relations between variables, through structural equation modelling (SEM) using AMOS 18.0 software. Construct refinement was enabled by the analysis of covariance residuals and modification indices, with the exclusion of items until the goodness-of-fit indices was achieved (Baumgartner and Homburg, 1996). This analysis revealed the need to remove two items from the initial scale – INFO2 and DIS4. When removing these indicators, the results show an appropriate specification of the proposed factorial structure. Then, to examine the severity of common method variance (CMV), the Harman's single factor test has been used. Our results indicate that six factors are extracted explaining 82.4% of the variance, and the unrotated factor solution indicates that the first factor accounts for the 16.84% of the variance, being below the commonly accepted threshold of 50% (Harman, 1976). Therefore, the potential bias for CMV in the measurement model is low.

The construct reliability, convergent validity and discriminant validity were addressed (Table 1). The construct reliabilities representing internal consistency were analysed through the Cronbach's alpha estimates, factor loadings and composite reliability (CR) values. Cronbach's alpha estimates ranging from 0.761 to 0.849 and CR values higher than 0.70 indicate internal consistency (Fornell and Larcker, 1981). In addition, the standardised factor loadings all reached the level of significance and exceeded the commonly accepted value of 0.60 (Hair *et al.*, 2010) indicating an adequate internal consistency of constructs. The average variance extracted (AVE) reached values for all constructs that were higher than the recommended threshold of 0.50, suggesting the convergent validity of the scale (Fornell and Larcker, 1981). Therefore, the measurement model is adequate to test the three alternative models.

In addition, discriminant validity is achieved because following the Fornell and Larcker (1981) criteria, the AVE values for each construct are greater than the squared correlation between the construct and any other construct in the model (Table 2).

5.2 Structural models

Multiple fit criteria were used to analyse the degree of the overall models fit. According to Hair *et al.* (2010), the normal fit index (NFI), the goodness-of-fit index (GFI), root mean square error or approximation (RMSEA), Tucker–Lewis index (TLI) and comparative fit index (CFI) are used to examine the models' overall goodness-of-fit (Hair *et al.*, 2010). The final measurement models show a reasonable good fit and results were deemed satisfactory (Table 3).

Model A named "engagement-and-use" (Figure 1) proposes that the four motivations influence both engagement with technology and technology use. Results of the GFI show a good support for this model [χ^2/df = 1.968; CFI = 0.970; RMSEA = 0.037; incremental fit index (IFI) = 0.970; NFI = 0.941; TLI = 0.964]. Considering Model B "use-to-engagement" (Figure 1) the fitness of good indices results indicate a good model fit, despite the CFI is slightly lower than for Model A (X^2/df = 2.148; CFI = 0.965; RMSEA = 0.040; IFI = 0.965; NFI = 0.936). Finally, our results for Model C "engagement-to-use" (Figure 1) indicate the poorest model fit (χ^2/df = 2.559; CFI = 0.952; RMSEA = 0.047; IFI = 0.952; NFI = 0.924). Therefore, findings support the validity of the "engagement-and-use" model (Model A) over the other two proposed models because all of the indices show better values.

6. Discussion

6.1 Comparison of the three structural competing models

The present study adopted the model of comparison approach proposed by Joreskog and Sorbom (1993), which requires the specification and test of a priori alternative models using

