UNIVERSIDADE CATÓLICA PORTUGUESA

Mobile apps market – understanding culture and gamification impact

Master's Final Assignment – Witten Assignment
Presented to *Universidade Católica Portuguesa* to obtain a Master's Degree in Management with a specialisation in Business Analytics

by

Andreia Filipa Gomes

Under supervision of
Prof. Gonçalo Baptista

Católica Porto Business School
April, 2024

Resumo

Atualmente, as tecnologias de informação são uma parte importante e indispensável da vida humana, devido ao desenvolvimento da Internet e dos dispositivos móveis, tais como smartphones e tablets (Tamilmani et al., 2021). A crescente utilização de dispositivos móveis impulsionou o desenvolvimento de software de aplicações móveis. Em 2023, o número global de downloads de aplicações móveis atingiu os 257 biliões (Ceci, 2024a).

O propósito deste estudo é entender o impacto da cultura e da gamificação no mercado das aplicações móveis. O nosso modelo teórico inovativo proposto resulta da combinação da *Unified theory of acceptance and use of technology (UTAUT2),* dimensões culturais de Hofstede e gamificação. O modelo teórico foi analisado recorrendo ao método *Partial Least Squares Structural Equation Modelling (PLS-SEM),* num estudo quantitativo realizado num país europeu. Na medida da pesquisa realizada, esta é a primeira vez que UTAUT2, dimensões culturais de Hofstede e uma variável da gamificação são combinados num estudo de aceitação de aplicações móveis, enriquecendo a literatura disponível sobre este assunto, e fornecendo conclusões sobre como a cultura e técnicas de jogo influenciam o comportamento do utilizador.

Os resultados revelam que a *performance expectancy* tem um papel significativo na explicação da *behavioural intention,* um indivíduo irá intencionar utilizar uma aplicação móvel quando acredita que isso resultará num resultado positivo. Além disso, *habit* demonstrou ser uma importante influência sobre *behavioural intention* e *use behaviour,* destacando que uma experiência passada positiva de

utilização de uma aplicação móvel influenciará o seu comportamento futuro. Adicionalmente, os resultados reconhecem *individualism/collectivism* como sendo um antecedente do *use behaviour*. Os resultados também confirmaram a influência da *behavioural intention* no *use behaviour*.

Os resultados deste estudo têm implicações teóricas e práticas. Para os investigadores, este estudo pode servir de base para um maior desenvolvimento e investigação futura sobre aceitação, impacto da cultura e gamificação na aceitação das tecnologias de informação. Para os profissionais, este estudo revela conclusões valiosas para empresas de desenvolvimento de aplicações móveis, por exemplo, sobre o design das aplicações móveis ou desenvolvimento de estratégias de marketing focadas na perspetiva do consumidor.

Keywords: aplicações móveis, UTAUT2, cultura, gamificação, aceitação.

Abstract

Nowadays, information technologies are an important and indispensable part of human life, due to the development of Internet and mobile devices, such as smartphones and tablets (Tamilmani et al., 2021). Mobile device utilization growth boosted mobile applications software development. In 2023, the global number of mobile apps downloads reached 257 billion (Ceci, 2024a).

The purpose of this research is to understand the impact of culture and gamification on the mobile apps market. Our innovative theoretical model results from the combination of the Extended unified theory of acceptance and use of technology (UTAUT2), Hofstede cultural dimensions, and a gamification construct. The theoretical model was tested using Partial Least Squares Structural Equation Modelling (PLS-SEM), in a quantitative study conducted in a European country. To the extent of the research conducted, this is the first time that UTAUT2, Hofstede cultural dimensions, and a gamification construct are combined in a mobile apps' acceptance study, enriching the literature on this subject, and providing new insights on how culture and game technics influence individual behaviour.

Findings reveal that performance expectancy has a significant role in explaining behavioural intention, supporting that an individual will intend to use a mobile app when he believes that it will result in a positive outcome. Furthermore, habit was shown to be an important influence over behavioural intention and use behaviour, highlighting that an individual positive previous experience when using a mobile app will influence his future behaviour. In terms

of culture, findings acknowledge individualism/collectivism as an antecedent of use behaviour. The results also confirmed the influence of behaviour intention over use behaviour. The results from this work have implications for researchers and practitioners. For researchers, it can serve as a basis for further development and future research on adoption, culture and gamification impact on information technologies acceptance. For practitioners, it reveals valuable insights for mobile apps development companies, for instance, regarding mobile apps design or marketing strategies development focused on the consumer perspective.

Keywords: mobile apps, UTAUT2, culture, gamification, acceptance

Table of contents

Table of Figures

Table of Tables

1. Introduction

In the 21st century, the development of Internet and smartphones has made information technologies an indispensable part of human life (Tamilmani et al., 2021). Smartphones utilization experienced an immense growth which also enabled a mobile application usage exponential increase (Hsiao et al., 2016; Tam et al., 2020). The term "apps" initially referred to general productivity and information retrieval type of software, including email, task list, and calendar, among others (Hsu & Lin, 2015).The increasingly user demand and the widespread availability of developer tools allowed the expansion and inclusion of other apps categories such as, games, social networking platforms among others, providing access to information on numerous areas such as, business, finance, lifestyle, and entertainment (Hsu & Lin, 2015). The popularity of mobile apps is not just proven by the number of worldwide downloads, that has been growing over the recent years, from more than 140 billion in 2016 to more than 257 billion downloads in 2023 but also, by the time users spent using and engaging with mobile apps, that has been increasing in the past years (Ceci, 2024a, 2024b) . Furthermore, the gross consumer mobile app spending reached 171 billion USD in 2023 (Ceci, 2024c).

Culture can influence the use of information technologies(Leidner & Kayworth, 2006).With globalization, it becomes even more important to understand how different cultural contexts affect the individual behaviour towards mobile apps acceptance, hence, culture has a significant role in technology adoption and use (Im et al., 2011). Gamification, understood as the use of game technics and elements in non-game contexts, has been associated

with affording similar experiences as games such as encouraging user motivation, engagement, and enjoyment (Deterding et al., 2011; Koivisto & Hamari, 2019; Seaborn & Fels, 2015). The user perception towards technology acceptance can be increased by the enjoyment provided (Venkatesh et al., 2012). Thereupon, when studying mobile apps acceptance, it is of most importance to understand how the incorporation of gamification elements affects the user's acceptance.

The main purpose of this research is to understand the impact of culture and gamification in the mobile apps market. The theoretical model developed results from the unique combination of the UTAUT2 - Extended unified theory of acceptance and use of technology, Hofstede cultural dimensions, and a gamification construct, that to the best of our knowledge has not yet been tested in literature. Studies that combine mobile apps acceptance with gamification and culture are scarce, and sometimes present contradictory results, requesting additional research, a gap we hereby intent to fulfil. This study brings new insights to the existent body of knowledge on mobile apps acceptance, by presenting a unique model, that aims to understand how two major trends, namely globalization and the increasing presence of mobile apps on people daily lives affect the user perception towards mobile apps acceptance.

In the next section, a theoretical background is presented beginning with a mobile apps' conceptualization and introduction to the unified theory of technology acceptance and use, followed by the conceptualization of culture and gamification concepts. Subsequently, the research model and hypothesis are presented, and the data collection methodology is described. Thereafter, the data is analysed, the results of the research are presented and discussed, including the

description of the theoretical and practical implications ending with the description of the limitations and suggestions for additional research.

2. Literature review

2.1. Culture

There are a multitude of definitions, conceptualizations and dimensions that are used to describe culture (Leidner & Kayworth, 2006). The word culture itself can mean all type of works, spiritual and intellectual development, the values, beliefs, customs, and practices by which man or woman live; or a whole way of life (Eagleton, 2016). Even though culture definitions present some variations, they share some common elements. Taras et al., (2009) defines culture as a shared set of distinct basic assumptions, values, practices, and artifacts that are formed and retained over a long period of time. Additionally, Hofstede(1980a), defines culture as the collective programming of the human mind that distinguishes the members of one human group from those of another. Therefore, culture can be considered as a system of collectively held values.

Hofstede's model of culture has a significant presence in literature, defining how culture has been conceptualized and measured (Taras et al., 2023). When published "Culture's consequences" in 1980, Hofstede identified a national cultural ranking that boosted countless of new opportunities in international business and management research (Taras et al., 2023). For instance, Hofstede work on national culture has been widely used and has allowed cross-country comparison research (Im et al., 2011). At first, the cultural framework only included four cultural dimensions: individualism/collectivism, power distance,

masculinity/femininity, and uncertainty avoidance. Afterwards, long-term orientation was added (Hofstede & Bond, 1988).

The individualism/collectivism dimension represents the relationship between the individual and the group and is the most popular dimension in cross-cultural research (Taras et al., 2023). This dimension is defined as the degree to which people prefer to act as an individual rather than as members of a groups (Hofstede, 1994). Power distance outlines the attitudes regarding people in power positions, in terms of the extent to which the less powerful accept inequality in power and considered it as normal (Hofstede, 1986). It can be defined as the extent to which a society accepts the fact that power in institutions and organizations may be distributed in a unequal manner (Hofstede, 1980b).The masculinity-femininity dimension demonstrates the duality between values like assertiveness, performance, success, and others, prevail over values like quality of life, service, and solidarity. Regarding this dimension, masculinity can be defined as the extent to which the dominant values in society are considered as "masculine" or as "feminine"(Hofstede, 1980b).Uncertainty avoidance outlines the preference for clear rules and guidance and, Hofstede, (1980b) defines it as the extent to which a society feels threatened by uncertain and ambiguous situations and tries to avoid these situations. Lastly, long-term orientation stands for the fostering of virtues oriented towards future rewards (Hofstede, 2001). Thereupon, it is related to values such as persistence, thrift, personal stability, and respect for tradition. (Taras et al., 2023).

