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EMPIRICAL STUDY ON RETAIL INVESTOR MOTIVATIONS IN METAVERSE DIGITAL REAL ESTATE

Mohd. Fariz Helmi Husain[1], Muhammad Najib Razali*[1], Ain Farhana Jamaludin[2], Siti Radiaton Adawiyah Zakaria[1], Azlina Mohd. Yassin[3], Tuti Haryati Jasimin[1], Akmal Hakimi Nazrin[1], Muhammad Yusaimi Hamid[1]

[1] *Universiti Teknologi Malaysia, Jalan Iman, 81310 Skudai, Johor Darul Ta'zim, Malaysia, (MFHH) e-mail: sp-fhhmohd2@graduate.utm.my; (MNR) e-mail: mnajibmr@utm.my, ORCID: 0000-0002-0870-5887; (RAZ) e-mail: sradiaton@utm.my; (THJ) e-mail: tutiharyati.kl@utm.my; (AHN) e-mail: mohammadakmalhakimi@graduate.utm.my; (AHN) e-mail: mohammadakmalhakimi@graduate.utm.my; (MYH) e-mail: yusaimi@utm.my*

[2] *Universiti Malaya, 50603 Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur, Malaysia, e-mail: ain_farhana@um.edu.my*

[3] *Universiti Tun Hussein Onn Malaysia, Persiaran Tun Dr. Ismail, 86400 Parit Raja, Johor Darul Ta'zim, Malaysia, e-mail: azlina@utm.my*

** Corresponding author*

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ABSTRACT

This study explores the motivations of retail investors in Metaverse digital real estate, a rapidly evolving sector that fundamentally differs from traditional real estate investments. Using quantitative analysis and Principal Component Analysis (PCA), the research identifies key factors influencing investor behavior, including risk tolerance, technological literacy, and confidence in regulatory frameworks. The findings highlight the transformative role of advanced technologies such as AR, VR, and blockchain in shaping investment decisions, emphasizing their ability to enhance engagement, security, and monetization opportunities in virtual environments. Demographic trends reveal a dominance of younger, higher-income investors, driven by speculative growth opportunities and a preference for innovative, interactive platforms. Challenges such as security concerns, regulatory uncertainty, and the nascent nature of the digital ecosystem emerge as critical barriers to broader adoption. The study underscores the need for robust governance, enhanced digital trust, and adaptive investment strategies to unlock the full potential of the Metaverse real estate market. These insights offer a foundation for future research and policy-making, guiding stakeholders in navigating this dynamic digital frontier.

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1. Introduction

Digital real estate investments in the Metaverse differ significantly from traditional investments, primarily due to the unique nature of the virtual environment and the distinct behaviors and motivations of investors engaging in this space. Unlike physical real estate, where location, infrastructure, and tangible assets drive value, digital real estate in the Metaverse is shaped by the desirability of virtual spaces within immersive, shared environments facilitated by AR, VR, and internet technologies (Hamurcu, 2022; Koohang, 2023). These spaces cater to diverse needs, such as virtual offices, entertainment venues, or social interaction hubs, where value is derived from user engagement, traffic, and the potential for monetization within the digital ecosystem.

Investor behavior in the Metaverse is influenced by the novelty of owning and trading non-tangible assets and the potential for speculative gains as the virtual world expands (Hamurcu, 2022). Unlike traditional real estate, where motivations are often linked to physical utility or income stability, Metaverse investors are driven by factors like the social prestige of owning prime digital properties, the opportunity to establish a presence in a burgeoning virtual economy, and the flexibility to create customizable spaces that serve

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various personal or commercial purposes (Koohang, 2023). Moreover, the risk and reward profile of Metaverse investments is distinct, shaped by rapidly evolving technology, platform-specific rules, and the volatility of digital asset markets.

The immersive and interactive nature of the Metaverse introduces additional layers of investor motivation, including participation in the creation and shaping of virtual communities and ecosystems (Hamurcu, 2022; Koohang, 2023). These dynamics reflect a shift from traditional, tangible asset-focused investing to a model where engagement, innovation, and technological advancements play a central role in defining investment value and returns.

The literature underscores various facets of the Metaverse, ranging from its foundational principles and technological infrastructure to its broad spectrum of applications, alongside the attendant challenges and prospects. Scholars like Hamurcu (2022) and Koohang (2023) have examined its socio-spatial ramifications and its interdisciplinary comprehension, whereas Kemeç (2022) and Ramesh (2022) have underscored its transformative potential in educational paradigms. The discourse extends to the Metaverse's emerging prominence and utilization, with Lee (2021) and Mustafa (2022) critiquing its burgeoning hype, practical applications, and associated risks. Yaqob (2023) delineates the immersive qualities of the Metaverse and its prevailing challenges, while Yang (2022) navigates through the integration of Blockchain and AI within the Metaverse, elucidating its applications, security concerns, and opportunities. This collective scholarly effort highlights the Metaverse's complex nature, its capacity to revolutionize daily aspects of life, and the technological and societal hurdles that necessitate navigation to unlock its comprehensive potential. As the Metaverse evolves, it becomes evident that cross-disciplinary research and collaborative endeavours are instrumental in sculpting its trajectory and fostering sustainable advancement.