Indicators	Lambda (λ)
*Information (*Baldus *et al.*, 2015*)* α = 0.784; CR = 0.870; AVE = 0.693	
INFO1: I use technology to find breaking news events	0.916
INFO2: I use technology to get updated information	0.829
INFO3: Technology provides me information that helps me make important decisions	0.737
*Social interaction (*Baldus *et al.*, 2015*; Hollebeek, 2011)* α = 0.768; CR = 0.836; AVE = 0.566	
SOC1: I often use technology to contribute of provide feedback to other people	0.742
SOC2: Using technology will give me an opportunity to meet and to know people	0.836
SOC3: I often use technology to discuss arguments, give my opinions and ideas	0.658
SOC4: I often use technology to join social networking	0.699
*Entertainment (*Novak *et al.*, 2000; Koufaris, 2002*)* α = 0.849; CR = 0.819; AVE = 0.612	
DIS1: I use technology to have fun	0.825
DIS2: Using technologies provides me with a lot of enjoyment	0.831
DIS3: I feel pleasure when experiencing/exploring new media technologies	0.625
*Type of content (*De Wulf *et al.*, 2006*)* α = 0.842; CR = 0.862; AVE = 0.662	
CONT1: Technology provides me up-to-date contents	0.743
CONT2: Technology provides me sufficient/wide variety of contents	0.884
CONT3: Technology provides me interesting contents pertaining to my concerns	0.732
Engagement (Koufaris, 2002; Sharafi *et al.*, 2006) α = 0.761; CR = 0.799; AVE = 0.592	
ENG1: When using technology, I am deeply engrossed in the activity	0.806
ENG2: When using technology, I fully concentrate on the activity	0.749
ENG3: When using technology, I am usually absorbed intensely in the activity	0.679
Use (Davis, 1989) α = 0.842; CR = 0.879; AVE = 0.710	
USE1: I will use technology in the next days	0.684
USE2: I plan to use technology in the future	0.886
USE3: I expect my use of technology to continue in the future	0.855

Table 1.
Scale refinement

	Correlation coefficients					
Variables	Inf	Soc	Ent	Cont	Eng	Use
Information	*0.799*					
Social interaction	0.145	*0.752*				
Entertainment	0.455	0.150	*0.782*			
Type of content	0.183	0.014	0.249	*0.814*		
Engagement	0.231	0.219	0.386	0.180	*0.769*	
Use	0.412	0.145	0.543	0.159	0.505	*0.843*

Note: The diagonal values in Italics represent the square root of the average variance extracted of each construct

Table 2.
Correlation matrix among constructs

the same set of data. More precisely, in the present study, the three models are empirically tested using the same population sample for the three alternative models. Therefore, the observed differences between the models are likely to be because of the proposed models themselves. In addition, SEM was developed to estimate the standardised coefficients for each path and the variance explained for each dependent variable (Table 4). To compare the three alternative models, we will analyse both the explanatory power using the observed variance (R^2) for the two dependent variables – use and engagement, as well as the path coefficients.

6.1.1 Analysis of path coefficients. Results show a significant and positive direct influence of entertainment ($\beta_{35A} = 0.350^{**}$), social interaction ($\beta_{25A} = 0.172^{**}$) and type of content ($\beta_{45A} = 0.109^{**}$) on the engagement with technology in Model A. More precisely, the entertainment motivation showed the strongest influence on technology engagement, followed by the motive of social interaction and the type of content. However, the obtained results do not support a significant influence of information search motivation in technology engagement ($\beta_{15A} = 0.029^{ns}$). Likewise, findings indicate that the entertainment motivation ($\beta_{36A} = 0.365^{**}$), followed by the information search motivation ($\beta_{16A} = 0.189^{**}$) have the strongest influence on the use of technology in Model A. Further, the motivation of social interaction ($\beta_{26A} = 0.019^{ns}$) and the type of content ($\beta_{46A} = 0.026^{ns}$) showed not statistical significance on the use of technology. Finally, findings support a significant influence of engagement with technology on technology usage ($\beta_{56A} = 0.280^{**}$), as initially hypothesised. Therefore, only three out of the nine research hypotheses are not supported in Model A.

The analysis of Model B "use-to-engagement" models reveals that the entertainment motivation has the strongest influence on the use of technology ($\beta_{36B} = 0.490^{**}$), followed by the information search motivation ($\beta_{16B} = 0.145^{**}$). So, these findings suggest that the hedonic use of technology may be the most important one for individuals, or, in other words, individuals use technology to experience enjoyment and fun. Similarly, findings suggest the lack of relationship between the social interaction motivation ($\beta_{26B} = 0.045^{ns}$) and the technology use, as well as between the type of content ($\beta_{46B} = 0.016^{ns}$) and the technology usage behaviour. One possible explanation for this result is that users create and share their own-generated content through the social media and the internet, and in turn, contents provided do not influence in their use of technologies. Finally, a positive direct relationship between technology use and engagement is supported ($\beta_{56B} = 0.458^{**}$), as initially hypothesised. So, we can state that the use of technology drives cognitive engagement.