2.2. Gamification

The concept of gamification first emerged in 2008 and has been gaining relevance over the years, translating into a growing academic interest on this field, considered to be one of the most important developments in the information systems field, among other domains (Deterding et al., 2011; Koivisto & Hamari, 2019; Seaborn & Fels, 2015). The definition of gamification presents some variations in the literature, nonetheless, it is generally defined as the use of game elements in non-game contexts, according to Deterding et al., (2011). Game elements can be considered as points, badges, levels, leaderboards, challenges, avatars, social network features, among others (Koivisto & Hamari, 2019; Sailer et al., 2017). In essence, it refers to the designing of systems and services with the purpose of affording similar experiences and motivations as games do thus, trying to enhance the end-user behaviour (Koivisto & Hamari, 2019). These similar experiences refer to, for instance, senses of enjoyment or accomplishment, that are considered to be instigated by games and game play (Ryan et al., 2006). Gamification can then be considered a motivational information system that results from a combination of utilitarian and hedonic purposes, in the way that the usefulness is determined by the enjoyment of its use, as in hedonic systems (Koivisto & Hamari, 2019). The potential of gamification derives in the inclusion of game elements and gameful affordances in the restructuring of tasks and activities (Koivisto & Hamari, 2019). The use of gamification encourages user motivation, engagement, and enjoyment (Seaborn & Fels, 2015).

Gamification has been researched and implemented into various domains such as education (Christy & Fox, 2014), commerce (Hamari, 2015), health (Jones et al., 2014), exercise (Hamari & Koivisto, 2015), crowdsourcing (Lin & Ding, 2023), environmental behaviour (Lounis et al., 2014), marketing and advertising

(Xi & Hamari, 2020), enterprise resource (Alcivar & Abad, 2016), as well as, government services and public engagement (Bista et al., 2014; Tolmie et al., 2014), to name a few. The education and learning domain are the most researched ones, both empirically and non-empirically (Koivisto & Hamari, 2019; Seaborn & Fels, 2015). In what concerns empirical research, the health and exercise and, crowdsourcing domains are also the target of most of the research conducted (Koivisto & Hamari, 2019).In addition, in the non-empirical research, the domains of design and development of gamification services, business and management also stand out (Koivisto & Hamari, 2019).

Following Hamari et al., (2014), Huotari & Hamari, (2017) and Deterding, (2015) an overall conceptualization of gamification can be derived, comprising three main elements: affordances, psychological outcomes, and behavioural outcomes. The affordances, elements that structure the games, lead to psychological outcomes (e.g. competence, autonomy, and relatedness) that further lead to behavioural outcomes, behaviours supported through the use of the gamification system (Koivisto & Hamari, 2019). The affordances can be grouped based on their type: achievement/progression-oriented (e.g. points and badges); social-oriented (e.g. social networking features); immersion-oriented (e.g. avatars); real-word related (e.g. motion tracking); miscellaneous elements (e.g. virtual helpers). Points, challenges, badges, and leaderboards, characterized as achievement/progression oriented, are the most commonly used affordances (Koivisto & Hamari, 2019). In terms of psychological outcomes, the analysis of empirical research on gamification reveals a focus on how the gamification implementations are perceived and experienced, whether it translates into motivation for the user (Koivisto & Hamari, 2019). Considering behavioural outcomes, most of the literature focuses on the interaction with a system or

performance metrics associated with its use such as, time-related variables or amount of content produced (Koivisto & Hamari, 2019).

Gamification can be associated with effects on affect and motivation, on behaviour and on cognitive learning (Koivisto & Hamari, 2019; Vlachopoulos & Makri, 2017). Nonetheless, knowledge on how gamification can lead to these outcomes still lacks (Nacke & Deterding, 2017). In addition, research on the effects of these outcomes presents some mixing and conflicting results, revealing that positive outcomes are not a given (Koivisto & Hamari, 2019) and gamification is not effective by itself (Sailer et al., 2017).

In their systematic review Krath et al., (2021), presented basic gamification working principles. It is stated that, through the use of game elements, goals and their relevance can be displayed, lead the users through predefined paths, provide direct feedback and support good performance positively and, simplify the content to manageable tasks. In essence, the gamification mechanics allows users to pursue their own goals, adapting the tasks to their own abilities and choose between several different progress paths. Furthermore, social gamification elements allow the users to compare their performance and connect to other users supporting each other and working towards a common goal.

One of the most popular theoretical foundation used in gamification research is the self-determination theory (SDT), followed by flow theory, experiential learning theory and constructivist learning theory (Krath et al., 2021).The theoretical foundations can be divided and analysed regarding their use in research, for instance, the self-determination theory is associated with the study of affect and motivational outcomes, the technology acceptance model with

behavioural outcomes and experiential learning theory with learning outcomes (Krath et al., 2021).

The self-determination theory is commonly used in gamification literature to explain why gamification is effective in consumer engagement. According to SDT, three basic psychological needs form de basis of human motivation: the need for competence, the need for autonomy and the need for relatedness (Ryan & Deci, 2000). As stated by Ryan & Deci, (2020), competence constitutes the feeling of mastery, a sense that one can succeed and grow; autonomy refers to a sense of ownership in one's actions; and relatedness concerns a sense of belonging and connection. Self-efficacy theory, as self-determination theory, also deals with the mechanics and mechanisms of motivation formation. This theory serves as a theoretical basis for other commonly used theories such as the technology acceptance model, by supporting the importance of ease of use for the acceptance of technology (Krath et al., 2021). The technology acceptance model states that behavioural attitude, that leads to the behavioural intention to use a determined system, depends on two behavioural benefits: perceived usefulness and perceived ease of use. Davis, (1989) defines perceived usefulness as the degree to which a person believes that using a particular system would enhance his or her job performance and, perceived ease of use as the degree to which a person believes that using a particular system would be free of effort.

2.3. The Extended unified theory of technology acceptance and use (UTAUT2)

The unified theory of acceptance and use of technology, also referred to as UTAUT, was developed as a comprehensive synthesis of prior technology acceptance research (Venkatesh et al., 2012), namely: (i) TRA - theory of reasoned action (Fishbein & Ajzen, 1975), (ii) TAM - technology acceptance model (Davis, 1989), (iii) MM - motivational model (Davis et al., 1992), (iv) TPB - theory of planned behavior (Ajzen, 1991), (v) Personal Computing utilization model (Thompson et al., 1991), (vi) DOI - innovation diffusion theory (Rogers, 1995), (vii) SCT - social cognitive theory (Compeau & Higgins, 1995), and (viii) the integrated model of technology acceptance and planned behavior (Taylor & Todd, 1995). This model is supported by four constructs, considered to play a significant role as direct determinants of user acceptance and usage behavior: performance expectancy; effort expectancy; social influence; and facilitating conditions. In addition, gender, age, voluntariness, and experience can be considered moderators of the beforementioned constructs, aiming to explain differences between individuals (Venkatesh et al., 2003). Later, the model evolved to seven constructs, adding hedonic motivation, price value and habit to its previous version, tailoring it to a consumer use context. In what concerns the moderators, voluntariness was dropped, being age, gender and experience the only moderating variables (Venkatesh et al., 2012).

3. Research model

Given the purpose of this research, to study the impact of culture and gamification on the mobile apps market, in terms of its acceptance and use, a theoretical model was developed. This model results from the combination of the Extended unified theory of acceptance and use of technology (UTAUT2) (Venkatesh et al., 2012), Hofstede cultural dimensions (Hofstede, 1980a) and a gamification construct (Baptista & Oliveira, 2017), as seen in Figure 1.

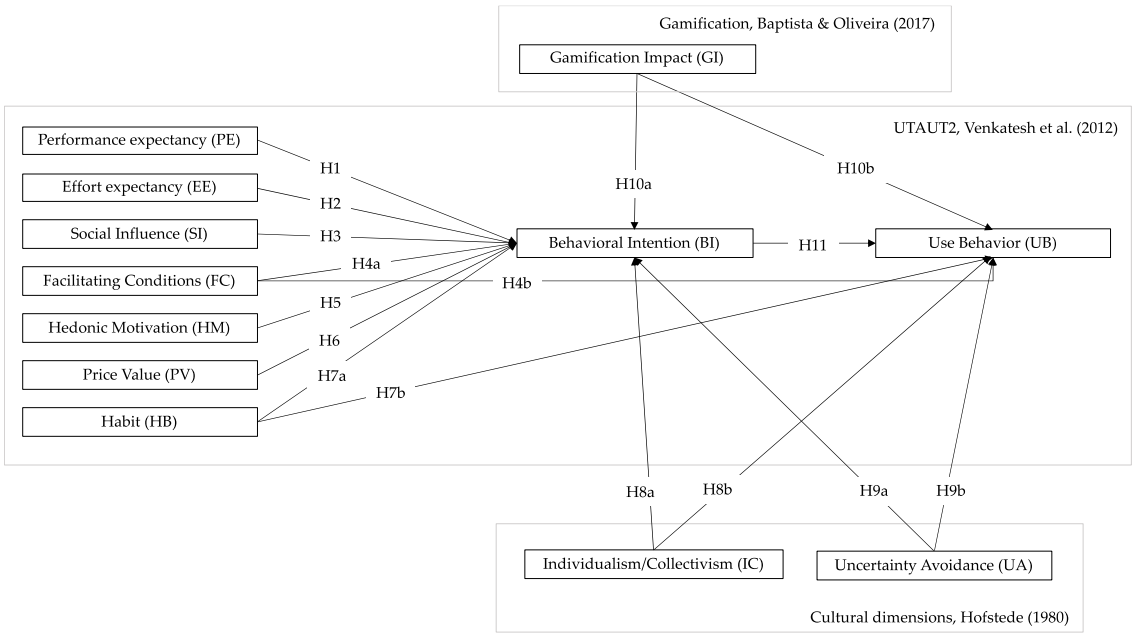

Figure 1 Theoretical research model

Figure 2 Theoretical research model

Researchers argue that understanding culture is of crucial importance to the information technologies study as it can influence the successful implementation and use of it (Leidner & Kayworth, 2006). Indeed, culture's role in technology acceptance has been the target of many studies, as culture affects the way that