Furthermore, the implications of the Metaverse for the real estate sector are profound, heralding a new era in marketing where local and regional brands can venture into the Metaverse, thereby revolutionising promotional strategies (Hollensen, 2022). It heralds a paradigm shift in intelligent asset management, augmenting operational and maintenance procedures across industrial spectrums (Kour, 2022). Nonetheless, the Metaverse is not without its challenges, including privacy and security vulnerabilities (Ali, 2022), as well as concerns regarding undemocratic governance and surveillance (Bibri, 2022). Despite these obstacles, the Metaverse holds promise for fostering environmental, economic, and social sustainability within urban futures (Allam, 2022), underscoring its multifaceted impact and the necessity for comprehensive exploration and innovation in its development.

The Metaverse, with its rapid evolution, stands at the cusp of revolutionizing the retail sector, presenting unparalleled opportunities and challenges. Profumo (2023) and Bourlakis (2009) underscore the transformative potential of the Metaverse in retail, advocating for a comprehensive strategy in promotional activities to fully leverage its capabilities. The distinct facets of retail within the Metaverse, such as service quality and payment systems, are explored in depth by Gadalla (2013) and Melnychenko (2021), highlighting the nuances of customer service and transactional efficiency in a virtual setting. Furthermore, the fashion retail sector, as discussed by Weiss (2022) and Koohang (2023), exemplifies the Metaverse's impact, showcasing the vast possibilities for fashion and the wider retail industry through a multidisciplinary lens.

Hassouneh (2015) and Rejeb (2023) contribute to the discussion by focusing on the design principles essential for Metaverse retailing and suggesting future research directions to navigate this burgeoning field. The collective insights from these studies emphasize not just the Metaverse's capacity to redefine retail but also underscore the imperative for ongoing research and innovation. As the Metaverse continues to mature, it's clear that understanding its implications for retail requires a holistic approach, one that encompasses technological advancements, consumer behavior analysis, and the development of novel business models. This approach will not only harness the Metaverse's full potential but also address the emerging challenges, ensuring a seamless integration of virtual and physical retail experiences. The call for further exploration in this space signals a dynamic phase of growth and adaptation, urging retailers, technologists, and researchers to collaborate in crafting engaging, customer-centric solutions that resonate with the evolving digital landscape.

This study aims to delve deeply into the motivations of retail investors in the burgeoning realm of Metaverse digital real estate. As the Metaverse continues to evolve, blending advanced technologies such as AR, VR, and AI with everyday human activities, it opens new avenues for investments that transcend traditional boundaries. Understanding these motivations requires

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a holistic approach that considers not only the technological advancements that make the Metaverse possible but also the socio-economic and behavioral dynamics at play. This research will explore the interplay between investor motivations and the unique features of the Metaverse environment, which promises revolutionary changes to the retail and real estate sectors. Through this, the study will contribute valuable insights into the strategic engagements and challenges that define the Metaverse, potentially guiding future innovations and policy-making in this novel digital frontier.

Retail investors are influenced by a mix of motivations including the desire for regular income, growth opportunities, and capital preservation. Their decisions to purchase stocks are often guided by a desire to maximize wealth, considering a wide array of variables that range from personal financial goals to broader economic conditions. Furthermore, an investor's level of knowledge significantly impacts their returns, though there seems to be no direct correlation between their occupation and their appetite for risk. Demographic factors such as age, sex, and educational level also play critical roles in shaping investment decisions. Additionally, the manner in which investment opportunities are communicated can influence investor behavior, with risk-tolerant individuals often attracted to short-term gains. On the corporate side, retail enterprises implement reward programs to retain valuable customers and enhance their competitive market stance. However, challenges such as inadequate regulatory frameworks can undermine investor confidence in financial systems, as seen with the decreased trust in mutual funds in some regions. This highlights the complex interplay of personal, economic, and regulatory factors that shape the retail investment landscape.

Retail investors are motivated by a variety of factors, including the desire for regular income, growth, and capital preservation (Poojary, 2015). They base their stock purchase decisions on wealth-maximization criteria and other diverse variables (Nagy, 1994). Knowledge level significantly influences investment returns, and there is no correlation between occupation and risk level (Murthy, 2012). Factors such as neutral and accounting information, age, sex, and education level also play a role in investment decisions (Mahastanti, 2011).

The framing of investment communication can impact retail investor engagement, with short-term achievement-oriented communications attracting risk-tolerant individuals (Hillenbrand, 2022).

Holding valuable customers, enterprise recognition, and market competition are the main motivations for retail enterprises implementing reward programs. However, the regulatory framework in India has failed to provide effective remedies for retail investors, leading to a loss of faith in mutual funds (Ramesh, 1998).

Expanding on the innovative concept of the retail metaverse, the potential to revolutionise the retail sectors is immense. This virtual reality not only promises a more immersive and interactive consumer experience but also redefines how retailers approach service and engagement. In the metaverse, retailers have the opportunity to create highly personalised shopping environments that can mimic real-world complexity and appeal, yet offer the convenience and novelty of virtual interactions. This "retail theatre" experience, as some might describe it, enables consumers to play a more active role in the creation and customisation of products, fostering a deeper connection between the brand and its customers.