On the other hand, the examination of Model C, labelled "engagement-to-use" indicates that in terms of the effect size, the entertainment motivation ($\beta_{35C} = 0.406^{**}$) seems to contribute the most to technology engagement, followed by social interaction ($\beta_{25C} = 0.168^{**}$) and the type of content ($\beta_{45C} = 0.104^{**}$). So, results support that the higher entertainment and social interaction motivation, the higher engagement with technology, and similarly, the more interesting contents the higher technology engagement. However, our findings do not provide empirical support for a significant influence of information motivation on technology engagement ($\beta_{15C} = 0.021^{ns}$). One possible explanation for this result is that individuals do not consider the information available to be credible and trustworthy; and in turn, the information does not create engagement. Interestingly, our findings report a direct positive effect of technology engagement on technology use ($\beta_{56C} = 0.493^{**}$) as initially expected but being slightly higher than the reverse relationship (use on engagement).

Table 3.
Goodness-of fit-indices for the three alternative models

	Absolute fit measures					Incremental fit measures					Parsimony measures
Models	Chi-square	df	GFI	RMR	RMSEA	AGFI	NFI	IFI	TLI	CFI	Normed Chi-square
A	377.920*	192	0.955	0.045	0.037	0.940	0.941	0.970	0.964	0.970	1.968
B	466.182*	217	0.946	0.054	0.040	0.931	0.936	0.965	0.959	0.965	2.148
C	555.374*	217	0.939	0.078	0.047	0.922	0.924	0.952	0.944	0.952	2.559

Note: $^{*}p < 0.001$

Table 4. Structural model estimates

Path relationships	Model A "engagement-and-use" Standardised coefficients	Hypotheses test	Model B "use-to-engagement" Standardised coefficients	Hypotheses test	Model C "engagement-to-use" Standardised coefficients	Hypotheses test
H1: Information → Engagement	$B_{15A} = 0.029^{ns}$	Not Supported	–	–	$B_{15C} = 0.021^{ns}$	Not supported
H2: Social interaction → Engagement	$\beta_{25A} = 0.172^{**}$	Supported	–	–	$\beta_{25C} = 0.168^{**}$	Supported
H3: Entertainment → Engagement	$\beta_{35A} = 0.350^{**}$	Supported	–	–	$\beta_{35C} = 0.406^{**}$	Supported
H4: Type of content → Engagement	$\beta_{45A} = 0.109^{**}$	Supported	–	–	$\beta_{45C} = 0.104^{**}$	Supported
H5: Information → Use	$B_{16A} = 0.189^{**}$	Supported	$B_{16B} = 0.145^{**}$	Supported	–	–
H6: Social interaction → Use	$\beta_{26A} = 0.019^{ns}$	Not Supported	$\beta_{26B} = 0.045^{ns}$	Not Supported	–	–
H7: Entertainment → Use	$\beta_{36A} = 0.365^{**}$	Supported	$\beta_{36B} = 0.490^{**}$	Supported	–	–
H8: Type of content → Use	$\beta_{46A} = 0.026^{ns}$	Not Supported	$\beta_{46B} = 0.016^{ns}$	Not Supported	–	–
H9: Engagement → Use	$B_{56A} = 0.280^{**}$	Supported	–	–	$\beta_{56C} = 0.493^{**}$	Supported
H10: Use → Engagement	–	–	$\beta_{56B} = 0.458^{**}$	Supported	–	–
	R^2 (use) = 0.450		R^2 (use) = 0.474		R^2 (use) = 0.336	
	R^2 (engagement) = 0.273		R^2 (engagement) = 0.270		R^2 (engagement) = 0.243	

Notes: ns = no significant; **significant ($p < 0.05$)

6.1.2 Analysis of the explained variance. The explanatory power of each competing model could be examined using the variance explained for the use and engagement with technology. According to Hair *et al.* (2010), the explained variance (R^2) for the dependent constructs in each one of the competing models could be used to evaluate the explanatory power of the models and to determine which model is superior in explaining individuals' technology behaviour.

