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A study of the impact of Metaverse attributes on intention to use - based on the Extended Technology Acceptance Model*

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This study analyzed the factors influencing users' intention to use the Metaverse by applying the extended technology acceptance model. In other words, the factors affecting users' intention to use the Metaverse were defined as technical characteristics (telepresence, interoperability, seamlessness, concurrence, and economy flow) and personal characteristics (social influence and perceived enjoyment) from the perspective of the Extended Technology Acceptance Model. For this purpose, a survey was conducted among men and women of various ages ranging from teenagers to 60s, and the data collected from 327 participants were analyzed using SPSS 22.0 and Smart PLS 4.0. The results showed that perceived usefulness and perceived ease of use, which are antecedents of the Extended Technology Acceptance Model, influence the intention to use Metaverse, and perceived ease of use influences perceived usefulness. Telepresence, interoperability and economy flow were found to have a positive effect on perceived usefulness, and interoperability, seamlessness and concurrence were found to have a positive effect on perceived ease of use. In addition, social influence and perceived enjoyment had a positive effect on intention to use the Metaverse. This study is significant in that it empirically analyzed the factors of users' acceptance of the Metaverse, which is attracting attention as a new platform that will bring significant changes to our daily lives and platform consumption environments.

Keywords : Metaverse, the Extended Technology Acceptance Model, Metaverse Attributes, social influence, perceived enjoyment

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1. Introduction

In the past few years, the global pandemic and the development of virtual reality and augmented reality technologies have led to a metaverse craze, where various interactions and transactions are possible in a virtual world (Yun et al., 2023). Metaverse is a combination of virtual and transcendent (Meta) and world and universe (Universe), which means 'hyper-connected and hyper-realistic digital world'. In other words, it is a digital environment that is free from the physical and functional constraints of the space we live in (Kim, 2021).

In the Korean government's 'Strategy for the

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Development of Virtual Convergence Economy', Metaverse was introduced as an innovation tool to overcome the economic crisis, and it was stated that the virtual convergence economy that creates new value is rapidly emerging due to the significant expansion of XR (eXtended Reality) technology, which includes Augmented Reality and Virtual Reality (Ministry of Science and ICT, 2021). In its report 'Seeing is Believing', PwC Consulting (2020) said that the VR and AR market, which constitute sub-technologies of the Metaverse, will grow to KRW 537 trillion in 2025 and KRW 1,700 trillion in 2030. In fact, the daily users of the Metaverse game service Roblox increased by 171% from 15.4 million in the first quarter of 2019 to 41.8 million in the first quarter of 2021, the monthly users of Minecraft increased by 250% from 40 million in June 2016 to 140 million in April 2021, and the global cumulative users of Zepeto, a representative Metaverse service in Korea, exceeded 200 million (Jung, 2021).

In the meantime, while the growth momentum has been centered on VR and AR for many years, collectively referred to as XR technology, including new technologies that will appear in the future such as virtual reality (VR), augmented reality (AR), and mixed reality (MR), the concept and business model of the Metaverse has gained attention in 2021, securing new growth momentum and evolving into XR technology (Park, 2021).

While interest in the Metaverse is growing rapidly around the world, there is no guarantee that the Metaverse will lead to widespread consumer acceptance. As we have already seen in the case of 3D TV, smart TV, and video phone, new media may face consumer rejection, and popularization may be delayed from the initial prediction.

Therefore, in order for the Metaverse to succeed in popularization through the process of acceptance and adoption without facing consumer rejection, research is needed to predict and analyze factors that affect consumer acceptance.

Most of the existing studies are related to services using virtual reality (VR) and augmented reality (AR) technologies, which are sub-concepts of XR (Lee et al. 2021; Hong & Han, 2020; Jeon & Nam, 2020), or studies on the conceptual definition and typology of Metaverse (Ko et al., 2021; Lee, 2021; Seok, 2021), and studies on the intention to continue using Metaverse services based on virtual reality (XR) technology are lacking.

Therefore, this study aims to investigate the intention to continue using Metaverse services based on the Extended Technology Acceptance Model (TAM). In addition, this study aims to provide implications by deriving factors that affect the intention to continue using Metaverse services that are different from virtual reality (VR) and augmented reality (AR) services.

2. Conceptual framework and Hypothesis

2.1. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), first proposed by Davis (1989), is a model based on the theory of reasoned action to predict an individual's

acceptance of an innovative technology.

TAM uses the theory of reasoned action as a theoretical basis to specify the causal relationship between users' attitudes, intentions, and actual computer acceptance behavior through the two main antecedents of TAM, perceived usefulness and perceived ease of use. Although TAM is less general than the theory of reasoned action because it is designed to apply only to computer use behavior, it may be more appropriate for modelling computer acceptance because it incorporates accumulated findings from information systems research (Davis et al., 1989).

TAM theorizes that an individual's behavioral intention to adopt an information system is determined by two beliefs. Perceived usefulness is defined as "the extent to which an individual perceives that using a particular information technology can improve his or her job performance" and perceived ease of use is defined as "the extent to which an individual expects to use a particular information technology easily and without much mental and physical effort". Perceived ease of use has a direct effect on perceived usefulness and technology use.

