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FACTORS INFLUENCING THE INTENTION TO ADOPT THE METAVERSE AMONG GAMERS AND NON-GAMERS: an analysis based on the technology acceptance model

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1 INTRODUCTION

The technological development process has evolved at an accelerated pace in recent years (Aburbeian et al., 2022; Toraman & Geçit, 2023). Over the past decades, the spread of the internet has facilitated the emergence of new digital technologies such as e-commerce, cryptocurrencies, blockchain, and more recently, the diffusion of the metaverse (Toraman, 2022, Toraman & Geçit, 2023). In this context, although the diffusion of technological processes has encountered some barriers (high costs, logistical issues) over the years, the use of new communication technologies like smartphones and personal computers has increased dramatically. Thus, the growing use of technological devices and digital penetration has brought new technology-related platforms into people's lives (Toraman & Geçit, 2023).

With the emergence of new virtual environments and technological platforms, the metaverse has gained prominence over the past few years. The term "metaverse" was originally applied in science fiction literature in the 1990s and therefore does not have a universally accepted meaning or scientifically grounded definition, but it was obviously inspired by technological development (Buchhlz et al., 2022). Three decades later, the notion of the metaverse has continuously evolved into a real business geared towards marketing, among other applications (Barrerah & Shah, 2023). Currently, there are already several metaverses belonging to various entities, each with its own standards and rules (Belka et al., 2022).

Contrary to common conception, the metaverse is not only related to the gaming field and the gaming public. The metaverse is expected to gradually evolve and accommodate diverse sectors, including economic sectors, healthcare, education, social commerce, advertising, smart manufacturing, and many others (Aharon et al., 2022). Due to the COVID-19 pandemic, the digitalization of many products and services, as well as the use of digital tools and channels have been observed more frequently than before (Toraman & Geçit, 2023). Thus, the popularity of technologies that can host other digital products and services such as the metaverse has also grown exceptionally (Dwivedi et al., 2022; Thurau et al., 2022).

The virtual environment of the metaverse will help brands interact with a wide range of consumers, but now with a higher level of immersion. Innovations are underway in the metaverse, enhancing virtual experiences (Dwivedi et al., 2022). From this perspective, the greater adoption of the metaverse by consumers and organizations will be complemented by better accessibility, transforming consumer behavior and experience on a large scale (Dwivedi et al., 2022). In this context, there is a significant gap in understanding why people do or do not intend to use metaverse-related technologies. This discussion, over the past few years, has generated debates among researchers and marketing professionals who strive to understand and influence consumer behavior regarding the adoption of the metaverse (Zhou et al., 2018; Branca et al., 2022; Buchhlz et al., 2022; Barrera & Shah, 2023).

For decades, industries in the technology sector have concentrated most of their advertising and communication resources, through targeted content, to attract the gaming public to embrace new technologies, including the metaverse (Shaw, 2012). In this sense, it is also necessary to take into account which factors may influence the adoption of the metaverse by non-gamers. From an academic point of view, there are still few studies that seek to analyze the antecedents that influence the intention to use the metaverse, whether by gamers or non-gamers

(Mostafa, 2022). However, as technologies have grown steadily in recent years, academic research and scales related to the adoption of new technologies have also gained popularity (Toraman; Geçit, 2023). From this perspective, recent studies highlight that the Technology Acceptance Model (TAM) is widely used in several areas of study to analyze the tendency of people, whether gamers or not, to adopt new systems and technologies (Aburbeian et al., 2022; Akour et al., 2022).

TAM posits that acceptance of a technology is primarily determined by perceived usefulness and ease of use. In the context of the metaverse, these perceptions can vary significantly between gamers, who are more familiar with virtual environments and emerging technologies, and non-gamers, who may have less experience or interest in such platforms (Shaw, 2012, Toraman & Geçit, 2023).

After the contextualization carried out, the following research question is asked: what are the factors that precede the intention to adopt the metaverse between gamers and non-gamers? To answer this question, the general objective of this research is to analyze the factors that precede the intention to adopt the metaverse between gamers and non-gamers from the perspective of TAM.

By investigating these differences, this study aims to contribute to developers, technology companies, and policymakers on how to best promote and facilitate the adoption of the metaverse, ensuring it meets the needs and expectations of a diverse user base.

2 THEORETICAL REFERENCE

2.1 Exploring the dimensions of the metaverse

Technological advances have substantially modified our communication patterns, and the rapid growth of the metaverse is undeniable. At this juncture, the metaverse emerges as a rising technology, capable of almost entirely involving the human senses in a digital context (Park & Kim, 2022). There was a significant transformation in the population’s habits. Everyday activities, such as shopping, social interactions and financial transactions, now find their way into virtual environments, shaping a new dynamic in the way we live and interact (Arpaci et. al., 2022).

The technology recognized as metaverse represents a new paradigm in virtual interaction and the construction of online communities. This innovative platform, which emerged in the wake of various technological advances, provides an immersive experience that incorporates elements of augmented reality, and blockchain technology (Toraman, & Geçit, 2023). By deeply integrating the virtual and real domains, the metaverse offers users the opportunity to create and shape the virtual environment in a personalized way, reflecting a constant evolution driven by the diverse contributions of participants (Wang et. al., 2023).

The metaverse has the potential to extend the physical world using augmented and virtual reality technologies allowing users to seamlessly interact in real and simulated environments using avatars and holograms (Dwivedi et al., 2022). Virtual environments and immersive games (such as Second Life, Fortnite, Roblox, and VRChat) have been described as antecedents of the metaverse and offer some insights into the potential socioeconomic impact of a functional persistent cross-platform metaverse (Dwivedi et. al., 2022). In this sense, the understanding of money, possessions and property is changing dramatically as consumption becomes digital and virtual (Belk et al., 2022). Due to this new scenario, organizations are beginning to evaluate the potential of the metaverse and how it can be integrated into their existing business models to serve new types of consumers (Dwivedi et. al., 2022).

Metaverses emerge as catalysts for a profound transformation in online social interactions, bringing with them a range of opportunities and challenges that reverberate in different spheres of knowledge and society. This rise implies substantial changes in communication, social interaction, relationship building, work practices, learning methods, teaching processes, consumption patterns and, ultimately, in the ways of existing and coexisting in the contemporary world (Felice; Schlemmer , 2022).