Our findings reveal the existence of a slight difference in the explained variance in the three models, although the three proposed models explain technology use and engagement well. More precisely, we can state that the R^2 values for the three models in technology use are medium, while the variance explained in technology engagement is low (Mathieson, 1991). We found that Model B "*use-to-engagement*" model explains more variance of technology use ($R^2_{use} = 0.474$) than Model A ($R^2_{use} = 0.450$) or Model C ($R^2_{use} = 0.336$). So, in Model B, information seeking, entertainment, socialisation and the type of content accounted for substantial variance in technology behavioural usage ($R^2 = 0.474$). Therefore, our findings indicate that Model B provides a better prediction of the technology usage behaviour, while Models B and C provide less explanatory power.

Conversely, the Model A "engagement-and-use" explains a slight more variance of engagement with technology ($R^2_{engagement} = 0.273$), than Model B ($R^2_{engagement} = 0.270$) and Model C ($R^2_{engagement} = 0.243$). So, results show that Model A provides a better explanatory power of technology engagement, compared with the other alternative models. In addition, Model A "engagement-and-use" explains higher number of relationships in technology behaviour than Models B and C. Finally, we propose the following models' comparison (Table 5).

6.1.3 Comparison of the three structural competing models. Regarding the comparison of the three alternative structural competing models, the first criterion developed to compare them is the model's ability to explain technology engagement and use. Our findings reveal that the three

Table 5.
Comparison of the three structural competing models

			Terms of comparison			
Models	Labels	Model description	Model fit	Path coefficients	Tech. use explanatory power (R^2 use)	Tech. engagement explanatory power (R^2 engagement)
Model A	"Engagement-and-use"	Technology engagement and use as consequences/ dependent variables	$A > B > C$	$A > C > B$	$B > A > C$	$A > B > C$
Model B	"Use-to-engagement"	Technology use precedes or is a prerequisite of technology use (use drives technology engagement)				
Model C	"Engagement-to-use"	Technology engagement precedes or is a prerequisite of technology use (engagement drives technology usage)				

models explain the technology behavioural usage quite well. Further, the Model B "use-to-engagement" explained more variance than Models A and C, and for this reason, this model could be considered as providing the better explanatory power. However, the three models provided only a moderate explanation on technology engagement, being Model A "engagement-and-use" and Model B "use-to-engagement" the models with the greater explanatory power.

The second criterion used for model comparison is the value of the information provided by each model. For this purpose, path coefficients and their significance and model fits were examined. Model A "engagement-and-use", which considers both technology engagement and use as consequences of different motivations – information search, entertainment, social interaction and type of content – provides a more comprehensive information on motivations that drive technology use and engagement. However, these two variables are not both addressed in the other competing models. Similarly, Model B labelled as "use-to-engagement" only provides information on the motivations influencing the use of technologies, assuming that technology engagement is subsequent to the use of technology. On the other hand, Model C "engagement-to-use" model provides information on engagement with technology, considering that cognitive engagement with technology serves as an antecedent of technology use – technology use is subsequent to engaging with technology.

Considering path coefficient values and their significance, we can conclude that Model A "engagement-and-use" is more specific and provides more complete information on both technology usage and engagement. Moreover, Model C labelled "engagement-to-use" provides more information than Model B because only one relationship was found to do not have a significant impact on the engagement with technology. So, in general terms, Model A "engagement-and-use" model provided the most comprehensive understanding of the variables influencing technology engagement and use. Therefore, one major conclusion is that Models A, C and B would be the stepwise order in model selection to explain technology behaviour.

Finally, the third criterion applied is the cost of use of the models, that is determined by the level of effort in using the model in a research context (Mathieson, 1991), which may include the development of the instrument and conducting the study. In this vein, the authors believe that the cost of the three competing models is quite similar.

7. Conclusions

The goal of the present research is to examine three structural alternative competing models to explain technology behaviour; and for this purpose, the different motivations that drive technology use proposed by the uses and gratifications theory were considered, and the Mathieson's (1991) criteria were adopted.