Although the original theoretical concept of TAM included attitude, the final model of TAM (Davis, 1989) excluded attitude by showing that attitude only partially mediated the effect of perceived usefulness on intention, and that the direct relationship between perceived usefulness and attitude was weak, but the direct relationship between perceived usefulness and intention to use was strong. The removal of attitude allows for a better understanding of the effects of perceived usefulness and perceived ease of use on the main dependent variable, intention (Venkatesh & Davis, 2000). Therefore, the hypothesis of the Metaverse based on the refined Technology Acceptance Model (TAM) is as follows.

H1. Perceived ease of use will positively influence perceived usefulness.
H2. Perceived usefulness will have a positive effect on intention to use the Metaverse.
H3. Perceived ease of use will have a positive effect on intention to use the Metaverse.

2.2. Metaverse Attributes

Although expressed in different terms by different researchers, the main characteristics of a Metaverse are not significantly different between them. Kim & Shin (2021) presented a SPICE model of the main characteristics of a Metaverse based on ASF, which are Seamlessness, Presence(Telepresence), Interoperability, Concurrence, and Economy Flow. Based on the summary by Kim & Shin (2021), the characteristics of the Metaverse are as follows.

2.2.1. Telepresence

Telepresence can be described as the feeling of being in a real environment (Davis et al., 2009) or the concept of being connected not only to an avatar but also to other digital spaces and environments in real life (Tasa & Görgülü, 2010). This is because it is important for platforms to create a similar experience in order to enhance the sense of

immersion in an environment that the user does not have physical contact with (Kim et al., 2022

Lee et al. (2021) presented factors affecting intention to use VR-based digital content subscription services, and found that among the characteristics of VR content, presence had a positive effect on both perceived usefulness and perceived enjoyment. Han & Ahn (2019) verified that telepresence affects enjoyment and usefulness in a distribution environment using VR technology, which in turn affects future intention to use VR.

H4: Telepresence will have a positive impact on perceived usefulness.
H5: Telepresence will have a positive impact on perceived ease of use.

2.2.2. Interoperability

Interoperability refers to a situation where data and information in the real world and the Metaverse are interconnected, so that the results of the user's experiences and actions in the Metaverse are connected to the real world, and the experience in the Metaverse becomes richer and more convenient based on lifelogging information in the real world. This is because even if online information is abundant, if the information is distant from the real world or if the information between users moves independently, the immersion of the platform is bound to decrease (Koo et al., 2021).

The higher a user perceives interoperability within a particular system, the more influential it is in shaping positive attitudes towards the technology (McMillan & Hwang, 2002). In a related study, Park & Nam (2017) measured the effect of perceived interoperability on information acceptance in a mobile health information service and found that higher perceived interoperability positively influenced perceived usefulness and perceived ease of use, leading to higher intention to use. Cha (2019) suggested that interoperability is a factor that must be increased in the case of interactive content because it acts as an instrumental device that makes active users more immersed in the content, and applied the technology acceptance model to verify the acceptance of theatre advertisements through NFC technology, and found that interoperability positively enhances perceived usefulness and perceived ease of use.

H6: Interoperability will have a positive impact on perceived usefulness.
H7: Interoperability will have a positive impact on perceived ease of use.

2.2.3. Seamlessness

Seamlessness can be described as the concept of whether a digital environment continues to function even when the user is not connected to it (Gilbert, 2011). For example, Fortnite allows users to play a battle royale-style game on one platform and then move directly to a party royale space to watch a performance, or to a community space to interact with others. What's important here is that you're not just able to do different things on one platform, but that your history is also linked. Rather than new connections and different characters in different places, it's the continuity that connects

memories and information, just as we do in real life (Koo et al., 2021).

H8: Seamlessness will have a positive impact on perceived usefulness.
H9: Seamlessness will have a positive impact on perceived ease of use.

2.2.4. Concurrence

Concurrence is the idea that a platform should be accessible to multiple users at the same time. It refers not only to connecting avatars in virtual reality, but also to another level, from real life to other digital spaces and environments (Tasa & Görgülü, 2010), which means that a large number of users in remote physical locations can interact simultaneously (Gilbert, 2011). In the real world, people do not create and expand information alone, but rather in large groups to share a variety of information. From this perspective, for a platform to be valuable, it must first have a large number of users (Kim et al., 2022).

H10: Concurrence will have a positive impact on perceived usefulness.
H11: Concurrence will have a positive impact on perceived ease of use.

2.2.5. Economy Flow

Economy Flow is the concept of whether the products or services present on the platform can be traded. It can be categorized into types that can be consumed anywhere regardless of where they are made, such as offline products being consumed online, products made online being consumed online, or online products being consumed offline (Guo & Chow, 2008). This diversity of transactions can increase the time spent immersed in the platform. For example, in gaming, users may need various items to customize their character or level up their character, and they may not be able to achieve their goals through in-platform activities alone, so they may use real money to help them. In this respect, it is important to be able to trade within the platform for elements that can make the user stand out in the Metaverse or provide convenience, which will increase sustainable use (Kim et al. 2022).

