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Switching to cloud gaming: A push-pull-mooring perspective

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ABSTRACT

The video game industry has witnessed a switching of gamers from traditional means of gaming to cloud gaming. Understanding the psychological mechanisms underlying such switching behavior at the individual level is important. Drawing on the technology switching literature and the push–pull-mooring (PPM) framework, we proposed a research model explaining the switching intention to cloud gaming services. Using a mixed methods approach, we first drew insights from a qualitative interview study and the technology switching literature to identify antecedents specific to cloud gaming. Then, we developed a research model that consolidates salient push, pull, and mooring factors influencing the switching intention. Using a quantitative survey study, we tested the research model with data collected from 305 gamers. This study contributes to the technology switching literature by contextualizing the PPM framework into cloud gaming services. The findings provide cloud gaming service practitioners with insights into attracting new gamers and retaining existing ones.

1. Introduction

Technological advancements have afforded improved gaming experiences, including enhanced graphics, plots, and special effects, but they have also increased demands on local devices for gameplay. Large volumes of game data must be downloaded and stored on the gamer's device, requiring substantial computing power for efficient processing and graphical rendering (Liu et al., 2015; Peñaherrera-Pulla et al., 2021). Consequently, traditional means of gaming—where video games are downloaded, stored, and executed locally on devices such as consoles, PCs, and mobile phones—require significant and continuous hardware investments and maintenance from gamers to manage the increasing complexity of game content and ensure a seamless gaming experience.

Emerging cloud gaming services, such as Amazon Luna, Boosteroid, GeForce Now, and Xbox Cloud, offer a revolutionary alternative that significantly enhances the gaming experience by overcoming the challenges and constraints faced by traditional means of gaming. By shifting the computation of game data and image rendering to remote servers and streaming the gameplay to gamers' local devices, cloud gaming transforms how games are delivered and experienced. Such a novel gaming delivery mode offers three key benefits. First, it leverages remote servers to deliver consistent, high-quality gaming experiences regardless of local device performance, eliminating the need for expensive hardware investments and maintenance. Second, it addresses compatibility issues related to software and operating system configurations by delivering gameplay directly to any digital device. Third, it provides instant access to games with seamless server-side updates and cross-device functionality, enhancing the overall gaming delivery experience (Cai et al., 2014; Chen et al., 2013; Cloudbase.gg, 2024; Laghari et al., 2019; Zhang et al., 2019). As a result, this enhanced gaming delivery experience has led some gamers to switch from traditional means of gaming to cloud gaming (Schmidt, 2022). For example, many *Cyberpunk 2077* gamers who previously relied on high-end systems to play the game locally have switched to cloud gaming (Newzoo, 2022). In particular, the global market share of cloud gaming is expected to increase from 0.37 % in 2019 to 2.83 % in 2024 and continues growing at a compound annual growth rate of 75.05 %, far exceeding the 5.6 % growth rate for traditional means of gaming (Newzoo, 2022).

A review of existing studies on cloud gaming reveals that most research is published within the computer science discipline and primarily focuses on the technical aspects of cloud gaming, such as system architecture, network performance, and data processing. However, little attention has been paid to understanding how the enhanced gaming delivery experience offered by cloud gaming entices gamers to switch

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from traditional means of gaming to cloud gaming. The appeal of cloud gaming lies not only in its ability to overcome the drawbacks of traditional gaming but also in its potential to deliver a superior and more accessible gaming experience, prompting a shift in gamers' preferences and behaviors. For cloud gaming service providers to sustain their businesses, achieving a critical mass by attracting a substantial number of gamers is essential (Eisenmann et al., 2006; McIntyre & Srinivasan, 2017). Therefore, investigating the factors that influence individual gamers' switching intention from traditional means of gaming to cloud gaming is both timely and necessary to gain richer theoretical insights and to provide actionable managerial recommendations. To this end, we endeavor to answer the following research question (RQ):

RQ: What are the factors influencing gamers' intention to switch from traditional means of gaming to cloud gaming?

Drawing on the push–pull-mooring (PPM) framework, we derived a theoretical model for understanding the factors influencing gamers' switching intention to cloud gaming. The PPM framework has been extensively used to elucidate switching phenomena in both online and offline contexts (e.g., Hsieh et al., 2012; Lin & Huang, 2014; Wu et al., 2017). It has been applied in previous studies of technology switching (Bhattacherjee & Park, 2014; Cao et al., 2020), making it a suitable theoretical lens for the current study. Accordingly, we contend that three categories of factors influence the intention to switch to cloud gaming: push, pull, and mooring (Bansal et al., 2005). The PPM framework systematically explains how negative perceptions of traditional gaming experiences (push factors), the positive perceptions of enhanced gaming delivery experiences in cloud gaming (pull factors), and other personal and environmental factors (mooring factors) together shape gamers' switching intention.

We adopted a mixed methods approach to construct and test our research model (Venkatesh et al., 2016). Specifically, we reviewed the literature to identify general factors influencing technology switching. Next, we conducted an interview study to uncover additional factors specific to the cloud gaming context. Finally, we tested the proposed research model using quantitative data collected through a survey and the structural equation modeling approach.

Our study presents several significant contributions to the field of business research. First, it proposes and validates a theoretical model of cloud gaming switching, which serves as a foundational framework to inform and guide future research endeavors in this emerging area. Second, it enhances the existing business and marketing literature by examining the switching intention in a novel digital service context, cloud gaming. Specifically, our research identifies the salient factors of gamers' intention to switch from traditional means of gaming to cloud gaming, extending the application of the PPM framework to the broader realm of business and digital service research. Moreover, by uncovering antecedents specific to cloud gaming that affect switching intention, our study paves the way for further exploration into the underlying psychological mechanisms influencing such switching intention and behavior. Finally, our findings provide valuable insights for practitioners into encouraging gamers to switch to cloud gaming. Cloud gaming practitioners then can better navigate the competitive landscape of the video game industry and enhance gamer acquisition and retention.

2. Literature review

2.1. Cloud gaming

Cloud gaming has predominantly garnered scholarly attention from the computer science discipline. The published studies have concentrated on improving the technical aspects of cloud gaming, including response latency (Shirmohammadi et al., 2015), adaptability (Nan et al., 2016), scene quality (Liu et al., 2015), and technological improvement (Hong et al., 2015; Li et al., 2015; Tian et al., 2015). These investigations have contributed significantly to understanding the infrastructure and technical requirements necessary for the effective deployment of cloud gaming. For instance, to address the high latency associated with the substantial bandwidth demands of cloud gaming, researchers have proposed a self-adaptive approach to reduce bandwidth consumption and, consequently, enhance response speed (Tian et al., 2015). In addition, studies have demonstrated that self-adaptive technologies, including advanced coding and system optimizations, can improve the frames per second and resolution ratios of cloud gaming experiences (Liu et al., 2015; Xu et al., 2018). Furthermore, adopting hybrid streaming techniques has achieved high fidelity in cloud gaming, enhancing the overall gaming experience (Nan et al., 2016).

In conclusion, while previous studies on cloud gaming have predominantly focused on technical aspects such as response latency, adaptability, scene quality, and technological improvements, there remains a critical gap in the literature concerning what drives individual gamers to switch from traditional means of gaming to cloud gaming. Understanding the psychological mechanisms underlying such switching intention is essential for comprehending the broader adoption of cloud gaming and for developing strategies to cater to gamers' evolving preferences.

2.2. Comparing traditional means of gaming and cloud gaming

As the video game industry evolves, a clear distinction between traditional means of gaming and the innovative approach of cloud gaming becomes apparent. This section illustrates the differences between traditional means of gaming and cloud gaming, focusing on infrastructure and hardware-related challenges as well as the enhanced gaming delivery experience afforded by cloud gaming.

2.2.1. Challenges faced by traditional means of gaming

Traditional means of gaming often impose significant infrastructure, hardware, finance, and logistics challenges on gamers. First, gaming performance is frequently constrained by the capabilities of individual hardware, which can hinder frame rates, graphical fidelity, and overall gaming experience (Cai et al., 2014). Gamers with lower-end hardware may encounter lag or poor visual quality, negatively affecting the gameplay experience. As a result, gamers may consistently find themselves constrained by the limitations of their existing systems, leading to dissatisfaction with traditional means of gaming.

Another limitation of traditional gaming is its software and system challenges. Games are often restricted to specific systems and configurations, which limits gamers' ability to play certain games based on their local software and systems, which can lead to compatibility issues (Cai et al., 2018). Gamers may struggle with game access due to software and system limitations, hindering a seamless gaming experience (Cloudbase.gg, 2024).

Furthermore, the financial burden associated with maintaining high-performance gaming setups can deter gamers from fully engaging with the latest video games from their local devices. Traditional gaming necessitates significant investments in hardware and software, creating an accessibility gap for those with limited budgets (Schmidt, 2022). Gamers must navigate the challenges of maintaining high-performance hardware and software, which can be prohibitively expensive and require frequent upgrades in order to enjoy the latest titles.

Lastly, traditional means of gaming often present logistical challenges for gamers, including cumbersome installation processes and the need for frequent updates. Gamers must manage the downloading of large game files and navigate complex installation procedures, which can consume valuable time and resources (Zhang et al., 2019).