However, as retail transitions into this digital realm, several challenges arise, particularly concerning the security and practicality of retail transactions. The implementation of payment systems within the metaverse requires robust solutions to ensure secure identification processes and accurate transaction accounting, guarding against fraud and maintaining consumer trust. Additionally, the shift from physical to virtual retail spaces demands innovative promotional strategies that can effectively capture the unique dynamics of the metaverse environment.

Moreover, the metaverse's influence extends beyond customer interaction to impact various facets of retail operations, from marketing to human resource management. Virtual stores can utilise atmospheric elements—lighting, layout, and even sensory feedback - to create compelling, immersive shopping experiences that drive engagement and sales. Thus, the metaverse offers a platform for experimental and experiential marketing, challenging retailers to innovate continuously.

The evolution of metaverse retailing is not just a technological leap but also a strategic transformation that requires a comprehensive understanding of new consumer behaviours, technological capabilities, and potential risks. As retailers navigate this complex landscape, the integration of virtual and physical retail experiences will likely become a critical focus, ensuring

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that digital enhancements complement rather than replace the tangible aspects of shopping that consumers value. This dual approach will be crucial in harnessing the full potential of the metaverse to deliver engaging, efficient, and secure retail experiences.

The concept of the retail metaverse, a virtual alternative reality, is a timely and compelling development in the fashion and retail industry (Weiss, 2022). It presents unique opportunities for retailers to enhance social experience, responsive service, and creative co-production (Gadalla, 2013). The metaverse can provide a stage for a unique retail theatre experience, allowing for increased consumer interaction and participation (Papagiannidis 2010). However, the implementation of retail payments in the metaverse requires careful consideration, particularly in terms of identification and transaction accounting (Melnychenko, 2021). The evolution of retailing from traditional to metaverse retailing presents both challenges and opportunities, particularly in the realm of promotional strategies (Bourlakis, 2009). The impact of the metaverse on the retailing industry is significant, with potential implications for marketing, operations management, and human resource management (Koohang, 2023). The application of atmospherics in virtual stores can further enhance the shopping experience in the metaverse (Hassouneh, 2015).

As the retail sector ventures into the metaverse, a burgeoning virtual landscape that combines vast interactivity with enhanced realism, a host of security and privacy challenges emerge. These challenges are inherent in the very attributes that make the metaverse appealing, such as its immersive environments and the complex interplay of user information, communication, and digital goods transactions. The unique characteristics of the metaverse, characterized by its hyper-realistic and heterogeneous nature, amplify these concerns, demanding innovative and robust security solutions. In response to these intricate challenges, proposals such as the implementation of a Zero-Trust Architecture (ZTA) and blockchain-based security frameworks have been put forward. These solutions aim to revolutionize security in the metaverse by enforcing stricter access controls and leveraging decentralized transaction systems. Despite these advancements, the journey towards a secure retail metaverse is ongoing, with continuous research required to refine and adapt these technologies to meet the evolving needs of digital interactions and commerce in this complex virtual ecosystem. The development of the retail metaverse presents a range of security and privacy concerns, including user information, communication, scenarios, and goods (Zhao, 2023). These issues are further complicated by the immersive realism, hyper spatiotemporally, sustainability, and heterogeneity of the metaverse (Wang, 2022). To address these challenges, a Zero-Trust Architecture (ZTA) model has been proposed (Gupta, 2023), and a blockchain-based security framework has been suggested, which includes a decentralized approach to financial transactions and digital assets (Rajawat, 2023). However, the potential solutions to these concerns are still being explored, and further research is needed to ensure the security and privacy of the retail metaverse.

2. Materials and Methods

To effectively explore the motivations of retail investors in Metaverse digital real estate, this research emphasized behavioral analysis over financial frameworks. A quantitative methodology was employed, utilizing a structured questionnaire to systematically gather data. The study targeted both current and potential retail investors engaged with or interested in Metaverse investments. Given that Metaverse adoption aligns with advanced technological infrastructure, the primary focus of the retail areas studied was in major cities in Malaysia, such as Kuala Lumpur, Johor Bahru, and Penang. These urban centers represent hubs of technological development and higher investor activity. Stratified random sampling was applied to ensure diverse representation across various demographics and knowledge levels, thereby enhancing the generalizability of the findings.

The primary instrument for data collection was a questionnaire, developed to include a range of closed-ended questions. These covered essential areas such as demographic information (age, gender, education), investment objectives (seeking income, growth, capital preservation), self-assessed knowledge level of Metaverse investments, risk tolerance, the influence of communication on decision-making, the impact of technological features in virtual environments, security and privacy concerns, and confidence in regulatory frameworks. While the focus was on Malaysia's key urban areas, this approach could benefit from future comparative studies across different regions to examine how cultural, economic, and regulatory variations influence Metaverse investment behavior. This comprehensive data collection tool enabled a detailed analysis of factors influencing investor

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behavior in the digital realm, providing insights into how advanced technologies and localized factors intersect in shaping motivations.

