



# Understanding antecedents of continuance and revisit intentions: The case of sport apps

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## ABSTRACT

Prior studies have investigated the antecedents of sport application (Sapp) adoption, but few researchers have concentrated on attitudinal, cognitive and behavioural factors' effects on users' continuance intention (CI) and revisit intention (RI). This study focused on the Sapp CI antecedents of use intensity and commitment to – and competence and satisfaction with – these tools. Analyses using structural equation modelling were conducted with data on 362 Sapp users from Malaga, Spain. The results confirm that commitment to and competence with Sapps are positively related to satisfaction and use intensity, which have a positive impact on CI and RI.

## 1. Introduction

Sport application (hereafter Sapp) use has been previously related to minor and moderate increases in physical activity (PA) levels (Western et al., 2022) and thus with less time spent being sedentary (Gal et al., 2018). More recently, the literature on sport has concentrated on the effects of activity restrictions related to social-distancing policies (e.g. Clemente-Suárez et al., 2022; Yomoda and Kurita, 2021). These restrictions have had a significant impact on sedentariness and the continuity of – and ways in which individuals engage in – sport activities (Mutz and Gerke, 2021; Son et al., 2021).

Possible explanations for reduced PA include the movement limitations imposed (Tang et al., 2019), but researchers have not yet addressed the more specific question of which antecedents explain users' return to Sapps (i.e. continuance intention [CI]). The absence of previous studies on this topic means effective measures cannot be taken to strengthen individuals' Sapp CI and, consequently, many sport enthusiasts' return to PAs, which may have been negatively affected in recent years and possibly again in the future.

The existing literature on explanations of PA and Sapp use comprehensively explains the link between various attitudes towards applications (hereafter apps) and their use (McLean et al., 2020; Song et al., 2018), as well as satisfaction with these tools and their usage (Perez-Aranda et al., 2021; Sha et al., 2019; Wang et al., 2019). However,

prior research on PA and Sapp use intentions has gaps regarding the factors affecting satisfaction and use intensity as antecedents of CI (i.e. commitment to and competence with these apps) and even more extensive lacunae in terms of revisit intention (RI). These gaps mean that public health services, sport organisations and sport enthusiasts may be unsure about how best to increase Sapp use.

The present study sought to fill these lacunae by developing a better understanding of the variables contributing to users' Sapp CI and RI. The main research problem addressed was the identification of Sapp CI and RI's antecedents. Finding these drivers is crucial because usage frequency usually falls dramatically in the first six months after Sapps are adopted (Pellegrini et al., 2018). The most recent literature on Sapps also indicates that more studies are needed of the relationship between wearables and PAs (Western et al., 2022) and between digital devices and habitual PA (Zeng et al., 2020).

More specifically, the current research analysed the Sapp CI and RI antecedents of commitment, competence, satisfaction and use intensity based on the information systems (IS) continuance model (Bhattacharjee, 2001). This theoretical framework postulates different reasons for CI than those suggested by the technology acceptance model (TAM). The specific variables examined as antecedents were sport and fitness app users' use intensity and their commitment to and competence and satisfaction with these apps.

Kim et al. (1997, p. 323) report a general consensus among

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researchers about defining commitment as ‘personal and behavioural mechanisms that bind individuals to a consistent pattern of behaviour’. Competence, in turn, is understood by Maleki et al. (2018, p. 18) as a set of demonstrable characteristics, experiences, behaviours, abilities and knowledge that contribute to individuals’ adequate performance of activities. Satisfaction can be conceptualised as users’ response to their experience with products and a combination of product and related services evaluations (Bhattacharjee, 2001). Finally, use intensity is described in the literature as the level of activity users develop over time (Thoumrungroje, 2014). The present study’s conceptual model thus included attitudinal (i.e. satisfaction), cognitive (i.e. competence) and behavioural factors (i.e. commitment).

This research’s primary goal was to evaluate whether and how much attitudinal, cognitive and behavioural antecedents of sport and fitness app influence Sapp CI and RI. The results make notable contributions in two areas. First, the study found empirically robust evidence that use intensity and commitment to and competence and satisfaction with Sapps are antecedents of users’ CI and RI. These findings provide a deeper understanding of individualised attitudinal, cognitive and behavioural factors’ impact on Sapp CI and RI among users engaging in PAs. Second, the results extend the IS continuance model by adding the outcomes regarding RI and the antecedents of competence and commitment.

This paper’s remaining sections are organised as follows. The next section summarises the literature review conducted, which led to the IS continuance model being selected as a theoretical framework. The third section describes the methodology, including the data collection and analytical procedures. The final two sections provide and discuss the analyses’ results and their implications.

## 2. Theoretical background

Sport enthusiasts’ continued use of Sapps has been related to these individuals’ satisfaction (Cho, 2016; Yan et al., 2021). However, the present study focused on additional unknown variables that could be related to Sapp users’ CI (Yan et al., 2021), including expanding the existing knowledge about the role of attitudinal, behavioural and cognitive drivers. The current research conceptualised this type of intention related to Sapp and the resulting PA as repeated engagement in and expression of an emotional commitment to or favourable behaviours towards using Sapps while practicing PAs. The IS continuance model has long been used to explain individuals’ repetition of and engagement in behaviours connected with technology, so this model was applied during the hypothesis development process.

The following two subsections provide definitions of leisure-time PAs and Sapps and discuss the findings of a literature review on Sapp CI. The third section then presents this study’s theoretical foundation and hypothesis development.

### 2.1. PAs, Sapps and location-based apps (LBAs)

In the literature on sport, a PA is broadly defined as ‘any body movement generated by the contraction of skeletal muscles that raises energy expenditure above resting metabolic rate’ (Thivel et al., 2018, p. 2). In studies of leisure activities, PAs have been related to any physically active way to spend free time (Wilhelm Stanis et al., 2009). Low PA and sedentarism are, in turn, characterised as any waking behaviours that require low rates of energy expenditure (Thivel et al., 2018). Specific sedentary behaviours are associated with problems such as excessive television watching and obesity (Biddle et al., 2017). In contrast, PA is generally connected to overall psychological and social well-being (Lesser and Nienhuis, 2020).

Another significant concept covered by the present research is Sapps. The literature on app behavioural intentions has been especially profuse in recent years (Chen et al., 2022; Kamdjoug et al., 2021; Kumar et al., 2021; Shahidi et al., 2022a), and previous studies have been conducted

on a wide range of topics such as shopping (Lee and Kim, 2019), food delivery (Kumar and Shah, 2021) or the StopCovid programme (Shahidi et al., 2022b). The Sapp literature reveals that fitness apps are mainly based on wearable technologies designed to monitor sport enthusiasts’ training programmes (Cardinale and Varley, 2017).