Our findings report that technology engagement and use could be both considered consequences of motivations such as information search, entertainment, social interaction and the type of content. Therefore, Model A "engagement-and-use", which considers both use and engagement as consequences of the motivational drivers, has been shown to be the superior model to explain and predict technology behaviour. So, the empirical analysis carried out allows to suggest that both the engagement with technology and the use of technology are driven by different motivations, as suggested by the uses and gratifications theory.

Derived from our research, the first conclusion is that the uses and gratifications theory is useful in explaining the main motivations that drive the use of technology, being information search, entertainment and socialisation variables that influence technology use. The second conclusions is that both technology use and engagement are consequences of different motivations.

The third research conclusion is that the main motivations or drivers in technology behaviour are entertainment, followed by the search for information in the use of technology. Similarly, the main drivers of technology engagement are entertainment, social interaction and the type of content. So, findings reveal that users are strongly motivated and influenced by hedonic factors when using technologies, such as enjoyment and having fun. These findings are in line with the previous literature on the uses and gratifications theory because researches noted that quite often users consider technologies as a form of entertainment (Dhir *et al.*, 2017).

Finally, the major contribution of this study is the empirical test of three alternative structural competing models to decide which one could be considered the structural model with greater explanatory power.

7.1 Managerial and theoretical implications

Some managerial implications derive from the present study. In the first place, this research provides managers and marketing scholars with a practical method to examine and compare structural competing models, allowing the selection of the model with greater explanatory power. More precisely, this method – based on the criteria proposed by Mathieson – has been applied to technology behaviour, helping to decide which is the structural model with greater explanatory power. In addition, the method presented here could be also applied to other theoretical and structural models that need to be compared. In other words, the present research provides an example of a procedure or method that allows the comparison different structural competing models to select the best one. In the second place, considering our findings managers should bear in mind that entertainment is the main motivation, which drives technology use and engagement behaviour. Accordingly, our results suggest that technology-based companies that aim to have their users engaged need to develop marketing activities and strategies that fulfil their needs for entertainment through emotional, imaginal and sensory experiences. For this purpose, companies could evoke hedonism and develop gamification strategies, providing experiences of fun, pleasure and enjoyment in technology use (Flavián *et al.*, 2019). Further, companies could use game elements in other contexts to provide enjoyable experiences for technology users.

Similarly, some theoretical implications derive from the present study. On one hand, this research empirically demonstrates which variables that explain the creation of technology use and engagement, namely information search, social interaction, entertainment and type of content. In addition, the present research reports that technology use and technology engagement could be both considered as consequences of motivational variables, instead of being considered one as an antecedent of the other. That is, two of the conceptual models proposed that users need to be engaged with technology to use it, and that conversely, users need to use technology to be engaged with it. However, our study indicates that various motivations make users to be engaged with technology and use it simultaneously. Put it in other words, different motivations such as information search, social interaction, entertainment and type of content impact on individuals' use and engagement with technology and this would be the best description of their technology behaviour. Finally, at the theoretical level, the present study contributes to the body of knowledge on technology behaviour with a practical method to compare different conceptual models.

7.2 Research limitations and future research guidance

This study has some limitations that represent avenues for future research. In the first place, future research on the topic could address the potential differences in technology behaviour focussing on one specific technology, such as for example examining the differences in

technology use in mobile games, mobile payment systems or social networks. Similarly, future research could focus on the use of different technology devices such as the use of smartphones and PCs (Barta *et al.*, 2021). In the second place, the mediating relationships between variables could be also analysed in further studies, given that this analysis was not developed in the present research. More specifically, it would be interesting to analyse the potential mediating effects in Models B and C, so that the mediating influence of technology use in Model B and technology engagement in Model C could be explored. Similarly, it could be also interesting to examine the potential moderating effect of the frequency of technology use in the proposed conceptual models. Thirdly, we used SEM to analyse and compare the alternative models, even though this is not the only type of analysis to compare alternative causal models.

Finally, future research could examine other theoretical models of technology use and adoption because other theoretical models could be conducted to explain technology behaviour among users. Likewise, further research could incorporate the potential influence of the context on the use of technologies.

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