2.2.2. Enhanced gaming delivery experience offered by cloud gaming

Cloud gaming addresses the constraints mentioned above and offers a better gaming experience by leveraging the power of remote servers to

provide consistent and high-quality streaming (Shea et al., 2015; Tian et al., 2015). Gamers no longer face performance limitations imposed by their local devices, as cloud gaming enables smooth scene transitions, high-resolution graphics, and real-time computations. This infrastructural shift allows gamers to access high-quality gaming experiences without expensive devices (Carrascosa & Bellalta, 2022). Furthermore, cloud gaming platforms can adjust game output based on real-time network conditions and device performance, ensuring an optimal gaming experience tailored to each gamer's context (Shirmohammadi et al., 2015).

Cloud gaming also presents a cost-effective alternative, overcoming the financial barriers of traditional gaming. By leveraging remote server capabilities, cloud gaming broadens access to cutting-edge titles, enabling a broader audience to enjoy the gaming experience without the financial burden of constant upgrades.

Lastly, cloud gaming mitigates the logistical challenges associated with traditional gaming by allowing gamers to access their favorite titles instantly through the streaming service. Since all games are stored, updated, and executed on remote servers, gamers can bypass lengthy downloads and updates that occur server-side automatically (Shea et al., 2015; Tian et al., 2015). The convenience of cross-device functionality fosters a more unified gaming environment, enabling gamers to transit between devices effortlessly and allowing for greater flexibility and freedom in gameplay.

To conclude, the comparison between traditional gaming and cloud gaming underscores the substantial benefits that cloud gaming offers. By effectively addressing the hardware, software, financial, and logistical limitations inherent in traditional gaming, cloud gaming not only enhances the overall gaming experience but also provides a more accessible, convenient, and compatible solution for gamers. As technology evolves, cloud gaming is poised to revolutionize the gaming landscape, offering a more inclusive and flexible solution that caters to broader and more diverse gamers.

2.3. Switching of technology and digital services

The switching phenomena in technology and digital services involve users replacing existing ones with new alternatives. This stream of research has gained considerable scholarly attention in business and marketing studies, prompting researchers to explore the underlying factors driving such switching intentions and behaviors (Hou et al., 2011; Hsieh et al., 2012). Various theoretical frameworks have been employed to investigate these phenomena, with the PPM framework emerging as the predominant one. The PPM framework is particularly notable for its origins in explaining human migration (Lee, 1966) and its extensive application to research on technology and digital service switching (Bhattacherjee & Park, 2014; Cao et al., 2020).

Based on the PPM framework, numerous antecedents to technology and digital service switching have been identified, including dissatisfaction (e.g., Lai & Wang, 2015; Lin & Huang, 2014; Liu & Xiao, 2014), switching costs (e.g., Wu et al., 2017; Ye & Potter, 2007; Zhang et al., 2008), and inertia (Li, 2018; Lin & Huang, 2014; Sun et al., 2017). However, the PPM framework does not delineate specific constructs related to switching intention and behavior; instead, it categorizes influencing factors into three primary domains: push, pull, and mooring. This categorization allows for contextualizing antecedents that may vary across different technological environments.

Recognizing the necessity of incorporating antecedents specific to the cloud gaming landscape, we comprehensively reviewed existing literature on technology and digital service switching, gaming, and cloud computing (see Table 1). The literature revealed several common factors influencing switching intention, including dissatisfaction, inertia, switching costs, habit, affective commitment, and alternative attractiveness.

3. Research design and theoretical foundation

3.1. The mixed methods design

We employed a mixed methods design to address the research question. Mixed methods research designs contain elements of both quantitative and qualitative approaches (Tashakkori et al., 1998). Mixed methods designs are particularly useful for studying emerging technology because the nature of the digital context changes frequently, and researchers often have difficulty drawing significant insights solely from existing theories and perspectives (Venkatesh et al., 2013). The mixed methods approach offers three specific benefits: addressing confirmatory and explanatory research questions, providing stronger inferences than a single method or worldview, and producing a greater assortment of divergent and/or complementary views (Venkatesh et al., 2016).

In this research, we used the PPM framework as the guideline theory to design two studies to address the proposed research question. First, we conducted a qualitative interview study to gain insights into the factors affecting the switching intention. Then, we constructed a research model that explicates the push, pull, and mooring factors that explain the switching intention to cloud gaming and tested the research model using a quantitative survey study.

3.2. The Push-Pull-Mooring framework

The PPM framework is rooted in the study of migration, originating from the seminal work "The Laws of Migration" by Ravenstein (1885). This foundational text posits that migration behavior is influenced by a combination of push factors, which drive individuals away from their original location, and pull factors, which attract them to a new destination. Ravenstein's work is considered the basis of the push–pull model, emphasizing the dual forces shaping human migration.

Building upon Ravenstein's model, Longino Jr (1992) introduced the concept of mooring factors, which Moon, (1995) subsequently adapted into the push–pull framework to create the PPM framework. Mooring factors encompass personal, situational, and contextual constraints that hinder the decision to migrate. This addition provides a more comprehensive understanding of the various influences on migration decisions (Moon, 1995).

The PPM framework has been recognized as valuable for explaining individuals' switching intentions and behavior in the context of technology and digital services (Jeong et al., 2023), encompassing both offline (Bansal et al., 2005) and online contexts (Cheng et al., 2019). While the PPM framework provides a robust theoretical perspective for understanding human migration, it does not delineate specific constructs within the push, pull, or mooring categories (Cheng et al., 2019). Consequently, studies employing the PPM framework have integrated a combination of generic constructs across these categories and have identified additional constructs specific to their particular research contexts. We followed the same to derive a contextualized model explaining the switching intention to cloud gaming through a mixed methods research design.

4. The qualitative study

4.1. Data collection

We used semi-structured interviews to collect data (Kallio et al., 2016). The interview can be broadly divided into two parts. In the initial stage, the interview questions focused on the participants' recollections of their experiences with traditional means of gaming, including the time and money invested in traditional means of gaming, the experience of mood swings during the gameplay, and the gaming devices used. Then, the interview questions were shifted to focus on cloud gaming. Participants were asked about their experiences and impressions of cloud gaming, including the gaming experiences, equipment

Table 1
A summary of studies on technology and digital service switching.

Study	Research context	Push variable(s)	Pull variable(s)	Mooring variable(s)	Control variable(s)
(Bhattacherjee & Park, 2014)	Google apps	Dissatisfaction	Relative usefulness Expected omnipresence	Switching costs Security concerns	Subjective norm Self-efficacy
(Chang et al., 2014)	Social networking sites	Regret Dissatisfaction	Alternative attractiveness	Switching costs	Not specified
(Chang et al., 2017)	Online shopping	Information searching Perceived value	Attractiveness Perceived quality	Self-efficacy Switching costs	Not specified
(Cheng et al., 2009)	Social networking sites	Dissatisfaction	Attraction	Switching costs	Not specified
(Cheng et al., 2019)	Cloud storage services	Perceived privacy risk Perceived security risk	Network externalities Innovation attributes Perceived enjoyment	Habit Switching costs	Gender Age Education Mobile OS
(Fang & Tang, 2017)	Instant messengers	Dissatisfaction	Referent network size Future expectations Perceived complementarity Perceived compatibility Similarity Innovativeness Enjoyment Ease of use Convenience	Switching costs	Not specified
(Gerhart & Koohikamali, 2019)	Social networking sites	Dissatisfaction Privacy concerns	Anonymity Open opinion expression Social norm	Continuity cost Switching cost	Not specified
(Handarkho & Harjoseputro, 2020)	Mobile payments	Perceived risk	Enjoyment Convenience Deal proneness	Consumer innovativeness Subjective norms Perceived herd behavior	Age Gender Income Occupation
(Hou et al., 2011)	Video games	Low enjoyment Low satisfaction Perception of insufficiency	Alternative attractiveness	Switching costs Social relationship Need for variety Prior switching experience	Not specified
(Hsieh et al., 2012)	Social networking sites	Weak connection Writing anxiety	Enjoyment Perceived usefulness Perceived ease of use	Switching costs Past experience	Not specified
(Jeong et al., 2023)	Online shopping	Dissatisfaction Prior experience Vicarious experience Risk perception	Social presence Innovativeness Alternative attractiveness Perceived value	Switching costs Inertia Self-efficacy Lock in	Not specified
(Lai et al., 2012)	Online shopping	Inconvenience	Peer influence Alternative attractiveness	Switching costs Trust Security and privacy	Not specified
(Lai & Wang, 2015)	Healthcare services	Low satisfaction Low commitment	Ubiquitous care Responsiveness Personalized care	Privacy and security Habit Switching costs Trust	Not specified
(Li, 2018)	Mobile apps	Poor aesthetic design	Locatability Transaction convenience Economic benefit Gamification	Perceived substitutability Inertia	Not specified
(Lin & Huang, 2014)	M-commerce	Disconfirmation Low satisfaction	Relative advantage	Inertia Switching costs Network effects Subjective norms	Not specified
(Liu & Xiao, 2014)	Social networking sites	Dissatisfaction	Socialization value Social image value Escapism value Self-improvement value Entertainment value Information-seeking value	Switching costs	Not specified
(Sun et al., 2017)	Instant messengers	Dissatisfaction Fatigue	Alternative attractiveness Subjective norm	Inertia	Not specified
(Susanty et al., 2020)	E-commerce	Lack of information support Perceived valuelessness	Alternative attractiveness	Computer self-efficacy	Not specified
(Tang & Chen, 2020)	Social networking sites	Dissatisfaction Person-brand unfit	Alternative attractiveness	Unfollowing costs	Gender Age

(*continued on next page*)

Table 1 (*continued*)

Study	Research context	Push variable(s)	Pull variable(s)	Mooring variable(s)	Control variable(s)
					Usage, frequency, and types of social networking site
(Wu et al., 2017)	Cloud storage services	Perceptions of risks	Critical mass Transfer trust	Social norm Switching costs	Not specified
(Ye & Potter, 2011)	Personal information technologies	Dissatisfaction	Relative advantage Perceived relative ease of use Perceived relative security	Subjective norm Perceived switching costs Habit	Gender Age Web experience
(Zhang et al., 2012)	Social networking sites	Dissatisfaction	Alternative attractiveness	Sunk costs	Not specified
(Zhou, 2016)	Mobile stores	Dissatisfaction	Alternative attractiveness	Switching costs Social influence	Not specified
This study	Cloud gaming	Dissatisfaction Inconvenience Unaffordability	Alternative attractiveness *Compatibility** *Ubiquity** *Comprehensiveness**	Inertia Switching costs Habit Affective commitment	Gender Age Education Income Trait innovativeness

Note. *Context-specific variables identified and tested in our study.

requirements, subscriptions, and pricing.