According to Wei (2014), these devices and apps are widely used in fitness and sport events and activities. This type of tool covers a considerable range of functions (i.e. outdoor tracking, virtual coaching, fitness monitoring, sport performance and body cooling). Relevant industry standards have not yet been established (Cardinale and Varley, 2017), but athletes, trainers and sport enthusiasts still tend to use these apps to measure and collect data on their sport activities, including during tourism-focused trips (Perez-Aranda et al., 2021).

The functions included in sport and fitness apps vary significantly. Some tools can help users relate their PA performances to specific locations such as sport clubs, events or tourism destinations. LBAs and location-based social networks, which are a type of LBA, allow individuals to record activities and link them with different locations or interact with others and receive notifications, thereby expanding and improving these apps’ usage (Akel and Armağan, 2021). More recently, Angosto et al. (2020) reviewed the existing research on intentions to use fitness and PA apps, finding that the most common variables associated with these plans are usefulness, ease of use, enjoyment, trust and social influence. The literature, however, includes calls for more studies of LBAs (Akel and Armağan, 2021).

### 2.2. Sapp CI

CI is usually understood as the intention to engage in usage behaviour repeatedly (Wu and Li, 2023), while RI is defined as a plan to consume a product or service again (Kumar et al., 2021). Both concepts are related to customer loyalty in the literature on retail business (Jaju et al., 2023; Liébana-Cabanillas et al., 2021). Previous research on Sapp and fitness app CI (see Table 1) has linked CI to individuals’ satisfaction (Chiu et al., 2020; Cho et al., 2020; Cho, 2016; Zhang et al., 2018). These investigations have further confirmed that relationships exist between expectations (Beldad and Hegner, 2018), social influences and injunctive social norms and Sapp users’ CI (Huang and Ren, 2020).

Behavioural factors have also been connected with CI as habit, hedonic motivations and price and/or value appear to be direct or indirect antecedents of CI (Yuan et al., 2015). These CI determinants also include recordability, networkability, credibility, comprehensibility, trendiness (Lee and Cho, 2017) and social comparison (Son et al., 2021). In addition, content quality and reliability have been found to be indirect antecedents of CI (Kim et al., 2019).

Research on this topic has recently become more prolific. In the last few years, various studies have linked Sapp CI with different drivers (Chiu et al., 2020; Damberg, 2021; Perez-Aranda et al., 2021; Yan et al., 2021). One of the cited investigations found that attitudes, performance expectancy, effort expectancy, perceived satisfaction, perceived enjoyment, perceived gamification and subjective norms are determinants of Sapp CI (Perez-Aranda et al., 2021). Another study confirmed that perceived usefulness, perceived ease of use, subjective norms, flow experiences and behavioural change techniques also affect Sapp users’ satisfaction and CI (Yan et al., 2021).

In addition, a third researcher determined that perceived performance, price value, perceived playfulness, habit and health consciousness are significant antecedents (Damberg, 2021). The last group of investigators cited above (i.e. Chiu et al., 2020) report that perceived usefulness, satisfaction and commitment are related to Sapp CI. Various authors have, nonetheless, called for more studies of antecedents of CI among LBA and health (Yuan, 2021) and Sapp users (Yan et al., 2021).

Overall, previous studies on Sapp CI have found satisfaction to be the most critical factor, as well as that this variable affects users’ CI and their leisure-time PAs. No prior research on sport, however, has related individual satisfaction and use intensity regarding RI. In addition, no

**Table 1**  
Prior studies of Sapp continuance intention (CI).

Constructs related to CI	Methodologies	Theoretical foundation	Authors
Performance expectancy, hedonic motivations, price value, habit	317 American students, structural equation modelling (SEM)	Unified theory of acceptance and use of technology (UTAUT2)	Yuan et al. (2015)
Confirmation, perceived usefulness, perceived ease of use, satisfaction	343 Korean adults, SEM	Post-acceptance model, technology acceptance model (TAM)	Cho (2016)
Recordability, networkability, credibility, comprehensibility, trendiness	142 American participants, confirmatory factor analysis	Uses and gratifications theory (UGT)	Lee and Cho (2017)
Perceived usefulness, perceived comfort, attitudes, control related factors, social comparison	236 sport product users, partial least squares (PLS)	Theory of planned behaviour	Song et al. (2018)
Perceived usefulness, trust	296 Chinese respondents, PLS	Elaboration likelihood model (ELM)	Chen et al. (2018)
Central behaviours, peripheral cues, trust, perceived e-Health literacy, satisfaction	273 Chinese participants, PLS	ELM	Zhang et al. (2018)
Perceived ease of use, perceived usefulness, injunctive social norms	476 German users, SEM	TAM	Beldad and Hegner (2018)
Perceived benefits, previous lifestyle incongruence, inspiration, well-being	324 Smartwatch users	TAM	Chuah (2019)
Perceived usefulness, enjoyment, sense of belonging, habit, satisfaction	356 Taiwanese users of Velodash	UGT	Chen et al. (2020)
Confirmation, perceived usefulness, satisfaction, investment size, quality of alternatives, commitment	343 Chinese consumers, SEM	Expectation-confirmation model, investment model	Chiu et al. (2020)
Technological functions, perceived usefulness, exercise self-efficacy, perceived ease of use, perceived enjoyment	449 Chinese respondents, health risk assessment	TAM, exercise self-efficacy	Huang and Ren (2020)
Perceived ease of use, perceived usefulness, satisfaction, investment size, quality of alternative, commitment	346 Chinese users, SEM	TAM, investment model	Cho et al. (2020)
Self-quantification, gamification, feedback, commitment	263 members of online fitness communities	SEM	Srivastava et al. (2021)
Performance expectancy, effort expectancy, perceived satisfaction, perceived enjoyment, perceived gamification, attitudes, subjective	362 Spanish users, PLS	Theory of reasoned action	Perez-Aranda et al. (2021)

**Table 1 (continued)**

Constructs related to CI	Methodologies	Theoretical foundation	Authors
norms, use during trips			
Perceived usefulness, perceived ease of use, subjective norm, flow experience, behavioural change techniques, satisfaction	397 respondents in China, PLS-SEM	Information systems continuance model	Yan et al. (2021)
Social comparison tendency, perceived usefulness, confirmation, perceived health, satisfaction	690 smart fitness wearable owners	Expected confirmation model	Gupta et al. (2021)
Perceived benefits (i.e. health, autonomy, social and hedonic), individual characteristics, technological innovativeness, perceived health self-efficacy	217 Indian respondents	TAM	Puri et al. (2022)
Interactivity, gamification	Experiment with 306 participants	Service-dominant logic	Windasari and Lin (2021)
Perceived performance, social influence, price value, perceived playfulness, habit, health consciousness	591 United Kingdom respondents PLS-SEM	UTAUT2	Damberg, 2021

Source: Authors

studies have developed a conceptual model with two attitudinal factors, such as commitment to and competence with apps, in combination with satisfaction and use intensity.