H12: Economy Flow will have a positive impact on perceived usefulness.
H13: Economy Flow will have a positive impact on perceived ease of use.

2.3. Individual Attributes

2.3.1. Social influence

Social influence refers to the influence of the opinions of one's peers on personal behavior. Influence Theory suggests that consumers tend to follow the opinions of those around them that they perceive as important. In particular, when individuals have insufficient information or lack certainty, they adopt behavior through the process of internalization, which is the process of establishing their own opinions with the help of others (Deutsch & Gerard, 1955).

Yang and Choi (2001) studied students' acceptance

of spreadsheets and the Internet by applying the Technology Acceptance Model and found that social influence, including subjective norms and social image, is a significant predictor of technology acceptance (Yang & Choi, 2001). Social influence was found to have a static effect on perceived usefulness and intention to use the Metaverse (Oh, 2021).

H14: Social influence will have a positive effect on intention to use the Metaverse.

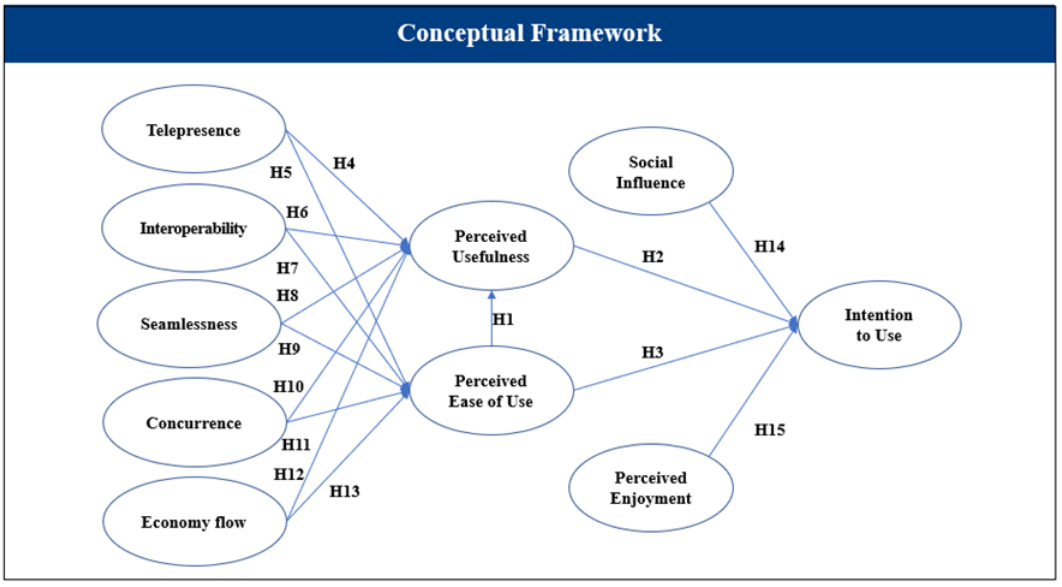
2.3.2. Perceived enjoyment

Perceived enjoyment refers to the perception that using a new technology is enjoyable in and of itself, regardless of whether or not it achieves a goal. Perceived enjoyment, the degree of pleasure and satisfaction in using a new information technology, is described as an important external variable in the TAM (Park & Hyun, 2013).

Venkatesh & Morris (2000) also described playfulness as an important factor influencing users' acceptance of new technologies, and a study by Qiao & Han (2019) found that perceived enjoyment of virtual reality content positively influenced intention to reuse. There are also studies that show that the fun factor of SNS influences perceived usefulness and intention to continue using (Cho, 2017). In this context, fun and enjoyment in using new media can be seen as a positive influence on acceptance of the media (Park & Hyun, 2013).

H15: Perceived enjoyment will have a positive effect on intention to use the Metaverse.

The following conceptual framework is formed <Figure 1>.



〈Figure 1〉 Conceptual Framework

3. Methods

3.1. Sample

Since the technical and personal characteristics of the Metaverse platform are related to the acceptance of the Metaverse, the survey required for this study needs to target people with experience using the Metaverse platform as much as possible, so the quota sampling method by gender and age was used.

The survey for the study was conducted with the support of online research agency Embrain over a two-day period from 6th to 7th February 2023. A total of 327 responses were collected through quota sampling by gender and age from the research firm's online panel of people who have used the Metaverse platform at least once, including men and women aged 14 to 64 years old living in Korea.. <Table 1> shows the demographic profile of the participants.

The demographic characteristics of the sample used in this study are shown in <Table1>. The average age of the sample was 31, with 76 (23.2%) in their teens and younger, 83 (25.4%) in their 20s, 82 (25.1%) in their 30s, and 86 (26.3%) in their 40s and older, and 159 (48.6%) males and 168 (51.4%) females.

The purpose of using the Metaverse was more likely to be for enjoyment and fun (271, 82.9%) than for exploring/learning new information (56, 17.1%).