For Tibúrcio et. al., (2022), immersion in virtual environments can trigger deep reflections on our perception of identity and values. In the virtual world, the meaning attributed to the possession of objects transcends the practical aspect, challenging deep-rooted concepts. While in the physical world we understand that the acquisition of a tangible good, such as a liter of fuel, represents an essential source of energy for our daily needs, this logic dissipates in the virtual environment, where such objects often lack intrinsic value. This discrepancy between the perceived value and the recognized value of objects can generate identity conflicts and uncertainties regarding our role in society (Tibúrcio et. al., 2022).

Immersion in the virtual environment is influenced by different aspects, as highlighted by Mennecke et. al., (2011). Technical preparation covers elements such as the interface, the experience offered, the setting in the virtual world, interactivity and sensory stimulation. The technical quality of these aspects allows the user to become emotionally and mentally involved in the virtual environment, strengthening their sense of presence while interacting with their avatar and perceiving the virtual space and objects. On the other hand, content variables concern specific elements generated by technology, such as the appearance and movements of the avatar, as well as obstacles present in the virtual environment. The inclusion of these elements contributes to establishing a greater similarity between the virtual world and the real world, deepening the users' sense of immersion. User variables, related to individual experience, mental state, perception of ability and self-confidence, play a fundamental role in the user's perception of the avatar's presence and influence their overall experience in the virtual environment.

The consumption of digital services in the metaverse significantly exceeds the time dedicated to conventional social networks, such as TikTok and YouTube. In this scenario, a dynamic ecosystem develops, where production and consumption feed back on each other: as users increase and extend their usage time, the variety of content served expands, driving, in turn, the growth of revenue for users. producers and digital advertising sales (Park; Kim, 2022). Brands will find the metaverse scenario a unique opportunity to engage a diverse consumer base by offering an innovative immersive experience (Dwivedi et al., 2022). The constant development of innovations in the metaverse aims to improve virtual interactions, providing increasingly immersive experiences (Dwivedi et al., 2022).

The metaverse presents an intrinsic capacity to establish its own economy, driven by the digital components that characterize the virtualization of resources (Yang et. al., 2022). These components encompass the digital generation, which mirrors the process of creating items in the physical world and evolves based on the digital content creators and the audience reached. Another crucial aspect is digital goods, which consist of the commercialization of non-physical items within the metaverse, such as avatar customization accessories (Belk et al., 2022). Additionally, there is the virtual market, a transaction space for avatars, in which artificial intelligence can play a role in the search for effective and automated trading strategies (Belk et al., 2022). Furthermore, there is virtual currency, which represents the form of exchange within the fully digital metaverse, allowing the implementation of a payment system so that avatars can carry out transactions using this digital currency (Belk et al., 2022; Dwivedi et al ., 2022).

It is essential that the metaverse has an expandable infrastructure capable of accommodating a large number of users, as this strengthens its social relevance. The large-scale implementation of this technology required advances in three key areas: hardware improvements, such as increasing graphics processing capacity and adoption of 5G technology; the development of recognition and expression models that make the most of the hardware's potential; and the provision of engaging content in which users can fully immerse themselves and interact (Park; Kim, 2022).

2.2 Technology acceptance model

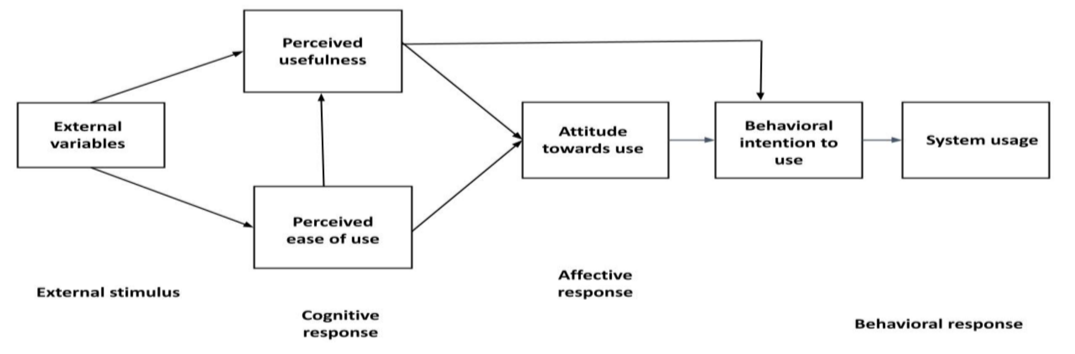
The implementation of technological innovations in various areas has an effective role in facilitating human life. It has become an essential need since society entered the era of technological revolutions (Aburbeian et. al., 2022). Although the metaverse does not yet exist in its entirety, platforms similar to the metaverse can be found that use the concept and resources of virtual reality. In this sense, as new technologies are introduced, it is important to test their acceptance among users and investigate the variables that may affect engagement with the new technology (Aburbeian et. al., 2022).

Innovation theory generally classifies technology users as highly innovative individuals who actively pursue innovative ideas. They are a specific type of user who deals with high levels of uncertainty and develops positive acceptance intentions (Iman et. al., 2022).

In this sense, the Technology Acceptance Model (TAM) has become a frequently used model to understand user behavior when adopting new technologies. (Toraman & Geçit, 2023, Mostafa, 2022, Aburbeian et. al., 2022). The interpretation of human behavior by experts has been a frequently studied subject. TAM bases its theoretical structure on the theory of reasoned action, which assumes that human behavior is due to specific causes (Toraman & Geçit, 2023).

The TAM was proposed by Davis (1989). The author states that perceived usefulness and perceived ease of use shape users' attitudes toward using technology, and that these attitudes influence users' behavioral intention to use or reject technology (Aburbeian et. al., 2022; Iman et. al., 2022).

Figure 1
Technology acceptance model (TAM)



Source: Adapted from Davis (1989) and Toraman & Geçit (2023).

The central constructs of TAM are perceived usefulness, perceived ease of use, attitude and behavioral intention to use the technology. The model proposes that perceived usefulness and perceived ease of use measure the effect of external factors to subsequently influence the attitude and intention to use a technology (Kemp et. al., 2024).

Perceived usefulness indicates the degree to which any user believes that a specific technology would improve their performance for specific purposes. (Iman et. al., 2022; Mostafa, 2022; Aburbeian et al., 2022). Perceived usefulness and ease of use are the most critical variables that influence the use or rejection of new technologies (Aburbeian et al, 2022; Mostafa, 2022).