Perceived usefulness and ease of use are the antecedents most often shown to be related directly or indirectly to Sapp CI. The remaining predictors analysed in previous research have been, in general, studied only once. Previous analyses have determined that the strongest precedents of CI are commitment (Chiu et al., 2020), perceived usefulness (Cho et al., 2020), satisfaction (Wang et al., 2019) and attitudes (Perez-Aranda et al., 2021).

### 3. Conceptual framework and hypotheses

#### 3.1. Theoretical foundation

The present study used the IS continuance model as its theoretical framework (Bhattacharjee, 2001). This model evolved out of the TAM and expectation confirmation theory (ECT). Bhattacharjee (2001) observes that CI as a concept seeks to explain repurchase intention or continued use after technology is initially adopted, and the cited author postulates that technology acceptance antecedents are different from those explaining CI.

The IS continuance model's most basic conceptual foundation is the theory of reasoned action (TRA) as this was the main theory underlying the TAM. The TRA has continued to be widely used as a conceptual framework for behaviours related to use of and intention to use technology (Alshammari and Rosli, 2020). This theory seeks to explain the drivers of consciously intended behaviours (Ajzen and Fishbein, 1975) and specific actions through components of isolated motivations (Ajzen and Fishbein, 1975), including distinguishing between cognitive (i.e. attitudinal behaviours) and subjective norms.

The TAM, in turn, incorporates cognitive theories that explain why individuals adopt new behaviours (Davis et al., 1989). This model has

been repeatedly used to clarify the determinants of technology acceptance in different user populations (Akram et al., 2021; Diwanji and Cortese, 2020; Driediger and Bhatiasevi, 2019; Rese et al., 2020). The TAM has continued to support more recent research (Holdack et al., 2020; Kimiagari and Malafe, 2021; Park et al., 2021).

The IS continuance model's second theoretical foundation was the ECT (Oliver, 1980), which has long been used to explain consumer satisfaction and post-purchase behaviour. This theory suggests that satisfaction primarily determines consumers' intention to repurchase and that expectations are a major antecedent of satisfaction. To develop the IS continuance model, Bhattacharjee (2001) expanded the ECT to include TAM-based post-consumption expectations such as perceived usefulness. The cited author offers different reasons for technology adoption than those traditionally used to explain CI, relating the latter concept more closely with continued use or repurchase intention after technology's initial adoption. The IS continuance model has been applied to various services and products in order to clarify users' CI, including self-delivery boxes (Wu and Li, 2023) and health apps (Yan et al., 2021).

### 3.2. Research model and hypothesis development

The literature review conducted for the present research further revealed a lack of studies focusing on attitudinal, cognitive and behavioural factors' effects on Sapp users' CI and RI. The current research included all three types of factors for different reasons. First, the available models were extended because Sapp users' knowledge of and willingness to use app functions can vary. Second, these individuals' abilities and personal interests can affect the way they perceive their satisfaction with and effective use of Sapps. Competence and commitment were thus added as indirect antecedents of CI through satisfaction and use intensity. The IS continuance model was also extended to reflect Sapps and LBAs' strong association with leisure-time PAs in specific locations by incorporating use intensity and satisfaction's link with RI.

No previous Sapp studies have related commitment's indirect effect (i.e. through satisfaction and use intensity) on CI, but precedents can be found in the Sapp literature for positing a connection between commitment and CI. For example, Cho et al. (2020) and Srivastava et al. (2021) related commitment directly to CI regarding wearable activity devices and Sapps. Prior research based on the TRA, TAM or theory of planned behaviour has also found connections between commitment, satisfaction and use intensity.

Many scholars have specifically focused on commitment and satisfaction's positive relationship over the years. Early on, Ellison et al. (1989) found a connection between commitment and life satisfaction. Wu et al.'s (2012) hierarchical regression analysis confirmed that affective commitment positively affects customer satisfaction. In addition, Hou et al. (2019) studied 400 couples from China and detected a relationship between commitment and marital satisfaction mediated by communication. Commitment has also been linked with use intensity in the literature. Cho et al. (2020) further verified an association between commitment and LBA use intention and concluded that commitment is an important determinant of users' CI in the literature on LBAs.

After reviewing the existing research, the current study assumed that a positive relationship exists between commitment and both satisfaction and use intensity. Thus, the following pair of hypotheses was formulated.

**H1a.** Sport enthusiasts' commitment to LBAs is positively related to their satisfaction with these apps.

**H2a.** Sport enthusiasts' commitment to LBAs is positively related to their use intensity.

The second set of hypotheses focused on competence's effects on satisfaction and use intensity. While no studies have been conducted of competence's impact on Sapp satisfaction and use intensity, the existing

literature shows that Sapps users' competence mediates the relationship between commensurable game elements and consumer loyalty (Feng et al., 2020). In addition, previous Sapps research has confirmed a positive link exists between CI and technological innovativeness as a personal user characteristic, which is related to their competence (Puri et al., 2022).

Competence has further been shown to have an effect on use intensity and satisfaction with reference to different technologies and behaviours. For example, Jenkins-Guarnieri et al. (2012) subjected data on 463 emerging adults to structural equation modelling (SEM) and found a positive relationship between interpersonal competency and Facebook use. To explore this link regarding sport enthusiasts, Moreno-Murcia et al. (2011) collected data from a sample of 472 adolescents between 16 and 20 years old and, using SEM, confirmed that sport competence has a positive relationship with healthy lifestyle habits (Moreno-Murcia et al., 2011). Motor competence has also been connected with PA (Robinson et al., 2015).

In research on competence's effect on satisfaction, Arifin (2015) established that proficiency influences job satisfaction based on data gathered from 117 teachers with a questionnaire and processed using SEM. In a parallel study, Tang et al. (2019) carried out a study of 583 hospitalised patients. The cited authors found significant associations between nurses' cultural competence measured on three subscales – positive communication, trust-building and shared decision-making behaviours – and patients' satisfaction. Jung (2012), in turn, analysed data collected from 291 nursing students, producing results that confirm positive effects of clinical competence on healthcare practice satisfaction.

Given the above findings and a IS continuance model approach, the present research posited that a positive link exists between competence and satisfaction and use intensity. Thus, the second pair of hypotheses was written as follows.

**H1b.** Sport enthusiasts' competence with LBAs is positively related to their use intensity.

**H2b.** Sport enthusiasts' competence with LBAs is positively related to their satisfaction with these apps.

The third group of hypotheses were related to satisfaction's effect on use intensity, CI and RI. Many Sapp studies have concentrated on satisfaction's impact on behavioural intentions (Cho et al., 2020; Gupta et al., 2021; Kim, 2021; Perez-Aranda et al., 2021). Researchers have detected a positive relationship between satisfaction and CI, in particular (Cho, 2016; Liébana-Cabanillas et al., 2021; Purohit et al., 2022).