Of the respondents, 115 (35.2%) use Minecraft as their primary Metaverse platform, followed by 75 (22.9%) for ZEPETO, 61 (18.7) for Animal Crossing, 51 (15.6%) for Roblox, 12 (3.7%) for Gather Town, 12 (3.7%) for Ifland, and 1 (0.3%) for Fortnite.

In addition, 37 (11.3%) of the respondents use the Metaverse platform almost daily, 71 (21.7%) use it every 2-3 days, 69 (21.1%) use it once a week, 45 (13.8%) use it every 2-3 weeks, and 105 (32.1%) use it once a month or less.

〈Table 1〉 Sample description (N = 327).

Construct		Frequency (N)	Percent (%)
Gender	Female	168	51.4
	Male	159	48.6
Age	~19	76	23.2
	20~29	83	25.4
	30~39	82	25.1
	40~	86	26.3
Purpose of using Metaverse	Utilitarian	56	17.1
	hedonic	271	82.9
Preferred Metaverse Platforms	Minecraft	115	35.2
	ZEPETO	75	22.9
	Animal Crossing	61	18.7
	Roblox	51	15.6
	Gather Town	12	3.7
	Ifland	12	3.7
	Fortnite	1	0.3
Purpose of using Metaverse	Almost every day	37	11.3
	Once every 2-3 days	71	21.7
	Once a week	69	21.1
	Once every 2-3 weeks	45	13.8
	Once a month or less	105	32.1

3.2. Measurement

The variables in the study are five independent variables representing Metaverse characteristics (Telepresence, Interactivity, Seamlessness, Concurrence, and economy flow), two independent variables

representing individual characteristics (Social Influence, Perceived Enjoyment), two parameters (Perceived Usefulness, Perceived Ease of Use), and the dependent variable (Intention to use) are 10 in total, and are operationally defined as shown in <Table 2> based on previous studies.

3.3. Data Analysis

In this study, partial least squares (PLS) path modelling was used to estimate the relationships hypothesized in this model. There are two approaches to specify or test hypothesized relationships in path analysis (Hair et al., 2010): covariance-based structural equation modeling (CB-SEM) and PLS-SEM. CB-SEM uses a maximum likelihood estimation (MLE) procedure to estimate model coefficients "so that the discrepancy between the estimated and sample covariance matrices is minimized" (Hair et al., 2014, p. 27). CB-SEM is more suitable for confirming or rejecting a developed theory. Conversely, PLS-SEM estimates model parameters in a way that maximizes the variance explained in endogenous variables and is preferred for research aimed at theory development

〈Table 2〉 Operational definition of variables

Construct	Operational Definition	Related studies
Telepresence	Perceived psychological identification in the context of using Metaverse services	Kim et. al.(2022), Davis et al.(2009), Dionisio et al.(2013), Gilbert(2011), Guthrie et. al.(2011), Noor(2010)
Interoperability	The extent to which users can participate and change the form and content of the Metaverse in real time.	Kim et. al.(2022), Cammack(2010), Davis et al.(2009), Dionisio et al.(2013), Noor(2010), Tasa and Görgülü(2010)
Seamlessness	The extent to which the Metaverse continues to function even when users are not connected to the digital environment.	Kim et. al.(2022), Gilbert(2011), Tasa and Görgülü(2010), Guthrie et al.(2011), McKerlich et al.(2011), Noor(2010)
Concurrence	The extent to which multiple users can simultaneously access the Metaverse platform	Kim et. al.(2022), Cammack(2010), Gilbert(2011), Guthrie et al.(2011), McKerlich et al.(2011)
Economy flow	The extent to which users can trade products or services that exist on the Metaverse platform.	Kim et al.(2022), Cammack(2010)
Social Influence	The extent to which your use of the Metaverse is influenced by the people around you	Son et al (2014), Oh (2021), Park & Kang (2021)
Perceived Enjoyment	The extent to which using the Metaverse is perceived as enjoyable or fun.	Kim et al. (2007), Park & Byun (2013), Oh (2021), Park& Kang (2021)
Perceived Usefulness	The extent to which Metaverse use is perceived to be useful in improving quality of life compared to before	Qiao & Han (2019), Oh (2021), Park& Kang (2021)
Perceived ease of use	The degree to which a Metaverse is perceived as easy and convenient to use	Qiao & Han (2019), Oh (2021), Park& Kang (2021)
Intention to use	The intention or plan to continue using the Metaverse service in the future	Davis et al. (1989), Venkatesh et al. (2003)

and prediction (Hair et al., 2014, p. 14).

PLS path modeling is also recommended over CB-SEM for testing complex models with many latent variables (Henseler et al., 2009). Compared to the average number of 4.4 latent variables in a CB-SEM (Shah & Goldstein, 2006), the proposed model in our study has 10 latent variables. In addition, the purpose of this study is to examine the impact of Metaverse attributes on intention to use, which is concerned with exploring a potentially new theoretical framework rather than confirming or validating established theories. For these reasons, a PLS path modeling approach is more appropriate for data analysis in the this study. According to Hair et al. (2017), a rough estimate of the minimum sample size should be 10 times the maximum number of arrowheads pointing at a latent variable anywhere in the PLS path model, which is known as the 10-fold rule. According to this rule, the number of structural paths is 15, so only 150 samples are needed, but 327 samples are sufficient for this study. Although PLS-SEM works efficiently with small sample sizes, previous studies have shown that it is possible to use PLS-SEM with a relatively large sample size (N=851) (Anderson & Swaminathan, 2011). Anderson and Gerbing (1988) proposed the two-stage methodology in which the measurement model was first validated and in the second stage, the bootstrapping technique was used to test hypotheses.