We invited 12 gamers to participate in online interviews between October and November 2022 through online recruitment. The gamers who participated in the interviews were required to demonstrate familiarity with cloud gaming and experience cloud gaming at least once. Three gamers met the minimum requirements, seven used traditional and cloud gaming means to varying degrees, and two only used cloud gaming. The cloud gaming services they used included PlayStation Now, Google Stadia, Amazon Luna, XCloud, and GeForce Now. The recording and processing of the audio contents of the interviews were authorized by the 12 participants, and thus, the interviews were recorded and then subsequently transcribed and analyzed. Field notes were taken during the interviews to supplement the interview data.

4.2. Data analysis

Thematic analysis was performed to the interview data to capture potential constructs. We adopted the principle of theoretical engagement in the thematic analysis (Sarker et al., 2013). The principle of theoretical engagement involves utilizing a *meta*-theoretical lens in the initial and iterative stages of qualitative data analysis (Stumpf & Califf, 2018). In other words, we drew on the PPM framework's conceptual foundation and the associated concepts to interpret the interview data. For example, the definitions of switching costs provided by Bhattacherjee and Park (2014) were used to identify gamers' investments in traditional means of gaming because these concepts have been instantiated in the switching literature for years (e.g., Carter et al., 2014; Chang & Chen, 2008; Sun et al., 2017).

4.3. Results from thematic analysis

We iteratively analyzed the data to identify antecedents that influence the switching of gamers from traditional means of gaming to cloud gaming. Challenges associated with traditional means of gaming, such as dissatisfaction, inconvenience, and high costs, were observed, echoing previous findings (e.g., Bhattacherjee & Park, 2014; Boudon, 2003; Lai et al., 2012). For instance, participants believed that continuous and frequent downloading, updating, and device upgrading for traditional means of gaming led to a certain degree of inconvenience.

In contrast, factors related to cloud gaming were identified as compatibility, ubiquity, comprehensiveness, and alternative attractiveness, highlighting the significant improvements in the gaming delivery experience. Specifically, compatibility and ubiquity reflect the inherent advantages of cloud gaming, such as its ability to function seamlessly across various devices. At the same time, comprehensiveness emphasizes the diversity of games and game genres available through cloud gaming services, highlighting the wide array of titles from various publishers that enhance the overall attractiveness of cloud gaming. Alternative attractiveness captures the overall merit of cloud gaming, offering a more streamlined and accessible gaming delivery experience.

Personal and environmental factors that might hinder the switch were summarized into three main categories: habit, affective commitment, and switching costs, aligning with previous studies (Cao et al., 2020; Polites & Karahanna, 2012; Sun et al., 2017). The results of the thematic analysis are presented in Appendix A.

5. The quantitative study

5.1. The proposed research model

Building on the insights gained from the interview study and the previous literature on technology and digital service switching, we derived a research model based on specific factors that explain switching intention to cloud gaming. Based on the PPM framework, we organized into the push, pull, and mooring categories. Constructs in the push category include inconvenience, unaffordability, and dissatisfaction relating to traditional means of gaming. Constructs in the pull category include compatibility, ubiquity, comprehensiveness, and alternative attractiveness relating to cloud gaming. Constructs in the mooring category include switching costs, habit, affective commitment, and inertia, representing situational and personal factors hindering switching. Fig. 1 depicts the research model.

5.2. Hypothesis Development

5.2.1. Push factors

Dissatisfaction represents the overall negative evaluation of users toward their experience with technology (Bhattacherjee & Park, 2014). Previous studies on switching behavior suggest that this negative evaluation is a primary cause for users to abandon incumbent technology (Gerhart & Koohikamali, 2019; Lai & Wang, 2015; Liu & Xiao, 2014). Similarly, an unsatisfactory gaming experience prompts gamers to seek alternative solutions actively (Chang et al., 2014; Sun et al., 2017). For instance, dissatisfaction has been identified as a major reason for gamers switching from one massively multiplayer online role-playing game to another (Hou et al., 2011). We expect that gamers who are dissatisfied with traditional means of gaming are more likely to seek alternative gaming solutions, such as cloud gaming. Therefore, we hypothesize that:

H1. Dissatisfaction with traditional means of gaming is positively associated with the intention to switch to cloud gaming.

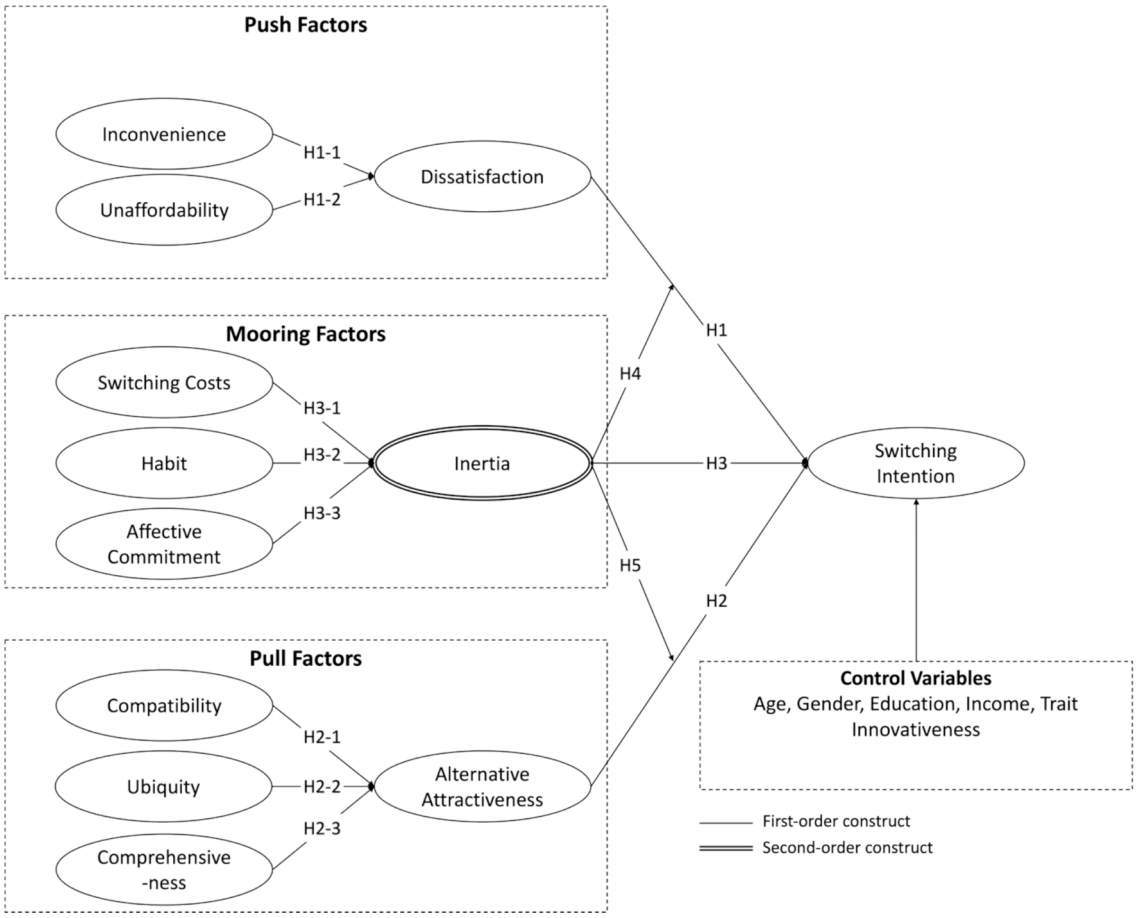

Fig. 1. The Research Model.

Inconvenience refers to the degree to which gamers encounter difficulties or frustrations that hinder their ability to achieve a satisfying gaming experience through traditional means of gaming (Collier & Kimes, 2013). It characterizes the time-consuming preparation required for traditional gaming methods, the annoyance and disruptions experienced during gaming, and the sense of nuisance or hassle associated with using these conventional gaming modes. The inconvenience can be viewed as a significant barrier to technology acceptance and is associated with negative user evaluations; higher levels of perceived inconvenience positively correlate with increased user dissatisfaction (Ding et al., 2011). In the context of traditional means of gaming, this inconvenience manifests in the increasing demands associated with hardware and software requirements in delivering the expected gaming experience. Gamers seeking a smooth gaming experience find themselves caught in a continuous cycle of updating and configuring their local devices (Cai et al., 2016; Cai et al., 2022). Our interview study highlights this issue, revealing the perceptions of gamers regarding inconvenience. For instance, one participant remarked, "*The new games often require substantial updates regularly, which is time-consuming and frustrating (Participant 6).*" Such reflections emphasize gamers' frustration and dissatisfaction due to the relentless need for hardware and software updates in traditional gaming environments. Therefore, we hypothesize that:

H1-1. Inconvenience is positively associated with dissatisfaction with traditional means of gaming.