Other app studies have analysed satisfaction's effect on use, use intention, future use intention and intention to return to specific destinations. For instance, Tussyadiah (2016) conducted an online survey of 644 individuals travelling within the United States and found that satisfaction is an antecedent of future use intention with regard to peer-to-peer accommodations. In addition, Duarte et al. (2018) examined satisfaction's impact on consumers' behavioural intentions in Portugal's online shopping market and confirmed that a positive link exists between these constructs. Prior studies on intentions to buy have also shown that satisfaction is an antecedent of online purchase plans (Belanche et al., 2012) and repatronage intention (Atulkar and Kesari, 2017).

The existing literature on satisfaction and behavioural intention includes Xu et al.'s (2015) study based on data from 347 app users and the partial least squares (PLS) method, which revealed a positive relationship between satisfaction and app CI. García-Fernández et al. (2018) further conducted research using a sample of 763 clients of low-cost fitness centres and found a positive connection between satisfaction and behavioural intention.

Keeping the IS continuance model and the above results in mind, the present study assumed that satisfaction has a positive effect on use intensity, CI and RI, so the following hypotheses were additionally

formulated.

**H3.** Sport enthusiasts' satisfaction with LBAs is positively related to their use intensity.

**H4a.** Sport enthusiasts' satisfaction with LBAs is positively related to their CI.

**H5a.** Sport enthusiasts' satisfaction with LBAs is positively related to their RI.

The final pair of hypotheses tested focused on use intensity's connection to CI and RI. Some research has treated habit – understood as habitual usage (Chen et al., 2020) – as a synonym for use intensity. An Sapp habit has been previously confirmed to be a predictor of Sapp CI (Chen et al., 2020; Damberg, 2021; Yuan et al., 2015). Prior parallel studies on use intensity's effects on behavioural intentions have further confirmed that use intensity has a positive impact on users' usage plans (Frasquet et al., 2017; Tontini et al., 2015). Following a similar line of reasoning, Garza and Royo-Vela (2019) analysed data on 687 tourists, in this case focusing on visit intensity and return intention's relationship, but the results failed to support their hypotheses.

However, Garza and Royo-Vela (2019) subsequently concluded that online platform use intensity is a predictor of brand behavioural intention, after conducting 200 interviews with young university students and applying SEM. Teng's (2017) study also found an indirect link between customer-brand relationships' length, depth and breadth and game behavioural intention through goal proximity and motivation to achieve gaming goals. In addition, researchers have associated CI (Amoroso and Lim, 2017) with the behavioural inertia of using a system continuously just because this is what has always been done and verified that this inertia has a stronger effect on CI than satisfaction does.

Given the above literature and the IS continuance model, the current research postulated that use intensity has a positive relationship with CI and RI. The final pair of hypotheses was thus developed as follows.

**H4b.** : Sport enthusiasts' LBA use intensity is positively related to their RI.

**H5b.** Sport enthusiasts' LBA use intensity is positively related to their CI.

Fig. 1 shows the conceptual model constructed for this study based on the literature review's findings. This model proposes that use intensity and commitment to and competence and satisfaction with Sapps are antecedents of sport enthusiasts' CI and RI regarding locations facilitating PAs.

#### 4. Methods

The data were analysed using the PLS technique and SmartPLS 3.3.2 software (Ringle et al., 2015). This technique allows researchers to evaluate measurement models' reliability and validity and to estimate the sign and significance of hypothesised relationships between structural models' constructs (Barroso et al., 2010).

##### 4.1. Instrument development

A two-step procedure was followed to validate the questionnaire developed for this research. First, five marketing experts checked the initial version of the scales for incorrect wording and incomprehensible items. Second, a pre-test was conducted with 10 users. The questionnaire's final version began with a section gathering sociodemographic data from respondents who do PAs regularly. The main section assessed users' usage of and intention towards Sapps, as well as the respondents' RI regarding places where they have previously done sport activities. The final section elicited the app users' general PA-related information.

All the survey items were adapted from the existing literature (see Appendix 1). Multi-item scales were used for all the variables included in the model except for CI and RI. The one-item approach has long been applied in psychology when measuring latent constructs (Baumann et al., 2007). The competence and commitment items were taken from Guesalaga (2016) and modified as needed (i.e. 4 and 2 items, respectively). Satisfaction was measured with a three-item scale based on Van Kerrebroeck et al.'s (2017) work. The use intensity items were adapted from Venkatesh et al.'s (2012) study. One item was included to measure RI based on the scale developed by Chalip et al. (2003). CI was also measured with one question taken from Tam et al.'s (2020) work. All the antecedent and intention constructs were assessed on a seven-point Likert-type scale (Montaño and Kasprzyk, 2015).

##### 4.2. Data collection, measures and sample profile

The study population was sport enthusiasts who have the following characteristics: doing leisure-time sport activities more than once a week and being users of Sapps. The data collection relied on quota sampling and followed Teeroovengadum and Nunkoo's (2018) recommended phases. The sample size was evaluated using a significance criterion (Singh and Masuku, 2014). The final sample consisted of 362 respondents, with a margin of error of 5.15% and a 95% confidence interval.

The data were gathered during spring 2019, between February and May, from different PA locations around Malaga, Spain, which has a growing population (i.e. 578,000 in 2020) (Instituto Nacional de

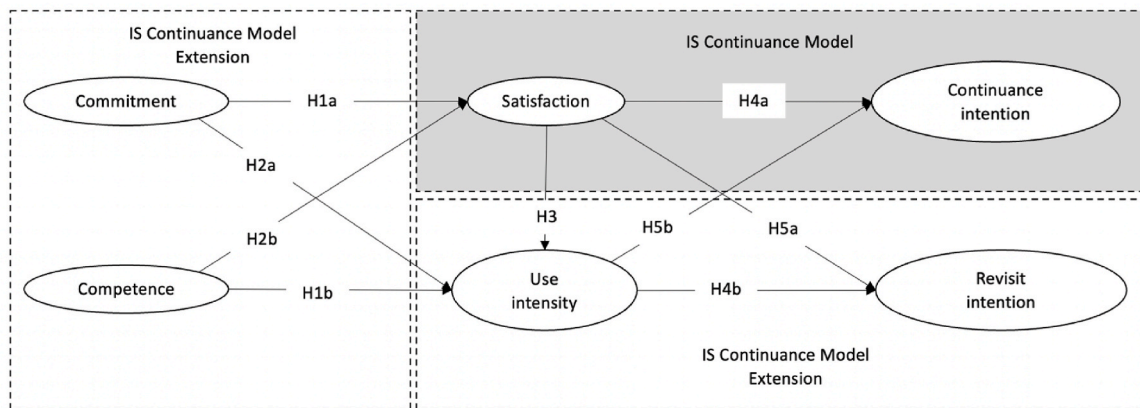


Fig. 1. Research model

Note. IS = information systems; H = hypothesis.