Perceived ease of use refers to the expectation that the system is user-friendly and easy to use (Pereira et. al., 2022). On the other hand, perceived usefulness refers to the level to which people believe that using a certain technology can improve their performance (Henningsson et al., 2020). Studies such as Mostafa (2022) indicate that perceived ease of use and perceived usefulness positively influence the behavioral intention to adopt new technologies (Mostafa, 2022). Based on this construct, the following hypotheses were formulated:

H1: Perceived ease of use influences the intention to use the metaverse.

H2: Perceived usefulness influences the intention to use the metaverse.

Behavioral intention consists of people's positive or negative thoughts regarding active use (Toraman & Geçit, 2023). Behavioral intention assesses someone's readiness to dedicate themselves to performing a behavior (Cheon et al., 2012). Considering these aspects together, the model indicates that when interacting with a new technology that is functional and easy to use, the user will adopt a favorable stance, which will increase the propensity to use such technology (Aburbeian et al., 2022).

Al-Oudat & Altamimi (2022) observed that individual perceptions are influenced by the quality of the system's infrastructure, whether robust or fragile. When infrastructure is robust, technology remains continuously accessible. The more advanced and solid a specific infrastructure is, the greater the adoption of a technology that uses it (Alsharhan et al., 2022). Research such as Mostafa (2022) has demonstrated that the availability of technology has a significant impact on the intention to use new technologies. Therefore, the following hypothesis was formulated:

H3: Technology availability affects behavioral intention to use the metaverse.

Trust is seen as a behavioral component that focuses on the individual's intention to use and reflects the level of security they feel regarding technology. Several studies have investigated the relationship between trust and the intention to use a certain technology (Al-Oudat & Altamimi, 2022). Research such as Mostafa (2022) and Toraman & Geçit (2023) showed that trust is an essential external factor in the adoption of technological innovations and can be considered a key element in influencing perceived usefulness and ease of use. From this, the following hypotheses were formulated:

H4: Trust influences perceived usefulness.

H5: Trust influences perceived ease of use.

Perceived compatibility refers to people's belief that their habits and adoption of new technologies will be the same. The compatibility of innovations with people's previous habits is considered a significant external factor in technology adoption (Karahanna et al., 1999;

Plouffe et al., 2001; Ramadhiana et al., 2021). Research such as Toraman & Geçit (2023) has shown that compatibility has a significant and positive impact on perceived usability and perceived ease of use. Therefore, the following hypotheses were formulated:

H6: Perceived compatibility influences perceived usefulness.

H7: Perceived compatibility influences perceived ease of use.

Finally, in this study the social influence variable was added. The social norm concerns the influence exerted by society on a person's decision whether or not to perform a certain action (Ajzen, 1991). In other words, social influence is the effect of others' expectations on the choice to engage in a specific activity, such as using technology (Mostafa, 2022). Studies such as those by Mostafa (2022) and Aburbeian et al. (2022) revealed that social influence affects the behavioral intention to use a technology. Therefore, the last hypothesis is formulated:

H8: Social influence influences behavioral intention to use the metaverse.

In short, the more pleasure the technology provides the user, the greater their perceived usefulness will be, and the easier the technology is to use, the more useful it will be considered (Aburbeian et al., 2022). In this way, social norms have a significant impact on behavioral intention, that is, the opinions of others influence engagement with technology (Photiadis & Papa, 2022; Al-Oudat & Altamimi, 2022).

3 METODOLOGY

Regarding its objectives, the research is classified as explanatory and descriptive. According to, explanatory research is used when the researcher seeks to explain the reasons behind phenomena and their causes through the recording, analysis, classification, and interpretation of observed phenomena (Prodanov & Freitas, 2013).

Descriptive research, on the other hand, aims to describe the characteristics of a particular population or phenomenon or to establish relationships between variables. This involves the use of standardized data collection techniques, such as questionnaires and systematic observation (Prodanov & Freitas, 2013). In terms of its approach, the present research is quantitative. The quantitative research allows for an objective, mathematical, and statistical treatment of the collected data, providing measurable results that are more easily testable and verifiable (Marconi & Lakatos (2003).

Regarding the data collection instrument, a questionnaire was administered both online and in person from January 25, 2024, to May 25, 2024. The criteria for sample participation were: being over 18 years old and living in Brazil. Additionally, a filter question was used to determine whether participants identified as gamers or non-gamers. Gamers are individuals who regularly play some type of electronic game/videogame, while non-gamers are individuals who do not play any type of electronic game (Shaw, 2012).

The sample was calculated from the A-priori sample size calculator for structural equation models, which requires some inputs for sample calculation, being (1) effect size, (2) desired statistical power level, (3) number of latent variables, (4) number of observed variables, (5) and probability level. For items 2 and 5, the input values were those suggested by Cohen (2013), being 80% and 0.05 respectively. As to the size of the effect, item 1, it was used the value of 0.5, considered high by Hair et al. (2009). Finally, the number of observed variables is 27, while the number of latent variables is 7. The result of the calculation recommended a minimum sample of 109 for each group (gamers and non-gamers) to be able to capture statistical effects through structural equation modeling. After the questionnaire was applied, the sample size gathered was 201 for the gamer group and 238 for the non-gamer group. The sample size exceeds the minimum required size; therefore, the sample is non-probabilistic.

The applied questionnaire was divided into three sections. The first section addressed the filter question; the second section used scales validated by the literature; the third section addressed the sociodemographic profile of the respondents (gender, age, and income). The scales used can be seen in the Table 1.

Table 1.