Unaffordability refers to the perceived economic burden associated with delivering the expected gaming experience, which necessitates continuous financial investments in hardware upgrades (Bansal et al., 2005). This financial strain is particularly remarkable in traditional gaming, where regular software updates and hardware enhancements are required to maintain optimal gaming performance and experience. Typically, individuals act rationally and carefully to evaluate the costs and benefits of their choices (Bansal et al., 2005; Boudon, 2003).

Existing research supports the notion that perceived high economic costs associated with a service can lead to user dissatisfaction, which may ultimately prompt a switch to alternative services (Brumec & Vrček, 2013; Liu et al., 2019). The financial burden associated with frequent upgrades can foster a sense of dissatisfaction among gamers, as they feel compelled to invest substantial amounts of money to keep up with evolving technology.

Insights from our qualitative study reinforce the notions above. For instance, Participant 10 articulated his frustration, "*I recently bought a graphics card, but it is already struggling to support the highest quality for my favorite game.*" This sentiment highlights gamers' economic pressures, where the need for regular hardware updates leads to financial strain and dissatisfaction. We therefore hypothesize that:

H1-2. Unaffordability is positively associated with dissatisfaction with traditional means of gaming.

5.2.2. *Pull factors*

Alternative attractiveness refers to gamers' positive perception of cloud gaming, which is significantly influenced by the enhanced gaming delivery experience that cloud gaming provides. Existing literature indicates that alternative attractiveness positively impacts the intention to switch to new technologies (Chang et al., 2014; Kim et al., 2006; Tang & Chen, 2020). Enhanced gaming delivery experience can be characterized by superiority in terms of *delivery range*, *delivery flexibility*, and

delivery diversity of gameplay (Carrascosa & Bellalta, 2022; Di Domenico et al., 2021; Laghari et al., 2019). These improvements transform how gameplay is delivered through cloud technologies and underscore the alternative attractiveness of cloud gaming compared to traditional gaming methods.

Gamers will likely switch when they perceive an overall advantage in the alternatives (Cheng et al., 2009). Specifically, these enhanced gaming delivery experience in cloud gaming encompasses (1) playing games across a wide range of devices (i.e., *compatibility for enhanced delivery range*), (2) playing games anytime and anywhere (i.e., *ubiquity for enhanced delivery flexibility*), and (3) choosing and trying out games from various genres and publishers (i.e., *comprehensiveness for enhanced delivery diversity*), thereby enhancing overall alternative attractiveness of cloud gaming in delivering the gameplay.

For instance, NVIDIA GeForce NOW allows gamers to launch games across devices and provides access to a library of titles instantly. These characteristics ensure that gamers can enjoy their games anytime, anywhere, and across devices, increasing the gaming experience's flexibility. The convenience of having an extensive library of games readily available encourages gamers to explore different titles and experiences, further solidifying their perception of cloud gaming as an attractive alternative. Moreover, the comprehensiveness of cloud gaming platforms broadens the gaming landscape by offering a diverse catalog of games from various genres and publishers, facilitating seamless cross-platform interactions. This extensive range of available games enriches the overall gaming experience. It enhances gamers' switching intention as they are drawn to the variety and accessibility offered by cloud gaming compared to traditional means of gaming.

Insights from our qualitative study further emphasize this appeal. Participant 3 noted, "*The ability to play my favorite games on any device without needing constant upgrades has made cloud gaming an obvious choice for me*." This sentiment underscores the significant role that enhanced delivery flexibility and diversity play in attracting gamers to cloud gaming. Therefore, we hypothesize that:

H2. Alternative attractiveness of cloud gaming is positively associated with switching intention to it.

Compatibility refers to the extent to which a cloud gaming service is compatible with different client devices, accessories, and game distribution platforms (Cai et al., 2015; Cai et al., 2014), greatly enhancing the gaming delivery experience. In traditional means of gaming, higher graphics quality and smoothness require more sophisticated software and hardware demands, which can limit the compatibility of the gaming environment with large-scale games. In contrast, cloud gaming integrates software and hardware more effectively, offering a high level of compatibility that reduces gamers' investment in gaming environments and peripherals (Cheng et al., 2019). For instance, services such as Boosteroid allow gamers to play high-quality games on various devices, including smartphones and non-gaming laptops. This adaptability enhances the attractiveness of cloud gaming, making it a more appealing option for gamers seeking flexibility and ease of use (Cai et al., 2018; Carrascosa & Bellalta, 2022; Zhang et al., 2019). Additionally, the extensive compatibility offered by cloud gaming services expands their *delivery range*, allowing gamers to access and enjoy titles across multiple platforms without being restricted by specific hardware.

Insights from our qualitative study provide further support for this view. Participant 12 commented, "*I love that I can switch from my desktop to my TV without losing any quality in gameplay. It makes cloud gaming so much more accessible and enjoyable*." This feedback highlights how the high level of compatibility in cloud gaming enhances its attractiveness to gamers by offering seamless transitions between devices. Therefore, we hypothesize that:

H2-1. Compatibility of cloud gaming is positively associated with alternative attractiveness.

Ubiquity refers to the extent to which gamers perceive a cloud gaming service can be used anytime and anywhere (Cai et al., 2015; Cai et al., 2014). It enriches the gaming delivery experience by liberating them from the constraints of specific hardware and locations (Liu et al., 2015; Nan et al., 2016). This characteristic allows gamers to engage in gaming sessions regardless of their environment, increasing usage and efficiency (Cai et al., 2015; Hong et al., 2015). This flexibility enhances the overall attractiveness of cloud gaming compared to traditional methods, as gamers can enjoy their favorite titles without worrying about location or time limitations (Schmidt, 2022), significantly improving the delivery flexibility of gameplay.

Insights from our qualitative study underline the importance of such ubiquity. Participant 5 stated, "*The best thing about cloud gaming is that I can play my favorite games wherever I am, whether on a train or in a café. It's like carrying a gaming console in my pocket*." Therefore, we hypothesize that:

H2-2. Ubiquity of cloud gaming is positively associated with alternative attractiveness.

Comprehensiveness emphasizes the diversity of games and game genres available through cloud gaming services, highlighting the wide array of titles from various publishers that enhance the overall attractiveness of cloud gaming. Comprehensiveness refers to the extent to which cloud gaming services offer access to an extensive library of games across different genres and publishers, thereby broadening gameplay delivery diversity (Schmidt, 2022). This diversity enriches the gaming experience and increases the likelihood of switching from traditional gaming platforms. Cloud gaming eliminates the need for multiple consoles or local devices by enabling gamers to switch between different platforms, facilitating greater accessibility to games (Di Domenico et al., 2021). For instance, the NetEase Cloud Gaming platform supports a variety of popular titles from sources such as Steam and Tencent, allowing gamers to enjoy a more extensive selection of games. This approach enhances the variety of gaming experiences available to gamers and contributes to the overall attractiveness of cloud gaming services. This perspective is echoed by Participant 8, who noted, "*I love how cloud gaming gives me access to so many games I'd never tried before. The variety is amazing*." This feedback emphasizes the role of comprehensiveness in making cloud gaming a compelling alternative to traditional gaming. Therefore, we hypothesize that:

H2-3. Comprehensiveness of cloud gaming is positively associated with alternative attractiveness.

5.2.3. Mooring factors

Inertia refers to the tendency of gamers to remain attached to and persist in existing behavioral patterns or the status quo, even in the presence of better alternatives or incentives for change (Polites & Karahanna, 2012; Samuelson & Zeckhauser, 1988a). Previous studies have indicated that inertia manifests as a bias toward the status quo, leading to a rigid perpetuation of existing behaviors (Sun et al., 2017). Despite recognizing the disadvantages of traditional gaming methods and the benefits of cloud gaming, gamers may find themselves entrenched in their current practices, which impedes their willingness to switch (Iranmanesh et al., 2022). Therefore, we posit that inertia is relevant to the context of switching from traditional means of gaming to cloud gaming. Gamers exhibiting inertia may continue using traditional gaming methods despite acknowledging their shortcomings and the advantages of cloud gaming. For instance, Participant 4 expressed, "*Even though I know cloud gaming is more convenient, I'm just so used to my current setup that changing feels like too much of a hassle*." This sentiment illustrates how inertia can keep gamers tied to traditional gaming methods despite being aware of superior alternatives. Therefore, we hypothesize that:

H3. Inertia toward traditional means of gaming is negatively associated with the intention to switch to cloud gaming.

Switching costs encompass all expenses incurred when switching from the existing option to the alternative (Dick & Basu, 1994). Notably, two primary types of switching costs can be identified: perceived costs due to lost benefits and perceived learning costs (Cai et al., 2022). In rational decision-making, individuals typically consider switching costs and aim to make choices that maximize their benefits (Samuelson & Zeckhauser, 1988a). When the perceived costs of switching exceed the benefits, inertia is likely to intensify (Patterson & Smith, 2003).