people use information systems (Im et al., 2011). The individualism/collectivism and uncertainty avoidance dimensions were proven to be the Hofstede cultural dimensions most applied in IT adoption and use studies (Leidner & Kayworth, 2006). Therefore, we opted for the inclusion of only these two dimensions in the theoretical model. The emergence of new technologies, such as mobile technologies, has enhanced companies to develop gamified applications (Hofacker et al., 2016). Previous research found that user engagement is positively associated with continued use intention of mobile apps (Bitrián et al., 2021), thus it is important to include a gamification construct in the research model.

Performance expectancy is understood as the degree to which an individual believes that using mobile applications will result in benefits in performing certain activities (Venkatesh et al., 2012). Individuals will use mobile apps if they believe it results in a positive outcome (Tam et al., 2020). Therefore, it can be hypothesized that:

H1. Performance expectancy has a positive impact on behavioral intention.

Effort expectancy is the degree of ease associated with the use of mobile applications (Venkatesh et al., 2012). Research indicates that the greater the innovation complexity, the lower will be its rate of adoption and intention to use it again (Brown & Venkatesh, 2005; Venkatesh & Brown, 2001). The easier it is to use a mobile application, the greater will be the intention to use it. Therefore, it can be hypothesized that:

H2. Effort expectancy has a positive impact on behavioral intention.

Social influence is the extent to which individuals perceive that others, such as family and friends, believe they should use mobile applications (Venkatesh et al., 2012). In this context, it can be perceived that the greater the social influence over a mobile application, the greater will be the intention to use it (Tam et al., 2020). Therefore, it can be hypothesized that:

H3. Social influence has a positive impact on behavioral intention.

Facilitating conditions refer to consumer's perceptions of the resources and support available to use mobile applications (Venkatesh et al., 2012). The greater the facilitating conditions associated with the use of mobile applications, the greater will be the individual's willingness to use them. Therefore, it can be hypothesized that:

H4a. Facilitating conditions has a positive impact on behavioral intention.
H4b. Facilitating conditions has a positive impact on use behavior.

Hedonic motivation refers to the level of fun or pleasure derived from using a mobile application (Venkatesh et al., 2012). The more entertainment mobile applications provide, the more individual's will be willing to use them, seeking for that enjoyment. Therefore, it can be hypothesized that:

H5. Hedonic motivation has a positive impact on behavioral intention.

Price value is perceived as the consumer cognitive tradeoff between the perceived benefits of using mobile applications and the monetary cost of using them (Venkatesh et al., 2012). The cost and pricing structure of a mobile

application may have a significant impact on its use (Venkatesh et al., 2012). Therefore, it can be hypothesized that:

H6. Price value has a positive impact on behavioral intention.

Habit reflects the multiple results of previous experiences using mobile apps (Venkatesh et al., 2012). Research shows that habit exerts a moderating effect on the relationship between intention and continuance behavior in IS (Limayem et al., 2007), thus it can also be expected to exert a direct effect over the same constructs. Therefore, it can be hypothesized that:

H7a. Habit has a positive impact on behavioral intention.

H7b. Habit has a positive impact on use behavior.

In individualistic societies, people are more concerned with themselves whereas in collectivist societies people are more concerned with the group they are inserted (Baptista & Oliveira, 2015). Countries with a strong individualistic culture have a positive attitude towards technology adoption, as individuals perceive that technology allows a more efficient task performance (Kovačić, 2005).Accordingly, it is predicted a lower rate of information technology adoption in collectivist societies (Zhao et al., 2014).Therefore, it can be hypothesized that:

H8a. Individualism / Collectivism directly affects the behavioral intention, in such a way that the relationship will be stronger among people with individualistic values.

H8b. Individualism / Collectivism directly affects the use behavior, in such a way that the relationship will be stronger among people with individualistic values.

The emergence of new technologies and information technology innovations, such as mobile apps, has an inherent level of risk that may be less acceptable to cultures with a lower tolerance for uncertainty (Tam & Oliveira, 2019). Thereupon, in countries with low tolerance for uncertainty, it is expected that the acceptance of technological innovation will depend on its ability to control or monitor uncertainty (Kaba & Osei-Bryson, 2013).Therefore, it can be hypothesized that:

H9a. Uncertainty avoidance directly affects the behavioral intention, in such a way that the relationship will be weaker amongst people with higher values of uncertainty avoidance.

H9b. Uncertainty avoidance directly affects the use behavior, in such a way that the relationship will be weaker amongst people with higher values of uncertainty avoidance.

The use of gamification is associated with the affordance of similar experiences and motivations as the use of games, such as enjoyment, which enhances the user behavior (Koivisto & Hamari, 2019). Gamification increases user engagement through the satisfaction of the needs for competence, autonomy, and relatedness which in turn, leads to a greater intention to use a mobile application (Bitrián et al., 2021). Therefore, it can be hypothesized that:

H10a. Gamification has a positive impact on behavioral intention.

H10b. Gamification has a positive impact on use behavior.

Behavioral intention has a strong influence on technology use (Venkatesh et al., 2003). In the context of this research, it is perceived that the adoption of mobile applications could be predicted by the individual's willingness to adopt this system. Therefore, it can be hypothesized that:

H11. Behavioral intention has a positive impact on use behavior.

4. Methods

Research on technology acceptancy has traditionally been conducted using survey research (Venkatesh et al., 2003). Considering the research model, a questionnaire in English (Appendix 1) was developed and organized in sections by the elements where the theoretical model was built upon, thus: UTAUT2 data constructs; Hofstede cultural dimensions; and gamification construct. At the end, an additional section was added containing questions regarding demographic characteristics. The UTAUT2 items and scales were adapted from Venkatesh et al. (2003) and Venkatesh et al. (2012) and, the use behaviour from Im et al. (2011) and Martins et al. (2014). The items and scales regarding Hofstede cultural dimensions were adapted from Srite & Karahanna (2006), and the gamification impact from Baptista & Oliveira, (2017). The items were measured according to a 7-point Likert scale ranging from "Strongly disagree" (1) to "Strongly agree" (7) except the use behaviour (UB), where the answer choices ranged from "Have not used" (1) to "Several times a day" (11).

The data collection was conducted in Portugal, targeting people over 18 years, that own a mobile device (e.g. smartphone), have Internet access, and have one or more applications in their device. Taking this into consideration, the questions were translated to Portuguese (Appendix 2), submitted to a native academic for revision and then translated back to English, to validate the translation and ensure its consistency. An online survey instrument was implemented with the questionnaire and shared through social media. The conduction of an online survey allows to reach a more diverse population in a less amount of time, thus it was believed to be the best instrument to conduct this research. Common method bias was analysed using two methods: Harman's single factor (Podsakoff

et al., 2003) and, random dependent variable (Hair et al., 2017; Kock & Lynn, 2012). Both tests confirmed the absence of significant common method bias in the data. A total of 203 valid responses to the questionnaire were collected over the period of November of 2023 to March of 2024. A vast majority of the respondents were women (69.0%), above 33% aged between 18 and 25 and more than 53% of the respondents were over 36 years old. Regarding the educational level, over 26% have a high school degree or below and, more than 42% have a bachelor's degree. Detailed descriptive statistics are shown in table 1.

Table 1 Detailed statistics of respondents' characteristics

Measure		**Frequency**	**%**
Gender	Female	140	69.0%
	Male	61	30.0%
	Other / I prefer not to answer	2	1.0%
Age	Between 18 and 25	68	33.5%
	Between 26 and 35	25	12.3%
	Between 36 and 45	41	20.2%
	Between 45 and 55	52	25.6%
	Over 56	16	7.9%
	I prefer not to answer	1	0.5%
Education	High school or below	54	26.6%
	University frequency	23	11.3%
	Bachelor degree	86	42.4%
	Master degree	30	14.8%
	Doctorate	6	3.0%
	Other / I prefer not to answer	4	2.0%

5. Data analysis and results

Structural equation modelling (SEM) is a statistical technique used to test and estimate causal relationships using a combination of statistical data and qualitative casual assumptions (Martins et al., 2014). SEM techniques can be divided into two groups: covariance-based and variance-based. The data analysis was performed using partial least squares equation modelling (PLS-SEM), a variance-based technique and, was supported by the software SmartPLS 4 (Ringle et al., 2022). PLS-SEM was considered suitable for this work because the theoretical model has not yet been tested, the structural model is complex, with numerous constructs and, the sample size is more than ten times greater than the number of structural paths directed to a construct (Hair et al., 2011).

A PLS-SEM analysis is normally composed by two steps: measurement model and structural model (Hair et al., 2011), as described in the next two subsections, respectively.