Estadística, 2022). Malaga is a mid-sized city that has invested heavily in sport and technologies. For instance, Google or Oracle have regional headquarters in Malaga (Openforbusiness, n.d.), and the municipality committed to organising the Davis Cup tennis event in 2022 and 2023 (Daviscup, 2022).

The PA locations selected for the survey were the municipal swimming pool pavilion, university sport centres, the city centre, the municipal basketball pavilion, three gyms, two sport clubs, a sport category killer retailer, the seaside promenade and two municipal athletics stadiums. These locations were then grouped into six zones, and each interviewer surveyed only in his or her assigned area. The survey was conducted as follows. Respondents were chosen in these locations and invited to participate in the study by answering the questionnaire with an interviewer’s help. To avoid bias (Allred and Ross-Davis, 2011), the interviewers applied the drop-off and pick-up method and communicated only when needed with interviewees. Only PA practitioners using Sapps during activities were interviewed.

The quotas used were based on the Centro de Investigaciones Sociológicas’s (2010) previous PA survey in Spain. The cited research’s results revealed that 7% of the respondents did sport activities more than 5 times a week, 56% participated in PAs 3 or 4 times a week and 37% took part in these activities 1 or 2 times a week. The present survey applied these figures so that, once one category’s quota was met in the sampling process, no more respondents with those characteristics were interviewed.

The respondents were 58% men and 42% women, and 70% were under 35 years old. Slightly more than the half of the sample (55.5%) already had a university degree. Table 2 provides the sample’s socio-demographic profile.

## 5. Results

### 5.1. Measurement model

The first step taken to evaluate the measurement model was to assess the individual items’ reliability (see Table 3). Indicators are considered an appropriate measure of the relevant construct if their weight is equal

**Table 2**  
Summary of respondents’ sociodemographic statistics (number = 362).

Variables	%
<b>Gender</b>	
Male	58.0%
Female	42.0%
<b>Age</b>	
18–25 years old	32.3%
26–45 years old	37.8%
46–55 years old	19.9%
56–65 years old	7.5%
> 65 years old	2.5%
<b>Education level</b>	
Primary school	8.3%
Secondary school	33.7%
University degree	55.5%
No formal schooling	2.5%
<b>Marital status</b>	
Married	27.1%
Divorced	3.9%
Common-law partnership	11.6%
Single	56.9%
Widow or widower	0.5%
<b>Previous Sapp use</b>	
< 1 year of experience	26.8%
> 1 and < 2 years of experience	35.1%
> 2 and < 3 years of experience	22.7%
> 3 and < 4 years of experience	9.9%
> 4 and < 5 years of experience	2.2%
> 5 years of experience	3.3%

**Table 3**  
Loadings, composite reliability (CR) and average variance extracted (AVE).

	Loading	Cronbach’s alpha	CR( $\rho_c$ )	AVE
<b>Commitment</b>		0.886	0.946	0.898
X1	0.946			
X2	0.949			
<b>Competence</b>		0.921	0.945	0.811
X3	0.925			
X4	0.936			
X5	0.925			
X6	0.809			
<b>Satisfaction</b>		0.944	0.973	0.947
X7	0.975			
X8	0.972			
<b>Use intensity</b>		0.771	0.895	0.810
X10	0.932			
X11	0.867			

to or higher than 0.707 (Barclay et al., 1995; Hair et al., 2011), which implies that the construct and its indicators’ shared variance is greater than the error variance (Carmines and Zeller, 1979). According to the present results, all the indicators have weights above 0.707, except for item X9, which has a value below 0.600. This item also had a poor fit after reverse coding, so X9 was eliminated to improve the scale’s reliability.

In the next step, the constructs’ reliability was evaluated based on composite reliability (CR) scores. Satisfactory CR values must fall between 0.60 and 0.70 for exploratory research and between 0.70 and 0.90 to meet the higher standards required of more advanced studies (Nunnally and Bernstein, 1994). Values below 0.60 indicate a lack of reliability (Hair et al., 2011; Richter et al., 2016). The values obtained for the current model’s constructs are well above the minimum threshold of 0.70, thereby confirming strong internal consistency (see Table 3 above).

The final step was to assess the model’s convergent and discriminant validity. The former requires researchers to determine whether each set of indicators represents or measures the same underlying construct, which can be confirmed by checking for one-dimensionality (Henseler et al., 2009). An average variance extracted (AVE) value above 0.50 shows that the relevant indicators explain more than 50% of the construct’s variability (Hair et al., 2011, 2014). The present model’s constructs all have AVE values above 0.50 (see Table 3 above).

Discriminant validity, in turn, reveals to what extent a specific construct differs from the model’s other variables in order to detect possible problems with overlapping. That is, each construct should share more variability with its own observable variables and their indicators than with other model constructs (Barclay et al., 1995). Three procedures were followed in this part of the last step. The first was to apply the Fornell-Larcker criterion (Fornell and Larcker, 1981). Another way to conduct this analysis is to demonstrate that the constructs’ intercorrelation values are less than the square root of AVE (see Table 4).

The second criterion applied was the heterotrait-monotrait (HTMT) ratio of correlations (Henseler et al., 2015). The cited authors found that, when they ran simulations, a lack of discriminant validity could best be detected using the HTMT ratio. This type of validity is present if the correlations between the indicators that measure the same construct (i.e. monotrait-heteromethod) are stronger than the correlations between the indicators that measure different constructs (i.e. heterotrait-heteromethod). The HTMT ratio should thus be lower than 0.85 or even 0.90.

Alternatively, the confidence interval’s upper limit can be set as under 1.00 to satisfy the aforementioned criterion (Henseler et al., 2015). In the current study, all the ratios met the most conservative criterion except for one ratio, but the latter meets the most liberal criterion based on confidence intervals presented by Henseler et al. (2015) (see Table 4 above).

The last criterion used to assess discriminant validity is less stringent

**Table 4**  
Discriminant validity of first-order constructs: heterotrait-monotrait (HTMT) and Fornell-Larcker criterion.

