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Article

Acceptance and use of live streaming on metaverse in Vietnam: An analysis with the UTAUT2

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Abstract: Virtual environments like the Metaverse have been gaining popularity in recent years. Live streaming has gained popularity as a favorite way to entertain among social network users, thanks to its real-time authenticity. This study will utilize the Extended Unified Theory of Acceptability and Use of Technology (UTAUT2) to examine the factors influencing the adoption of live streaming in the Metaverse, a new platform with greater immersion, among citizens in Vietnam. The research used a quantitative approach, collected data from a sample of participants through a structured questionnaire including Performance Expectancy (PEE), Effort Expectancy (EEF), Social Influence (SCI), Hedonic Motivation (HEM), and Experience (EXP). Additionally, technological Self-Efficacy (TSE) as an extended alternative is thought to influence that relationship as well. Results from the PLS-SEM technique was used to examine perception, acceptance, and adoption differences among demographic groups. Remarkably, the results show experience has a remarkable impact on the relationship between behavioral intention and the adoption use Metaverse for livestreaming. This study contributes theoretical value for investors and researchers on the entertainment and technology sectors due to the abilities of the live-streaming industry and the advanced features of metaverse in this digital world.

Keywords: adoption; virtual environment; technology; mixed-reality; use behavior

1. Introduction

The Metaverse has become popular in recent years due to advanced technology. The “Metaverse” is a term used to describe a large interconnected virtual world where individuals can communicate, access immersive digital information, and merge the physical and digital realms through technologies like VR, AR, and MR (Balakrishnan, 2014). Within the Metaverse, live streaming has emerged as a prominent and influential phenomenon (Daniel Thomas, 2023). Live streaming involves the real-time broadcasting of audio and video content over the Internet, enabling users to interact effectively online; and share their experiences, talents, and perspectives with a global audience. Thus, modern advances are expected to expand the live-streaming experience through the Metaverse.

The metaverse is a vast virtual environment that combines augmented reality (AR), virtual reality (VR), and blockchain technology (Nguyen et al., 2024a). It is becoming more closely connected with livestreaming to provide immersive and participatory experiences. Livestreaming in the digital age allows individuals to transmit their virtual experiences, organize live gatherings, and interact with audiences worldwide in real-time (Ki et al., 2024). This collaboration improves social connectedness, enabling viewers to not only observe but actively engage in virtual

concerts, gaming contests, and educational seminars inside the metaverse. By combining the real-time nature of livestreaming with the limitless potential of the metaverse, users may achieve a heightened degree of involvement and communication, erasing the distinctions between virtual and physical worlds.

Multiple reasons contribute to the widespread popularity of live streaming in the Metaverse. Initially, it facilitates prospects for people to participate in collective encounters and groups, fostering a feeling of inclusion and interpersonal engagement. Furthermore, the incorporation of live streaming technology in the Metaverse offers a very profitable opportunity for enterprises to promote their brand, improve their reputation, increase profits, and enhance the viewer's experience (Dwivedi et al., 2023). Furthermore, the advent of live streaming has introduced a novel means of experiencing entertainment, providing immediate entry to previously inaccessible events and encounters. The IT sector is aggressively striving to achieve this goal. While research on the virtual economy in the Metaverse is available, there has been little emphasis given to live streaming in this context. Specifically, existing research has focused on teaching (Nguyen et al., 2024) and banking service (Nguyen et al., 2023a). Most people in Vietnam lack familiarity with the Metaverse concept, and live streams primarily revolve around shopping, gaming, and entertainment on well-known network platforms (Dang et al., 2024). Consequently, only individuals interested in technology and capable of investing in 3D experiences are aware of the Metaverse Livestream. Hence, the objective of the research is to ascertain the inclination of prospective users to embrace live stream technology in the internationally acknowledged Metaverse, drawing on the four aforementioned disparities.

This research aims to examine the implementation of Metaverse for live streaming in Vietnam. It will investigate many aspects utilizing the Extended Unified Theory of Acceptance and Use of Technology (UTAUT2) as the theoretical framework and descriptive measurement as the technique. Understanding the factors and limitations that shape individuals' attitudes and behaviors towards live streaming within the cultural and societal framework is achievable. In order to accomplish the research goals, it is important to explicitly establish the objectives and provide specific questions to provide guidance for the investigation: Firstly, what are the primary determinants that impact the adoption and use of research conducted directly in the Metaverse inside Vietnam? The concept of the Metaverse remains unfamiliar to people in Vietnam, despite it being an ongoing and prevalent trend in the present, rather than something that belongs only to the future. The second inquiry pertains to the disparities in the adoption and use of live streaming across various demographic segments in Viet Nam. The resolution to this topic lies on addressing the subjective and objective aspects of individuals.

Through a quantitative research approach, data will be collected from a sample of participants using a structured questionnaire. The questionnaire will assess participants' perceptions of the UTAUT2 constructs, including Performance Expectancy, Effort Expectancy, Social Influence, Hedonic Motivation, and Technological Self-Efficacy. We will gather demographic data to examine how acceptance and usage of live streaming in the Metaverse vary among different age groups, genders, and educational backgrounds, as well as their intentions and behaviors. Statistical analysis techniques, such as regression analysis, will be applied

to examine the relationships between variables. The collected data will be analyzed using appropriate statistical techniques to draw meaningful conclusions and insights. Six sections comprise the study. Forces are explained in the first section, followed by existing studies, an extended unified theory of UTAUT2, Metaverse, live streaming, and hypothesis development in the second section. Section 3 delves into our research methodology, while Section 4 focuses on data analysis. The results and implications of our findings are discussed in Section 5, leading to the conclusion in Section 6.

2. Literature review

2.1. Metaverse and live streaming

The term "Metaverse" originated from Neal Stephenson's novel "Snow Crash" in 1992 (Joshua, 2017) deriving from a Macedonian word with the same root as the English word "Metaverse" (De Felice et al., 2023). In this space, users can create their digital avatars for the virtual environment (Koohang et al., 2023) which is supported by augmented reality (AR) and virtual reality (VR) technologies. Thus, the up-to-date technology of Metaverse plays a significant role in changing traditional live streaming with its amazing functions following the key terms: immerse, avatar, 3D environment, and interactive (Daniel, 2023).