5.1. Measurement Model

The measurement model analysis consists in the assessment of the reliability and validity of the measures through four criteria: items reliability, internal consistency, convergent validity, and discriminant validity.

Considering the items reliability, best practices recommend that all factor loadings should be greater than 0.7 (Hair et al., 2017). The items UA4, UA3, UB1 and UB2 were dropped at this stage as they presented factor loading lower than

the threshold. Internal consistency was assessed through composite reliability (CR) and Cronbach's Alpha. Both indicators should present values over 0.7 (Hair et al., 2017). As it can be seen in the Table 2, all items obey to that criterion. The convergent validity was assessed with the average variance extracted (AVE) and, as it can be observed in the same table, all constructs present an AVE higher than the minimum acceptable value of 0.5. (Fornell & Larcker, 1981).

Table 2 Quality criteria and factor loadings

Construct	Average variance extracted (AVE)	Composite reliability	Cronbach's alpha	Item	Loadings
PE	0.764	0.902	0.895	PE1	0.878
				PE2	0.916
				PE3	0.920
				PE4	0.774
EE	0.923	0.935	0.917	EE1	0.954
				EE3	0.967
SI	0.917	0.916	0.910	SI1	0.953
				SI3	0.962
FC	0.779	0.869	0.859	FC1	0.903
				FC2	0.898
				FC4	0.846
HM	0.880	0.868	0.864	HM2	0.943
				HM3	0.933
PV	0.930	0.942	0.925	PV1	0.958
				PV3	0.970
HB	0.697	0.875	0.854	HB1	0.876
				HB2	0.755
				HB3	0.784
				HB4	0.914
IC	0.652	0.900	0.870	IC1	0.730
				IC2	0.751
				IC3	0.848
				IC4	0.889
				IC5	0.807
UA	0.904	0.898	0.894	UA1	0.947
				UA2	0.955

Construct	Average variance extracted (AVE)	Composite reliability	Cronbach's alpha	Item	Loadings
GI	0.844	0.909	0.907	GI1	0.900
				GI2	0.917
				GI3	0.938
BI	0.872	0.927	0.926	BI1	0.920
				BI2	0.928
				BI3	0.952

Discriminant validity was analysed considering three measures. Firstly, the cross-loadings were analysed (Appendix 3), confirming that the loading of each indicator is higher than all corresponding cross-loading (Götz et al., 2010). Secondly, the Fornell-Larcker criterion was used, confirming that the square root of AVE, in bold in Table 3, is greater than the correlations between the constructs (Fornell & Larcker, 1981).

Table 3 Correlation matrix

	PE	EE	SI	FC	HM	PV	HB	IC	UA	GI	BI	UB
PE	**0.874**											
EE	0.546	**0.961**										
SI	0.443	0.363	**0.958**									
FC	0.636	0.710	0.445	**0.883**								
HM	0.584	0.584	0.405	0.578	**0.938**							
PV	0.443	0.555	0.523	0.560	0.470	**0.964**						
HB	0.581	0.518	0.440	0.567	0.632	0.531	**0.835**					
IC	0.142	0.132	0.276	0.192	0.151	0.234	0.212	**0.807**				
UA	0.580	0.444	0.345	0.593	0.526	0.347	0.491	0.123	**0.951**			
GI	0.386	0.338	0.356	0.335	0.394	0.395	0.405	0.291	0.281	**0.919**		
BI	0.629	0.423	0.481	0.506	0.556	0.469	0.674	0.215	0.509	0.405	**0.934**	
UB	0.273	0.232	0.105	0.186	0.314	0.203	0.458	-0.031	0.134	0.224	0.371	**1.000**

According to Henseler et al., (2015), these two measures, considered as the initial standard approach, present low sensitivity to detect discriminant validity, to which it is recommended to complement it with the use of a new criterion, the heterotrait-monotrait ratio of correlations (HTMT). The HTMT was then calculated and, as it can be seen in the Table 4, all values are below the recommended threshold of 0.9 (Henseler et al., 2015).

Table 4 Heterotrait-monotrait ratio of correlations (HTMT)

	PE	**EE**	**SI**	**FC**	**HM**	**PV**	**HB**	**IC**	**UA**	**GI**	**BI**	**UB**
PE												
EE	0.592											
SI	0.674	0.396										
FC	0.723	0.789	0.508									
HM	0.657	0.651	0.455	0.665								
PV	0.486	0.604	0.569	0.625	0.522							
HB	0.644	0.566	0.492	0.639	0.720	0.586						
IC	0.159	0.135	0.302	0.196	0.167	0.251	0.247					
UA	0.642	0.490	0.385	0.679	0.599	0.383	0.547	0.195				
GI	0.428	0.369	0.389	0.379	0.445	0.432	0.456	0.326	0.310			
BI	0.688	0.454	0.523	0.562	0.619	0.503	0.747	0.229	0.556	0.440		
UB	0.287	0.242	0.108	0.197	0.337	0.212	0.494	0.048	0.142	0.236	0.385	

Considering the results obtained and their analysis, it can be stated that the model has good construct reliability, internal consistency, convergent validity, and discriminant validity. Thereupon, it is ready for the next step, the structural model test and hypothesis testing.

5.2. Structural model and hypothesis testing

Collinearity was assessed through the computation of the variance inflation factor (VIF) (Appendix 4). VIF values above the threshold of 5 could indicate potential collinearity problems (Hair et al., 2011). Taking this criterion into account, the items EE2, FC3, HM1, PV2, EE4 and SI2 were dropped at this stage. All the tests were carried out once more to ensure the model validity and confirm the absence of potential multicollinearity problems.

The assessment of the hypothesis and construct's relationships is based on the examination of the standardized paths. The path significance levels were calculated using bootstrapping resampling method with 5,000 iterations of sampling (Henseler et al., 2009). The results obtained can be seen in the Figure 2.

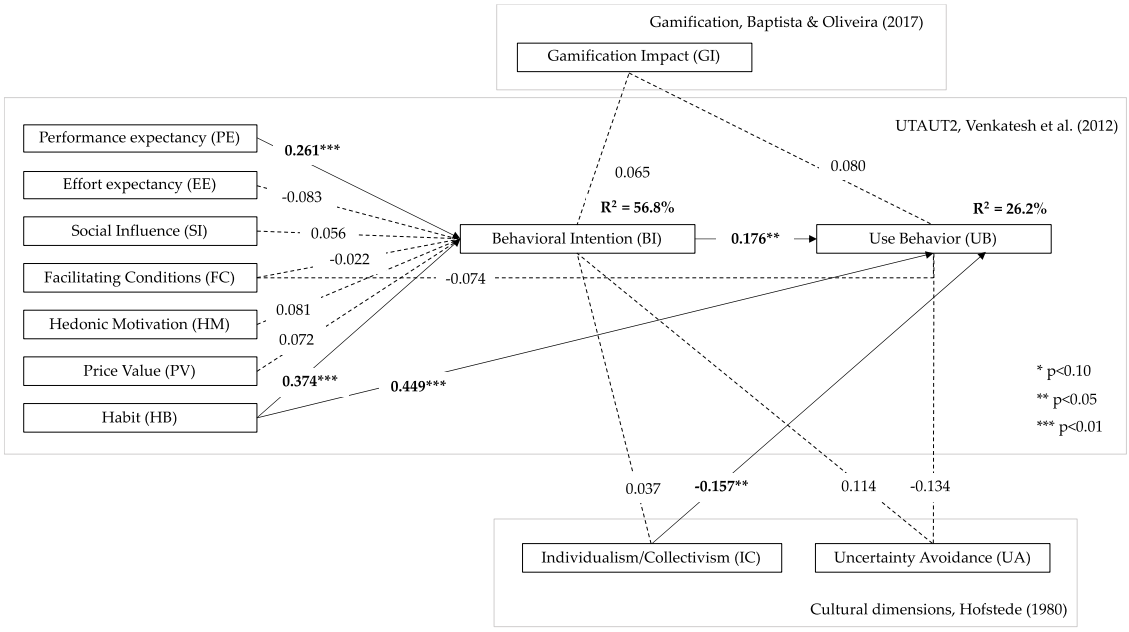

Figure 3 Structural model results

The model explains 56.8% of the variation in behavioural intention and 26.2% of the use behaviour. Performance expectancy ($\hat{\beta}$=0.261; p<0.01) and habit ($\hat{\beta}$=0.374; p<0.01) were found to be statistically significant in explaining behavioural intention, thus supporting the hypothesis H1 and H7a. In addition, habit ($\hat{\beta}$=0.449; p<0.01) and individualism/collectivism ($\hat{\beta}$= -0.157; p<0.05) were found to be statistically significant in explaining use behaviour, thus supporting respectively the hypothesis H7b and H8b. Furthermore, the behavioural intention ($\hat{\beta}$=0.176; p<0.05) was found statistically significant in explaining the use behaviour, supporting the hypothesis H11.

The influence of effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, individualism/collectivism, uncertainty avoidance and gamification over the behavioural intention were found statistically nonsignificant, thus not supporting hypothesis H2, H3, H4a, H5, H6, H8a, H9a and H10a. Complementarily, the influence of facilitating conditions, uncertainty avoidance and gamification on use behaviour were found to be not statistically significant, rejecting hypothesis H4b, H9b and H10b. Table 5 describes the outcomes of the hypothesis tested.