4. Results

4.1. Measurement Validation

Internal consistency, convergent validity, and discriminant validity were analyzed to test the measurement model. The Mean, Standard Deviation, and Loadings of all the constructs in the study are shown in <Table 3>. Convergent validity shows "how different measures relate to the same conceptual construct" (Dinev & Hart, 2004, p. 417). <Table 4> shows that all ten constructs met the required thresholds as the loading values were above 0.7, Composite Reliability was above 0.7 and Average Variance Extracted exceeded 0.5 (Hair et al., 2014). The value of Cronbach's Alpha to determine internal consistency was also greater than 0.7 (Fornell & Larcker, 1981). Thus, the convergent validity of the constructs was established.

The Fornell-Larcker criteria was examined to test the discriminant validity. Discriminant validity indicates "the extent to which the measure is adequately discriminated from related constructs within the nomological net" (Dinev & Hart, 2004, p. 417). <Table 5> shows that the square roots of the mean variances extracted from construct are higher than the correlation values on the left and bottom, respectively, satisfying the Fornell-Locker criterion(Fornell & Larcker, 1981; Huh & Lee, 2022).

Next, the R2 value (Coefficient of determination) was evaluated. Metaverse attributes represented 50.0% of the explained variance for Perceived Usefulness and 23.7% of the explained variance for Perceived Ease of Use. Also, Perceived Usefulness, Perceived Ease of Use, Social Influence and Perceived Enjoyment represented 61.6% of the explained variance for Intention to Use.

〈Table 3〉 Mean, SD, and loadings of constructs.

Construct	Item	Mean	SD	Loading
Telepresence	Tel1	2.939	0.981	0.825
	Tel2	2.896	1.062	0.886
	Tel3	2.612	1.016	0.833
Interoperability	Int1	3.287	0.862	0.806
	Int2	3.401	0.865	0.839
	Int3	3.492	0.867	0.840
	Int4	3.394	0.919	0.808
Seamlessness	Seam1	3.144	0.871	0.747
	Seam2	2.862	0.940	0.763
	Seam3	3.229	0.902	0.743
	Seam4	2.966	0.952	0.851
Concurrence	Con1	3.502	0.793	0.805
	Con2	3.318	0.855	0.799
	Con3	3.657	0.816	0.806
Economy flow	EF1	3.248	0.822	0.891
	EF2	3.217	0.845	0.843
	EF3	3.278	0.834	0.863
Social Influence	SI1	2.758	0.977	0.794
	SI2	3.263	0.911	0.815
	SI3	2.676	1.080	0.806
Perceived	PE1	3.517	0.853	0.835
Enjoyment	PE2	3.474	0.859	0.870
	PE3	3.630	0.794	0.870
	PE4	3.602	0.828	0.807
Perceived	PU1	3.086	0.911	0.808
Usefulness	PU2	3.242	0.867	0.775
	PU3	3.468	0.887	0.798
	PU4	3.266	0.867	0.812
Perceived	PEU1	3.547	0.784	0.834
Ease of Use	PEU2	3.45	0.837	0.836
	PEU3	3.367	0.919	0.808
	PEU4	3.404	0.93	0.801
Intention to Use	IU1	3.538	0.823	0.889
	IU2	3.336	0.862	0.900
	IU3	3.177	0.895	0.864

〈Table 4〉 Cronbach's Alpha, composite reliability, and average variance extracted of constructs

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Telepresence	0.806	0.885	0.721
Interoperability	0.842	0.894	0.678
Seamlessness	0.785	0.859	0.604
Concurrence	0.726	0.845	0.645
Economy flow	0.839	0.900	0.750
Social Influence	0.730	0.847	0.648
Perceived Enjoyment	0.867	0.910	0.716
Perceived Usefulness	0.810	0.876	0.638
Perceived Ease of Use	0.838	0.891	0.672
Intention to Use	0.861	0.915	0.782

〈Table 5〉 Discriminant validity-Fornell-Larcker criterion.