	Continuance intention	Commitment	Competence	Revisit intention	Satisfaction	Use intensity
<b>Continuance intention</b>	n.a.	<i>0.244</i>	<i>0.286</i>	<i>0.192</i>	<i>0.275</i>	<i>0.280</i>
<b>Commitment</b>	0.259 (0.147, 0.358)	<b>0.948</b>	<i>0.742</i>	<i>0.569</i>	<i>0.751</i>	<i>0.703</i>
<b>Competence</b>	0.295 (0.181, 0.393)	0.820 (0.758, 0.873)	<b>0.900</b>	<i>0.483</i>	<i>0.691</i>	<i>0.789</i>
<b>Revisit intention</b>	0.192 (0.087, 0.296)	0.604 (0.518, 0.680)	0.503 (0.403, 0.590)	n.a.	<i>0.645</i>	<i>0.480</i>
<b>Satisfaction</b>	0.283 (0.173, 0.380)	0.819 (0.765, 0.868)	0.739 (0.676, 0.793)	0.663 (0.579, 0.740)	<b>0.973</b>	<i>0.611</i>
<b>Use intensity</b>	0.308 (0.192, 0.412)	0.830 (0.760, 0.897)	0.921 (0.864, 0.978)	0.531 (0.428, 0.632)	0.703 (0.610, 0.779)	<b>0.900</b>

Note. HTMT and bootstrap confidence interval below the diagonal; square root of average variance extracted on the diagonal in bold; correlations above the diagonal in italics to assess the Fornell-Larcker criterion; n.a. = not applicable.

– a cross-loadings evaluation. The results should show that each indicator has a higher loading on its own construct than on the model’s other latent variables (Hair et al., 2011; Henseler et al., 2009). The following table was generated during the analysis of individual questionnaire items, which confirmed the model’s discriminant validity (see Table 5).

Finally, the standardised root mean square residual (SRMR) was evaluated to check the model’s goodness of fit (see Table 6). The SRMR needs to be lower than 0.08 (Hu and Bentler, 1999).

5.2. Structural model

After the measurement model was validated, the structural model (see Fig. 2) was also evaluated using PLS analysis to test the structural relationships between the variables mentioned in the hypotheses. This model was assessed by examining its coefficient of determination ( $R^2$ ) values. The Stone-Geisser test or  $Q^2$  scores (see Table 6 above) were also checked to confirm predictive relevance, and the path coefficients were calculated. The estimated values’ stability was evaluated using  $t$ -statistics obtained with a bootstrap test run on 1000 repeated samples (see Table 7).

The above model’s predictive power was measured based on the latent dependent variables’  $R^2$  values, which indicate how much of the constructs’ variance is explained by the model. The values should be higher than 0.1 (Falk and Miller, 1992). As mentioned previously, another measure of predictive relevance is the Stone-Geisser test or  $Q^2$  scores, which were obtained by following a blindfolding procedure (Hair et al., 2011; Richter et al., 2016). If a specific endogenous latent variable’s value is greater than 0, that construct has predictive relevance (Hair et al., 2011). The present results (see Table 7 above) confirm that the proposed model has predictive relevance.

The final step was to analyse the standardised regression coefficients’ weights, which can be used to check whether the proposed hypotheses are statistically significant (Hair et al., 2011). The current results (see

**Table 5**  
Cross-loading matrix after item elimination.

	Commitment	Competence	Satisfaction	Use intensity	Continuance intention	Revisit intention
X1	<b>0.946</b>	0.710	0.690	0.665	0.533	0.249
X2	<b>0.949</b>	0.697	0.731	0.668	0.545	0.213
X3	0.674	<b>0.925</b>	0.623	0.782	0.440	0.272
X4	0.684	<b>0.936</b>	0.629	0.757	0.421	0.289
X5	0.733	<b>0.925</b>	0.686	0.695	0.503	0.281
X6	0.574	<b>0.809</b>	0.545	0.595	0.370	0.177
X7	0.750	0.696	<b>0.975</b>	0.603	0.644	0.279
X8	0.709	0.648	<b>0.972</b>	0.586	0.610	0.256
X10	0.730	0.778	0.616	<b>0.932</b>	0.507	0.305
X11	0.508	0.627	0.466	<b>0.867</b>	0.335	0.182
X12	0.569	0.483	0.645	0.480	<b>1.000</b>	0.192
X13	0.244	0.286	0.275	0.280	0.192	<b>1.000</b>

Note. None of the Gaussian copula values for each construct was significant ( $p > 0.05$ ), suggesting that endogeneity was absent in this study.

**Table 6**  
Standardised root mean square residual (SRMR) analysis of model fit.

	Estimated model		Saturated model	
	Value	HI95	Value	HI95
SRMR	0.045	0.092	0.042	0.066
$d_{ULS}$	0.161	0.659	0.138	0.337
$d_G$	0.251	2.475	0.241	1.692

Note. HI95 = 95% quartile of bootstrap discrepancies;  $d_{ULS}$  = unweighted least squares discrepancy;  $d_G$  = geodesic discrepancy.

Table 8) show that all the hypotheses received support in this empirical research.

To validate the above findings, the non-parametric technique of confidence intervals was also applied. According to Henseler et al. (2009, p. 306), ‘if a confidence interval for an estimated path coefficient  $\beta$  does not include zero, the hypothesis that  $\beta$  equals zero is rejected.’ The current results thus confirm the earlier findings for the structural model (see Table 8 above).

6. Conclusions, discussion and future trends

6.1. Discussion

This study’s most significant conclusion is that all the attitudinal, cognitive and behavioural antecedents analysed increase Sapp CI and RI. More specifically, competence and commitment are critical determining factors for use intensity and satisfaction with Sapps. Users’ use intensity and satisfaction with these apps affect their CI and RI. These results clarify researchers’ previous findings on Sapp CI, thereby helping sport specialists to deal with sport enthusiasts’ decreasing CI.