Table 5 Hypothesis outcomes

		Statiscally significant		**Hyphtesis support**	
Hypothesis		**Yes**	**No**	**Yes**	**No**
H1	PE -> BI	$\hat{\beta}$ = 0.261; p = 0.001**		X	
H2	EE -> BI		X		X
H3	SI -> BI		X		X
H4a	FC -> BI		X		X
H4b	FC -> UB		X		X
H5	HM -> BI		X		X
H6	PV -> BI		X		X
H7a	HB -> BI	$\hat{\beta}$ = 0.374; p = 0.000***		X	
H7b	HB -> UB	$\hat{\beta}$ = 0.449; p = 0.000***		X	

Hypothesis		Statiscally significant		Hyphtesis support	
		Yes	No	Yes	No
H8a	IC -> BI		X		X
H8b	IC -> UB	$\hat{\beta}$ = -0.157; p = 0.021**		X	
H9a	UA -> BI		X		X
H9b	UA -> UB		X		X
H10a	GI -> BI		X		X
H10b	GI -> UB		X		X
H11	BI -> UB	$\hat{\beta}$ = 0.176; p = 0.031**		X	

6. Discussion

Our theoretical model results from a unique combination of the UTAUT2 model (Venkatesh et al., 2012), Hofstede cultural dimensions (Hofstede, 1980a), and a gamification construct (Baptista & Oliveira, 2017). This model explains 56.8% of variation in the behavioural intention of mobile apps usage, which is a solid value but lower than some previous research (Baptista & Oliveira, 2017; Chopdar et al., 2018). Regarding use behaviour, the results obtained show that this model explains 26.2% of its variation, a value that can be considered low. This result can be due the sample specificities or, due to the fact that the model does not present a considerable number of variables to infer significant results over the use behaviour.

The research model validates the positive and statistically significant relationship between performance expectancy and behavioural intention, confirming that an individual believes that using mobile apps results in a positive outcome, which is supported by prior research (Tam et al., 2020; Venkatesh et al., 2012). Findings on the relationship between habit and behavioural intention as well as use behaviour are also validated and consistent with earlier research (Limayem et al., 2007). This result translates the fact that respondents' previous experiences of using mobile apps, positively influence their intention and future behaviour towards them. It is important to note that habit is considered by the respondents as the most important antecedent of behaviour intention and use behaviour, in line with previous research (Baptista & Oliveira, 2015; Hew et al., 2015). In addition, the positive and statistically significant relationship between behavioural intention and use behaviour is validated by the model, being consistent with prior research (Venkatesh et al., 2003, 2012). This indicates that a

user willingness to use a mobile app, positively influences their behaviour towards that action.

Considering the Hofstede cultural dimensions included in the model, the individualism/collectivism was found to be significant over the use behaviour, in line with what was expected (Hofstede, 1980b) , proving that culture has an impact on mobile apps acceptance. Previous research shows that individualism/collectivism has a significant moderating effect between behavioural intention and use behaviour (Baptista & Oliveira, 2015).Nonetheless, the negative sign was not the expected as Portugal can be considered an individualistic society (Hofstede, 2024) which would mean that it is open to the adoption of a technology such as mobile apps.

The results obtained did not confirm the significance of five UTAUT2 constructs on behavioural intention namely effort expectancy, social influence, facilitating conditions, hedonic motivation, and price value, and facilitating conditions on use behaviour. The finding related to effort expectancy contradicts the findings of Venkatesh et al., (2012) but is in line with prior research (Baptista & Oliveira, 2015). Considering this result, it can be argued that mobile apps are considered easy to use and not at all complex. Social influence nonsignificant impact over behavioural intention was not aligned with what was suggested by Venkatesh et al., (2012). However, it is consistent with some earlier research (Hew et al., 2015). This result indicates that individuals don't value important other's opinions when intending to use a mobile app. Nonetheless, research on mobile apps stated that social influence does not exert a lot of influence on continuance intention of mobile apps usage (Tam et al., 2020). The hedonic motivation result of no significance over the behavioural intention was not expected. Prior research indicates that hedonic motivation constitutes a

determining role on technology acceptance and use (Brown & Venkatesh, 2005; Venkatesh et al., 2012). This result can be considered counterintuitive as hedonic motivation represents the level of entertainment provided by a mobile app. Nonetheless, previous research stated the nonsignificant relationship between this construct and user's continuance intention of mobile apps usage (Tam et al., 2020). Price value was found to be not statistically significant over behavioural intention, which is consistent with previous research (Baptista & Oliveira, 2015; Hew et al., 2015). This can be explained by the fact that a vast majority of mobile apps are free of payment or inexpensive (Tam et al., 2020). Thereupon, according to the respondents, price value does not constitute an important factor in the intention to use a mobile app. The facilitating conditions result of no significance over the behavioural intention and use behaviour was not expected, according to Venkatesh et al., (2012). However, research on mobile apps continuance intention suggested a similar result (Tam et al., 2020), highlighting the fact that mobile apps incorporation in user's daily routines can lead to a reduction of facilitating conditions importance.

In what concerns Hofstede cultural dimensions, the significance of individualism/collectivism and uncertainty avoidance dimensions on the behavioural intention as well as uncertainty avoidance significance over use behaviour, were not proven by the model. Considering the uncertainty avoidance nonsignificant impact over behavioural intention and use behaviour, the results were not expected as previous research shows that uncertainty avoidance has a significant moderating effect between behaviour intention and use behaviour (Baptista & Oliveira, 2015). Portugal has a very low tolerance for uncertainty(Hofstede, 2024), societies with this characteristic resist the emergence of technological innovations, such as mobile apps. Thereupon, it would be expected of this dimension to play a more significant role in this study.

The gamification significance over behavioural intention and use behaviour was not proven by the model, contrarily to what was expected and with previous research (Baptista & Oliveira, 2017). The use of gamification elements, such as points and rewards, creates an enjoyable experience for the mobile app's users, enhancing their behaviour (Bitrián et al., 2021). This is a counterintuitive result, as it would be expected that gamification would play a more significant role in explaining behavioural intention and use behaviour. Nonetheless this result is aligned with the result obtained of no significant relationship between hedonic motivation and behavioural intention, mentioned earlier. This highlights the fact that respondents do not value the entertainment side of mobile apps as much as their utilitarian value.

6.1. Theoretical and practical implications

Different cultures affect the acceptance of mobile apps. In a movement toward globalization, it is crucial to promote additional cultural studies. One of the main important contributions of this study is an innovative and integrated theoretical model that combines the UTAUT2 model with Hofstede cultural dimensions, and a gamification impact construct, as far as we know not yet tested until now. The research model was applied in a mobile app context, with the purpose of understanding mobile apps acceptance and use, examining the culture and gamification impact. For researchers, this study can serve as basis for further refinement of individual models of acceptance, a starting point for future studies. The number of models that synergistically combine acceptance with culture and gamification in literature are very scarce, a gap that we are trying to reduce

hereby. Considering a managerial context, understanding the key constructs in the proposed model is crucial to design, develop, and to upgrade mobile apps and mobile services that may yield high levels of adoption and acceptance between users. The results suggest the significant importance of performance expectancy over the behavioural intention, individualism/collectivism over use behaviour and, habit over both behavioural intention and use behaviour. This research provides important insights for app developers and service providers, as they should focus on the development of functionalities and services that answer the specific needs of consumers from different cultures, adapting marketing strategies and apps design, aiming to provide the consumer a positive experience when using mobile apps.

6.3. Limitations and future research

Although this study brings new insights to the existent body of knowledge on mobile apps acceptance, it is important to also acknowledge its limitations. Regarding the sample, it's gender characteristics can be considered to not be equally distributed as a vast majority of the respondents were females (69.0%). It is important to note that the questionnaire was available to answer for more time than what was expected, with the purpose of collecting more answers and thus, have a more representative data.

This study was applied in a more general mobile apps context thus it would be interesting to apply this research model in a specific mobile apps segment such as gaming, banking, finance, weather, travel, streaming, social media, fitness, and health apps. In addition, future studies should consider replicate this study in

other countries and do a cross-country comparison, which could provide promising insights on countries distinctive characteristics and how they influence mobile apps acceptance and use on different geographical contexts. It would also be of great interest, to reshape this research model, inserting moderators, such as age and gender over UTAUT2 constructs. The incorporation of other Hofstede cultural dimensions should also be studied and would provide interesting and more thorough insights on the cultural effect on mobile apps acceptance and use. In addition, the moderating effect of Hofstede cultural dimensions on the relationship between UTAUT2 constructs or even the inclusion of other culture theories, would also be an interesting object of study. Regarding gamification, future studies should include more variables that intend to study the gamification impact on behavioural intention, but mostly, use behaviour, where the research model presented a lower predictive power.

7. Conclusion

The mobile apps market has been experiencing a tremendous growth in the last years with an enormous impact in people's daily lives. A unique model was developed, resulting from the combination of the Extended unified theory of acceptance and use of technology, Hofstede cultural dimensions, and a gamification construct, as far as we know not yet tested in literature. Our results indicate convergences and divergences when compared with previous literature, confirming the unique characteristics of the work. Findings reveal that performance expectancy has a significant role in explaining behavioural intention. Furthermore, habit was shown to be an important influence over behavioural intention and use behaviour. In addition, findings acknowledge individualism/collectivism as an antecedent of use behaviour, proving that culture indeed has a significant impact on mobile apps acceptance. The results also confirmed the influence of behaviour intention over use behaviour.

Regarding the work's objectives, they were fully accomplished, contributing to knowledge advancement. For researchers, this study can serve as a basis for further development and future research on acceptance, gamification, and culture impact on information technologies acceptance. For practitioners, this study reveals valuable insights for mobile apps development companies, whether in terms of design or as in a consumer perspective.

Bibliography

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *211*(50), 179–211.