In China alone, the number of 2021 is 47.2% increase, higher than the figure of 2020 in comparison (Media Entertainment Industry Research Center, 2022). Organizers are able to earn more money from virtual events by sponsorship and advertisements thanks to the powerful features of live streaming, such as live chat, polls, Q&A sessions, which helps enhance connections despite of geographical separation (Gupta, 2020). Zhang and Liu (2024) explore why Chinese users consume video game livestreams, highlighting motivations such as entertainment, social interaction, and information seeking. They emphasize the importance of real-time communication and community building, where user identification with streamers and the gaming community enhances engagement. In contrast, Arun et al. (2021) examines broader streaming service adoption, focusing on binge-watching behaviors driven by relaxation, escapism, and narrative engagement. They find that control over content consumption, high-quality content, and social influences like FOMO play key roles. Both studies underscore that interactive and user-centered features are crucial for driving engagement in livestreaming and streaming platforms. The ability to elicit genuine real-life emotions is a key advantage, as highlighted by Hadi et al. (2023), while immersive and role-playing experiences foster interpersonal communication, making live streaming in the Metaverse more attractive than traditional web-based interactions (Jafar et al., 2023). In 2022, at the singer Ariana Grande's concert in Fortnite (Marco, 2022), her avatar raised and danced with fans during her performance, and it made fun of the audience's experience. In fact, with the infinity of Metaverse's traits, the ability to broaden the connection and experience based on the success of live streaming—the US $70-gained-industry in 2021 (Christopher, 2023), assumed the next development for this virtual environment to have the space to shine (Marco, 2022).

As reality has shown, the Metaverse has attracted giants such as Microsoft, Facebook, etc. to spend the bulk of the money to develop it. For instance, realizing the capability of the Metaverse in the near future, Facebook changed its company's name

to “Meta” in 2021 and invested an average of 10 billion dollars per year (Mike, 2022). In Vietnam, live streaming is a potential career (Vietnam Insider, 2022) and an active activity following Statista, where the tech-savvy populace thrives on social media (Vietnam Insider, 2022). However, these concepts are rudimentary. Taking use of the new trend of Metaverse, the business may tailor their offers to meet the demands and expectations of customers, thereby promoting the integration and general acceptance of live streaming.

2.2. The unified theory of acceptance and use of technology 2 (UTAUT2)

The first Unified Theory of Acceptance and Use of Technology was developed to investigate the acceptance and use of technology in various contexts (Nguyen et al., 2023a; Nguyen et al., 2023b). Many contexts utilize the UTAUT model to gauge acceptance attitudes towards a particular technology. The impact of the four core variables, such as Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Condition on behavioral intention is moderated by four factors: gender, age, experience, and voluntariness of use, shaping the relationship between them. Realizing the presence of Hedonic Motivation (HEM), Price Value (PV), and Habit (HT) have a remarkable influence on using technology, Venkatesh added the three constructs to the original model (Tamilmani et al., 2019). Price Value illustrates the trade-off between the advantages acquired and the price, whereas Habit spoke of the degree of automation unrelated to behavior intention. Thus, this is a modern and comprehensive theory that may explain technology acceptance and use in a wide range of complicated and diverse circumstances. UTAUT2 is, however, a sophisticated and challenging theory to test and evaluate, so it is necessary to modify or expand depending on the environment and technology. The UTAUT2 paradigm is well-suited for studying the adoption of metaverse livestreaming since it encompasses several elements such as hedonic motivation, price value, and habit (Dang et al., 2023). These components are essential for comprehending user participation with metaverse livestreams, since they include both practical and recreational aspects. The model’s emphasis on social impact and conducive settings is well-suited to the interactive and technologically complex nature of metaverse experiences. UTAUT2 establishes a direct connection between the desire to behave in a certain manner and the actual behavior, allowing for accurate predictions of long-term adoption (Nguyen et al., 2024; Nguyen et al., 2023b). This makes it a valuable tool for understanding the intricate dynamics of metaverse streaming adoption.

2.3. Hypothesis development

Understanding the factors influencing people’s acceptance and use of new technology is becoming increasingly important as the rapid pace of technology advances. More scientific research using UTAUT2 has emerged as a reliable model because of its efficiency in mentioned variables. In this research, we modified the UTAUT2 model with two modified elements as regards Technological Self-efficacy and Adoption. Incorporating these variables would enhance the model’s explanatory capacity and provide more profound insights into the elements that influence individuals’ inclination to embrace and use new technologies. The proposed model is

presented in **Figure 1**.

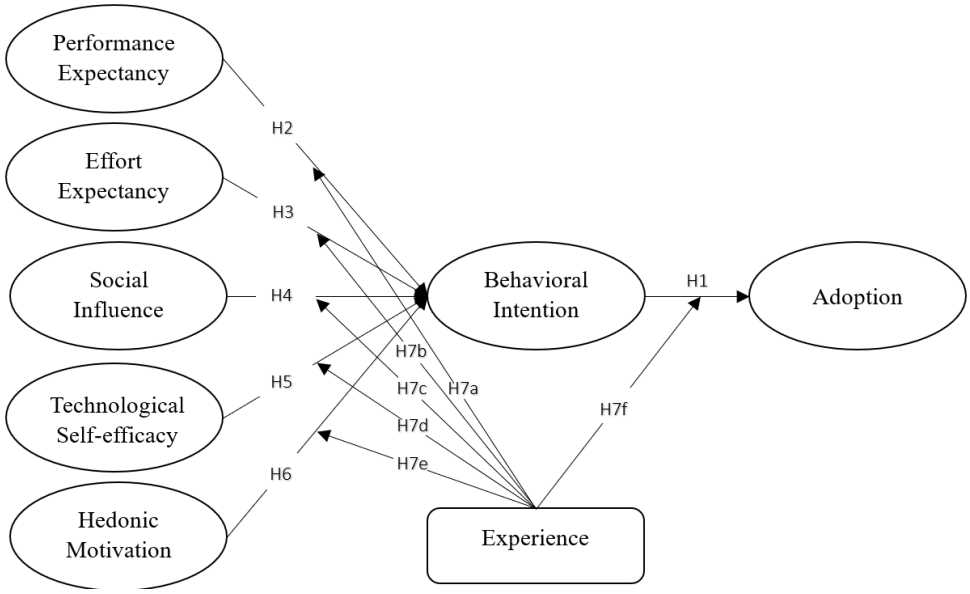

Figure 1. Proposed model.

1) Adoption of live streaming in Metaverse

When mentioning intention, it illustrates the degree of setting up plans for further use consciously. It may be based on the usefulness, easy-to-use technology to decide acceptance and use (Ramírez-Correa et al., 2019). Prior research believed that users may have a strong tendency before accepting a certain technology and they may have an influence on others after that. In fact, social media brings other perspectives and attitudes to communication and changes the ways businesses reflect. Therefore, we hypothesize:

- H1. In Vietnam, Behavioral Intention (BI) has a positive impact on the adoption of live streaming in Metaverse.