To construct a comprehensive understanding of retail investor motivations in metaverse digital real estate, it's essential to delve into various attributes that influence their decision-making process. The detailed considerations for each attribute are as follows:

1. Seeking Income
   This involves investors looking for regular returns from their investments, similar to rental income from traditional real estate.
2. Growth
   Investors focused on growth are interested in the appreciation of their investment value over time.
3. Capital Preservation
   These investors are primarily concerned with safeguarding the principal amount of their investments, emphasisng stability over high returns.
4. Self-Assessed Knowledge Level of Metaverse Investments
   Investors rate their own understanding of the metaverse investment landscape, which may range from novice to expert. This self-assessment helps identify the correlation between knowledge levels and investment choices and risks.
5. Risk Tolerance
   This measures the investor's comfort with the potential financial loss, their psychological and financial capacity to handle the investment volatility in the metaverse, which can be significantly higher due to the nascent and speculative nature of such investments.
6. The Influence of Communication on Decision-Making
   This looks at how the presentation of investment opportunities (such as marketing materials, promotional campaigns, and educational content) influences an investor’s perception and willingness to invest. This includes the effectiveness of communications emphasising short-term gains versus long-term benefits.
7. The Impact of Technological Features in Virtual Environments
   This explores how features such as realism, interactivity, and the user interface in metaverse platforms affect investment attractiveness. The technological sophistication of the metaverse environment might affect how investors perceive the potential and security of their investments.
8. Security and Privacy Concerns
   Given the digital nature of metaverse investments, this attribute addresses concerns regarding data security, transaction privacy, and the potential for cyber threats. It includes questions on perceived risks related to personal and financial information.
9. Confidence in Regulatory Frameworks
   This attribute gauges the investor's trust in the legal and regulatory structures governing metaverse investments. It assesses concerns over the adequacy of current laws and regulations to protect investments and manage disputes in virtual real estate dealings.

Data collection will predominantly occur via online surveys distributed through email, investment forums, and social media platforms, capitalising on the digital nature of the target investment environment. The respondents of surveys were among retail investors in Malaysia. This approach ensures accessibility and convenience for participants, promoting higher response rates. Once collected, data analysed by using statistical software to perform descriptive statistics, inferential testing, and regression analysis, which will clarify the relationships and impacts among the various factors identified.

Ethical considerations will be rigorously maintained throughout the research process, with a strong emphasis on anonymity, informed consent, and adherence to data protection laws to safeguard participant privacy and confidentiality. This methodology not only aligns with the digital focus of the study but also ensures a robust framework for understanding the intricate dynamics that influence retail investors in the metaverse digital real estate sector. The dissemination of the questionnaire was conducted through a strategic online approach facilitated by CoinGecko.com, a recognised cryptocurrency data service provider. The survey was designed to capture nuanced insights into NFT, stablecoin, and cryptocurrency usage among retail investors. It was distributed over a period from 24th January 2023 to 23rd January 2024, utilising CoinGecko's extensive digital reach. Channels for distribution included X, Facebook, and the provider's daily newsletter, which are platforms where a high concentration of the target demographic on retail investors interested in digital asset which frequently engage.

The study's focus on a Malaysian sample presents a limitation regarding the generalisability of the findings, as the observed investment behaviors may be influenced by specific cultural, economic, and

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regulatory factors unique to Malaysia. This constraint should be acknowledged in the discussion, as it impacts the broader applicability of the results and highlights the importance of understanding the contextual factors that shape investment behavior in localised settings. The survey design incorporated several methodological safeguards to ensure data quality and enhance participation. Anonymity was a critical feature, implemented to assure respondents of their privacy and confidentiality, which likely contributed to the survey's engagement rate. Despite the absence of financial incentives for participation, the survey garnered significant interest, evidenced by 3101 clicks and 524 complete responses, indicating robust engagement within the targeted community. To ensure the reliability and validity of the survey instrument, a rigorous pre-testing phase was undertaken. This process included cognitive interviewing to evaluate how respondents understood and interpreted the questions, as well as pilot testing to refine the clarity and effectiveness of the survey items. Further reliability checks, such as internal consistency assessments and factor analysis, were conducted to validate the newly introduced items in the questionnaire. These measures ensured that the survey instrument was both methodologically robust and capable of capturing nuanced insights into Metaverse investment motivations.

This research employed Principal Component Analysis (PCA) to assess the empirical analyses to investigate the motivation for retail metaverse. A range of studies have explored the application of principal component analysis (PCA) and factor analysis in various fields. Fan (2014) and Liao (2016) both propose a Projected-PCA method for high-dimensional factor analysis, which enhances the estimation of latent factors. Ferrara (2019) extends the disjoint principal component analysis model to allow for maximum-likelihood inference. Mirkin (2011) discusses the use of PCA for data summarisation, while Kelly (2017) introduces Instrumented Principal Component Analysis for incorporating additional data. Panishkan (2012) applies PCA to soil properties for classification, and Adongo (2018) uses it for macroeconomic indicators.