Research scales

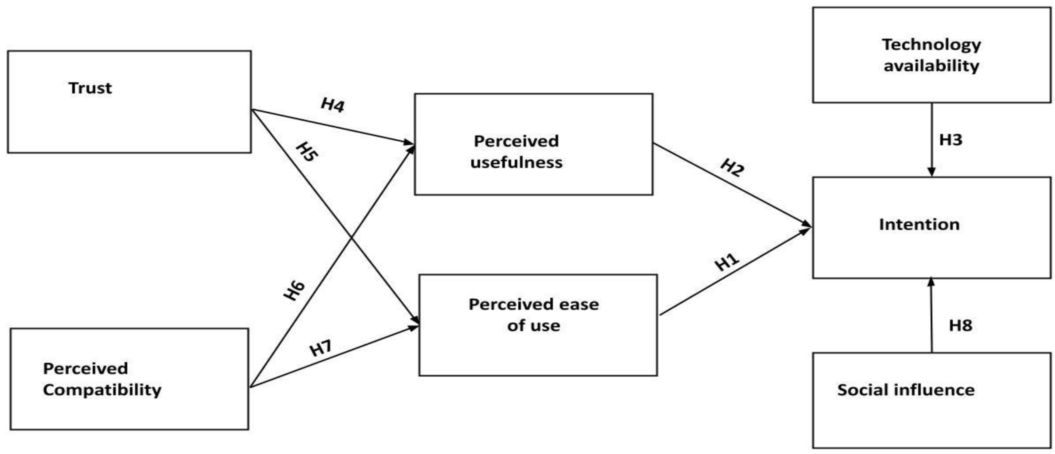
COP1	Using metaverse fits well with my lifestyle.	Toraman & Geçit (2023)
COP2	Using metaverse fits well with how I purchase products and services	
COP3	I would appreciate using metaverse instead of alternative models of payment.	
TRU1	I trust metaverse systems to be reliable.	
TRU2	I trust metaverse systems to be secure.	
TRU3	I believe metaverse systems are trustworthy.	
TRU4	I trust metaverse systems.	
TRU5	Even if the metaverse systems are not monitored, I will trust them to do the job correctly	
PU1	Using metaverse systems would enable me to accomplish financial tasks and payments quickly	
PU2	Using metaverse systems would improve my performance in making payments.	
PU3	Using metaverse systems would enhance my effectiveness in making payments	
PU4	Using metaverse systems would make it easier for me to manage and make payments.	
PEOU1	Learning to use metaverse systems would be easy for me	
PEOU2	Getting the metaverse system to do what I want it to do would be easy.	
PEOU3	My interaction with the metaverse system would be clear and understandable	
PEOU4	It would be easy for me to become skilful at using the metaverse system.	
TA1	I consider that mobile phone are not equipped with technology compatible with the metaverse	Mostafa (2022)
TA2	I consider that Metaverse technology is available	
TA3	I consider that they are not enough opportunities for the use of metaverse technology	
TA4	I consider that the use of Metaverse Technology is mainly based on the availability of the technology everywhere	
SOI1	People who influence my behavior would think that I would like to use the metaverse technology	Mostafa (2022); Abubeian et al. (2022)
SOI2	People who are important to me would think that I would like to participate in the metaverse technology	
SOI3	Others' opinion about the Metaverse affects my intention to use it.	
SOI4	I want to try Metaverse due to its technology trend.	
INT1	I am likely to use metaverse in the near future.	Toraman & Geçit (2023
INT2	I am willing to use metaverse in the near future	
INT3	I intend to use metaverse when the opportunity arises	

INT = Intention; PEC = Perceived compatibility; PEOU = Perceived ease of use; PU = Perceived usefulness; SOI = Social influence; TEA = Technology availability; TRU = Trust.

A theoretical model was proposed, which is represented in Figure 2. This model is a visual representation of the relationships previously discussed in the literature review.

Figure 2

Theoric model



Regarding data analysis, this study will use structural equation modeling (SEM) to test the hypotheses suggested in the theoretical framework. According to Hair et al. (2009), SEM uses a series of measures that describe how well a researcher's theory explains the observed covariance matrix among measured variables. To ensure the validity and reliability of the data, indicators of internal consistency, composite reliability, convergent validity, and discriminant validity were analyzed. Cronbach's alpha was used to measure internal consistency. Average variances extracted (AVE) were used to measure convergent validity. Additionally, the cross-loadings technique proposed by Fornell and Lacker (1981) was used to measure discriminant validity. Moreover, all analyses were performed using the SmartPLS 4 software.

4 RESULTS ANALYSIS

4.1 Descriptive analysis

The sample profile of 201 gamers indicated that 150 (74.6%) of the respondents are male, while 51 (25.4%) are female. Approximately 103 (51.2%) of the gamers are aged between 18 and 24 years, followed by 72 (35.8%) who are between 25 and 34 years old. Another 22 (10.9%) are aged between 35 and 44 years, while only 4.3% are older than 44 years.

Regarding education, 110 (54.7%) gamers have completed high school, while 58 (28.8%) have a bachelor's degree, followed by 28 (14%) who have completed a master's degree or postgraduate studies. Finally, 5 (2.5%) of the gamers in the sample have only completed elementary school. Additionally, it is noted that approximately 34% of the gamers who responded to the questionnaire have a monthly household income between 1 to 3 minimum wages, followed by 28.9% who have a monthly household income between 4 to 6 minimum wages.

The sample profile of 238 non-gamers indicated that 84 (35.3%) of the respondents are male, while 154 (64.7%) are female. Approximately 100 (42%) of the non-gamers are aged between 25 and 34 years, followed by 62 (26%) who are between 18 and 24 years old. Another 42 (17.6%) are aged between 35 and 44 years, while only 34 (14.4%) are older than 44 years.

Regarding education, 96 (40.3%) non-gamers have completed high school, while 76 (31.9%) have completed a master's degree or postgraduate studies, followed by 63 (26.5%) who have only a bachelor's degree. Finally, 3 (1.6%) of the non-gamers in the sample have only completed elementary school. Additionally, it is noted that approximately 29% of the non-gamers who responded to the questionnaire have a monthly household income between 1 to 3 minimum wages, followed by 24.8% who have a monthly household income between 4 to 6 minimum wages. Lastly, about 46.2% of the non-gamers group have a monthly household income greater than 6 minimum wages.

4.2 Reliability and validity

First, before proceeding with the SEM of the proposed model, the obtained data were tested for their distribution to verify if they followed a normal curve distribution. Through the application of Kolmogorov-Smirnov and Shapiro-Wilker tests for normality, it was found that , for all variables, the null hypothesis of normalities was rejected, since in all cases the p-value was less than 0.05, indicating that the data did not have a normal distribution. Thus, to confirm the validity of the proposed hypotheses, we proceeded with Structural Equation Modeling (SEM) using the Bootstrapping algorithm.