2) Behavioral intention

PE illustrates the usefulness of using technology to their performances Venkatesh et al., 2012), and it has a remarkable influence on Behavioral Intention (Venkatesh and Zhang, 2010). In previous research, there is evidence that in the digital media industry (Goswami and Chukkali, 2022; Wong et al., 2014) and Metaverse technology in general (Yang et al., 2022), performance expectancy is also a strong element linked to people' acceptance with a certain technology. Therefore, it is reasonable to build a hypothesis that:

- H2. In Vietnam, PEE has a positive impact on behavioral intention to livestream in Metaverse.

EEF refers to the level of user-friendliness or the anticipated ease of use that people associate with a certain technology. It demonstrates the conviction that using a certain strategy will need no exertion. Chin conducted studies using a rapid method to assess the comparable concept known as Perceived Ease of Use (PEU): Convenient for me; adaptable for interaction; to acquire proficiency in using the system; user-friendly (Chin et al., 2008). In Metaverse, there have been many users and artists used to organize the meetings, playing games, etc. (Marco, 2022), so they are more likely

to be pleased by the simplicity of the use of the Metaverse. As a result, we propose the following hypothesis:

- H3. In Vietnam, EEF has a positive impact on behavioral intention to livestream in Metaverse.

Social Influence (SCI) refers to the impact that others' views, including those of friends, family, and influencers, have on consumers' adoption of a particular technology (Venkatesh et al., 2012). Previous research has shown that Social Influence (SCI) is an aspect that positively affects attitudes toward technology use (Wolff, 2021). Similarly, the intention to live streaming in Metaverse may be encouraged through social tendency around potential users. A tendency to utilize technology is influenced by one's attitude toward technology (Svenningsson et al., 2022). Given the evidence discussed above, social influence plays an essential role in impacting participant's behavioral intentions, which we will examine by the following hypothesis:

- H4. In Vietnam, SCI has a positive effect on behavioral intention to livestream in Metaverse.

Technological Self-efficacy (TSE) is an extended variable added to this study's model because it is thought to be a significant factor (Q. Zhang et al., 2023) in the acceptance of a particular new technology. TSE was first introduced in Bandura's social cognitive theory of career in 1986 and relates to an individual's sense of competence in performing a task or their confidence in applying information technology knowledge with ease and effectiveness (Davis et al., 1989). According to the results of Jason and Foste (2021), technological self-efficacy in the survey positively showed users' beliefs in using new technology. It was discovered that clients with a high level of TSE greatly favor simple mobile technologies. TSE has also been proven in previous research to impact the intention to utilize technology for learning (Teo, 2011) and to use STEM. We contend that people with a high TSE will be more likely to livestream on Metaverse because they have faith in their capability to explore and connect with this innovative and interesting virtual world. Thus, from such improvement, we hypothesize:

- H5. In Vietnam, TSE has a positive impact on behavioral intention to livestream in Metaverse.

Hedonic motivation is described as the desire to achieve something for the sake of interior fulfillment that is concerned with the core of an individual's psychological and emotional experiences (Ryan and Deci, 1985). The research by Tamilmani evaluated the importance of Hedonic Motivation on technology acceptance (Tamilmani et al., 2021). It is understood simply by Baabdullah. (2018) as motivation or hedonic, constituted of pleasure, leisure, amusement, and cheerfulness, and it is required for the usage of contemporary customer BI apps and systems. All research above shows a positive relation to Behavioral Intention (BI), which leads to the following hypothesis:

- H6. In Vietnam, Hedonic Motivation (HEM) has a positive impact on behavioral intention to livestream in Metaverse.

3) Experience

Experience is defined as the number of years that a person has used a technique for a period (Venkatesh et al., 2003). The level of a third variable, or moderator variable, impacts the independent variable in different ways, thereby influencing the

relationship between independent variables and dependent variables in research (Edwards and Lambert, 2007). Those with seasoned skills in technology will have different perceptions and beliefs related to ease of use, usefulness, social influence, technological self-efficacy, and hedonic motivation of Metaverse than those who are lower ones. The elimination of gender and age in the model is believed to not significantly influence on factors mentioned above though some prior studies use them to moderate the relationship between elements affecting technologies and use (Granić, 2022). In conclusion, we put only "Experience" into the model and consider its effect on behavioral intention to use live streaming on Metaverse and people's adoption at the end. In this study context, those who experience well will handle utilities better than others, and it can relate to their adoption to use technology (Venkatesh et al., 2003). Thus, we hypothesize:

- H7a. PEE to Adoption of Live Streaming (ADP) is moderated by experience.
- H7b. PEE to Adoption to live streaming (ADP) is moderated by experience.
- H7c. CSI to Adoption to live streaming (ADP) is moderated by experience.
- H7d. TSE to Adoption to live streaming (ADP) is moderated by experience.
- H7e. HEM to Adoption to live streaming (ADP) is moderated by experience.
- H7f. Behavioral Intention (BI) to Adoption to live streaming (ADP) is moderated by experience.

3. Methodology

3.1. Data collection

Researchers used the quantitative research approach to collect data to test the acceptance and use of live streaming in Metaverse in Vietnam. The survey collects information from participants in Vietnam who have fundamental knowledge and understanding of live stream and Metaverse. Ensuring data collection and reliability and avoiding indiscrimination is the vital element of this research. The sample size was determined based on statistical principles and the need for representativeness. Participants were chosen using a judgment sample and were involved in the study by completing a structured questionnaire and providing data (Nguyen et al., 2024). The questionnaires were converted and translated from English to Vietnamese to reach Vietnamese residents' understanding and then translated back to English to continue researching. In addition, the questions for the target population are screened for their structure and demographics: Different age groups, genders, education levels, income levels, and occupations (Nguyen et al., 2023b). Survey participants can provide more accurate data samples for their personal views since there is no requirement for identification and guaranteed confidentiality of the collected data.