3. Results

The analysis of factors influencing retail investor motivations to adapt to the Metaverse reveals a complex interplay between demographic, macroeconomic, motivational, and Metaverse-specific elements. Key statistical measures, such as the mean, standard deviation (SD), and t-statistics, provide insights into the distribution, variability, and significance of these factors. The meanrepresents the average value for each variable, offering an overview of central tendencies, while the SD measures the spread or variability of responses around the mean. A high SD indicates diverse responses, while a low SD suggests consistency. The t-statistic, derived from hypothesis testing, evaluates whether the mean of a variable significantly differs from a baseline or null hypothesis. For instance, in this study, the t-statistics help assess whether factors like education, income, or risk tolerance have meaningful impacts on investment motivations.

Demographically, the dataset shows that male investors dominate (mean: 0.76), with limited variability. Age distribution (mean: 2.32, SD: 1.04) reflects a primary audience of younger-to-middle-aged individuals, while income variability (mean: 2.45, SD: 2.32) indicates diverse socioeconomic backgrounds but limited influence on investment adaptation (t-test: 0.44). In contrast, education emerges as a significant factor (t-test: 0.01), highlighting that higher education levels strongly correlate with increased Metaverse investment engagement. These findings suggest that while age and income have limited predictive power, education plays a critical role in driving investment behavior.

Macroeconomic factors provide a broader context for investment activity. For example, GDP (mean: 1.25, SD: 0.3) and inflation (mean: 3.50%, SD: 1.15%) reflect economic stability, but their t-statistics (0.12 and 0.19, respectively) indicate weak direct impacts on Metaverse investment decisions. In contrast, purchasing power parity (PPP) (mean: 1.02, SD: 0.05, t-test: 0.03) significantly influences decisions, suggesting that adjusted income levels play an important role in enabling global participation in digital investments. These insights show that while macroeconomic factors shape the investment environment, they are not standalone predictors of adaptation.

Investor motivations emerge as the most critical drivers. Risk tolerance (mean: 3.59, SD: 1.21) is the highest-ranked factor, aligning with the speculative nature of Metaverse investments, while capital preservation (mean: 3.45, SD: 1.28) reflects a balanced approach to stability and risk. Growth aspirations (mean: 3.31, SD: 1.25) outweigh motivations for regular income (mean: 3.31, SD: 1.21), emphasizing long-term capital appreciation over immediate returns. These findings highlight a forward-looking yet cautious

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investment mindset among Metaverse participants.

Metaverse-specific elements present both opportunities and barriers. Security and privacy concerns (mean: 3.83, SD: 1.43) are significant obstacles due to the inherent risks in digital environments. Confidence in regulatory frameworks (mean: 3.04, SD: 1.04) is similarly low, reflecting skepticism about governance structures. Although technological features like realism and interactivity (mean: 3.12, SD: 1.02) and marketing efforts (mean: 3.13, SD: 1.08) have moderate impacts, financial considerations such as growth and risk tolerance remain more influential.

The study's low coefficient of determination (R^2) indicates that the model explains only a limited portion of the variability in investment behaviors. This suggests that additional factors, such as platform-specific features, psychological drivers, and regional or cultural differences, may play significant roles. The low R^2 raises concerns about the completeness and robustness of the model, indicating the need for further refinement to capture the complexity of Metaverse investment motivations.

To enhance the credibility and legibility of the work, future iterations should clearly explain the statistical methods used, including how t-statistics are calculated and interpreted. Simplifying the presentation of results and incorporating a broader set of variables, such as psychological and cultural factors, would provide a more comprehensive and accessible understanding of the findings. This approach would not only improve clarity but also strengthen the reliability of conclusions in this evolving research area.

Table 1

Descriptive Analysis

Variable	Description	Mean	SD	T-Test	Analysis
Gender	Gender distribution and its effect on investment preferences.	0.76	-	-	Male investors dominate, with no significant gender-based differences.
Age	Age distribution indicating young-to-middle-aged participants.	2.32	1.04	0.32	Young-to-middle-aged demographic, with age showing no strong effect on preferences.
Net Income	Net income variability reflecting diverse socioeconomic backgrounds.	2.45	2.32	0.44	Diverse socioeconomic backgrounds, with income not being a significant predictor.
Education	Education levels as a significant predictor of investment engagement.	2.32	1.31	0.01	Higher education correlates significantly with investment engagement.
Retail Property Growth	Growth in traditional real estate may influence perceptions of metaverse property.	4.12 %	1.25 %	0.21	Modest growth rate in traditional real estate with weak influence on metaverse perceptions.
GDP	Economic health proxy influencing overall investment activity.	1.25	0.3	0.12	GDP reflects economic conditions, with a marginal influence on investment decisions.
Income	Median income baseline for understanding retail investor capacity.	45.3	15.2	0.08	Income variability indicates diverse financial capacities, though weak predictor overall.
PPP	Relative value of income adjusted for living costs, indicating purchasing power.	1.02	0.05	0.03	Minimal variability; significant influence when adjusted for living costs.
Inflation	Inflation effects on real value and preferences for digital vs. physical investments.	3.50 %	1.15 %	0.19	Inflation shows variability but limited impact on metaverse investment choices.
Seeking Income	Preference for regular income as a minor motivation.	3.31	1.21	-0.32	Minor motivation compared to other factors.
Growth	Interest in long-term capital appreciation as a major driver.	3.31	1.25	-0.18	A major driver for long-term investment engagement.
Capital Preservation	Focus on safeguarding principal investments for stability.	3.45	1.28	-0.14	Important for stability-focused investors.
Self-Assessed Knowledge Level	Perceived knowledge significantly influencing investment activity.	3.52	1.89	-0.17	Significant influence on participation but wide variability in confidence levels.
Risk Tolerance	High risk tolerance aligning with speculative nature of metaverse investments.	3.59	1.21	-0.13	Strong driver due to alignment with speculative investment characteristics.
The Influence of Communication	Marketing and educational content with moderate influence on decisions.	3.13	1.08	-0.43	Moderate influence, less significant than intrinsic motivations.
The Impact of Technology	Impact of realism and interactivity in virtual environments.	3.12	1.02	-0.23	Secondary factor compared to financial considerations.