To meet the criteria evaluating a good fit of the theoretical model, reliability and validity criteria were used. Reliability of multiple scales is best measured by Cronbach's alpha and composite reliability. The Cronbach's alpha and composite reliability values between 0.70 and 0.90 are considered satisfactory (Hair *et al*., 2009). Additionally, the criterion of convergent validity was used, which shows the value of the Average Variance Extracted (AVE), ranging from 0.578 to 0.805, exceeding the minimum required value of 0.50, as proposed in the studies by Fornell and Lacker (1981), demonstrating good convergent validity. Furthermore, in addition to the values of each AVE, Table 2 shows that the results of Cronbach's alpha and composite reliability of the scales used are considered satisfactory.

Table 2
Cronbach's alpha and composite realibility

Construct	AVE (gamers)	Cronbach's alpha (gamers)	Composite reliability (gamers)	AVE (non-gamers)	Cronbach's alpha (non- gamers)	Composite reliability (non-gamers)
Intention	0.935	0.965	0.966	0.935	0.965	0.966
Perceived ease of use	0.798	0.875	0.903	0.778	0.905	0.921
Perceived usefulness	0.929	0.975	0.975	0.942	0.969	0.969
Perceveid compatibility	0.787	0.867	0.881	0.788	0.867	0.879
Social influence	0.518	0.716	0.855	0.639	0.708	0.754
Technology availability	0.741	0.824	0.845	0.741	0.824	0.845
Trust	0.835	0.946	0.954	0.835	0.946	0.954

The next step was the assessment of the discriminant validity of the SEM, which is understood as an indicator that the constructs or latent variables are independent of each other (Coelho et al., 2018). It was opted to observe the cross-loadings, which are the indicators with higher factor loadings on their respective constructs than on others (Fornell; Lacker, 1981). The Table 3 represents the cross-loadings of the gamers group model and Table 4 shows the cross-loadings of the non-gamers group model.

Table 3

Cross loadings - gamers

	Intention	Perceived ease of use	Perceived usefulness	Perceveid compatibility	Social influence	Technology availability	Trust
INT1	0.955	0.413	0.496	0.516	0.735	0.315	0.406
INT2	0.977	0.435	0.493	0.530	0.751	0.334	0.405
INT3	0.968	0.422	0.507	0.540	0.778	0.319	0.409
PEC1	0.540	0.336	0.537	0.885	0.617	0.405	0.571
PEC2	0.457	0.329	0.534	0.906	0.568	0.398	0.637
PEC3	0.462	0.368	0.722	0.871	0.551	0.434	0.663
PEOU1	0.376	0.838	0.193	0.179	0.311	0.242	0.222
PEOU2	0.364	0.920	0.433	0.449	0.448	0.442	0.455
PEOU3	0.435	0.920	0.409	0.374	0.463	0.445	0.396
PU1	0.494	0.400	0.943	0.631	0.578	0.428	0.696
PU2	0.490	0.398	0.974	0.664	0.597	0.508	0.664
PU3	0.525	0.401	0.981	0.680	0.634	0.510	0.664
PU4	0.479	0.354	0.958	0.674	0.638	0.484	0.641
SOI1	0.429	0.440	0.550	0.575	0.756	0.495	0.574
SOI2	0.396	0.405	0.383	0.443	0.718	0.426	0.491
SOI3	0.282	0.129	0.401	0.394	0.541	0.357	0.382
SOI4	0.854	0.350	0.507	0.497	0.831	0.326	0.354
TEA1	0.323	0.382	0.391	0.363	0.439	0.887	0.365
TEA2	0.291	0.420	0.443	0.404	0.423	0.920	0.431
TEA3	0.239	0.317	0.477	0.463	0.486	0.768	0.534
TRU1	0.378	0.382	0.647	0.713	0.568	0.482	0.957
TRU2	0.373	0.370	0.655	0.684	0.539	0.460	0.963
TRU3	0.393	0.369	0.650	0.686	0.546	0.462	0.970
TRU4	0.416	0.397	0.677	0.681	0.566	0.449	0.975
TRU5	0.357	0.377	0.510	0.438	0.401	0.446	0.665

INT = Intention; PEC = Perceived compatibility; PEOU = Perceived ease of use; PU = Perceived usefulness; SOI = Social influence; TEA = Technology availability; TRU = Trust.

Table 4

Cross loadings - non gamers

	Intention	Perceived ease of use	Perceived usefulness	Perceveid compatibility	Social influence	Technology availability	Trust
INT1	0.955	0.432	0.497	0.516	0.446	0.315	0.406
INT2	0.977	0.464	0.497	0.531	0.442	0.334	0.405
INT3	0.968	0.450	0.510	0.540	0.470	0.319	0.409
PEC1	0.540	0.353	0.529	0.886	0.571	0.405	0.571
PEC2	0.457	0.347	0.527	0.907	0.563	0.398	0.637
PEC3	0.462	0.367	0.715	0.869	0.465	0.434	0.663
PEOU1	0.376	0.808	0.202	0.179	0.240	0.242	0.222
PEOU2	0.364	0.898	0.440	0.449	0.466	0.442	0.455
PEOU3	0.435	0.920	0.417	0.374	0.409	0.445	0.396
PEOU4	0.459	0.897	0.415	0.374	0.476	0.419	0.384
PU1	0.494	0.417	0.955	0.630	0.499	0.428	0.696
PU2	0.490	0.415	0.979	0.663	0.533	0.508	0.664
PU3	0.525	0.422	0.977	0.679	0.553	0.510	0.664
SOI1	0.429	0.481	0.540	0.575	0.881	0.495	0.574
SOI2	0.395	0.435	0.370	0.444	0.868	0.426	0.491
SOI3	0.282	0.131	0.392	0.394	0.621	0.357	0.382
TA1	0.323	0.403	0.393	0.363	0.390	0.887	0.365
TA2	0.291	0.432	0.445	0.404	0.431	0.920	0.431
TA3	0.239	0.318	0.460	0.463	0.604	0.768	0.534
TRU1	0.378	0.393	0.645	0.713	0.632	0.482	0.957
TRU2	0.393	0.379	0.654	0.686	0.597	0.462	0.970
TRU3	0.373	0.377	0.659	0.684	0.594	0.460	0.963
TRU4	0.416	0.407	0.682	0.681	0.603	0.449	0.975
TRU5	0.357	0.377	0.517	0.438	0.331	0.446	0.665

INT = Intention; PEC = Perceived compatibility; PEOU = Perceived ease of use; PU = Perceived usefulness; SOI = Social influence; TEA = Technology availability; TRU = Trust.