3.2. Measures

Surveys were employed in this study to gather information. Surveys are better suited than other sorts of research on people's behavior since they give research data based on actual observation (Kelley et al., 2003; Nguyen et al., 2023a). An electronic questionnaire was utilized in the current study using Google Forms. The Extended Unified Theory of Technology Use and Acceptance (UTAUT2) model will serve as

the basis for the variables measured in the data collection questionnaire. The variables consist of PEE, EEF, SCI, HEM which are adopted from Nguyen et al. (2023a), EXP, and TSE are adopted from Balakrishnan et al. (2022). The measurement of each construct will be done through a 7-item Likert scale, where participants will rate them from 1 (strongly disagree) to 7 (strongly agree) (Duc et al., 2023). The statements associated with each construct were based on demographic information that developed a commerce measure as recommended by the PLS. Smart-PLS of handling complex data and providing valuable insights into literature that, in a research model, required a sample size ten times the most complex relationship. Therefore, the minimum sample size required is 10 × 7 = 70. The recommended minimum sample size is 103, according to G*Power statistical software version 3.1, with $f^2 = 0.15$, $\alpha = 0.05$, $(1 - \beta) = 0.8$, and 7 predictors.

4. Data analysis

4.1. Statistical analysis

The demographics of the sample are depicted in **Table 1**. The study's data indicates that 303 digital media professionals in Vietnam were surveyed. According to **Table 1**, women make up more than half of the participants, accounting for 54.79%. A recent report by McKinsey reveals that women show a higher preference (41%) than men (34%) for using metaverse platforms and livestreaming videos, and women make up the majority (59%) of viewers compared to men (38%) in the metaverse (Mina and Lareina, 2022). The age distribution of participants shows that 65.35% are between 35 and 50, while those over 50 account for 25.41%. The age groups of 18–20 and 20–35 make up less than 10%, with 6.27% and 2.97% respectively. In Vietnam, 84.16% of participants hold bachelor's degrees, indicating completion of university or college studies. Additionally, 13.53% have professional qualifications beyond a bachelor's degree, while only 2.31% have master's or PhD degrees. Among the respondents, around 44.88% had experience exceeding 2 years. Approximately 43% represented individuals with 1–2 years and 6 months to 1 year, while 11.88% reported less than 6 months of experience.

Table 1. Descriptive statistics.

Demographic characteristics		**Frequency (Total: 303)**	**Percentage**
Gender	Male	137	45.21%
	Female	166	54.79%
Age	18–20 years old	19	6.27%
	20–35 years old	9	2.97%
	35–50 years old	198	65.35%
	Above 50 years old	77	25.41%
Education level	Bachelor's degree	255	84.16%
	Master/Ph.D. degree	7	2.31%
	Professional qualification	41	13.53%

Table 1. (*Continued*).

Demographic characteristics		Frequency (Total: 303)	Percentage
Experience	Under 6 months	36	11.88%
	Above 2 years	136	44.88%
	From 1–2 years	77	25.41%
	From 6 months–1 year	54	17.82%

4.2. Assessing the outer measurement model

Because the partial least square (PLS) approach was better suited for evaluating the theoretical development, it was used to assess the structural models. Furthermore, it allows for the use of a small sample size to test a structural route model and does not require data distributional constraints (Chin, 1998). To assess the measurement model, it is important to consider reliability measures like composite reliability (rho_c), composite reliability (rho_a), and Cronbach's alpha, as well as validity measures including convergent validity and discriminant validity (Sarstedt et al., 2017). Reliability can be evaluated using composite reliability, while model validity can be assessed through convergent and discriminant validity. When estimating reflective measurement models in PLS-SEM, Cronbach's alpha is the minimum acceptable level of internal consistency reliability, while rho_c represents the maximum. Consequently, the construct's reliability should be within the bounds of Cronbach's alpha and the composite reliability (rho_c). The construct reliability values, as shown in **Table 2**, have Cronbach's alpha ranging from 0.793 to 0.938, which exceeds the threshold of 0.7 (Jum and Ira, 2010). Furthermore, **Table 2** reveals that the composite reliability (rho_c) values range from 0.862 to 0.956, exceeding the threshold value of 0.7 (Kline, 2015; Nguyen et al., 2023b). The findings provide evidence for the reliability of the construct. The constructs were considered error-free in an acceptable manner during the final assessment.

Sarstedt et al. (2017) recommended the use of tests for average variance extracted (AVE) for evaluating convergent validity. If AVE is 0.50 or above, it meets the acceptable threshold. When the construct is at or above this level, it generally accounts for (more than) 50% of the variance in its items. Moreover, the AVE values generated, as shown in **Table 2**, surpassed the threshold value of '0.5', ranging from 0.675 to 0.878. These findings suggest that it is achievable to establish convergent validity for all constructs. The authors Sarstedt et al. (2017) employed Fornell-Larker criterion to measure discriminant validity. The AVE values and square roots in **Table 3** exceed the correlations with other constructs, indicating conformity with the Fornell-Larcker condition. Additionally, we can confirm discriminant validity when the indicators have higher loadings on their respective constructs compared to cross-loadings on other constructs (Hair et al., 2017). To evaluate discriminant validity, this study employs cross-loading and relies on prior assumptions. **Table 4** indicates a strong loading of the indicators on their corresponding constructs. This proves discriminant validity. Discriminant validity has been established based on the findings. The analysis findings of the measurement model assessment did not reveal any issues with validity and reliability. Thus, the data that has been collected can be utilized for evaluating and analyzing the structural model.

Table 2. Loading, composite reliability, Cronbach's alpha, and average variance extracted.

Latent construct	Items	Outer loading	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
ADP	ADP1	0.905	0.901	0.931	0.771
	ADP2	0.842			
	ADP3	0.904			
	ADP4	0.859			
BI	BI1	0.856	0.838	0.892	0.675
	BI2	0.832			
	BI3	0.837			
	BI4	0.758			
EEF	EEF1	0.899	0.862	0.915	0.783
	EEF2	0.895			
	EEF3	0.86			
EXP	EXP1	0.937	0.861	0.935	0.878
	EXP2	0.936			
HEM	HEM1	0.919	0.938	0.956	0.844
	HEM2	0.914			
	HEM3	0.925			
	HEM4	0.915			
PEE	PEE1	0.764	0.852	0.9	0.693
	PEE2	0.861			
	PEE3	0.86			
	PEE4	0.841			
SCI	SCI1	0.864	0.793	0.862	0.678
	SCI2	0.889			
	SCI3	0.705			
TSE	TSE1	0.88	0.882	0.919	0.739
	TSE2	0.87			
	TSE3	0.87			
	TSE4	0.818			

Table 3. Fornell-Larker criterion.

Fornell	ADP	BI	EEF	EXP	HEM	PEE	SCI	TSE
ADP	0.878	-	-	-	-	-	-	-
BI	0.789	0.821	-	-	-	-	-	-
EEF	0.639	0.54	0.885	-	-	-	-	-
EXP	0.822	0.722	0.502	0.937	-	-	-	-
HEM	0.757	0.746	0.505	0.74	0.919	-	-	-
PEE	0.509	0.475	0.528	0.433	0.431	0.833	-	-
SCI	0.673	0.644	0.537	0.643	0.705	0.433	0.823	-
TSE	0.73	0.692	0.576	0.626	0.67	0.508	0.73	0.86

Table 4. Cross loading results.