In the context of gaming mode switching, perceived costs associated with lost benefits relate to the gamers' perception of the time, money, and effort already invested in traditional gaming. If gamers view their past investments as significant, they may experience inertia to stay (Cai et al., 2022). Switching to a new gaming mode can incur various costs, including learning costs, which refer to the extra time and effort required to adopt a new service (Patterson & Smith, 2003). Given the considerable differences and novelty between cloud gaming and traditional gaming, gamers must expend additional effort to learn and adapt to cloud gaming. When gamers perceive the time and effort required to initiate a new service as unworthy, they may remain reluctant to change, thereby reinforcing the status quo (Sun et al., 2017). Participant 7 shared, "*I've spent years building my game library and hardware setup. It would be hard for me to give it up*." This reflection underscores how perceived switching costs can reinforce inertia and deter gamers from transitioning to cloud gaming. Therefore, we hypothesize that:

H3-1. Switching costs are positively associated with inertia toward traditional means of gaming.

Habit refers to the automatic responses of gamers who have engaged with traditional means of gaming over an extended period (Cao et al., 2020). It may perpetuate gamers' use of traditional means of gaming. Polites & Karahanna (2012) used the concept of habit to extend theoretical explanations of status quo bias beyond conscious antecedents, framing habit as a subconscious contributor to inertia. Specifically, habits can reinforce users' continued adherence to the status quo because habitual behaviors can be performed efficiently and with little effort (Aarts et al., 1998; Liao et al., 2006). We posit that gamers' habits regarding traditional means of gaming contribute to their inclination to maintain the status quo. It is crucial to distinguish between habit and inertia. While habit is an automatic response triggered by environmental cues, inertia reflects a conscious decision to persist despite the presence of superior alternatives (Polites & Karahanna, 2012). For example, when users have become accustomed to a specific service, they may be less likely to evaluate the advantages of various alternatives thoroughly. Instead, inertia may reduce their perception of the attractiveness of alternatives (Cheng et al., 2019; Polites & Karahanna, 2012; Ye & Potter, 2011).

Furthermore, the formation of habits may also lead to inertia by creating a state of comfort that discourages the pursuit of change (Sun et al., 2017). For gamers, these subconscious habits facilitate the automation of processes such as downloading, updating, and switching devices, thereby perpetuating their comfort in traditional means of gaming. Several interviewees (Participants 2, 4, and 9) indicated that they habitually purchase the latest graphics cards, games, and other hardware to enhance their gaming experience. Therefore, we hypothesize that:

H3-2. Habit is positively associated with inertia toward traditional means of gaming.

Affective commitment refers to emotional attachment, identification, and involvement with a target, which reflects the desire to maintain a relationship (Allen & Meyer, 1990). Previous research has identified affective commitment as a significant factor influencing continuance intention (Sun et al., 2017). Specifically, affective commitment fosters users' maintenance of their relationship with existing digital services due to emotional attachment and a sense of belonging (Bateman et al., 2011; Jin et al., 2010). Although affective commitment may be perceived as irrational, individuals often remain loyal to the status quo out of emotional ties (Čater & Čater, 2009). In the gaming context, the emotional bond associated with affective commitment can be particularly potent, given the immersive nature of games and the substantial time and effort invested by gamers. As a result, gamers may develop a sense of belonging and loyalty to traditional means of gaming, which they have utilized, enjoyed, and emotionally invested in over time (Polites & Karahanna, 2012). This affective commitment may cultivate resistance to change and a preference for the status quo, even when gamers recognize the benefits of cloud gaming. Therefore, we propose that once gamers develop an affective commitment to traditional means of gaming, they are more inclined to maintain the status quo. For instance, Participant 9 described, "*There's something about sitting down at my own gaming setup, using my console and physical copies of games. It's a whole experience I've grown attached to over the years, and it's hard to imagine gaming any other way*." This emphasizes how gamers' emotional connection to the traditional gaming environment—encompassing the physical hardware, setup, and experience—reinforces their commitment to this gaming mode, even when alternatives like cloud gaming exist. Therefore, we hypothesize that:

H3-3. Affective commitment is positively associated with inertia toward traditional means of gaming.

Inertia plays a critical role in moderating the relationship between dissatisfaction with traditional gaming methods and the intention to switch to cloud gaming. Psychological resistance associated with inertia often leads individuals to remain entrenched in their current behaviors (Polites & Karahanna, 2012). Even when gamers experience dissatisfaction with traditional gaming due to factors such as high upfront costs, limited hardware capabilities, and the necessity for physical media, the intention to switch to cloud gaming may remain low. This reluctance is largely driven by established habits and emotional ties to conventional gaming methods, which create substantial barriers to change (Kim & Kankanhalli, 2009). Consequently, inertia can weaken the motivation to transition to cloud gaming despite the recognized benefits of features like lower initial costs and the ability to stream high-quality games without expensive hardware. Therefore, we hypothesize that:

H4. Inertia toward traditional means of gaming negatively moderates the effect of dissatisfaction on switching intention to cloud gaming.

Inertia also affects the perception of the attractiveness of alternatives and influences the intention to switch. Previous research has demonstrated that individuals often display a bias toward the status quo, leading them to prefer familiar products and services even when superior alternatives exist (Samuelson & Zeckhauser, 1988b). In the context of gaming, inertia reinforces this bias toward traditional methods, causing gamers to undervalue the advantages of cloud gaming services like Nvidia GeForce NOW or Xbox Cloud Gaming, which offers high accessibility across devices, lower costs, and enhanced performance capabilities. The emotional and financial investments made in traditional gaming systems further exacerbate this bias, perpetuating a cycle of resistance to change. Consequently, users with higher levels of inertia are less likely to consider the attractiveness of new alternatives, even when they acknowledge their potential benefits (Polites & Karahanna, 2012). Therefore, we hypothesize that:

H5. Inertia toward traditional means of gaming negatively moderates the effect of alternative attractiveness on switching intention to cloud gaming.

5.3. Data collection and analysis

5.3.1. Data collection

We employed a self-reported online survey for data collection. This method has been widely utilized in studies of online technologies due to the tech-savvy nature of users (e.g., Cheng et al., 2019; Lee et al., 2021; Wu et al., 2017). We recruited individuals with a demonstrated understanding of cloud gaming to participate in the online survey.

We employed Amazon Mechanical Turk, a data collection service in the United States, to distribute the questionnaire and collect data. The online survey commenced with screening questions designed to identify target respondents with specific knowledge of cloud gaming. Respondents unfamiliar with cloud gaming were thanked and dismissed from the survey. Additionally, respondents were asked to list any cloud gaming services they were aware of at the beginning of the survey. Demographic questions were asked toward the end of the survey.

We ensured data quality in our study through various approaches. We implemented a function that flagged duplicate responses if participants attempted to complete the survey from the same Internet Protocol (IP) address. Responses completed in under five minutes were excluded. Additionally, we incorporated five attention-check questions throughout the questionnaire to identify any potentially careless, random, or haphazard responses.

5.3.2. Measures

We adopted validated measurement scales for the focal constructs from the literature, making minor modifications to the measurement items to align with the current research context on gaming mode switching. All measures are summarized in Appendix B.

We conducted a face validity check on the measurement items to eliminate any double-barreled, ambiguous, or unfamiliar items (see MacKenzie et al., 2011). Five doctoral students with expertise in information technology and business research participated in the face validity check. This assessment focused on the measurement items themselves and did not require participants to rank or respond to them. The respondents were given a list of measurement items and asked to evaluate and comment on their simplicity, precision, and clarity. The reviewed measurement items were pretested for comprehensiveness, clarity, and desirable psychometric properties. No significant issues emerged during the face validity check.

For the focal constructs in our research model, we used perceptual scales with items measured on a 7-point Likert scale. Multiple items were employed to assess each construct, ensuring the estimation of construct validity and reliability. Given that demographic variables are significant factors in determining the use of information technology (Venkatesh et al., 2003), we included age, gender, income, education, and trait innovativeness as control variables.

5.3.3. The demographic profile of the respondents

We initially collected a total of 713 responses. Following a data-cleaning process, which involved screening out responses that failed the attention-check questions and implementing quality control measures as suggested by Aguinis et al. (2021), we retained 305 valid responses for our analysis. Specifically, we excluded responses based on several criteria: failure to correctly answer all five attention-check questions, completion time anomalies indicating insufficient engagement (e.g., excessively rapid responses), and inconsistent answer patterns suggesting random responding. The final dataset comprised 197 male and 108 female respondents, predominantly young adults, with 70.5 % aged between 18 and 35. To assess potential non-response bias, we conducted t-tests comparing the demographics of early and late respondents. We found no significant differences, indicating that non-response bias is unlikely to affect our study. The demographic profile of the respondents is summarized in Table 2.

5.4. Data analysis and results

5.4.1. Preliminary tests

To ensure that common method bias did not pose a threat to our dataset, we conducted three tests to assess its potential impact. First, we performed Harman's single-factor test using principal component analysis. The first factor accounted for less than 50 % of the variance (27.12 %), indicating that the items in the dataset loaded significantly onto more than one principal component and that no single dominant factor was present (Harman, 1976).

Second, we evaluated the correlations between the principal constructs and a marker variable (Lindell & Whitney, 2001), running attitude, a theoretically unrelated construct in the cloud gaming context. Common method bias is indicated by high correlations among all (or most) constructs, including the marker variable, in the correlation matrix. The correlations with marker variables were trivial or low, ranging from 0.02 to 0.11, suggesting that common method bias is unlikely to be

Table 2
The demographic profile of the respondents (n = 305).