Alcivar, I., & Abad, A. G. (2016). Design and evaluation of a gamified system for ERP training. *Computers in Human Behavior*, *58*, 109–118. https://doi.org/10.1016/j.chb.2015.12.018

Baptista, G., & Oliveira, T. (2015). Understanding mobile banking: The unified theory of acceptance and use of technology combined with cultural moderators. *Computers in Human Behavior*, *50*, 418–430. https://doi.org/10.1016/j.chb.2015.04.024

Baptista, G., & Oliveira, T. (2017). Why so serious? Gamification impact in the acceptance of mobile banking services. *Internet Research*, *27*(1), 118–139. https://doi.org/10.1108/IntR-10-2015-0295

Bista, S. K., Nepal, S., Paris, C., & Colineau, N. (2014). Gamification for online communities: A case study for delivering government services. *International Journal of Cooperative Information Systems*, *23*(02), 1441002. https://doi.org/10.1142/S0218843014410020

Bitrián, P., Buil, I., & Catalán, S. (2021). Enhancing user engagement: The role of gamification in mobile apps. *Journal of Business Research*, *132*, 170–185. https://doi.org/10.1016/j.jbusres.2021.04.028

Brown, S. A., & Venkatesh, V. (2005). Model of adoption of technology in the household: A baseline model test and extension incorporating household life cycle. *MIS Quarterly*, *29*(4), 399–426.

Ceci, L. (2024a). *Annual number of global mobile app downloads 2016-2023*. Statista. https://www.statista.com/statistics/271644/worldwide-free-and-paid-mobile-app-store-downloads/

Ceci, L. (2024b). *Cumulative number of hours spent using apps worldwide from 2020 to 2023*. Statista. https://www.statista.com/statistics/1446684/cumulative-time-spent-on-apps/

Ceci, L. (2024c). *Global mobile app consumer spending 2016-2023*. Statista. https://www.statista.com/statistics/870642/global-mobile-app-spend-consumer/#:~:text=In%202023%2C%20gross%20consumer%20mobile,billion%20U.S.%20dollars%20in%202022.

Chopdar, P. Kr., Korfiatis, N., Sivakumar, V. J., & Lytras, M. D. (2018). Mobile shopping apps adoption and perceived risks: A cross-country perspective utilizing the Unified Theory of Acceptance and Use of Technology. *Computers in Human Behavior*, *86*, 109–128. https://doi.org/10.1016/j.chb.2018.04.017

Christy, K. R., & Fox, J. (2014). Leaderboards in a virtual classroom: A test of stereotype threat and social comparison explanations for women's math performance. *Computers and Education*, *78*, 66–77. https://doi.org/10.1016/j.compedu.2014.05.005

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: development of a measure and initial test. *MIS Quarterly*, *19*(2), 189. https://doi.org/10.2307/249688

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319. https://doi.org/10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, JSTOR Journals*, *35*(8).

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace [1]. *Journal of Applied Social*

Psychology, *22*(14), 1111–1132. https://doi.org/10.1111/j.1559-1816.1992.tb00945.x

Deterding, S. (2015). The lens of intrinsic skill atoms: A method for gameful design. *Human-Computer Interaction*, *30*(3–4), 294 – 335. https://doi.org/10.1080/07370024.2014.993471

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: defining "gamification." *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, 9–15. https://doi.org/10.1145/2181037.2181040

Eagleton, Terry. (2016). *Culture*. Yale University Press.

Fishbein, M., & Ajzen, I. (1975). Belief, attitud, intention and behavior: An introduction to theory and research. *MA: Addison-Wesley*.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39. https://doi.org/10.2307/3151312

Götz, O., Liehr-Gobbers, K., & Krafft, M. (2010). Evaluation of structural equation models using the partial least aquares (PLS) approach. In *Handbook of Partial Least Squares* (pp. 691–711). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-32827-8_30

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A Primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). SAGE Publications, Inc.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19*(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202

Hamari, J. (2015). Why do people buy virtual goods? Attitude toward virtual good purchases versus game enjoyment. *International Journal of*

Information Management, *35*(3), 299–308. https://doi.org/10.1016/j.ijinfomgt.2015.01.007

Hamari, J., & Koivisto, J. (2015). "Working out for likes": An empirical study on social influence in exercise gamification. *Computers in Human Behavior*, *50*, 333–347. https://doi.org/10.1016/j.chb.2015.04.018

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? - A literature review of empirical studies on gamification. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 3025–3034. https://doi.org/10.1109/HICSS.2014.377

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). *The use of partial least squares path modeling in international marketing* (pp. 277–319). https://doi.org/10.1108/S1474-7979(2009)0000020014

Hew, J.-J., Lee, V.-H., Ooi, K.-B., & Wei, J. (2015). What catalyses mobile apps usage intention: an empirical analysis. *Industrial Management & Data Systems*, *115*(7), 1269–1291. https://doi.org/10.1108/IMDS-01-2015-0028

Hofacker, C. F., de Ruyter, K., Lurie, N. H., Manchanda, P., & Donaldson, J. (2016). Gamification and mobile marketing effectiveness. *Journal of Interactive Marketing*, *34*, 25–36. https://doi.org/10.1016/j.intmar.2016.03.001

Hofstede, G. (1980a). Culture and Organizations. *International Studies of Management & Organization*, *10*(4), 15–41. https://doi.org/10.1080/00208825.1980.11656300

Hofstede, G. (1980b). Motivation, leadership, and organization: Do American theories apply abroad? *Organizational Dynamics*, *9*(1), 42–63. https://doi.org/10.1016/0090-2616(80)90013-3

Hofstede, G. (1986). Cultural differences in teaching and learning. *International Journal of Intercultural Relations*, *10*(3), 301–320. https://doi.org/10.1016/0147-1767(86)90015-5

Hofstede, G. (1994). Management scientists are human. *Management Science*, *40*(1), 4–13.

Hofstede, G. (2001). *Culture's Consequences : Comparing Values, Behaviors, Institutions and Organizations Across Nations* (2nd ed). Thousand Oaks, Calif : SAGE Publications, Inc.

Hofstede, G. (2024). *Country comparison tool* . Hofstede Insights. https://www.hofstede-insights.com/country-comparison-tool?countries=portugal

Hofstede, G., & Bond, M. H. (1988). The Confucius connection: From cultural roots to economic growth. *Organizational Dynamics*, *16*(4), 5–21. https://doi.org/10.1016/0090-2616(88)90009-5

Hsiao, C. H., Chang, J. J., & Tang, K. Y. (2016). Exploring the influential factors in continuance usage of mobile social Apps: Satisfaction, habit, and customer value perspectives. *Telematics and Informatics*, *33*(2), 342–355. https://doi.org/10.1016/j.tele.2015.08.014

Hsu, C. L., & Lin, J. C. C. (2015). What drives purchase intention for paid mobile apps?-An expectation confirmation model with perceived value. *Electronic Commerce Research and Applications*, *14*(1), 46–57. https://doi.org/10.1016/j.elerap.2014.11.003

Huotari, K., & Hamari, J. (2017). A definition for gamification: anchoring gamification in the service marketing literature. *Electronic Markets*, *27*(1), 21–31. https://doi.org/10.1007/s12525-015-0212-z

Im, I., Hong, S., & Kang, M. S. (2011). An international comparison of technology adoption: Testing the UTAUT model. *Information and Management*, *48*(1), 1–8. https://doi.org/10.1016/j.im.2010.09.001

Jones, B. A., Madden, G. J., & Wengreen, H. J. (2014). The FIT Game: Preliminary evaluation of a gamification approach to increasing fruit and vegetable consumption in school. *Preventive Medicine*, *68*, 76–79. https://doi.org/10.1016/j.ypmed.2014.04.015

Kaba, B., & Osei-Bryson, K. M. (2013). Examining influence of national culture on individuals' attitude and use of information and communication technology: Assessment of moderating effect of culture through cross countries study. *International Journal of Information Management*, *33*(3), 441–452. https://doi.org/10.1016/j.ijinfomgt.2013.01.010

Kock, N., & Lynn, G. (2012). Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations. *Journal of the Association for Information Systems*, *13*(7), 546–580. https://doi.org/10.17705/1jais.00302

Koivisto, J., & Hamari, J. (2019). The rise of motivational information systems: A review of gamification research. In *International Journal of Information Management* (Vol. 45, pp. 191–210). Elsevier Ltd. https://doi.org/10.1016/j.ijinfomgt.2018.10.013

Kovačić, Z. J. (2005). The impact of national culture on worldwide eGovernment readiness. In *Informing Science Journal* (Vol. 8).

Krath, J., Schürmann, L., & von Korflesch, H. F. O. (2021). Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning. *Computers in Human Behavior*, *125*. https://doi.org/10.1016/j.chb.2021.106963

Leidner, & Kayworth. (2006). Review: A review of culture in information systems research: Toward a theory of information technology culture conflict. *MIS Quarterly*, *30*(2), 357. https://doi.org/10.2307/25148735

Limayem, M., Hirt, S., & Cheung, C. (2007). How habit limits the predictive power of intention: The case of information systems continuance. *MIS Quarterly*, *31*(4), 705–737. https://doi.org/10.2307/25148817

Lin, Y. L., & Ding, N. Da. (2023). Competitive gamification in crowdsourcing-based contextual-aware recommender systems. *International Journal of Human Computer Studies*, *177*. https://doi.org/10.1016/j.ijhcs.2023.103083

Lounis, S., Pramatari, K., & Theotokis, A. (2014). Gamification is all about fun: The role of incentive type and community collaboration. *ECIS 2014 Proceedings - 22nd European Conference on Information Systems*. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84905837140&partnerID=40&md5=7a27a695cac7ba40abfebeb33e118377

Martins, C., Oliveira, T., & Popovič, A. (2014). Understanding the internet banking adoption: A unified theory of acceptance and use of technology and perceived risk application. *International Journal of Information Management*, *34*(1), 1–13. https://doi.org/10.1016/j.ijinfomgt.2013.06.002

Nacke, L. E., & Deterding, S. (2017). The maturing of gamification research. In *Computers in Human Behavior* (Vol. 71, pp. 450–454). Elsevier Ltd. https://doi.org/10.1016/j.chb.2016.11.062

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. In *Journal of Applied Psychology* (Vol. 88, Issue 5, pp. 879–903). https://doi.org/10.1037/0021-9010.88.5.879

Ringle, C. M., Wende, S., & Becker, J.-M. (2022). *"SmartPLS 4."* Oststeinbek: SmartPLS GmbH. http://www.smartpls.com.