	ADP	BI	EEF	EXP	HEM	PEE	SCI	TSE
ADP1	0.905	0.751	0.615	0.673	0.659	0.429	0.597	0.654
ADP2	0.842	0.614	0.591	0.62	0.572	0.385	0.547	0.616
ADP3	0.904	0.711	0.592	0.713	0.714	0.488	0.626	0.682
ADP4	0.859	0.687	0.46	0.854	0.697	0.476	0.588	0.613
BI1	0.651	0.856	0.436	0.676	0.698	0.413	0.61	0.581
BI2	0.613	0.832	0.353	0.582	0.625	0.355	0.553	0.592
BI3	0.626	0.837	0.375	0.579	0.641	0.376	0.544	0.566
BI4	0.701	0.758	0.607	0.53	0.482	0.415	0.403	0.534
EEF1	0.601	0.527	0.899	0.437	0.464	0.484	0.49	0.524
EEF2	0.543	0.439	0.895	0.416	0.393	0.456	0.455	0.496
EEF3	0.547	0.458	0.86	0.48	0.478	0.46	0.478	0.508
EXP1	0.768	0.685	0.429	0.937	0.737	0.389	0.611	0.591
EXP2	0.772	0.668	0.512	0.936	0.649	0.423	0.594	0.582
HEM1	0.702	0.67	0.493	0.676	0.919	0.423	0.654	0.636
HEM2	0.712	0.669	0.47	0.688	0.914	0.363	0.633	0.633
HEM3	0.686	0.696	0.45	0.654	0.925	0.39	0.658	0.577
HEM4	0.681	0.707	0.443	0.7	0.915	0.406	0.647	0.619
PEE1	0.379	0.359	0.373	0.382	0.361	0.764	0.352	0.349
PEE2	0.44	0.391	0.443	0.354	0.317	0.861	0.351	0.415
PEE3	0.399	0.365	0.423	0.324	0.333	0.86	0.308	0.4
PEE4	0.467	0.454	0.504	0.38	0.413	0.841	0.419	0.506
SCI1	0.609	0.582	0.597	0.546	0.586	0.44	0.864	0.625
SCI2	0.61	0.578	0.433	0.596	0.627	0.337	0.889	0.692
SCI3	0.418	0.409	0.253	0.434	0.532	0.28	0.705	0.461
TSE1	0.647	0.582	0.587	0.505	0.554	0.465	0.653	0.88
TSE2	0.632	0.568	0.499	0.525	0.543	0.436	0.589	0.87
TSE3	0.654	0.597	0.524	0.592	0.602	0.444	0.583	0.87
TSE4	0.579	0.628	0.377	0.526	0.6	0.401	0.677	0.818

4.3. Assessing the inner measurement model

After validating the hypotheses, the 5000 bootstrapping subsamples approach with no sign change option at 95 percent confidence intervals was used to execute the inner structural model and also estimate the route importance of hypotheses (Sarstedt et al., 2017). The use of the PLS-SEM technique allowed for the formulation of hypotheses based on estimations and findings. When testing the hypothesis, the *p*-value of a route is used to determine its strength. When a *p*-value is less than 0.05, it is deemed significant. The β values and *p*-values for these hypotheses can be found in **Table 5** and **Figure 2**. Data analysis shows that the empirical data supported hypotheses H1, H3, H5 and H6 but H4, H6, all moderator effects of H7 were unsupported.

Table 5. The outcome of the structural model examination.

PLS Path	Path coefficients (*β*)	Sample Mean (M)	Standard Deviation (STDEV)	*T* Statistics (|O/STDEV|)	*P* Values	2.5%	97.5%	Remarks
BI → ADP	0.407	0.409	0.062	6.611	0.000	0.289	0.528	Supported
EEF → BI	0.142	0.142	0.07	2.022	0.043	0.003	0.273	Supported
HEM →-> BI	0.312	0.317	0.071	4.361	0.000	0.179	0.461	Supported
PEE → BI	0.031	0.037	0.051	0.602	0.547	−0.05	0.154	Unsupported
SCI → BI	0.006	0.007	0.072	0.086	0.931	−0.136	0.142	Unsupported
TSE → BI	0.208	0.206	0.068	3.078	0.002	0.078	0.339	Supported
EXP × EEF → BI	0.106	0.127	0.059	1.781	0.075	0.031	0.27	Unsupported
EXP × HEM → BI	0.035	0.035	0.065	0.545	0.586	−0.1	0.156	Unsupported
EXP × SCI → BI	−0.093	−0.097	0.067	1.394	0.163	−0.226	0.034	Unsupported
EXP × PEE → BI	−0.073	−0.08	0.055	1.316	0.188	−0.201	0.021	Unsupported
EXP × TSE → BI	0.044	0.037	0.066	0.665	0.506	−0.088	0.172	Unsupported
EXP × BI → ADP	−0.023	−0.023	0.028	0.809	0.418	−0.08	0.03	Unsupported

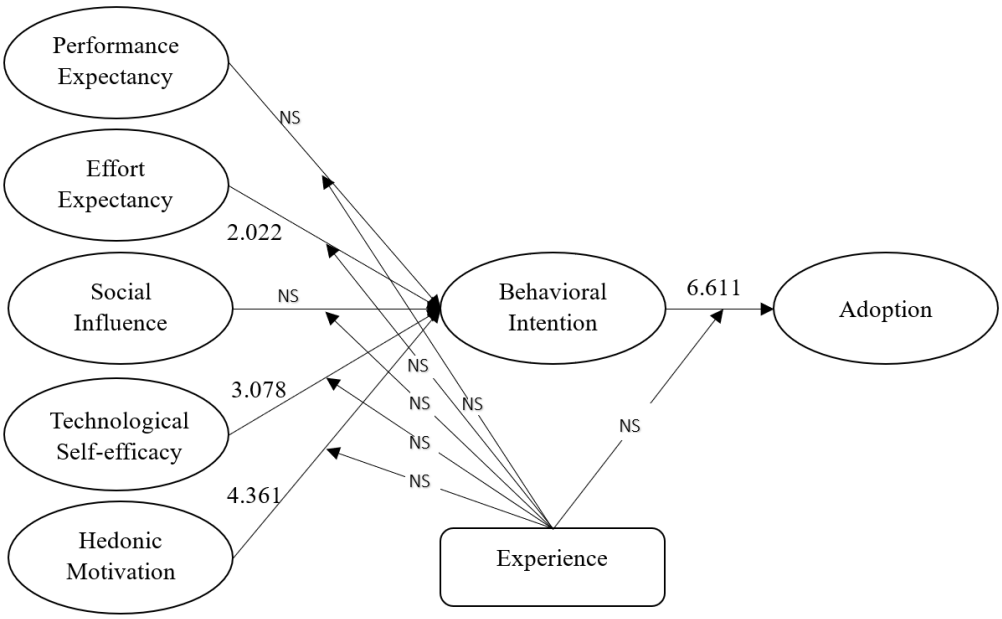

Figure 2. Structural model testing results.