	Concurrence	Economy flow	Intention to Use	Interoperability	Perceived Ease of Use	Perceived Enjoyment	Perceived Usefulness	Seamless ness	Social Influence	Telepresence
Concurrence	**0.803**									
Economy flow	0.505	**0.866**								
Intention to Use	0.481	0.382	**0.884**							
Interoperability	0.643	0.475	0.546	**0.823**						
Perceived Ease of Use	0.457	0.225	0.498	0.376	**0.820**					
Perceived Enjoyment	0.503	0.344	0.688	0.516	0.421	**0.846**				
Perceived Usefulness	0.522	0.445	0.677	0.621	0.410	0.667	**0.798**			
Seamlessness	0.297	0.117	0.114	0.157	0.242	0.080	0.108	**0.777**		
Social Influence	0.375	0.396	0.512	0.426	0.315	0.349	0.540	0.202	**0.805**	
Telepresence	0.436	0.356	0.533	0.496	0.280	0.492	0.525	0.265	0.483	**0.849**

4.2. PLS Path Modeling and Hypotheses Testing

Before the structural model evaluation, multicollinearity must be checked to ensure valid results. The Variance Inflation Factor (VIF) values were below 5, between 1.363 to 2.482, implying the absence of multicollinearity in the model (Hair & Lukas, 2014). Next, the structural model was evaluated by the bootstrapping method (5,000 resamples) to check the significance of the hypotheses <Table 6>.

All hypotheses related to TAM were supported. Hypothesis 1 was supported, revealing that Perceived Ease of Use (β =.169, t=2.902, p=.004) was positively associated with Perceived Usefulness. Hypothesis 2 and 3 were supported, indicating that Perceived Usefulness (β =.248, t=4.148, p=.000) and Perceived Ease of Use (β =.175, t=4.128,

〈Table 6〉 Results of hypothesis testing.

Hypo.	Path	β	s.e.	t-value	p-value	Result
H1	Perceived Ease of Use → Perceived Usefulness	0.169	0.058	2.902	0.004	Supported
H2	Perceived Usefulness → Intention to Use	0.248	0.06	4.148	0.000	Supported
H3	Perceived Ease of Use → Intention to Use	0.175	0.042	4.128	0.000	Supported
H4	Telepresence → Perceived Usefulness	0.256	0.048	5.363	0.000	Supported
H5	Telepresence → Perceived Ease of Use	0.051	0.069	0.736	0.462	Not Supported
H6	Interoperability → Perceived Usefulness	0.331	0.051	6.517	0.000	Supported
H7	Interoperability → Perceived Ease of Use	0.139	0.075	1.858	0.063	Supported
H8	Seamlessness → Perceived Usefulness	-0.092	0.064	1.432	0.152	Not Supported
H9	Seamlessness → Perceived Ease of Use	0.113	0.056	2.036	0.042	Supported
H10	Concurrence → Perceived Usefulness	0.083	0.068	1.214	0.225	Not Supported
H11	Concurrence → Perceived Ease of Use	0.332	0.077	4.294	0.000	Supported
H12	Economy flow → Perceived Usefulness	0.127	0.053	2.427	0.015	Supported
H13	Economy flow → Perceived Ease of Use	-0.040	0.069	0.581	0.561	Not Supported
H14	Social Influence → Intention to Use	0.189	0.05	3.797	0.000	Supported
H15	Perceived Enjoyment → Intention to Use	0.383	0.062	6.183	0.000	Supported

p=.000) were positively related to Intention to Use.

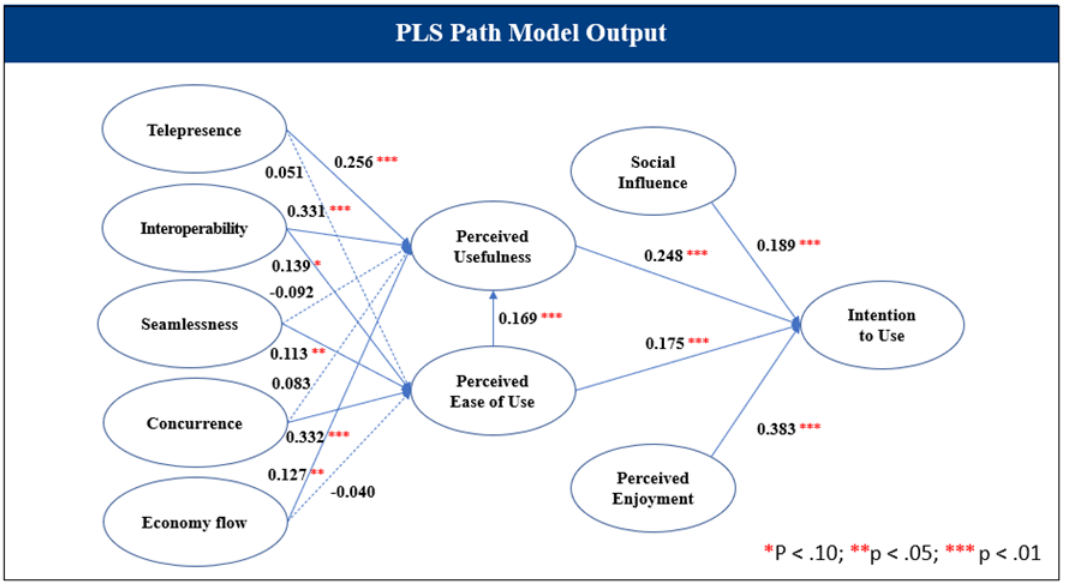
Hypotheses about the effects of Metaverse characteristics on Perceived Usefulness and Perceived Ease of Use were partially supported and partially rejected. The results show that Telepresence was positively associated with Perceived Usefulness (β =.256, t=5.363, p=.000), but was not positively associated with Perceived Ease of Use (β =.051, t=0.736, p=.462). Interoperability had a significant effect on Perceived Usefulness (β =.331, t=6.517, p=.000) and Perceived Ease of Use (β =.139, t=1.858, p=.063). Meanwhile, Seamlessness (β =.113, t=2.036, p=.042) and Concurrence (β =.332, t=4.294, p=.000) were positively related to Perceived Ease of Use but Seamlessness (β =-.092, t=1.432, p=.152) and Concurrence (β =.083, t=1.214, p=.225) were not positively related to Perceived Usefulness. On the other hand, Economy Flow had a significant effect on Perceived Usefulness (β =.127, t=2.427, p=.015), but not on Perceived Ease of Use (β =-.040, t=0.581, p=.561). Therefore, H4, H6, H7, H9, H11 and H12 were supported but H5, H8, H10 and H13 were not supported.