Rogers, E. (1995). *Diffusion of innovations.* F. Press, Ed.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, *61*. https://doi.org/10.1016/j.cedpsych.2020.101860

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion*, *30*(4), 344–360. https://doi.org/10.1007/s11031-006-9051-8

Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior*, *69*, 371–380. https://doi.org/10.1016/j.chb.2016.12.033

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. *International Journal of Human Computer Studies*, *74*, 14–31. https://doi.org/10.1016/j.ijhcs.2014.09.006

Srite, M., & Karahanna, E. (2006). The role of espoused national cultural values in technology acceptance. *MIS Quarterly*, *30*(3), 679–704. https://doi.org/10.2307/25148745

Tam, C., & Oliveira, T. (2019). Does culture influence m-banking use and individual performance? *Information and Management*, *56*(3), 356–363. https://doi.org/10.1016/j.im.2018.07.009

Tam, C., Santos, D., & Oliveira, T. (2020). Exploring the influential factors of continuance intention to use mobile Apps: Extending the expectation

confirmation model. *Information Systems Frontiers*, *22*(1), 243–257. https://doi.org/10.1007/s10796-018-9864-5

Tamilmani, K., Rana, N. P., Wamba, S. F., & Dwivedi, R. (2021). The extended Unified Theory of Acceptance and Use of Technology (UTAUT2): A systematic literature review and theory evaluation. *International Journal of Information Management*, *57*. https://doi.org/10.1016/j.ijinfomgt.2020.102269

Taras, V., Rowney, J., & Steel, P. (2009). Half a century of measuring culture: Review of approaches, challenges, and limitations based on the analysis of 121 instruments for quantifying culture. *Journal of International Management*, *15*(4), 357–373. https://doi.org/10.1016/j.intman.2008.08.005

Taras, V., Steel, P., & Stackhouse, M. (2023). A comparative evaluation of seven instruments for measuring values comprising Hofstede's model of culture. *Journal of World Business*, *58*(1). https://doi.org/10.1016/j.jwb.2022.101386

Taylor, S., & Todd, P. (1995). Assessing IT usage: The role of prior experience. *MIS Quarterly*, *19*(4), 561. https://doi.org/10.2307/249633

Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal computing: toward a conceptual model of utilization. *MIS Quarterly*, *15*(1), 125. https://doi.org/10.2307/249443

Tolmie, P., Chamberlain, A., & Benford, S. (2014). Designing for reportability: sustainable gamification, public engagement, and promoting environmental debate. *Personal and Ubiquitous Computing*, *18*(7), 1763–1774. https://doi.org/10.1007/s00779-013-0755-y

Venkatesh, Morris, Davis, & Davis. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425. https://doi.org/10.2307/30036540

Venkatesh, Thong, & Xu. (2012). Consumer acceptance and use of information technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly*, *36*(1), 157. https://doi.org/10.2307/41410412

Venkatesh, V., & Brown, S. A. (2001). A Longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. *MIS Quarterly*, *25*(1), 71–102. https://doi.org/10.2307/3250959

Vlachopoulos, D., & Makri, A. (2017). The effect of games and simulations on higher education: a systematic literature review. In *International Journal of Educational Technology in Higher Education* (Vol. 14, Issue 1). Springer Netherlands. https://doi.org/10.1186/s41239-017-0062-1

Xi, N., & Hamari, J. (2020). Does gamification affect brand engagement and equity? A study in online brand communities. *Journal of Business Research*, *109*, 449–460. https://doi.org/10.1016/j.jbusres.2019.11.058

Zhao, F., Shen, K. N., & Collier, A. (2014). Effects of national culture on e-government diffusion - A global study of 55 countries. *Information and Management*, *51*(8), 1005–1016. https://doi.org/10.1016/j.im.2014.06.004

Appendices

Appendix 1: Questionnaire – English version

Construct			Source
Indicate to what extent you agree with the following statements on a scale of 1 to 7, where: (1) Strongly disagree; (2) Disagree; (3) Somewhat disagree; (4) Either agree or disagree; (5) Somewhat agree; (6) Agree; (7) Strongly disagree.			
PE	PE1	I find mobile apps useful in my daily life.	(Venkatesh et al., 2003, 2012)
	PE2	Using mobile apps increases my chances of achieving things that are important to me.	
	PE3	Using mobile apps helps me accomplish things more quickly.	
	PE4	Using mobile apps increases my productivity.	
EE	EE1	Learning how to use mobile apps is easy for me.	(Venkatesh et al., 2003, 2012)
	EE2	My interaction with mobile apps is clear and understandable.	
	EE3	I find mobile apps easy to use.	
	EE4	It is easy for me to become skillful at using mobile apps.	
SI	SI1	People who are important to me think that I should use mobile apps.	(Venkatesh et al., 2003, 2012)
	SI2	People who influence my behavior think that I should use mobile apps.	
	SI3	People whose opinions that I value prefer that I use mobile apps.	
FC	FC1	I have the resources necessary to use mobile apps.	(Venkatesh et al., 2003, 2012)
	FC2	I have the knowledge necessary to use mobile apps.	
	FC3	Mobile apps are compatible with other technologies I use.	
	FC4	I can get help from others when I have difficulties using mobile apps.	
HM	HM1	Using mobile apps is fun.	

	HM2	Using mobile apps is enjoyable.	(Venkatesh et al., 2003, 2012)
	HM3	Using mobile apps is very entertaining.	
PV	PV1	Mobile apps are reasonably priced.	(Venkatesh et al., 2003, 2012)
	PV2	Mobile apps are a good value for the money.	
	PV3	At the current price, mobile apps provide a good value.	
HB	HB1	The use of mobile apps has become a habit for me.	(Venkatesh et al., 2003, 2012)
	HB2	I am addicted to using mobile apps.	
	HB3	I must use mobile apps.	
	HB4	Using mobile apps has become natural to me.	
IC	IC1	Being accepted as a member of a group is more important than having autonomy and independence.	(Srite & Karahanna, 2006)
	IC2	Being accepted as a member of a group is more important than being independent.	
	IC3	Group success is more important than individual success.	
	IC4	Being loyal to a group is more important than individual gain.	
	IC5	Individual rewards are not as important as group welfare	
UA	UA1	Rules and regulations are important because they inform workers what the organization expects of them.	(Srite & Karahanna, 2006)
	UA2	Order and structure are very important in a work environment.	
	UA3	It is better to have a bad situation that you know about, than to have an uncertain situation which might be better.	
	UA4	People should avoid making changes because things could get worse.	
GI	GI1	If mobile apps were more fun/enjoyable I probably use it more often.	(Baptista & Oliveira, 2017)
	GI2	If using mobile apps would give me points, rewards and prizes, I probably would use it more often.	
	GI3	If mobile apps were more fun/enjoyable I probably advise others to use it.	
BI	BI1	I intend to continue using mobile apps in the future.	

	BI2	I will always try to use mobile apps in my daily life.	(Venkatesh et al., 2003, 2012)
	BI3	I plan to continue to use mobile apps frequently.	
Indicate, on a scale of 1 to 11, where: (1) Have not used; (2) Once a year; (3) Once in six months; (4) Once in three months; (5) Once a month; (6) Once a week; (7) Once in 4-5 days; (8) Once in 2-3 days; (9) Almost every day; (10) Every day; (11) Several times a day.			
UB	UB1	What is your actual frequency of use of games mobile apps?	(Im et al., 2011; Martins et al., 2014)
	UB2	What is your actual frequency of use of travel mobile apps?	
	UB3	What is your actual frequency of use of social media mobile apps?	

Appendix 2: Questionnaire – Portuguese version

Construct			Source
Indique o seu grau de concordância com as seguintes afirmações, numa escala de 1 a 7 sendo que: (1) Discordo totalmente; (2) Discordo; (3) Discordo ligeiramente; (4) Não concordo nem discordo; (5) Concordo ligeiramente; (6) Concordo; (7) Concordo totalmente.			
PE	PE1	Considero que as aplicações móveis são úteis no meu dia-a-dia	(Venkatesh et al., 2003, 2012)
	PE2	Usar aplicações móveis aumenta as probabilidades de alcançar coisas importantes para mim.	
	PE3	Usar aplicações móveis ajuda-me a atingir coisas mais rapidamente.	
	PE4	Usar aplicações móveis aumenta a minha produtividade.	
EE	EE1	Aprender a usar aplicações móveis é fácil para mim.	(Venkatesh et al., 2003, 2012)
	EE2	A minha interação com aplicações móveis é clara e intuitiva.	
	EE3	Considero que aplicações móveis são de fácil utilização.	
	EE4	É fácil para mim tornar-me hábil no uso de aplicações móveis.	
SI	SI1	Pessoas que me são importantes consideram que eu deveria usar aplicações móveis.	(Venkatesh et al., 2003, 2012)
	SI2	Pessoas que influenciam o meu comportamento consideram que eu deveria usar aplicações móveis.	
	SI3	Pessoas cuja opinião eu valorizo preferem que eu use aplicações móveis.	
FC	FC1	Eu disponho dos recursos necessários para usar aplicações móveis.	(Venkatesh et al., 2003, 2012)
	FC2	Eu disponho do conhecimento necessário para usar aplicações móveis.	
	FC3	As aplicações móveis são compatíveis com outras tecnologias que uso.	