5. Discussions and implications

This study examined the dynamics of live streaming uptake in Vietnam inside the Metaverse, using UTAUT2 as a framework. The complete assessment included of Performance Expectancy (PEE), Effort Expectancy (EEF), Social Influence (SCI), Hedonic Motivation (HEM), and Experience (EXP). In addition, the inclusion of the expanded aspect of Technological Self-Efficacy (TSE) sought to enhance comprehension of user acceptability and adoption in the digital domain. This study uncovers the factors that determine people's tendency to utilize the metaverse for live streaming in Vietnam. The investigation centered on three factors: Effort Expectancy (EEF), Hedonic Motivation (HEM), and Technological Self-Efficacy (TSE). The incorporation of live streaming in the Metaverse is heavily driven by the level of

experience and its impact on behavioral intention. The integration of live streaming into the Metaverse is heavily impacted by individuals' experience in terms of their behavioral intention and familiarity with virtual settings. While the study yielded useful insights, the results may have limited generalizability owing to the sample consisting mostly of persons with high socioeconomic level and previous exposure to digital technology. This research highlights the significance of experience in the Metaverse in influencing the acceptance of live streaming, indicating that those who have used it before are more inclined to embrace this technology. The adoption and use of live streaming in the Metaverse in Vietnam are mostly determined by the user's experience, as shown by data analysis. Young individuals and males with a strong interest in virtual reality are more likely to embrace real-time transmission in the Metaverse, while women show a stronger interest in streaming. User demographics play a crucial role in determining the level of adoption.

Companies that serve as complementors in dynamic ecosystems with developing technologies should pay attention to the substantial consequences of our research. Full cooperation and use of technology in the digital, user-centric environment is vital for enterprises, researchers, and several other sectors. The research indicates that using the Live stream technology in the Metaverse may have extensive importance for people or organizations, exerting a profound influence on defining Vietnam's technological future. When customizing user interfaces, features, and content, it is important to take into account the requirements of both novice and proficient users. To increase the attractiveness of the Metaverse for users, it is important to focus on making it user-friendly, promoting interactive involvement, and providing individualized experiences. Integrating Metaverse-based business and education fosters creativity, problem-solving, and adaptation, all of which are crucial for achieving success in a constantly changing digital realm. Utilizing livestreaming in the Metaverse has the potential to greatly transform corporate sales and client purchases. By giving priority to user-friendly interfaces, interactive participation, and customized encounters, the allure of the Metaverse may be significantly amplified. Businesses in Vietnam should acknowledge the prosperous potential present in the metaverse. As the metaverse continues to grow, they have the ability to use the marketing, engagement, and e-commerce opportunities that it offers. It enhances the range of business models and applications that empower people and corporations to create and monetize novel products and services. The implications and contributions outlined here serve as a foundation for future study. Further research is needed to examine the adoption of Metaverse, levels of technological knowledge, and user preferences by conducting cross-cultural and demographic comparisons.

6. Conclusion

Metaverse technology is expected to drive the future of Internet development as civilization advances. Following the declaration made by the creator of Facebook in 2021, there is a significant level of excitement for groundbreaking technologies that will profoundly change the world. A novel virtual reality realm will supplant the internet, enabling the advancement of education, business, and lifestyle. This research investigated the perceptions of testers in Vietnam on the metaverse system and

analyzed the aspects that impact their willingness to utilize it, specifically in relation to its livestreaming feature. The research revealed a strong correlation between users' beliefs about embracing the metaverse and their degree of innovativeness, which is impacted by many aspects including Effort Expectancy, Technological Self-Efficacy, Hedonic Motivation, and Behavioral Intention. The research offers a thorough comprehension of the many aspects that impact the utilization of live streaming in the metaverse. The objective is to surmount technical, social, and trust barriers in order to attain widespread use of this technology.

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References

Arun, T. M., Singh, S., Khan, S. J., et al. (2021). Just One More Episode: Exploring Consumer Motivations for Adoption of Streaming Services. Asia Pacific Journal of Information Systems, 31(1), 17–42. https://doi.org/10.14329/apjis.2021.31.1.17

Baabdullah, A. M. (2018). Consumer adoption of Mobile Social Network Games (M-SNGs) in Saudi Arabia: The role of social influence, hedonic motivation and trust. Technology in Society, 53, 91–102. https://doi.org/10.1016/J.TECHSOC.2018.01.004

Balakrishnan. (2014). Understanding the immersive experience: Examining the influence of [PhD thesis]. University of Missouri-Columbia.

Balakrishnan, J., Abed, S. S., & Jones, P. (2022). The role of meta-UTAUT factors, perceived anthropomorphism, perceived intelligence, and social self-efficacy in chatbot-based services? Technological Forecasting and Social Change, 180, 121692. https://doi.org/10.1016/j.techfore.2022.121692

Chin, W. W. (1998). The Partial Least Squares Approach to Structural Equation Modeling. Modern Methods for Business Research. Available online: https://books.google.com.vn/books?hl=vi&lr=&id=EDZ5AgAAQBAJ&oi=fnd&pg=PA295&dq=Chin,+W.+W.+(1998)&ots=49yA7vv6ei&sig=Y29Aerl7SNh6kaNJYzVBSUx9reU&redir_esc=y#v=onepage&q=Chin%2C%20W.%20W.%20(1998)&f=false (accessed on 17 June 2024).

Chin, W. W., Peterson, R. A., & Brown, S. P. (2008). Structural Equation Modeling in Marketing: Some Practical Reminders. Journal of Marketing Theory and Practice, 16(4), 287–298. https://doi.org/10.2753/MTP1069-6679160402

Christopher, B. (2023). 18+ Fascinating Live Streaming Statistics & Facts for 2023. Available online: https://findstack.com/resources/live-streaming-statistics/ (accessed on 17 June 2024).