This investigation confirmed that Sapps and LBAs have recently

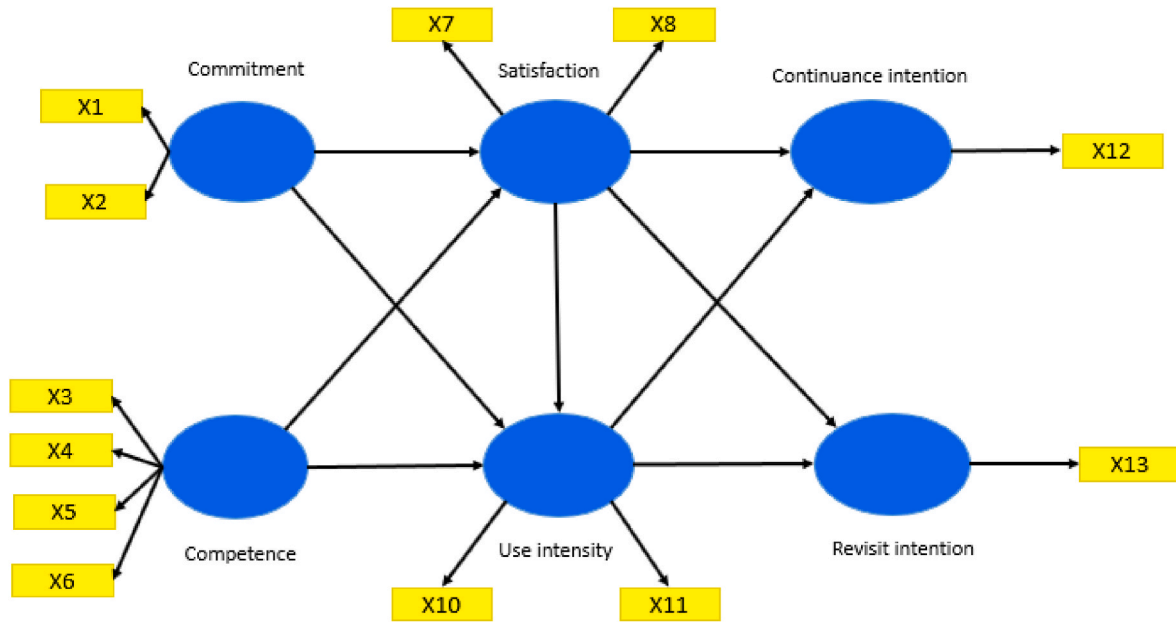


Fig. 2. Structural model.

**Table 7**  
Stone-Geisser test and variance explained.

	R <sup>2</sup>	Q <sup>2</sup> (=1-SSE/SSO)
Continuance intention	0.096	0.087
Revisit intention	0.428	0.416
Satisfaction	0.601	0.565
Use intensity	0.654	0.510

Note. SSE = sum of squares of prediction errors; SSO = sum of squares of observations.

become tools with which individuals can track and record results while doing leisure-time PAs. Prior studies have highlighted the need for more thorough studies of LBAs (Akel and Armağan, 2021) and the ways that people engage in leisure PAs (Mutz and Gerke, 2021; Son et al., 2021). The present investigation more specifically addressed the question of which antecedents explain the Sapp use (i.e. CI) and the PAs being monitored by focusing on understanding the variables contributing to users' CI and RI regarding Sapps. The proposed model proved to be a good fit for the data, and all the hypotheses were supported. This study, therefore, confirmed the selected factors' positive effects on the posited relationships, thereby providing significant insights into the connections among the CI antecedents of commitment, competence, use intensity and satisfaction and achieving the primary research goal.

This study's main goal was to clarify attitudinal, cognitive and behavioural determinants' effects on Sapp users' CI. As expected, satisfaction and use intensity are antecedents of Sapp users' behavioural intentions, and all the drivers under study have positive impacts on Sapp

**Table 8**  
Results for structural model.

Hypothesis	$\beta$ coefficient	T-statistic	P-value	2.5%	97.5%	Supported
Commitment -> Satisfaction	0.529	9.146	0.000	0.412	0.646	Yes
Commitment -> Use intensity	0.261	4.272	0.000	0.133	0.373	Yes
Competence -> Satisfaction	0.298	5.128	0.000	0.184	0.411	Yes
Competence -> Use intensity	0.596	10.523	0.000	0.488	0.713	Yes
Satisfaction -> Continuance intention	0.166	2.642	0.008	0.044	0.287	Yes
Satisfaction -> Revisit intention	0.561	10.394	0.000	0.453	0.666	Yes
Use intensity -> Continuance intention	0.178	3.022	0.003	0.057	0.301	Yes
Use intensity -> Revisit intention	0.137	2.601	0.009	0.035	0.243	Yes

Note.  $\beta$  = beta.

CI and RI. These results are in line with previous research on satisfaction's effect on behavioural intentions (Atulkar and Kesari, 2017; Belanche et al., 2012; Duarte et al., 2018), on Sapp use and higher PA levels (Gal et al., 2018; Zeng et al., 2020) and on Sapp satisfaction and CI (Beldad and Hegner, 2018; Cho, 2016; Yan et al., 2021). More specifically, commitment has the most significant influence on satisfaction, while competence has the strongest impact on use intensity and satisfaction does the same for RI.

In addition, the present investigation added two extensions to the IS continuance model by including the outcomes for RI and integrating behavioural and cognitive determinants. The findings reveal that Sapp users' RI and CI with regard to leisure-time PAs can be explained by these consumers' satisfaction with Sapps and use intensity. This impact is especially clear when these two drivers are preceded by the cognitive antecedent of competence with – and behavioural antecedent of commitment to – Sapps.

Finally, the current results contrast with Bhattacharjee's (2001) findings in that satisfaction does not have the most significant influence on CI since satisfaction's effect is only a little stronger than that of use intensity, which is similar to Amoroso and Lim's (2017) results. Instead, satisfaction actually has the most notable influence on RI. This pattern may reflect that, when location-based technology is used, the stronger relationship between satisfaction and CI highlighted by the IS continuance model can shift to a more significant link between satisfaction and location RI. One explanation could be the importance that some sport enthusiasts may place on having the option to check their improvement in leisure-time PAs by comparing their new performance and past results in the same situations and locations.

This study's results fill gaps in previous leisure PA studies. Prior CI research has mainly focused on perceptions, but cognitive, attitudinal and behavioural factors also need to be carefully considered. The present findings thus contribute to a deeper understanding of how Sapp users' CI and RI develop.

## 6.2. Theoretical implications

The existing literature shows that little is known about which attitudinal, cognitive and behavioural elements are antecedents of Sapp users' RI and CI. This study's results contribute to theoretical research on post-adoption behaviour through the assessment of cognitive, attitudinal and behavioural antecedents of CI and RI. The investigation also expanded the IS continuance model by identifying these variables' attitudinal, cognitive and behavioural antecedents and providing novel outcomes regarding RI. The findings thus elucidate specific aspects of determinants of Sapp users' intentions.

The proposed model provides a more holistic explanation of how different antecedents interact with sport enthusiasts' RI with reference to specific locations and CI in terms of using Sapps in these places. An aggregate approach is better suited to defining complete behavioural processes such as the one analysed in this research. In addition, the results reveal that factors affecting Sapp behavioural intentions can be strengthened by experiences provided in sport-focused locations or by organisations that facilitate PAs. Notably, these antecedents are not necessarily intrinsic to these locations.

The findings, therefore, fill research gaps regarding the roles that satisfaction, use intensity, competence and commitment play as RI and CI determinants. More specifically, commitment has a stronger impact on satisfaction (i.e. attitudinal driver), and competence (i.e. cognitive factor) has a more powerful effect on use intensity (i.e. behavioural variable). The results for direct effects on RI and CI include that satisfaction (i.e. attitudinal factor) with Sapps has a greater impact on RI, while use intensity (i.e. behavioural driver) has a stronger effect on CI.