	FC4	Eu consigo obter ajuda de outras pessoas quando tenho dificuldades em usar aplicações móveis.	
HM	HM1	Usar aplicações móveis é divertido.	(Venkatesh et al., 2003, 2012)
	HM2	Usar aplicações móveis é agradável.	
	HM3	Usar aplicações móveis entretém muito.	
PV	PV1	As aplicações móveis têm preços razoáveis.	(Venkatesh et al., 2003, 2012)
	PV2	As aplicações móveis apresentam uma boa relação qualidade/preço.	
	PV3	Ao preço atual, as aplicações móveis providenciam um bom valor.	
HB	HB1	O uso de aplicações móveis tornou-se um hábito para mim	(Venkatesh et al., 2003, 2012)
	HB2	Eu sou viciado no uso de aplicações móveis	
	HB3	Eu tenho de usar aplicações móveis.	
	HB4	O uso de aplicações móveis tornou-se natural para mim.	
IC	IC1	Ser aceite como membro de um grupo é mais importante do que ter autonomia e independência.	(Srite & Karahanna, 2006)
	IC2	Ser aceite como membro de um grupo é mais importante do que ser independente.	
	IC3	O sucesso do grupo é mais importante do que o sucesso individual.	
	IC4	Ser leal a um grupo é mais importante do que o ganho individual.	
	IC5	Recompensas individuais não são tão importantes quanto o bem-estar do grupo.	
UA	UA1	Regras e regulamentos são importantes porque informam os trabalhadores sobre o que a organização espera deles.	(Srite & Karahanna, 2006)
	UA2	Ordem e estrutura são muito importantes num ambiente de trabalho.	
	UA3	É melhor uma situação complicada que conheça, do que ter uma situação incerta que poderia ser melhor.	
	UA4	As pessoas devem evitar fazer mudanças porque as coisas podem piorar.	

GI	GI1	Se as aplicações móveis fossem mais divertidas/agradáveis, provavelmente usá-las-ia com maior frequência.	(Baptista & Oliveira, 2017)
	GI2	Se a utilização de aplicações móveis me desse pontos, recompensas e prémios, provavelmente usá-las-ia com maior frequência.	
	GI3	Se as aplicações móveis fossem mais divertidas/agradáveis, provavelmente recomendaria a sua utilização a outras pessoas.	
BI	BI1	Eu tenho a intenção de continuar a utilizar aplicações móveis no futuro	(Venkatesh et al., 2003, 2012)
	BI2	Eu tentarei sempre utilizar aplicações móveis no meu dia-a-dia.	
	BI3	Eu pretendo utilizar aplicações móveis frequentemente.	
Indique, numa escala de 1 a 11, sendo que: (1) Não utilizo; (2) Uma vez por ano; (3) Uma vez em seis meses; (4) Uma vez em 3 meses; (5) Uma vez por mês; (6) Uma vez por semana; (7) Uma vez em 4-5 dias; (8) Uma vez em 2-3 dias; (9) Quase todos os dias; (10) Todos os dias; (11) Várias vezes por dia.			
UB	UB1	Com que frequência utiliza aplicações móveis de jogos?	(Im et al., 2011; Martins et al., 2014)
	UB2	Com que frequência utiliza aplicações móveis de viagens/transportes?	
	UB3	Com que frequência utiliza aplicações móveis de redes sociais?	

Appendix 3: Cross-loadings

Constructs		PE	EE	SI	FC	HM	PV	HB	IC	UA	GI	BI	UB
PE	PE1	**0.878**	0.603	0.439	0.672	0.592	0.428	0.562	0.064	0.590	0.325	0.560	0.288
	PE2	**0.916**	0.472	0.581	0.553	0.568	0.400	0.534	0.126	0.490	0.367	0.569	0.232
	PE3	**0.920**	0.518	0.522	0.594	0.497	0.388	0.547	0.117	0.600	0.352	0.581	0.256
	PE4	**0.774**	0.292	0.576	0.384	0.367	0.330	0.371	0.200	0.324	0.305	0.482	0.172
EE	EE1	0.474	**0.954**	0.295	0.672	0.537	0.503	0.484	0.102	0.417	0.305	0.372	0.215
	EE3	0.568	**0.967**	0.395	0.692	0.582	0.560	0.511	0.148	0.435	0.341	0.436	0.230
SI	SI1	0.597	0.397	**0.953**	0.458	0.410	0.513	0.427	0.280	0.361	0.320	0.437	0.064
	SI3	0.560	0.304	**0.962**	0.396	0.368	0.489	0.417	0.250	0.302	0.359	0.482	0.133
FC	FC1	0.563	0.633	0.392	**0.903**	0.537	0.535	0.505	0.154	0.549	0.285	0.473	0.128
	FC2	0.551	0.736	0.378	**0.898**	0.538	0.531	0.554	0.168	0.499	0.325	0.463	0.234
	FC4	0.577	0.488	0.414	**0.846**	0.447	0.404	0.431	0.191	0.526	0.275	0.396	0.121
HM	HM2	0.595	0.621	0.453	0.586	**0.943**	0.518	0.583	0.143	0.495	0.374	0.542	0.306
	HM3	0.496	0.468	0.302	0.494	**0.933**	0.357	0.604	0.142	0.492	0.365	0.499	0.282
PV	PV1	0.422	0.577	0.490	0.560	0.460	**0.958**	0.510	0.233	0.336	0.386	0.414	0.199
	PV3	0.433	0.500	0.516	0.523	0.447	**0.970**	0.514	0.220	0.333	0.377	0.485	0.194
HB	HB1	0.589	0.566	0.427	0.575	0.636	0.523	**0.876**	0.142	0.526	0.401	0.655	0.393
	HB2	0.341	0.310	0.261	0.322	0.415	0.314	**0.755**	0.189	0.276	0.323	0.431	0.360
	HB3	0.373	0.271	0.348	0.356	0.367	0.383	**0.784**	0.247	0.322	0.248	0.501	0.327
	HB4	0.585	0.527	0.410	0.586	0.640	0.516	**0.914**	0.153	0.470	0.366	0.630	0.443
IC	IC1	0.035	0.070	0.195	0.037	0.098	0.153	0.145	**0.730**	-0.110	0.242	0.116	-0.054
	IC2	0.059	0.034	0.188	0.019	0.097	0.129	0.157	**0.751**	-0.058	0.210	0.133	0.016
	IC3	0.101	0.110	0.154	0.157	0.084	0.175	0.105	**0.848**	0.142	0.218	0.158	-0.053
	IC4	0.164	0.146	0.242	0.226	0.163	0.233	0.205	**0.889**	0.184	0.276	0.222	0.009
	IC5	0.160	0.134	0.305	0.240	0.145	0.221	0.219	**0.807**	0.203	0.228	0.203	-0.050
UA	UA1	0.555	0.449	0.343	0.589	0.509	0.367	0.454	0.120	**0.947**	0.238	0.465	0.124
	UA2	0.548	0.396	0.313	0.540	0.492	0.295	0.479	0.114	**0.955**	0.294	0.501	0.131
GI	GI1	0.376	0.361	0.302	0.309	0.344	0.390	0.398	0.278	0.236	**0.900**	0.356	0.223
	GI2	0.323	0.282	0.293	0.321	0.379	0.350	0.353	0.252	0.261	**0.917**	0.358	0.198
	GI3	0.364	0.289	0.380	0.296	0.362	0.349	0.365	0.272	0.277	**0.938**	0.400	0.198
BI	BI1	0.630	0.484	0.439	0.555	0.556	0.455	0.650	0.199	0.560	0.390	**0.920**	0.351
	BI2	0.548	0.341	0.436	0.422	0.480	0.444	0.621	0.244	0.430	0.331	**0.928**	0.330
	BI3	0.580	0.353	0.471	0.434	0.518	0.413	0.615	0.161	0.430	0.411	**0.952**	0.358
UB	UB3	0.273	0.232	0.105	0.186	0.314	0.203	0.458	-0.031	0.134	0.224	0.371	**1.000**

Appendix 4: VIF

Construct		VIF
PE	PE1	3.236
	PE2	3.401
	PE3	3.907
	PE4	1.903
EE	EE1	3.546
	EE3	3.546
SI	SI1	3.286
	SI3	3.286
FC	FC1	2.435
	FC2	2.255
	FC4	1.946
HM	HM2	2.371
	HM3	2.371
PV	PV1	3.843
	PV3	3.843
HB	HB1	3.066
	HB2	1.647
	HB3	1.864
	HB4	3.658
IC	IC1	4.708
	IC2	4.971
	IC3	2.560
	IC4	3.064
	IC5	2.012
UA	UA1	2.889
	UA2	2.889
GI	GI1	2.568
	GI2	3.187
	GI3	3.643
BI	BI1	3.068
	BI2	3.849
	BI3	4.878
UB	UB3	1.000