Dang, T. Q, Wei-Han Tan, G., Aw, E. C. X., et al. (2024). Can you resist the virtual temptations? Unveiling impulsive buying in metaverse retail. Asia Pacific Journal of Marketing and Logistics. https://doi.org/10.1108/APJML-09-2023-0911

Dang, T. Q., Tran, P. T., & Nguyen, L. T. (2023). Are You Ready for Tapping into the Metaverse in Higher Education? Integrated by Dual PLS-SEM and ANN Approach. In: Current and Future Trends on Intelligent Technology Adoption. Springer Nature Switzerland.

Daniel, T. T. (2023). Metaverse live streaming is more than just watching shows in a 3D virtual world. Available online: https://venturebeat.com/virtual/metaverse-live-streaming-is-more-than-just-watching-shows-in-a-3d-virtual-world/ (accessed on 17 June 2024).

Daniel, T. (2023). Metaverse live streaming is more than just watching shows in a 3D virtual world. Spanish Journal of Marketing—ESIC. https://doi.org/10.1108/SJME-03-2022-0043

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. Management Science, 35(8), 982–1003. https://doi.org/10.1287/mnsc.35.8.982

De Felice, F., De Luca, C., Chiara, S. Di, & Petrillo, A. (2023). Physical and digital worlds: implications and opportunities of the metaverse. Procedia Computer Science, 217, 1744–1754. https://doi.org/10.1016/j.procs.2022.12.374

Dogruel, L., Joeckel, S., & Bowman, N. D. (2015). The use and acceptance of new media entertainment technology by elderly users: development of an expanded technology acceptance model. Behaviour & Information Technology, 34(11), 1052–1063. https://doi.org/10.1080/0144929X.2015.1077890

Dwivedi, Y. K., Hughes, L., Wang, Y., et al. (2023). Metaverse marketing: How the metaverse will shape the future of consumer research and practice. Psychology and Marketing, 40(4), 750–776. https://doi.org/10.1002/mar.21767

Edwards, J. R., & Lambert, L. S. (2007). Methods for integrating moderation and mediation: A general analytical framework using moderated path analysis. Psychological Methods, 12(1), 1–22. https://doi.org/10.1037/1082-989X.12.1.1

Goswami, S., & Chukkali, S. (2022). A Study to Understand the Behavioral Intentions and Attitudes Towards Using Metaverse. Journal of Pharmaceutical Negative Results. https://doi.org/10.47750/pnr.2022.13.S10.624

Granić, A. (2022). Educational Technology Adoption: A systematic review. Education and Information Technologies, 27(7), 9725–9744. https://doi.org/10.1007/s10639-022-10951-7

Gupta, A. (2020). Live Streaming Market Size, Share, Analysis and Forecast 2030. Available online: https://www.marketresearchfuture.com/reports/live-streaming-market-10134 (accessed on 17 June 2024).

Hadi, R., Melumad, S., & Park, E. S. (2023). The Metaverse: A new digital frontier for consumer behavior. Journal of Consumer Psychology. https://doi.org/10.1002/jcpy.1356

Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. Industrial Management & Data Systems, 117(3), 442–458. https://doi.org/10.1108/IMDS-04-2016-0130

Huggett, J. (2020). Virtually Real or Really Virtual: Towards a Heritage Metaverse. Studies in Digital Heritage, 4(1), 1–15. https://doi.org/10.14434/sdh.v4i1.26218

Jafar, R. M. S., Ahmad, W., & Sun, Y. (2023). Unfolding the impacts of metaverse aspects on telepresence, product knowledge, and purchase intentions in the metaverse stores. Technology in Society, 74, 102265. https://doi.org/10.1016/J.TECHSOC.2023.102265

Jason, D. S., & Lori, L. F. (2021). Does technology self-efficacy influence the effect of training presentation mode on training self-efficacy? Computers in Human Behavior Reports, 4, 100124. https://doi.org/10.1016/J.CHBR.2021.100124

Joshua, J. (2017). Information Bodies: Computational Anxiety in Neal Stephenson's Snow Crash. Interdisciplinary Literary Studies, 19(1), 17–47. https://doi.org/10.5325/intelitestud.19.1.0017

Jum, N., & Ira, H. B. (2010). Psychometric Theory. McGraw-Hill Companies.

Kelley, K., Clark, B., Brown, V., & Sitzia, J. (2003). Good practice in the conduct and reporting of survey research. International Journal for Quality in Health Care, 15(3), 261–266. https://doi.org/10.1093/intqhc/mzg031

Ki, C. W., Chenn, A., Man Chong, S., & Cho, E. (2024). Is livestream shopping conceptually New? a comparative literature review of livestream shopping and TV home shopping research. Journal of Business Research, 174, 114504. https://doi.org/10.1016/j.jbusres.2024.114504

Kline, R. B. (2015). Principles and practice of structural equation modeling, 4th ed. Guilford Press.

Koohang, A., Nord, J. H., Ooi, K. B., et al. (2023). Shaping the Metaverse into Reality: A Holistic Multidisciplinary Understanding of Opportunities, Challenges, and Avenues for Future Investigation. Journal of Computer Information Systems, 63(3), 735–765. https://doi.org/10.1080/08874417.2023.2165197

Marco, Q. G. (2022). Metaverse concerts are getting the red carpet treatment thanks to a new category for this year's MTV Video Music Awards. Available online: https://fortune.com/crypto/2022/08/19/mtv-metaverse-concerts-video-music-awards-roblox/ (accessed on 17 June 2024).

Mike, I. (2022). Meta spent $10 billion on the metaverse in 2021, dragging down profit. Available online: https://www.nytimes.com/2022/02/02/technology/meta-facebook-earnings-metaverse.html (accessed on 17 June 2024).

Mina, A., & Lareina, Y. (2022). Even in the metaverse, women remain locked out of leadership roles. Available online: https://www.mckinsey.com/featured-insights/diversity-and-inclusion/even-in-the-metaverse-women-remain-locked-out-of-leadership-roles (accessed on 17 June 2024).

Miyazaki, K., Uchiba, T., Kwak, H., & An, J. (2022). Characterizing Spontaneous Ideation Contest on Social Media: Case Study on the Name Change of Facebook to Meta. In: Proceedings of the 2022 IEEE International Conference on Big Data (Big Data).