Age	No. [%]
18–25	79 [25.9]
26–35	136 [44.6]
36–45	58 [19.0]
46–55	17 [5.6]
56–65	12 [3.9]
≥ 66	3 [1.0]
Gender	
Male	197 [64.6]
Female	108 [35.4]
Educational Background	
Completed primary school or below	1 [0.3]
Some secondary	8 [2.6]
Completed secondary school	6 [2.0]
Vocational or similar	10 [3.3]
Some universities but no degree	12 [3.9]
University bachelor's degree	223 [73.1]
Graduate or professional degree	45 [14.8]
Annual Income (USD)	
≤ $19,999	25 [8.2]
$20,000 – $29,999	37 [12.1]
$30,000 – $39,999	81 [26.6]
$40,000 – $49,999	58 [19.0]
$50,000 – $59,999	42 [13.8]
$60,000 – $69,999	47 [15.4]
≥ $70,000	15 [4.9]
Cloud Gaming Services Used	
Amazon Luna	30 [9.8]
Xbox Cloud	92 [30.2]
Boosteroid	11 [3.6]
Nvidia GeForce Now	61 [20.0]
Sony PlayStation Now	76 [24.9]
Shadow PC	13 [4.3]
Others	21 [6.9]
Gaming Frequency	
Once every several months	3 [1.0]
Once a month	5 [1.6]
Several times a month	5 [1.6]
Once a week	11 [3.6]
Several times a week	155 [50.8]
Once a day	78 [25.6]
Several times a day	35 [11.5]
Gaming Duration (per time)	
< 1 h	16 [5.2]
1–2 h	131 [43.0]
3–4 h	110 [36.1]
5–6 h	21 [6.9]
7–8 h	15 [4.9]
9–10 h	7 [2.3]
> 10 h	5 [1.6]

a concern in this study.

Third, as suggested by Pavlou et al. (2007), we examined the correlation matrix for extremely high correlations (e.g., $r > 0.90$), which typically indicate the presence of common method bias. We found no extremely high correlations, and the presence of low correlations further indicated that no single factor was influencing all constructs.

To further address concerns regarding common method bias through statistical means, we employed the single-method-factor approach recommended by Podsakoff et al. (2003). This method estimates biases at the measurement level and controls for measurement error, thus providing a more nuanced understanding of potential biases in our data. Upon applying the single-method-factor analysis, the additional method factor did not account for a significant portion of the variance in the measurement items, suggesting that method bias was not a predominant concern in our dataset. This result further substantiates the robustness of our findings against the threat of common method bias.

5.4.2. Model testing

We validated the measurement and structural models using covariance-based structural equation modeling (CB-SEM) with AMOS. CB-SEM estimates model parameters by focusing on the covariances among variables. This method, which includes confirmatory factor analysis and path analysis, allows for rigorous testing of theoretical relationships between latent variables through observed data (Byrne, 2010; Kline, 2015). CB-SEM is particularly advantageous for theory testing and confirmation, as it enables researchers to specify a priori hypotheses about the interrelationships among latent constructs and test the overall model fit (Bollen, 1989; Jöreskog & Sörbom, 1996). It adheres to more stringent assumptions regarding measurement scales, sample size, and data distribution, thereby providing a more confirmatory analysis (Hair, 2009). The use of AMOS software enhances understanding of the model through sophisticated estimation procedures and diagnostics for model evaluation, such as chi-square tests, comparative fit index (CFI), and root mean square error of approximation (RMSEA) (Arbuckle, 2011). Following a two-step modeling approach, we first assessed the measurement model to establish the reliability and validity of the constructs. Then, we evaluated the structural model to test the hypothesized relationships. This revised approach using AMOS ensures that our findings are robust and well-substantiated, adhering to the rigorous standards of CB-SEM for theory testing and model validation.

5.4.2.1. Measurement model. Testing the measurement model involves estimating the reliability, convergent validity, and discriminant validity of the measurement items (Hair et al., 2017). The measurement model results are summarized below, indicating that all measures were reliable and valid.

Reliability refers to the internal consistency of the measurement items, assessed using (1) Cronbach's alpha and (2) composite reliability (CR). As shown in Table 3, Cronbach's alpha and CR for all reflective constructs were above 0.7, meeting the recommended thresholds (Hair et al., 2017).

Convergent validity is the extent to which the items on a scale are theoretically related (Fornell & Larcker, 1981). It is assessed using two criteria: (1) the average variance extracted (AVE) should be at least 0.5, and (2) all item loadings should exceed 0.7 (Hair et al., 2017). As illustrated in Table 3, all latent constructs exceeded the recommended thresholds. The AVE values ranged between 0.69 and 0.90, and all item loadings exceeded 0.7, indicating adequate convergent validity.

Discriminant validity in the context of CB-SEM is assessed by ensuring that the correlations between constructs are sufficiently low. According to Fornell and Larcker (1981), discriminant validity is confirmed when the square root of the AVE for each construct is greater than the correlations between that construct and all other constructs in the model. This ensures that each construct is measuring a distinct phenomenon. Our analysis examined the correlation matrix and confirmed that no two constructs exhibited a correlation exceeding 0.85 (see Appendix C), indicating adequate discriminant validity. Additionally, the square roots of the AVEs were compared against the correlations between constructs, as per Fornell and Larcker's criterion, further substantiating the discriminant validity of our model.

Table 3
Psychometric properties of measures.

Construct	Item	Loadings
Dissatisfaction (α = 0.91; CR = 0.91; AVE = 0.71)	DIS1	0.85
	DIS2	0.85
	DIS3	0.86
	DIS4	0.81
Inconvenience (α = 0.91; CR = 0.92; AVE = 0.73)	INC1	0.89
	INC2	0.89
	INC3	0.74
	INC4	0.89
Unaffordability (α = 0.90; CR = 0.90; AVE = 0.70)	UNA1	0.79
	UNA2	0.93
	UNA3	0.84
	UNA4	0.77
Alternative attractiveness (α = 0.91; CR = 0.94; AVE = 0.72)	ALAT1	0.79
	ALAT2	0.90
	ALAT3	0.85
	ALAT4	0.84
Compatibility (α = 0.90; CR = 0.90; AVE = 0.69)	COM1	0.85
	COM2	0.83
	COM3	0.79
	COM4	0.85
Ubiquity (α = 0.92; CR = 0.92; AVE = 0.74)	UBI1	0.88
	UBI2	0.83
	UBI3	0.86
	UBI4	0.86
Comprehensiveness (α = 0.89; CR = 0.89; AVE = 0.72)	COMP1	0.84
	COMP2	0.85
	COMP3	0.86
Habit (α = 0.96; CR = 0.96; AVE = 0.89)	HAB1	0.92
	HAB2	0.97
	HAB3	0.94
Affective commitment (α = 0.96; CR = 0.97; AVE = 0.90)	AFCO1	0.92
	AFCO2	0.97
	AFCO3	0.96
Switching costs (α = 0.92; CR = 0.93; AVE = 0.76)	SWCO1	0.88
	SWCO2	0.88
	SWCO3	0.86
	SWCO4	0.87
Affective based inertia (α = 0.93; CR = 0.93; AVE = 0.81)	ABI1	0.83
	ABI2	0.93
	ABI3	0.93
Behavioral based inertia (α = 0.93; CR = 0.93; AVE = 0.82)	BBI1	0.93
	BBI2	0.92
	BBI3	0.86
Cognitive based inertia (α = 0.93; CR = 0.93; AVE = 0.82)	CBI1	0.88
	CBI2	0.90
	CBI3	0.93
Switching intention (α = 0.91; CR = 0.91; AVE = 0.71)	SWIN1	0.81
	SWIN2	0.92
	SWIN3	0.86
	SWIN4	0.78

Note: Cronbach's Alpha = α; Composite reliability = CR; Average Variance Extracted = AVE.

5.4.2.2. Structural model. Structural equation modeling (AMOS version 26) was used to examine the relationships in the research model. The hypothesized research model was generally supported, indicating satisfactory nomological validity (See Fig. 2). Specifically, an R^2 greater than 19 % is generally considered an acceptable level of explanation of the dependent variable by the independent variables, and that greater than 33 % equates to a medium level of explanation (Chin, 1998; Urbach & Ahlemann, 2010). The research model explained a substantial amount of the variance in the dependent variables. In particular, the model explained 48 % variance of the switching intention.