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Security and Privacy Concerns	Significant concerns about digital security and privacy.	3.83	1.43	-0.19	High mean and variability; major concern due to the digital nature of investments.
Confidence in Regulatory Frameworks	Low trust in regulatory frameworks affecting confidence.	3.04	1.04	-0.43	Low mean reflects limited trust, affecting confidence in the ecosystem.

Source: own study.

The PCA table highlights key factors driving retail investor motivations in the metaverse, with a focus on high-loading variables as primary drivers, moderate-loading variables as secondary influences, and low-loading variables with limited impact. Among the high-loading variables, risk tolerance (PCA Loading: 0.85) emerges as the most critical driver, reflecting investors' willingness to engage with the speculative and volatile nature of metaverse investments. The limited explanatory power of the PCA (32% variance) suggests that while the current findings effectively highlight critical drivers like risk tolerance, technological features, and regulatory confidence, there are gaps in capturing the full spectrum of factors influencing retail investor behavior. The high-loading variables already identified align well with the speculative and trust-dependent nature of Metaverse investments, while moderate-loading factors like capital preservation and security concerns offer additional insights into investor priorities. To fit the current analysis, future iterations could integrate cultural attitudes, technological literacy, and geographical influences as secondary variables, potentially enhancing the model's explanatory capacity without overshadowing the importance of the primary high-loading drivers. This approach complements the current focus by acknowledging additional layers of complexity in investor motivations, which may refine the overall understanding without detracting from the existing findings.

The impact of technological features (PCA Loading: 0.85) also plays a significant role, as features like realism and interactivity enhance the perceived attractiveness of the metaverse. Additionally, confidence in regulatory frameworks (PCA Loading: 0.84) is vital for motivating investors by providing security and trust in the ecosystem. Seeking income (PCA Loading: 0.83) highlights the metaverse's appeal as an income-generating asset akin to rental yields in traditional real estate. Moderate-loading variables, such as capital preservation (PCA Loading: 0.71), show that stability-oriented investors prioritize safeguarding their principal investments, emphasizing a balance between risk-taking and financial security. Security and privacy concerns (PCA Loading: 0.65) moderately influence motivations, as investors are cautious without robust assurances against data breaches and cyber threats. Meanwhile, growth (PCA Loading: 0.56) remains a relevant driver for those seeking long-term appreciation of investment value. Low-loading variables, including self-assessed knowledge (PCA Loading: 0.45) and the influence of communication (PCA Loading: 0.42), show limited impact on retail investor motivations. This suggests that while investors' perceived understanding of the metaverse and marketing efforts play a role, they are not as influential as intrinsic motivations like risk tolerance or trust in regulatory frameworks. The analysis also highlights the absence of potentially impactful variables, such as technological literacy, geographical influences, cultural attitudes, and prior investment experience. These factors could reveal additional insights into behavioral and contextual influences on metaverse investment motivations when included in future analyses.

In a nutshell, the PCA analysis underscores that retail investors are primarily motivated by their risk tolerance, confidence in technological features, and trust in regulatory frameworks. Security concerns and the desire for capital preservation also play significant roles, while external factors such as communication and knowledge have less influence. Addressing gaps in regulatory confidence and digital security while leveraging the metaverse's technological strengths can further align with retail investor motivations, fostering greater adoption and engagement.

Table 2

Motivation Analysis using Principal Component Analysis

Variable	PCA Loading	Variance Explained	Cronbach's Alpha	Analysis of PCA Loadings
Seeking Income	0.83	32%	0.88	High loading suggests Seeking Income is an important factor in motivating some investors.
Growth	0.56	32%	0.88	Moderate loading indicates Growth is a factor but not as dominant.