Nguyen, B. H. T., Le, T. H., Dang, T. Q., & Nguyen, L. T. (2023). What role does ai chatbot perform in the f&b industry? perspective from loyalty and value co-creation: integrated Pls-Sem and Ann techniques. Journal of Law and Sustainable Development, 11(4). https://doi.org/10.55908/sdgs.v11i4.794

Nguyen, B. H. T., Dang, T. Q., Nguyen, L. T., & Tran, T. T. T. (2024). Are we ready for education in Metaverse? PLS-SEM analysis. Edelweiss Applied Science and Technology, 8(2), 73–83. https://doi.org/10.55214/25768484.v8i2.693

Nguyen, L. T., Dang, T. Q., & Duc, D. T. V. (2024). The Dark Sides of AI Advertising: The Integration of Cognitive Appraisal Theory and Information Quality Theory. Social Science Computer Review. https://doi.org/10.1177/08944393241258760

Nguyen, L. T., Duc, D. T. V., Dang, T. Q., & Nguyen, D. P. (2023a). Metaverse Banking Service: Are We Ready to Adopt? A Deep Learning-Based Dual-Stage SEM-ANN Analysis. Human Behavior and Emerging Technologies. https://doi.org/10.1155/2023/6617371

Nguyen, L. T., Phan, T. T. C., Dang, D. V. T., & Tran, T. T. T. (2023b). Mobile Payment Adoption in Vietnam: A Two-Staged SEM-ANN Approach BT. In: Current and Future Trends on Intelligent Technology Adoption. Springer Nature Switzerland.

Pan, X. (2020). Technology Acceptance, Technological Self-Efficacy, and Attitude Toward Technology-Based Self-Directed Learning: Learning Motivation as a Mediator. Frontiers in Psychology, 11. https://doi.org/10.3389/fpsyg.2020.564294

Priyansha, S. (2022). The Surge of Virtual Concerts and Live Video Streaming in Metaverse. Available online: https://www.oodlestechnologies.com/blogs/the-surge-of-virtual-concerts-and-live-video-streaming-in-metaverse/ (accessed on 17 June 2024).

Ramírez-Correa, P., Rondán-Cataluña, F. J., Arenas-Gaitán, J., & Martín-Velicia, F. (2019). Analysing the acceptation of online games in mobile devices: An application of UTAUT2. Journal of Retailing and Consumer Services, 50, 85–93. https://doi.org/10.1016/J.JRETCONSER.2019.04.018

Rodriguez-Gil, L., Orduña, P., García-Zubia, J., & López-de-Ipiña, D. (2018). Interactive live-streaming technologies and approaches for web-based applications. Multimedia Tools and Applications, 77(6), 6471–6502. https://doi.org/10.1007/s11042-017-4556-6

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

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2017). Partial Least Squares Structural Equation Modeling. In: Handbook of Market Research. Springer International Publishing. pp. 1–40.

Soltani, I., & Gharbi, J. E. (2008). Journal of Internet Banking and Commerce Determinants and Consequences of the Website Perceived Value. Journal of Internet Banking and Commerce, 13(1).

Svenningsson, J., Höst, G., Hultén, M., & Hallström, J. (2022). Students' attitudes toward technology: exploring the relationship among affective, cognitive and behavioral components of the attitude construct. International Journal of Technology and Design Education, 32(3), 1531–1551. https://doi.org/10.1007/s10798-021-09657-7

Tamilmani, K., Rana, N. P., & Dwivedi, Y. K. (2021). Consumer Acceptance and Use of Information Technology: A Meta-Analytic Evaluation of UTAUT2. Information Systems Frontiers, 23(4), 987–1005. https://doi.org/10.1007/s10796-020-10007-6

Tamilmani, K., Rana, N. P., Prakasam, N., & Dwivedi, Y. K. (2019). The battle of Brain vs. Heart: A literature review and meta-analysis of "hedonic motivation" use in UTAUT2. International Journal of Information Management. https://doi.org/10.1016/j.ijinfomgt.2019.01.008

Tarhini, A., Hone, K., & Liu, X. (2015). A cross-cultural examination of the impact of social, organisational and individual factors on educational technology acceptance between British and Lebanese university students. British Journal of Educational Technology, 46(4), 739–755. https://doi.org/10.1111/bjet.12169

Teng, Z., Cai, Y., Gao, Y., et al. (2022). Factors Affecting Learners' Adoption of an Educational Metaverse Platform: An Empirical Study Based on an Extended UTAUT Model. Mobile Information Systems. https://doi.org/10.1155/2022/5479215

Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. Computers & Education, 57(4), 2432–2440. https://doi.org/10.1016/j.compedu.2011.06.008

Venkatesh, V, Morris, M. G., Davis, G. B. & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly, 27(3), 425. https://doi.org/10.2307/30036540

Venkatesh, V., Thong, J. Y. L. & Xu, X. (2012a). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. MIS Quarterly, 36(1), 157. https://doi.org/10.2307/41410412

Venkatesh, V., & Zhang, X. (2010). Unified Theory of Acceptance and Use of Technology: U.S. Vs. China. Journal of Global

Information Technology Management, 13(1), 5–27. https://doi.org/10.1080/1097198X.2010.10856507

Vietnam Insider. (2022). Live streaming is now a growing livelihood in Vietnam—Vietnam Insider. Available online: https://vietnaminsider.vn/live-streaming-is-now-a-growing-livelihood-in-vietnam/ (accessed on 17 June 2024).

Wolff, J. (2021). How Is Technology Changing the World, and How Should the World Change Technology? Global Perspectives, 2(1). https://doi.org/10.1525/gp.2021.27353

Wong, C. H., Wei-Han Tan, G., Loke, S. P., & Ooi, K. B. (2014). Mobile TV: a new form of entertainment? Industrial Management & Data Systems, 114(7), 1050–1067. https://doi.org/10.1108/IMDS-05-2014-0146

Yang, F., Ren, L., & Gu, C. (2022). A study of college students' intention to use metaverse technology for basketball learning based on UTAUT2. Heliyon, 8(9). https://doi.org/10.1016/j.heliyon.2022.e10562

Zhang, J., & Liu, R. (2024). Why do Chinese people consume video game live streaming on the platform? An exploratory study connecting affordance-based gratifications, user identification, and user engagement. Telematics and Informatics, 86, 102075. https://doi.org/10.1016/j.tele.2023.102075

Zhang, Q., Khan, S., Cao, M., & Khan, S. U. (2023). Factors Determining Consumer Acceptance of NFC Mobile Payment: An Extended Mobile Technology Acceptance Model. Sustainability, 15(4), 3664. https://doi.org/10.3390/su15043664

Zheng, X., Cheung, C. M. K., Lee, M. K. O., & Liang, L. (2015). Building brand loyalty through user engagement in online brand communities in social networking sites. Information Technology & People, 28(1), 90–106. https://doi.org/10.1108/ITP-08-2013-0144