Meanwhile, Hypothesis 14 and 15 were supported, indicating that Social Influence (β =.189, t=3.797, p=.000) and Perceived Enjoyment (β =.383, t=6.183, p=.000) were positively related to Intention to Use.

5. Conclusion

5.1. Discussion

This study examines the factors that influence the intention to use Metaverse by applying the



〈Figure 2〉 Partial Least Squares (PLS) Path Model Output

Extended Technology Acceptance Model (ETAM). Since the pandemic, Metaverse platforms have started to proliferate. They have leveraged the strength of the technologies such as virtual reality (VR) and augmented reality (AR), which allow interaction among people in the three-dimensional virtual world(Kim, 2022). However, new platform such as Metaverse does not necessarily lead to diffusion through user acceptance and adoption. This is because popularization may be delayed due to user rejection and innovation resistance (Choi et al., 2017). Therefore, in order for new platform such as Metaverse to be stably accepted and diffused, it is necessary to explore and analyze the acceptance factors that determine users' intention to use Metaverse from the initial stage of acceptance and diffusion.

This study empirically analyzed various acceptance factors affecting the intention to use the Metaverse by applying the Extended Technology Acceptance model (EATM), i.e., the factors affecting the intention to use the Metaverse were set as Metaverse characteristics such as Telepresence, Interoperability, Seamlessness, Concurrence, and Economy Flow, and personal characteristics such as Social Influence and Perceived Enjoyment, and were tested through a structural model. The results are as follow.

First, Perceived Ease of Use was found to have a positive effect on Perceived Usefulness. These results suggest that the more people perceive the Metaverse as easy to use, the more useful they find it to them. In addition, Perceived Usefulness and Perceived Ease of Use were found to have a positive effect on the intention to use the Metaverse. It was

found that the attitude was formed and the intention to use it increased.

Second, among the Metaverse characteristics, Telepresence, Interoperability and Economy Flow were found to have a positive impact on Perceived Usefulness, and Interoperability, Seamlessness and Concurrence were found to have a positive impact on Perceived Ease of Use.

Telepresence can be described as the feeling of being in a real environment (Davis et al., 2009) or the concept of being connected not only to an avatar but also to other digital spaces and environments in real life (Tasa & Görgülü, 2010). The higher this sense of telepresence, the more useful the Metaverse platform was found to be.

Interoperability refers to a situation where data and information in the real world and the Metaverse are interconnected, so that the results of the user's experiences and actions in the Metaverse are connected to the real world, and the experience in the Metaverse becomes richer and more convenient based on lifelogging information in the real world. The higher this interoperability, the more useful and easy-to-use the Metaverse platform was found to be.

Economy Flow is the concept of whether the products or services present on the platform can be traded. This diversity of transactions can increase the time spent immersed in the platform. The more of these economic flows there are, the more useful the Metaverse platform becomes.

Seamlessness can be described as the concept of whether a digital environment continues to function even when the user is not connected to it (Gilbert, 2011). The more continuity there is, the easier it is to use the Metaverse platform.

Concurrence is the idea that a platform should be accessible to multiple users at the same time. It turns out that the more concurrency you have, the easier it is to use the Metaverse platform.

Third, we found that Social Influence had a positive effect on Intention to Use the Metaverse. These results suggest that the more positive the perception of the Metaverse by the people they care about, the more socially influenced they are to believe that the Metaverse is useful to them, and the more they intend to use the Metaverse. In addition, Perceived Enjoyment had a static effect on the Intention to Use the Metaverse. These results suggest that the more fun and enjoyment people have with the Metaverse, the more they perceive the Metaverse to be useful and accessible to them.

5.2. Theoretical and managerial implications

The theoretical implications of this study are as follows.

First, this study examined the factors affecting the intention to accept the technology by subdividing the factors into technology characteristics (telepresence, interoperability, seamlessness, concurrence, and economy flow) and personal characteristics (social influence and perceived enjoyment) among actual Metaverse users at the current stage of Metaverse technology growth.

Second, as Metaverse research is currently in its infancy, most of the studies conducted are conceptual and typological studies of Metaverses. However, this study provides a basis for empirical Metaverse

research by examining the impact of adopting Metaverse technology through actual Metaverse users.