Upon analyzing Table 3 and 4, it is noted that the factor loadings of the variables on the original constructs are always higher than on others, confirming that both models (gamers and non-gamers) have good discriminant validity (Fornell & Lacker, 1981).

After ensuring that the reliability and validity procedures were met, the fit indices of both structural model were analyzed. The Bootstrapping algorithm (random sampling) of SmartPLS 4 software was used, with a parameter of 1000 for the number of cases and samples. This procedure aims to perform 1000 simulations with the dataset to obtain the results of the Student's t-distribution test and standard errors (Coelho et al., 2018). For a sample of 201 gamers and 238 non-gamers, the value of the Student's t-distribution is 1.96, for a 95% confidence interval and significance of 0.05 (Hair *et al.*, 2009). If the result of the Student's t-test is equal to or greater than 1.96, the null hypothesis is rejected, meaning the correlation/regression is statistically significant (Hair et al., 2009). Additionally, the main fit indices commonly reported in SEM to assess the model fit quality were presented. The common criteria for SEM were previously suggested, and a comparison between the results obtained in this study and the values recommended by the literature (Hair et al., 2009) are presented in Table 5.

Table 5

Fit indices

Fit indices	Recommended Criterion	Results in this Study (gamers)	Results in this Study (non-gamers)
Comparative fit index (CFI)	> 0.9	1	1
Tucker-Lweis Index (TLI)	> 0.9	1	1
Bentler-Bonett non normed fit index (NFI)	> 0.9	0.98	0.99
Bollen's relative fit index (RFI)	> 0.9	0.98	0.99
Bollen's incremental fit index (IFI)	> 0.9	0.99	1
Goodness of fit index (GFI)	> 0.9	0.98	0.99
Standardized root mean square residual (SRMR)	< 0.06	0.04	0.05
Chi- Square	-	255.20	153.66
Degrees of freedom	-	271	261
CMIN/DF	<=3	0.94	0.59

Cmin = Chi-Square; DF = Degrees of freedom.

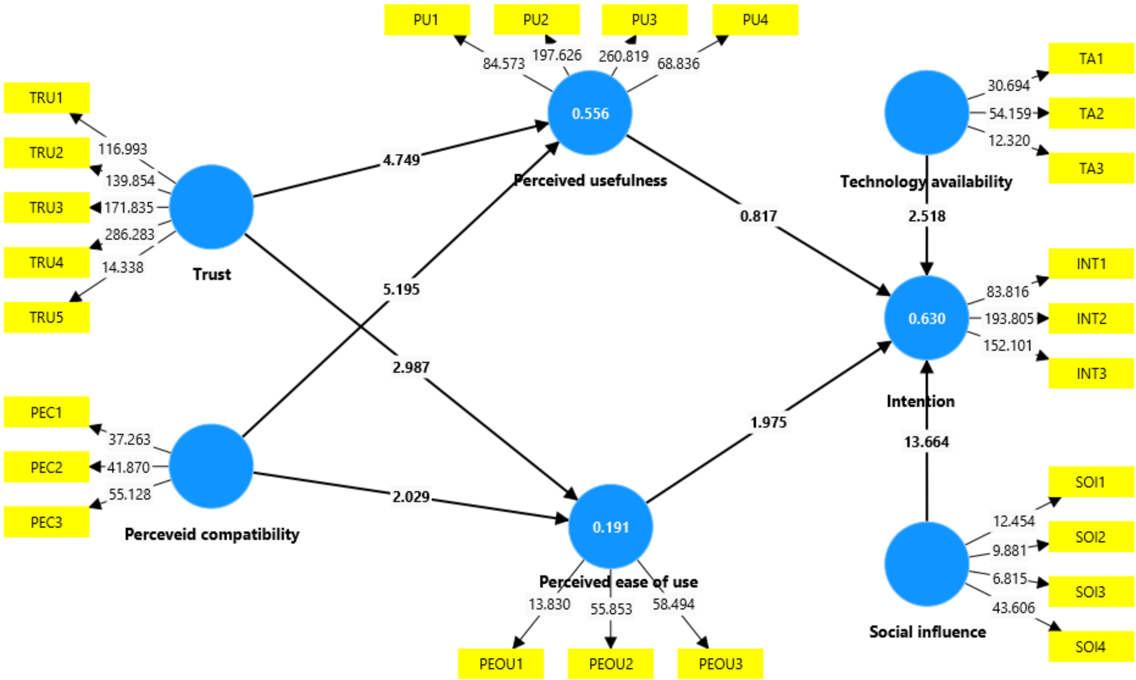
With regard to the Chi-square value and Degrees of freedom, there is no consensus in the literature regarding a cutoff point. However, it is noted that the ratio of Chi-square to Degrees of freedom (Chi-square/DF) should be less than 3 (Hair et al., 2009). In the case of both tested models, the ratio of Chi-square to degrees of freedom was considered ideal, as a value less than 3 was obtained.

4.3 Analysis of the adjusted structural model for gamers

After all fit indices were considered satisfactory, the next step was to estimate the adjusted structural model of both groups (gamers and non-gamers) and then a comparison was made between the hypotheses and the results obtained for each model.

Figure 3

Adjusted structural model for gamers



Based on the results presented by the structural model, it can be inferred that perceived compatibility and trust constructs explain 55.6% ($R^2 = 0.556$) of the variance in the perceived usefulness construct. Furthermore, based on Figure 3, 19.1% ($R^2 = 0.191$) of the variance in the perceived ease of use construct is explained by the perceived compatibility and trust constructs. Finally, 65% ($R^2 = 0.650$) of the variance in the intention construct is explained by perceived ease of use, social influence, and technology availability. The model results also show that the relationship between perceived usefulness and intention is not significant ($T < 1.96$). Based on the analysis of results obtained through the adjusted structural model for gamers, Table 6 compares the hypotheses formulated with the results obtained in the structural model.

Table 6.