The obtained path coefficients and levels of significance indicated

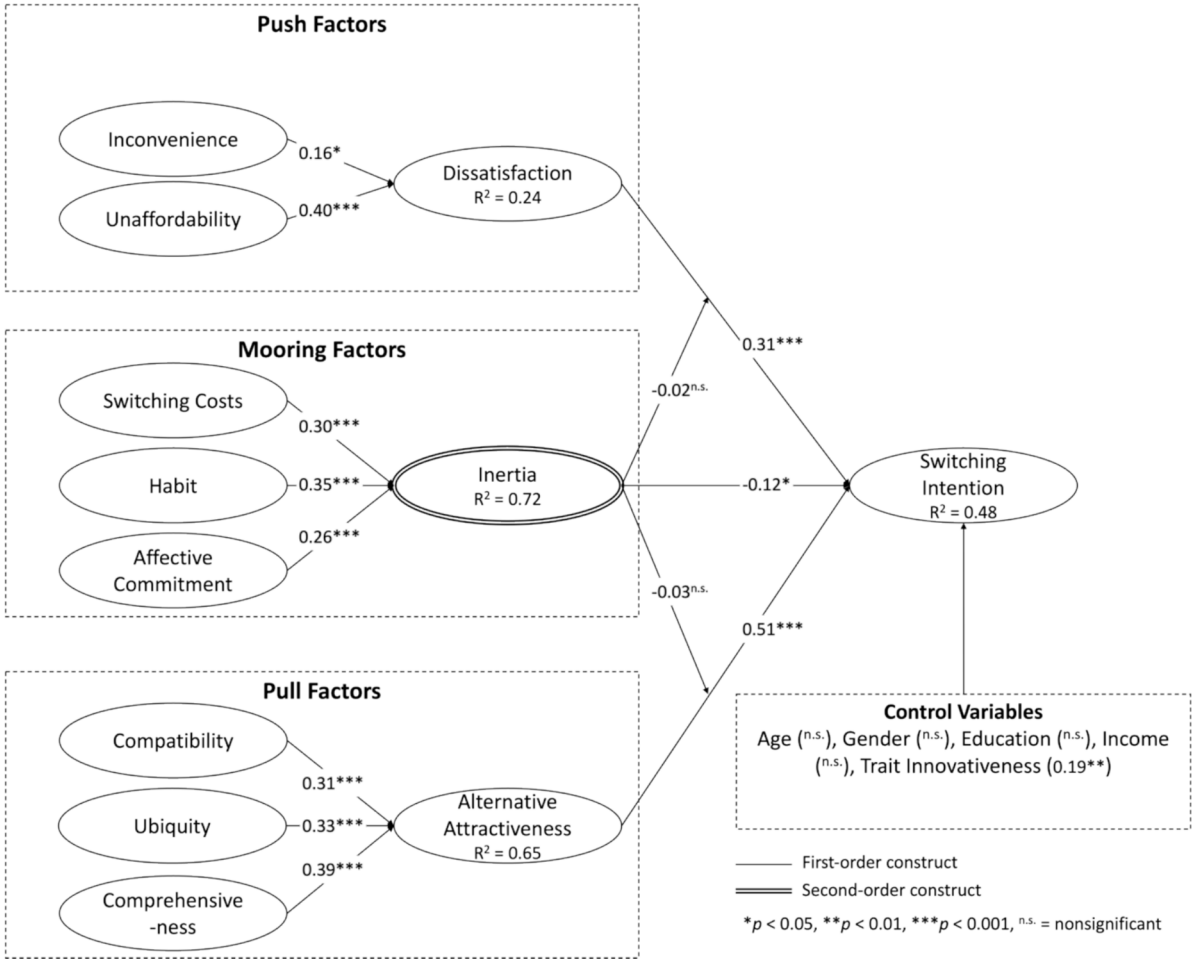

Fig. 2. Test Results.

that most of the hypotheses were supported. Specifically, dissatisfaction ($\beta = 0.31$, $p < 0.001$), alternative attractiveness ($\beta = 0.51$, $p < 0.001$), and inertia ($\beta = -0.12$, $p < 0.05$) exerted significant effects on switching intention, supporting hypotheses 1, 2, and 3. Inconvenience ($\beta = 0.16$, $p < 0.05$) and unaffordability ($\beta = 0.40$, $p < 0.001$) exerted positive and significant effects on dissatisfaction, supporting hypotheses 1–1 and 1–2 and explaining 24 % variance of dissatisfaction. Compatibility ($\beta = 0.31$, $p < 0.001$), ubiquity ($\beta = 0.33$, $p < 0.001$), and comprehensiveness ($\beta = 0.39$, $p < 0.001$) exerted positive and significant effects on alternative attractiveness, supporting hypotheses 2–1, 2–2, and 2–3 and explaining 65 % variance of alternative attractiveness. Switching costs ($\beta = 0.30$, $p < 0.001$), habit ($\beta = 0.35$, $p < 0.001$), and affective commitment ($\beta = 0.26$, $p < 0.001$) exerted positive and significant effects on inertia, supporting hypotheses 3–1, 3–2, and 3–3 and explaining 72 % variance of inertia. The effects of inertia on the relationship between dissatisfaction and switching intention and the relationship between alternative attractiveness and switching intention were non-significant, not supporting hypotheses 4 and 5. For control variables, trait innovativeness exerted a significant effect on switching intention.

6. Discussion

With the rapid advancement of cloud computing technology and network infrastructure, there has been a significant shift from traditional means of gaming to cloud gaming at the individual level. This switching is largely driven by the enhanced game delivery experience offered by cloud gaming, which addresses many of the limitations and challenges associated with traditional means of gaming. To advance scientific understanding and provide actionable managerial insights into this phenomenon, we draw on the PPM framework (Bansal et al., 2005) and the technology switching literature to propose a research model that explains psychological mechanisms underlying gaming modes switching. We empirically tested the research model with gamers through an online survey. The results provided strong empirical support for our proposed research model and most of the hypotheses. We discuss our major findings below.

6.1. Key findings

First, our study reveals that the alternative attractiveness offered by cloud gaming is the most significant driving force behind gamers' switching intention. Cloud gaming delivers a better game delivery experience by enabling (1) playing games across a wide range of devices, (2) playing games anytime and anywhere, and (3) choosing and trying out games from various genres and publishers, thereby enhancing overall alternative attractiveness of cloud gaming and liberating gamers from traditional constraints (Cai et al., 2018; Cai et al., 2022). These attributes set cloud gaming apart and have garnered positive reception from gamers. This attractive aspect of cloud gaming establishes a robust foundation for its emergence as a preferred alternative to traditional gaming modes. The results suggest that cloud gaming's capability to offer a smooth gaming delivery experience is a critical factor in its allure for gamers, reinforcing the fact that enhanced gaming delivery experiences (i.e., delivery range, flexibility, and diversity) are key determinants in the switching from traditional to cloud gaming services.

Second, unlike previous studies (Anwar et al., 2023; Bhattacherjee &

Park, 2014; Chou et al., 2016), we did not observe a significant moderating effect of the mooring factor on the relationships between push/pull factors and switching intention in the context of gaming mode switching. Previous studies often focus on utilitarian contexts, such as cloud storage (Wu et al., 2017), where user investments in such services are more critical and lead to greater attachment. In contrast, given the hedonic nature of gaming, gamers are primarily driven by the pursuit of enjoyment and satisfaction. This pursuit can lead gamers to switch from traditional gaming to cloud gaming, which may offer more satisfying game delivery experiences, regardless of potential mooring factors.

Additionally, consistent with previous research (Agarwal & Prasad, 1998; Messerschmidt & Hinz, 2013; Thakur & Srivastava, 2014), we found that trait innovativeness, as a control variable, positively affected the intention to switch to cloud gaming. This might be because innovative individuals tend to exhibit curiosity about new technologies and are, therefore, more likely to switch (Parasuraman & Colby, 2015), highlighting the potentially salient roles of technology-related individual characteristics in the technology switching phenomenon.

6.2. Implications for theory and research

This study advances the existing literature in several ways. This study advances the switching literature by extending the research stream to the novel and emerging context of cloud gaming services. Our research integrates and extends the existing switching literature by incorporating contextualized factors, addressing the need for models that reflect specific factors related to cloud gaming. This approach responds to previous calls for more nuanced research models (Cheng et al., 2019; Wu et al., 2017) and contributes to a more comprehensive understanding of how digital service switching occurs in different contexts.

Second, this study contributes to the cloud gaming literature by proposing and validating a comprehensive cloud gaming switching research model using mixed methods research design. The established literature on switching revealed established factors like dissatisfaction, inconvenience, and switching costs (Bhattacherjee & Park, 2014; Cao et al., 2020; Chang et al., 2014; Lai et al., 2012; Sun et al., 2017); our qualitative interview study identified further cloud gaming-specific antecedents such as ubiquity, compatibility, and comprehensiveness. Such contextualization of the research model enriches the cloud gaming literature by providing a more detailed and context-specific explanation of why gamers switch to cloud gaming (Gefen, 2002). The mixed methods research design can be referenced by future studies on technology switching for contextualization purposes.

Finally, this study contributes to the PPM literature by applying and extending the PPM framework in the context of cloud gaming switching, offering a novel perspective. While the PPM framework has been widely employed to examine switching behavior in technology and digital services, its primary application has been in utilitarian contexts. Cloud gaming, by contrast, is inherently hedonic, and gamers' switching motivations display distinct characteristics. By identifying unique antecedents specific to cloud gaming switching—such as cross-device compatibility, ubiquitous accessibility, and the comprehensiveness of game titles and genres—this study broadens the application scope of the PPM framework. These factors, often overlooked in prior PPM studies, particularly in hedonic service contexts, underscore the distinctiveness of our proposed model for cloud gaming switching. Our findings enhance the understanding of "pull" factors within the PPM framework, demonstrating its relevance to high-entertainment, low-utilitarian contexts and paving the way for its broader application across diverse digital service landscapes.

6.3. Implications for practice

This study offers implications for practice in several ways. First, our research highlights that cloud gaming's unique features—such as ubiquitous access, high device compatibility, and an extensive game library—are central to attracting new gamers. As cloud technology evolves, its ability to deliver a seamless and accessible gaming experience becomes increasingly compelling (Newzoo, 2022). Gaming practitioners should anticipate this shift by investing in robust cloud infrastructure. Ensuring high-speed network connections, powerful servers, and optimized streaming services is important. By focusing on these technological advancements, platforms can maintain high performance and deliver an exceptional gaming delivery experience. From a market perspective, understanding and addressing gamers' needs is essential. Cloud gaming's ability to offer affordable subscription models and enhanced delivery range, flexibility, and diversity significantly enhances the gaming delivery experience. Effective marketing strategies to highlight the benefits of cloud gaming—such as its cost-effectiveness, convenience, cross-device compatibility, and comprehensiveness—can enhance its appeal.