Third, there have been studies on user acceptance of telepresence and interoperability as characteristics in existing AR and VR studies, but there are no studies on user acceptance of the five different Metaverse characteristics used in this study, which makes it different.

The results of this study provide direction on which technical aspects of the Metaverse should be further enhanced at the enterprise level. A successful Metaverse strategy should be designed to provide an engaging, immersive, and social experience that satisfies users' needs for telepresence, interoperability, and economy flow, while also being seamless, easy to use, and enjoyable.

First, to enhance telepresence, the Metaverse platform should provide high-quality graphics and audio, as well as intuitive controls that allow users to interact with the virtual world in a realistic way. This could include features such as haptic feedback, VR and AR integration, and realistic physics simulation.

Second, to improve interoperability, the platform should allow users to interact seamlessly with other users and applications across different devices and platforms. This could include the development of open standards and APIs that enable the sharing of data and content between different applications and platforms.

Third, to facilitate a smooth economy flow, the platform should provide a robust and transparent economic system that allows the exchange of virtual goods and services. This could include the development of a virtual currency and marketplace, as well as tools for creating and selling user-generated content.

Fourth, to improve the perceived ease of use, the platform should be designed to provide a seamless and intuitive user experience. This could include features such as contextual help and guidance, as well as automated processes that reduce the need for manual intervention.

Fifth, to promote concurrence, the platform should provide tools and incentives for users to collaborate and compete with each other. This could include features such as multiplayer games, virtual events, and social networking tools that encourage users to interact and engage with each other.

Sixth, to increase the intention to use the Metaverse, the platform should leverage social influence by providing social networking tools and features that allow users to connect and engage with each other. This could include features such as user profiles, friend lists, and group chat.

Finally, the platform should be designed to provide a fun and enjoyable experience for users. This could involve the development of engaging and immersive content, as well as features like achievements, rewards, and leaderboards that encourage users to explore and engage with the virtual world.

5.3. Limitations and future research

This section lists a few limitations of this study that should be taken into consideration.

First, since the sample was composed of users who have used the Metaverse platform, it would be meaningful to study adoption resistance among

non-users of the Metaverse platform in the future.

Second, although the dependent variable of this study was the intention to use Metaverse, it would have been a better study if the intention to continue using Metaverse was additionally asked since it was a survey of Metaverse users.

Third, this study was conducted based on the technology acceptance model, but in future studies, it would be more useful to conduct additional verification work using various acceptance models such as value-based acceptance model and expectancy confirmation model.

Fourth, the Metaverse has a variety of technical characteristics, including telepresence, interoperability, seamlessness, concurrence, and economy flow, and personal characteristics, including social influence and perceived enjoyment, but this study covered only five technical factors and two personal factors by synthesizing previous studies on technology acceptance models and the characteristics of the Metaverse. Therefore, if future studies verify the influence relationship between various factors considering the unique characteristics of the Metaverse, it will provide more useful implications for the development of Metaverse technology.

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국문요약

메타버스특성이 이용의도에 미치는 영향에 관한 연구 – 확장된 기술수용모델을 기반으로

김승범* · 이형용**

본 연구에서는 확장된 기술 수용 모델을 적용하여 사용자의 메타버스 사용 의도에 영향을 미치는 요인을 분석했습니다. 즉, 확장된 기술수용모델의 관점에서 메타버스 이용의도에 영향을 미치는 요인을 기술적 특성(원격실재감, 상호운용성, 연속성, 동시성, 경제적 흐름)과 개인적 특성(사회적 영향력, 지각된 즐거움)으로 정의하고, 메타버스 이용의도에 영향을 미치는 요인들을 분석했습니다. 이를 위해 10대부터 60대까지 다양한 연령대의 남녀를 대상으로 설문조사를 실시했으며, 327명의 참여자로부터 수집된 데이터는 SPSS 22.0과 Smart PLS 4.0을 사용하여 분석했습니다. 그 결과 확장된 기술 수용 모델의 선행 요인인 지각된 유용성과 지각된 사용 용이성이 메타버스 사용 의도에 영향을 미치고, 지각된 사용 용이성은 지각된 유용성에 영향을 미치는 것으로 나타났습니다. 원격실재감, 상호운용성, 경제성 흐름은 인지된 유용성에 긍정적인 영향을 미치는 것으로 나타났으며, 상호운용성, 연속성, 동시성은 인지된 사용 용이성에 긍정적인 영향을 미치는 것으로 나타났습니다. 또한 사회적 영향력과 지각된 즐거움은 메타버스 사용 의도에 긍정적인 영향을 미치는 것으로 나타났습니다. 본 연구는 우리의 일상과 플랫폼 소비 환경에 큰 변화를 가져올 새로운 플랫폼으로 주목받고 있는 메타버스에 대한 사용자의 수용 요인을 실증적으로 분석했다는 점에서 의의가 있습니다.

주제어 : 메타버스, 확장된 기술 수용 모델, 메타버스 특성, 사회적 영향력, 인지된 즐거움

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