Results of the hypotheses analyses for the adjusted structural model for gamers

Hypotheses	Hypothese direction	*bootstraping t value*	Results
H1: Perceived ease of use → Intention	+	1.975	Hypothesis not rejected
H2: Perceived usefulness → Intention	+	0.817	Hypothesis rejected
H3: Technology availability → Intention	+	2.518	Hypothesis not rejected
H4: Trust → Perceived usefulness	+	4.749	Hypothesis not rejected
H5: Trust → Perceived ease of use	+	2.987	Hypothesis not rejected

H6: Perceived compatibility → Perceived usefulness	+	2.029	Hypothesis not rejected
H7: Perceived compatibility → Perceived ease of use	+	5.195	Hypothesis not rejected
H8: Social influence → Intention	+	13.664	Hypothesis not rejected

The SmartPLS 4 extraction does not provide p-values. However, the distribution of the extracted coefficients in the 1000 demanded resamplings closely resembles the standard t-distribution, so the value of 1.96 is the reference for rejecting or not rejecting the hypotheses.

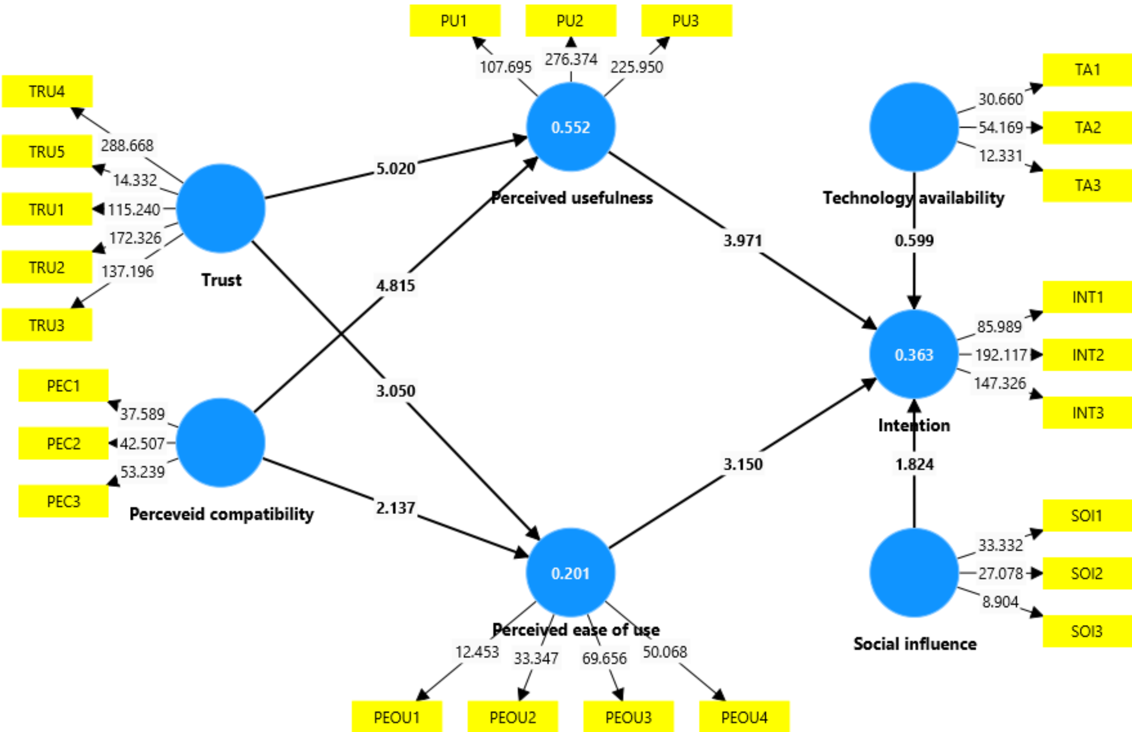
Regarding the results presented in Table 6, it is highlighted that a t-value >= 1.96 indicates that the hypothesis should not be rejected (Hair et al., 2009; Coelho et al., 2018). The results demonstrate that H1, H3, H4, H5, H6, H7 and H8 were statistically supported, while H2 was the only hypothesis rejected (t value < 1.96).

4.4 Analysis of the adjusted structural model for non-gamers

The next step was the estimation of the adjusted structural model for non-gamers. Figure 4 shows the non-gamers model results.

Figure 4

Adjusted structural model for non-gamers



Based on the results presented by the structural model, it can be inferred that perceived compatibility and trust constructs explain 55.2% ($R^2 = 0.552$) of the variance in the perceived usefulness construct. Furthermore, based on Figure 4, 20.1% ($R^2 = 0.201$) of the variance in the perceived ease of use construct is explained by the perceived compatibility and trust constructs. Finally, 36.3% ($R^2 = 0.363$) of the variance in the intention construct is explained by perceived ease of use and perceived usefulnes. The model results also show that the relationship between technology availability, social influence and intention are not significant ($T < 1.96$). Based on the analysis of results obtained through the adjusted structural model for non-gamers, Table 7 compares the hypotheses formulated with the results obtained in the structural model.

Table 7

tabltabl for non-gamers

Hypotheses	Hypothese direction	*bootstraping t value*	Results
H1: Perceived ease of use → Intention	+	3.150	Hypothesis not rejected
H2: Perceived usefulness → Intention	+	3.971	Hypothesis not rejected
H3: Technology availability → Intention	+	0.599	Hypothesis rejected
H4: Trust → Perceived usefulness	+	5.020	Hypothesis not rejected
H5: Trust → Perceived ease of use	+	3.050	Hypothesis not rejected
H6: Perceived compatibility → Perceived usefulness	+	2.137	Hypothesis not rejected
H7: Perceived compatibility → Perceived ease of use	+	4.815	Hypothesis not rejected
H8: Social influence → Intention	+	1.824	Hypothesis rejected

The SmartPLS 4 extraction does not provide p-values. However, the distribution of the extracted coefficients in the 1000 demanded resamplings closely resembles the standard t-distribution, so the value of 1.96 is the reference for rejecting or not rejecting the hypotheses.

The results in Table 7 demonstrate that H1, H2, H4, H5, H6 and H7 were statistically supported (t value > 1.96), while H3 and H8 were the only hypothesis rejected (t value < 1.96).

4.5 Discussions

Regarding H1, the results show that, in both games and non-games structural models, the perceived ease of use positively influences individuals' intention to use the Metaverse. These results are corroborated by the studies of Aburbeian et al. (2022). This means that when there is a perception that the Metaverse technology is easy to use, the user will have a greater predisposition to use it, whether they are gamers or non-gamers. Based on these results, marketing professionals and information technology developers should work together to create interfaces that are intuitive and easy to navigate, along with marketing campaigns that emphasize the ease of use of the Metaverse.