Second, our study emphasizes that cloud gaming's attractiveness lies in its technological novelty and enhanced gaming delivery experience. Cloud gaming offers a more comprehensive, convenient, and accessible gaming environment than traditional gaming methods. To capitalize on this, cloud gaming platforms should strengthen collaborations across the value chain, including game developers, technology providers, and marketing teams. Additionally, providing personalized game recommendations and tailored gaming settings will further enhance the gaming delivery experience, catering to individual preferences and increasing satisfaction.

Lastly, addressing economic factors is crucial for reducing switching barriers. Our study shows that the high economic burden of traditional gaming, such as the cost of hardware and games, drives gamers to seek more affordable alternatives. Cloud gaming platforms can attract gamers by lowering entry costs and offering flexible payment models, such as hourly subscriptions with a game pass. This approach allows gamers to access a broad range of games at a lower cost without incurring expenses during inactive periods, effectively delivering the promised ubiquitous gaming experience. By mitigating the financial hurdles associated with traditional gaming, cloud gaming platforms can further entice gamers to switch.

6.4. Limitations and Directions for future research

This study acknowledges several limitations, offering valuable avenues for future research. First, our study does not include all factors affecting cloud gaming switching. Other relevant infrastructure and platform-related factors, such as bandwidth requirements and pricing models, may influence gamers' decisions to switch from traditional gaming to cloud gaming. These factors could either facilitate or hinder the switching intention and behavior. For instance, the high bandwidth required for cloud gaming might deter some gamers from switching. Additionally, due to the limitations of cloud computing power, gamers might experience delays when demand is high, having to wait in queues to access servers. Given that cloud gaming is still in its early stages of growth, we recommend that future research conduct a more comprehensive exploration of these potential antecedents to understand better the factors influencing gamers' switching intention.

Second, our research model was tested using data collected from gamers in developed countries, which may limit the generalizability of our findings to other regions, cultures, and demographic groups. For example, in developing countries, where network infrastructure may be less advanced, gamers might have lower perceptions of the benefits of cloud gaming (i.e., pull factors), which could reduce their intention to switch from traditional gaming to cloud gaming. Thus, future research should examine this phenomenon across different countries and demographic groups to identify additional antecedents that may impact gaming mode switching.

Finally, further detailed classification of gamers and their behaviors may yield more precise findings and uncover additional factors influencing switching. This perspective highlights that online switching is a

dynamic process rather than a one-time event. Specifically, gamers may oscillate between cloud gaming and traditional gaming. We suggest that future research employ a longitudinal research design to explore the switching process more comprehensively, focusing on segmenting gamers' switching status to capture the nuances of this ongoing process.

CRediT authorship contribution statement

Winston T. Su: Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Zach W.Y. Lee:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Formal analysis, Conceptualization. **Xinming He:** Writing – review & editing, Validation, Supervision, Resources, Methodology, Conceptualization. **Tommy K.H. Chan:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Table A1
Thematic analysis.

	Dissatisfaction	Inconvenience	Unaffordability	Alternative attractiveness	Compatibility	Ubiquity	Comprehensiveness	Habit	Affective commitment	Switching costs
1	x		x	x	x	x	x	x	x	x
2	x	x	x	x		x	x		x	x
3	x	x	x		x	x	x	x	x	
4		x	x	x	x			x		x
5	x	x			x	x	x	x	x	
6	x			x	x	x				
7	x	x	x			x	x	x		x
8		x	x	x	x	x	x	x	x	x
9	x		x	x		x		x	x	x
10	x	x	x	x	x	x	x	x	x	x
11	x		x		x	x	x		x	x
12	x	x	x	x	x	x		x	x	x

Appendix B

Table B1
Measures.

Dissatisfaction	Traditional means of gaming makes me feel extremely dissatisfied. Traditional means of gaming makes me feel extremely unpleasant. Traditional means of gaming is absolutely terrible for me. Traditional means of gaming makes me feel extremely displeased.	(Bhattacherjee & Park, 2014)
Inconvenience	Traditional means of gaming requires a lot of time to prepare. The process of traditional means of gaming has brought annoyance to my gaming experience. In general, traditional means of gaming is inconvenient. Using the traditional means of gaming gives me a nuisance in playing games.	(Torkzadeh & Dhillon, 2002)
Unaffordability	The price of playing traditional means of gaming is high. The price of playing traditional means of gaming is expensive. The full cost of playing traditional means of gaming is unreasonable. In general, traditional means of gaming is unaffordable.	(Bansal et al., 2005)
Compatibility	Cloud gaming can be launched seamlessly across devices (e.g., laptops, desktops, smart phones, and tablets) I have. Cloud gaming supports different platforms. Cloud gaming can launch games from different distributors or developers. In general, cloud gaming has a high level of compatibility.	(Moores, 2012)
Ubiquity	Cloud gaming can be used anytime. Cloud gaming can be used anywhere. Cloud gaming launches and runs right away without any initiating, updating, or downloading. In general, cloud gaming is ubiquitous.	(Mäntymäki et al., 2020)
Comprehensiveness	The cloud gaming service offers a good variety of games. The cross-platform data interoperability of cloud gaming brings me a diverse gaming and social experience. In general, the game contents of the cloud gaming service are comprehensive	(Limayem et al., 2007)
Alternative attractiveness	I have a good impression on cloud gaming. Cloud gaming provides a good gaming experience. Cloud gaming is attractive to me. Cloud gaming serves my needs well.	(Hou et al., 2011)
Inertia	*Affective based* I will continue using traditional means of gaming because it would be stressful to change. I will continue using traditional means of gaming because I am comfortable doing so. I will continue using traditional means of gaming because I enjoy doing so.	(Polites & Karahanna, 2012)

(*continued on next page*)

Table B1 (*continued*)

	Behavioral based	
	I will continue using traditional means of gaming simply because it is what I have always done.	
	I will continue using traditional means of gaming simply because it is part of my normal routine.	
	I will continue using traditional means of gaming simply because I have done so regularly in the past.	
	Cognitive based	
	I will continue using traditional means of gaming even though I know it is not the best means of playing gaming.	
	I will continue using traditional means of gaming even though I know it is not the most efficient means of playing gaming.	
	I will continue using traditional means of gaming even though I know it is not the most effective means to play games.	
Switching costs	I have already put a lot of money into traditional means of gaming.	(Cao et al., 2020)
	I would lose a lot if I switched to cloud gaming.	
	My previously purchased gaming devices will become meaningless if I switch to cloud gaming.	
	My previously purchased games will become meaningless if I switch to cloud gaming.	
Habit	Using traditional means of gaming is natural to me.	(Cheng et al., 2019)
	When I need to play a game, the traditional means of gaming is an obvious choice for me.	
	I use traditional means of gaming immediately without thinking.	
Affective commitment	I feel emotionally attached to traditional means of gaming.	(Cao et al., 2020)
	I feel a strong connection to traditional means of gaming.	
	I would feel emotionally lost if I left traditional means of gaming.	
Switching intention	I would like to discontinue my use of traditional means of gaming and move to cloud gaming.	(Bhattacherjee & Park, 2014)
	I would like to switch from traditional means of gaming to cloud gaming.	
	I intend to invest the time and effort that I have invested in traditional means of gaming into cloud gaming.	
	I intend to distribute more use from traditional means of gaming to cloud gaming in the foreseeable future.	
Trait innovativeness	I enjoy the challenge of figuring out new technology.	(Parasuraman & Colby, 2015)
	I find new technology to be mentally stimulating.	
	I prefer to use the most advanced information technologies available.	
	I keep up with the latest technological developments in my areas of interest.	

Appendix C

Table C1
The correlations matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Affective based inertia	**0.90**													
2. Affective commitment	0.76	**0.95**												
3. Alternative attractiveness	0.01	0.00	**0.85**											
4. Behavioral based inertia	0.69	0.60	−0.08	**0.91**										
5. Cognitive based inertia	0.51	0.54	−0.02	0.56	**0.91**									
6. Compatibility	−0.08	−0.07	0.65	−0.11	−0.12	**0.83**								
7. Comprehensiveness	−0.07	−0.11	0.61	−0.03	−0.04	0.38	**0.85**							
8. Dissatisfaction	−0.01	−0.05	0.28	−0.02	−0.04	0.27	0.09	**0.84**						
9. Habit	0.79	0.80	−0.03	0.56	0.61	−0.16	−0.08	−0.07	**0.94**					
10. Inconvenience	−0.16	−0.11	0.15	0.02	−0.07	0.24	0.11	0.32	−0.12	**0.85**				
11. Switching costs	0.75	0.80	0.10	0.57	0.62	0.02	−0.11	−0.06	0.78	−0.06	**0.87**			
12. Switching intention	−0.06	−0.10	0.57	−0.11	−0.19	0.52	0.27	0.47	−0.18	0.36	−0.02	**0.84**		
13. Ubiquity	−0.09	−0.02	0.63	−0.10	−0.12	0.62	0.30	0.35	−0.10	0.29	−0.01	0.57	**0.86**	
14. Unaffordability	−0.07	−0.11	0.37	−0.12	−0.05	0.39	0.11	0.45	−0.14	0.42	0.03	0.63	0.39	**0.84**

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