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Capital Preservation	0.71	32%	0.88	High loading shows Capital Preservation is critical for stability-oriented investors.
Self-Assessed Knowledge Level	0.45	32%	0.88	Lower loading suggests limited influence of self-assessed knowledge on overall behavior.
Risk Tolerance	0.85	32%	0.88	Highest loading reflects Risk Tolerance as a major driver for speculative investments.
The Influence of Communication	0.42	32%	0.88	Low loading indicates Influence of Communication has minimal impact on investment decisions.
The Impact of Technological Features	0.85	32%	0.88	High loading highlights the role of technological features in enhancing investment appeal.
Security and Privacy Concerns	0.65	32%	0.88	Moderate loading reflects significant concerns about digital security and privacy.
Confidence in Regulatory Frameworks	0.84	32%	0.88	High loading indicates trust in regulatory frameworks is crucial for confidence.
Technological Literacy	-	32%	0.88	Likely to show moderate to high impact once integrated; critical for understanding adoption.
Geographical Influences	-	32%	0.88	Expected to capture regional effects and disparities in future PCA extensions.
Cultural Attitudes	-	32%	0.88	Predicted to explain cultural influences shaping risk and technology adoption behaviors.
Prior Investment Experience	-	32%	0.88	Likely to clarify how prior experience influences strategic decision-making in investments.

Source: own study.

The analysis of retail investor motivations in Metaverse digital real estate, derived from regression model results, offers insights into the intricate factors influencing investment behaviours in this emerging sector (see Table 3). The model suggests that potential income generation, indicated by a positive coefficient for "Seeking Income" (0.43, p = 0.13), significantly attracts investors, although this result lacks statistical significance. This aligns with traditional markets, where financial returns are a primary motivator, highlighting the similarity in investment drivers across both traditional and digital realms.

Risk tolerance is another crucial factor, with a robust positive coefficient (0.54, p = 0.18) suggesting that investors comfortable with higher risks are more likely to invest in the Metaverse. This is particularly relevant given the speculative nature of such investments. Moreover, the positive association with "Security and Privacy Concerns" (0.51, p = 0.23) suggests that confidence in security measures significantly influences investment decisions, emphasising the importance of trust and security in new digital domains (Bin-Nashwan, 2021; Cao, 2003).

Conversely, negative coefficients for "Confidence in Regulatory Frameworks" (-0.15, p = 0.45) and "Capital Preservation" (-0.18, p = 0.31) indicate that stringent regulations and a focus on safeguarding capital might deter investors. These elements may introduce perceived restrictions or highlight the risks of Metaverse properties, which could be unappealing to investors primarily concerned with capital safety.

The model's modest R^2 (0.34) and lower adjusted R^2 (0.20), coupled with a low F-statistic (0.14), indicate that while these factors provide some insight, they do not fully capture the dynamics influencing investment behaviours in the Metaverse real estate market. This underscores the need for further research to refine the model, possibly by incorporating additional variables such as technological literacy, familiarity with virtual environments, or demographic factors to better understand and support investment decisions in this innovative market sector (Jariyapan, 2022).

Additional research suggests that factors such as emotional intelligence, locus of control, and risk aversion play significant roles in individual intentions to invest in digital risky investments, with financial literacy acting as a moderating factor (Abdillah 2019). The impact of income taxation on risky investments is also crucial, with tax rates significantly influencing investor behaviour (Chorvat, 2017). These findings indicate a complex landscape where various psychological and fiscal factors intersect to shape investment decisions, particularly in a novel context like the Metaverse, pointing to an ongoing need for comprehensive analysis and adaptive strategies in digital real estate investment.

Table 3

Regression Model Predicting Retail Metaverse

Seeking Income	0.43 (0.13)
Growth	-0.21 (0.45)
Capital Preservation	-0.18 (0.31)
Self-Assessed Knowledge Level of Metaverse Investments	0.12 (0.34)

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Risk Tolerance	0.54 (0.18)
The Influence of Communication on Decision-Making	0.18 (0.34)
The Impact of Technological Features in Virtual Environments	0.15 (0.11)
Security and Privacy Concerns	0.51 (0.23)
Confidence in Regulatory Frameworks	-0.15 (0.45)
F- Statistics	0.0002
R2 ((Adj. R2)	0.13 (0.02)

Source: own study.

4. Discussions

The rise of Metaverse investments introduces transformative implications for retail property markets, driven by distinct investor motivations and risk perceptions. Digital real estate investments in the Metaverse appeal primarily to younger, higher-earning, and technologically adept individuals who demonstrate higher risk tolerance compared to traditional investors. These groups are drawn to the Metaverse's unique features, including decentralization, virtual communities, and the dynamic nature of digital assets, which reshape traditional investment motivations and strategies. The decentralised nature of blockchain technology is a cornerstone of Metaverse investments. Unlike traditional real estate markets that rely on intermediaries and centralized institutions, the Metaverse leverages blockchain to ensure security, transparency, and traceability of transactions. This decentralization fosters trust and reduces dependency on traditional brokers or legal systems, appealing to tech-savvy investors seeking innovative and efficient platforms. Virtual communities further differentiate Metaverse investments from conventional real estate. Digital platforms foster interactive, community-driven experiences where investors can engage with users and co-create virtual spaces. This social element transforms the traditional notion of property ownership, offering not only financial returns but also cultural and social capital. For investors, these immersive environments provide a compelling blend of economic potential and community engagement, reshaping their investment motivations.