The results demonstrated that, for the structural model adjusted for gamers, perceived usefulness does not positively influence the intention to use metaverse technology, leading to the rejection of H2. However, for the structural model adjusted for non-gamers, H2 was not rejected. These findings suggest the need for a segmented approach to the development and marketing of the Metaverse, taking into account the differences in perceived usefulness between gamers and non-gamers. The more people perceive metaverse technology as useful, the greater their intention to use this type of technology (Aburbeian et al., 2022; Toraman & Geçit, 2023).

Regarding H3, the results show that, for the structural model adjusted for gamers, technology availability does not influence the intention to use the metaverse, leading to the rejection of H3. However, for the structural model adjusted for non-gamers, H3 was not rejected. These results may indicate that for gamers, technology availability might not be an essential factor, as they may already have access to the necessary technologies (Shaw, 2012; Lee et al., 2021). For the non-gamer group, technology availability can be a significant barrier. The lack of access to adequate devices can hinder the adoption of the metaverse by non-gamers, while their absence can decrease the intention to use the Metaverse (Shaw, 2012; Toraman & Geçit, 2023).

Regarding H4 and H5, the results indicate that in both groups (gamers and non-gamers), trust positively influences perceived usefulness (H4) and perceived ease of use (H5). Therefore, H4 and H5 should not be rejected. These results suggest that trust should be considered an additional critical factor in the TAM model, specifically in the context of the metaverse (Toraman & Geçit, 2023). This broadens the theoretical understanding of TAM by incorporating trust as an essential determinant of perceived usefulness and perceived ease of use. Furthermore, from a commercial perspective, trust in Metaverse systems can be an important factor for people, whether gamers or non-gamers, to purchase products and services from brands and companies (Toraman & Geçit, 2022; Belk et al., 2022).

Regarding H6 and H7, the results show that, for both gamers and non-gamers, perceived compatibility positively influences perceived usefulness (H6) and perceived ease of use (H7) of the Metaverse. The positive effect of perceived compatibility on an individual's perceived usefulness and perceived ease of use is among the essential findings of the present study. The results indicate that perceived compatibility is a crucial factor that affects the perception of usefulness and ease of use of the Metaverse, for both gamers and non-gamers. This underscores the importance of considering compatibility as an important antecedent to the adoption of the Metaverse. These results are corroborated by other studies that also highlighted the importance of perceived compatibility in the context of new technology adoption (Mostafa, 2022, Toraman & Geçit, 2023;). Furthermore, marketing campaigns should emphasize the compatibility of the metaverse with other popular technologies and how this can facilitate its adoption.

Regarding H8, the results show that, for the structural model adjusted for gamers, social influence does positively influence the intention to use the metaverse system; therefore, H8 should not be rejected. However, for the structural model adjusted for non-gamers, the results indicate that social influence does not significantly influence the intention to adopt metaverse systems; thus, for the non-gamers group, H8 should be rejected. One possible explanation for this result is that gamers often belong to online communities where the exchange of information and recommendations about new technologies is common (Shaw, 2012; Mostafa, 2022). In this sense, the approval and use of the metaverse by friends and influencers in the gaming community may exert a strong influence on the intention to adopt it. Regarding the non-gamers group, they may not have an equivalent community where social recommendations play a significant role in the adoption of the metaverse, reducing the influence of the social influence variable.

The results indicate that perceived ease of use, perceived compatibility, and trust are critical factors in the adoption of metaverse technology for both gamers and non-gamers. The differentiated impact of perceived usefulness and social influence between these groups underscores the need for tailored strategies in both technology development and marketing efforts. Policy makers, marketing professionals, and companies should segment their strategies to help in understanding the varying needs and perceptions of gamers and non-gamers.

Finally, by highlighting the importance of trust and perceived compatibility, the study extends the TAM model, suggesting that these external factors should be integrated into the TAM model when applied to complex technologies like the metaverse.

5. CONCLUSIONS

The main scope of this study was to analyze the factors that precede the intention to adopt the metaverse among gamers and non-gamers from the perspective of TAM. To this end, a theoretical review of TAM and the metaverse was carried out, followed by a data analysis using structural equation modeling. Classified as a descriptive and explanatory study with a quantitative approach, this research sought to clarify existing gaps and deepen the understanding of the determinants of metaverse adoption among gamers and non-gamers in Brazil.

The findings of this study underscore the importance of perceived ease of use, perceived compatibility, and trust in the adoption of metaverse technology for both gamers and non-gamers. The positive influence of perceived ease of use on individuals' intention to use the Metaverse suggests that creating intuitive and user-friendly interfaces is crucial. This finding highlights the need for collaboration between marketing professionals and IT developers to emphasize the ease of use in marketing campaigns, thereby enhancing the adoption of the Metaverse.

The differentiated impact of perceived usefulness between gamers and non-gamers reveals that gamers do not find perceived usefulness to be a significant factor, while non-gamers do. This indicates the necessity for a segmented approach in both development and marketing strategies, addressing the specific needs and perceptions of each group. Additionally, the results show that technology availability is a significant barrier for non-gamers but not for gamers, further emphasizing the need to address access issues to increase adoption among non-gamers.

Trust emerged as a critical factor influencing both perceived usefulness and perceived ease of use, suggesting that it should be integrated into the TAM model when applied to complex technologies like the metaverse. This highlights the commercial importance of building trust in metaverse systems to encourage the purchase of products and services from brands and companies.

Perceived compatibility significantly affects both perceived usefulness and perceived ease of use for gamers and non-gamers. This underscores the importance of ensuring compatibility with other popular technologies to facilitate the adoption of the metaverse. Marketing campaigns should emphasize this compatibility to further drive adoption.

The study extends the TAM model by incorporating external factors such as trust, technology avalaibility, social influence and perceived compatibility, providing a more comprehensive understanding of the determinants of technology adoption in the context of the metaverse. The results suggest that policy makers, marketing professionals, and companies should segment their strategies to better understand and address the varying needs and perceptions of different user groups, ultimately enhancing the adoption and success of metaverse technology.

As a limitation of this research, the study may not have considered other external factors that influence the adoption of the metaverse, such as economic, political, or sociodemographic influences. For future research, it is suggested to investigate the influence of other external factors that were not analyzed in the present study, such as technological advancements, privacy policies, and economic impacts on the adoption of the metaverse.

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