This study confirmed that Sapp users' CI and RI are related to attitudinal, cognitive and behavioural factors. These behavioural intentions specifically develop through a complex process in which individuals' interests, continuous use of apps (i.e. commitment) and knowledge about and facility with Sapps (i.e. competence) affect use intensity and satisfaction with these tools. Thus, commitment to and competence with Sapps has an impact on the intensity of LBA use and satisfaction while doing leisure-time PAs. Use intensity and satisfaction, in turn, have a positive effect on CI and RI when users have previously engaged in these activities and reduced their sedentariness.

The coronavirus disease-19 (COVID-19) pandemic has underlined how, in specific cases or moments, many sport enthusiasts can be externally influenced to stop doing any PA (i.e. sport centres' closure). In situations in which PAs are limited, a fuller understanding of factors affecting Sapp users' CI and RI could help practitioners and sport organisations encourage individuals to return to leisure-time PAs. Trainers can also apply the findings to initiatives fostering Sapp users' resumption of past activities. In this context, the conceptual model validated in this study provides a better approach to generating Sapp users' CI and RI and extends the IS continuance model's usefulness in this specific context.

Finally, the above findings indicate that satisfaction has a greater impact on RI than on CI. This result should be kept in mind when future studies opt to focus on app-related CI without differentiating between CI and RI. Measures need to be taken to ensure satisfaction's effect on RI is not lost or hidden.

## 6.3. Practical implications

These findings also reveal an exciting path for sport enthusiasts, trainers and organisations to follow in the present COVID-19 context and beyond this crisis. If good experiences with Sapps foster greater CI

and RI among Sapp users, individuals and organisations can take advantage of this process to improve app users' chances of returning to or doing leisure-time PAs. In general, the results show that competence and commitment are direct antecedents of Sapp use intensity and satisfaction.

Sport enthusiasts and organisations thus need to improve, among other things, individuals' ability to benefit from these apps by fostering and expanding their knowledge about the functionalities of and information recorded in these tools. Users can also be encouraged to use Sapps continuously through bonus features such as forums in which sport enthusiasts can exchange experiences and recommendations. These platforms may further help individuals to continue using their Sapps by providing access to PA companions or competitions based on comparing participants' performance.

In addition, use intensity and satisfaction predicts CI and RI, which means sport enthusiasts should choose specific apps adapted to their needs according to the PAs done or objectives set. Sport organisations need to identify new Sapp users and the best practitioners to involve them from the start in relevant communication initiatives. These organisations further should develop satisfying sport offers based on apps, for instance, creating personalised apps or improving resources' compatibility with existing apps (i.e. route indications). These entities could also improve their current practices, such as reminding users to record their leisure-time PA on their Sapp and helping enthusiasts to increase their physical abilities through personal effort and sport centre fitness staff's explanations.

Sport organisations could additionally facilitate Sapp and LBA use during individuals' free time and strengthen users' competence, for example, by providing interactive maps and geolocation routing services and expanding good Internet connections' availability. In this context, these organisations can promote their own or other Sapps and LBAs in their facilities, offer helpful information or provide special offers via these channels to regular users or those who most often download apps. Concurrently, sport programme managers can define sport market segments (e.g. elderly sport enthusiasts) and then promote and organise specific products based on these consumers' specific needs so that Sapp users can be encouraged to participate at appropriate levels or to emulate their sport role models.

More specifically, sport enthusiasts could benefit from increasing their understanding of their apps' functions and instruments and spending more time using apps when doing leisure-time PAs, which should enhance these individuals' CI and RI. Their satisfaction will improve if they select specific Sapps that cover all these users' measurable results or specific needs and that offer the desired functions, thereby building up stronger CI and RI regarding leisure-time PAs.

## 6.4. Limitations and future research

While this study's findings are promising, the analyses relied on a limited sample of sport enthusiasts to achieve this first approximation to a more holistic model. In addition, CI and RI were measured by one item even though [Bhattacharjee \(2001\)](#) included more indicators of CI in the original IS continuance model. Future research could expand on the present research's results by applying the same procedures separately to sport practitioners and professionals. Fuzzy-set qualitative comparative analysis is another possible method used to deal with relatively complex scenarios and describe how certain configurations of variables may lead to specific outcomes.

In addition, further investigations are needed to explore factors with adverse effects, such as payment for app use, and moderator and mediating variables' effect, such as age, type of sport or PA routines. These factors could affect the proposed model's relationships. This study should also be replicated in other geographical areas with contrasting features, for example, cities in Asia or Latin America. Mixed methods may also help researchers collect more accurate data and a wider range of information from participants. Finally, PAs involve heterogeneous

behaviours, so another potentially interesting option would be to conduct the same research using varied gender segments and different types of sport activities (e.g. injury-provoking) or antecedents (e.g. fear, ease of use or self-confidence).

**Data availability**

Data will be made available on request.

**Appendix 1. Measurement instrument**

Constructs	Items	Measures
User characteristics Adapted from Bigné et al. (2007) and Vallespín-Arán et al. (2017)	X0.1: Age X0.2: Gender X0.3: Education X0.4: Marital status X0.5: Experience using LBAs	Ranges: 18–25, 26–35, 36–45, 46–55, 56–65, 65 or more years old Male, female No formal education, primary school, secondary school, university Single, married, widow or widower, divorced, common-law marriage None, <1 year, 1–2 years, 2–3 years, 4–5 years, >5 years
Commitment Adapted from Guesalaga (2016)	X1: I spend more than 1 h a week interacting with Sapps.	7-point Likert scale (1 = ‘Strongly disagree’; 7 = ‘Strongly agree’ or 1 = ‘Unlike me’; 7 = ‘Like me’ or 1 = ‘Very infrequently’ (0–1 times); 7 = ‘Very frequently’ (6–7 times)
Competence Adapted from Guesalaga (2016)	X2: When I do a PA, I use my Sapps. X3: I have a general command of how to use Sapps. X4: I am familiar with and know a lot about Sapps use. X5: I have a solid understanding of how to useSapps. X6: I have received enough information about how to use basic Sapps. X7: I am satisfied with my experiences with my Sapps.	
Satisfaction Adapted from Van Kerrebroeck et al. (2017)	X8: The experiences I have had with my Sapps have been just what I need. X9: My experiences with my Sapps have not been what I thought they would be.	
Use intensity Adapted from Venkatesh et al. (2012)	X10: Choose the number that best describes how frequently you use Sapps. X11: Choose the number that best describes how frequently you use Sapps while travelling.	
Continuance intention Adapted from Tam et al. (2020)	X12: Choose the number that best describes your intention to continue using mobile Sapps or wearables when practicing any PA in the future.	
Revisit intention Adapted from Chalip et al. (2003)	X13: Would you go back to the sport clubs, event locations or tourism destinations where you have previously used your Sapps?	

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