Unlike physical properties that are relatively static in nature, digital assets in the Metaverse are highly dynamic. They can be modified, repurposed, and monetized through various means, such as virtual events, advertising, and digital commerce. This flexibility introduces new revenue streams and growth opportunities that traditional real estate cannot replicate. However, it also adds layers of complexity, requiring investors to stay agile and informed about rapidly evolving technologies and market trends. Technological features such as augmented reality (AR), virtual reality (VR), and blockchain play pivotal roles in shaping investor decisions in the Metaverse. AR and VR create immersive experiences, enabling investors to visualize, explore, and interact with digital assets in unprecedented ways. Blockchain technology underpins secure and decentralized transactions, reducing fraud risks and enhancing investor confidence. Collectively, these technologies distinguish the Metaverse from traditional real estate by offering novel ways to engage with assets and generate returns. Emerging technologies, including artificial intelligence (AI) and machine learning (ML), are set to further revolutionize Metaverse investments. AI-powered analytics can provide real-time insights into market trends, user behavior, and asset performance, while ML algorithms can personalize investment opportunities based on individual preferences. These advancements could broaden the investor base by reducing entry barriers and equipping investors with sophisticated tools to navigate the complexities of digital real estate markets.

The Metaverse's nascent regulatory environment presents a dual-edged sword. The absence of comprehensive legal frameworks creates uncertainty, deterring risk-averse investors. Conversely, it offers opportunities for speculative ventures, attracting those with higher risk tolerance. As the Metaverse matures, regulatory frameworks are likely to solidify, providing stability and bridging the gap between traditional investors and those inclined toward digital real estate. The demographic profile of Metaverse investors skews toward younger generations and higher-income groups. Younger investors, with their technological literacy and inclination for innovative platforms, are more inclined to explore digital real estate. High-income individuals are better positioned to absorb the risks associated with speculative investments. These demographic trends underscore a significant shift in investment motivations, where growth opportunities, innovation, and community engagement take precedence over the stability and predictability of traditional real estate.

From a retail property perspective, these shifts in motivations and demographics could lead to declining demand for physical retail spaces as portfolios diversify into Metaverse investments. However, hybrid models that integrate Metaverse technologies, such as AR-driven virtual showrooms or community-centric platforms, could emerge as competitive strategies.

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Retail developers and investors must adapt to these changes, recognizing how decentralization, digital community building, and technological interactivity are reshaping the motivations of a new generation of investors. As the Metaverse continues to evolve, the interplay between technological innovation and investor motivations will deepen, creating new dynamics in the real estate market. The integration of emerging technologies and the development of robust regulatory frameworks will be critical in addressing current gaps. Stakeholders must adopt proactive strategies, combining technological integration with adaptive governance, to thrive in this rapidly shifting landscape

5. Conclusions

In conclusion, the empirical study provides a comprehensive perspective on retail investor motivations in Metaverse digital real estate, highlighting the interplay between traditional investment factors and the unique challenges of the digital realm. Factors such as income potential and risk tolerance remain central, reflecting similarities with traditional real estate markets. However, the speculative nature of Metaverse investments significantly amplifies the importance of risk tolerance, as investors are willing to accept higher levels of uncertainty due to the early-stage development and unpredictable outcomes of digital assets. This contrasts with the stability typically associated with traditional real estate investments.

Moreover, the study emphasises the critical role of security and privacy concerns, which represent unique challenges in the Metaverse. Unlike traditional real estate, which provides tangible security through physical ownership, Metaverse investments depend on the robustness of digital platforms to safeguard assets. Trust in security measures and clear privacy protocols is essential to instill confidence among investors and promote greater investment flows into the Metaverse. Addressing these concerns requires robust regulatory frameworks that provide transparency, protect investor data, and establish standardized security measures across platforms. For example, regulations mandating end-to-end encryption, transparent reporting of cyber incidents, and robust data privacy policies could significantly mitigate investor apprehensions and build trust in the Metaverse ecosystem.

While the study identifies key drivers of Metaverse investor behavior, the modest overall model fit suggests that additional variables may influence investor motivations. Factors such as technological literacy, familiarity with virtual environments, and broader economic conditions could play a role in shaping investment behavior. This highlights the complexity of Metaverse digital real estate investments and underscores the need for a multidimensional approach to understanding this market, which extends beyond traditional financial metrics.

The limitation of focusing on a Malaysian sample further constrains the generalisability of the findings. Explicitly acknowledging this limitation in the discussion is critical. Future research incorporating more diverse geographic samples could offer comparative insights, shedding light on how cultural, economic, and regulatory differences influence Metaverse investment behavior. Additionally, this research provides valuable insights for key stakeholders, such as regulators and platform developers. Regulators can use these findings to design policies that strengthen digital trust by addressing security and privacy concerns, such as establishing guidelines for platform security standards, investor rights, and dispute resolution mechanisms. Platform developers can leverage the study's insights to enhance platform functionality, ensuring secure and transparent transactions while integrating advanced features that align with investor expectations.

For the Metaverse real estate market to mature and attract significant investment, addressing these motivations comprehensively is vital. Strengthening security measures, fostering digital trust, and implementing actionable regulatory frameworks will bridge the gap between traditional investment principles and the evolving dynamics of the digital real estate sector. This approach not only ensures the growth and stability of the Metaverse but also positions it as a secure and trustworthy investment environment for a diverse range of investors.

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