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A SEM-PLS INVESTIGATION OF CYBERSECURITY LITERACY AND FINANCIAL PRUDENCE IN GENERATION Z'S DIGITAL INVESTMENT DECISIONS

UMA ANÁLISE SEM-PLS SOBRE A ALFABETIZAÇÃO EM SEGURANÇA CIBERNÉTICA E A PRUDÊNCIA FINANCEIRA NAS DECISÕES DE INVESTIMENTO DIGITAL DA GERAÇÃO Z

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Abstract
This study aims to analyze the influence of cybersecurity literacy and financial prudence on investment decision-making among Generation Z in Central Java, Indonesia. Alongside the rapid expansion of digital investment platforms, a comprehensive understanding of cybersecurity and prudent financial management has become an essential determinant in the investment decision-making process, particularly among digital natives. This research adopts a quantitative approach employing a survey design involving 330 Generation Z respondents aged 18–27 years in Central Java who possess experience or interest in digital investment activities. Data were analyzed using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method to examine the relationships among the proposed variables. The findings indicate that cybersecurity literacy exerts a positive and statistically significant effect on investment decisions ($\beta = 0.312$; $p < 0.001$). Financial prudence likewise demonstrates a positive and significant influence on investment decisions ($\beta = 0.287$; $p < 0.001$). Furthermore, risk perception is found to mediate the relationship between cybersecurity literacy and investment decisions ($\beta = 0.156$; $p < 0.01$). These results suggest that Generation Z

Resumo
Este estudo tem como objetivo analisar a influência da alfabetização em segurança cibernética e da prudência financeira na tomada de decisões de investimento entre a Geração Z na província de Java Central, na Indonésia. Paralelamente à rápida expansão das plataformas de investimento digital, uma compreensão abrangente da segurança cibernética e da gestão financeira prudente tornou-se um fator determinante no processo de tomada de decisões de investimento, particularmente entre os nativos digitais. Esta pesquisa adota uma abordagem quantitativa, empregando um projeto de pesquisa com 330 entrevistados da Geração Z, com idades entre 18 e 27 anos, na região de Java Central, que possuem experiência ou interesse em atividades de investimento digital. Os dados foram analisados por meio do método de Modelagem de Equações Estruturais – Mínimos Quadrados Parciais (SEM-PLS) para examinar as relações entre as variáveis propostas. Os resultados indicam que a alfabetização em segurança cibernética exerce um efeito positivo e estatisticamente significativo nas decisões de investimento ($\beta = 0{,}312$; $p < 0{,}001$). A prudência financeira também exerce influência positiva e significativa nas decisões de

individuals with higher levels of cybersecurity literacy are more likely to make rational and well-considered investment decisions, taking risk factors into account more carefully. Financial prudence also serves as an important predictor in mitigating speculative investment behavior. The practical implications of this study underscore the necessity of integrating cybersecurity education into financial literacy curricula, developing user-friendly investment platforms equipped with transparent security features, and implementing comprehensive investor education programs tailored specifically to the characteristics of Generation Z.

Keywords: Cybersecurity Literacy. Financial Prudence. Investing Decision. Z Generation. Digital Investing. Behavioral Finance.

investimento (β = 0,287; p < 0,001). Além disso, constatou-se que a percepção de risco medeia a relação entre o conhecimento em segurança cibernética e as decisões de investimento (β = 0,156; p < 0,01). Esses resultados sugerem que os indivíduos da Geração Z com níveis mais elevados de alfabetização em segurança cibernética são mais propensos a tomar decisões de investimento racionais e bem ponderadas, levando em conta os fatores de risco com maior cuidado. A prudência financeira também funciona como um importante indicador na mitigação de comportamentos de investimento especulativos. As implicações práticas deste estudo ressaltam a necessidade de integrar a educação em segurança cibernética aos currículos de educação financeira, desenvolver plataformas de investimento fáceis de usar e equipadas com recursos de segurança transparentes, e implementar programas abrangentes de educação do investidor adaptados especificamente às características da Geração Z.

Palavras-chave: *Conhecimento em Segurança Cibernética. Prudência Financeira. Decisão de Investimento. Geração Z. Investimento Digital. Finanças Comportamentais.*

1 INTRODUCTION

The era of digitalization has fundamentally reshaped the investment landscape, particularly for Generation Z individuals born between 1997 and 2012 who have grown up as digital natives. In Indonesia, the number of young investors has increased exponentially, as evidenced by data from the Indonesia Stock Exchange indicating a substantial rise in investors under the age of 30 in recent years. This trend is closely associated with the widespread accessibility of digital investment platforms, social media, and fintech applications that enable investment participation with relatively low initial capital (Hasan, Ayub, Ellahi, & Saleem, 2022; Zhao & Zhang, 2021).

Nevertheless, this increased accessibility also introduces new challenges, particularly concerning cybersecurity and prudent investment decision-making. Although Generation Z demonstrates a high level of digital proficiency, research suggests that their awareness of cybersecurity risks in financial contexts remains insufficient (Terták &

Kovács, 2023). Cross-national studies reveal that the disparity between general digital competence and digital data security knowledge may reach up to 30 percentage points, with digital data protection consistently representing the weakest domain. In Palestine, for example, the rapid development of fintech has necessitated coordinated initiatives among regulators, financial institutions, and industry stakeholders to strengthen digital infrastructure, enhance technological capacity, and establish a clearer and more adaptive regulatory framework (Hurani, Abdel-Haq, & Camdzic, 2024).

Within the sphere of digital investment, cybersecurity literacy has emerged as a critical yet relatively underexamined factor in the behavioral finance literature. In contrast to traditional financial literacy which primarily emphasizes knowledge of financial products and personal financial management cybersecurity literacy encompasses the capacity to recognize cyber threats, safeguard personal and financial data, and make secure decisions within digital environments (J. Kumar, Rani, Rani, & Rani, 2024; Urrea & Garcia-Garcia, 2023). Empirical studies by Ruiz *et al*. (Ruiz, 2026) and Alqudah *et al*. (Alqudah, Alarabiat, Alomari, Abu Dalbouh, & Alqudah, 2026) underscore the importance of cybersecurity literacy in shaping investment decision-making, particularly in mitigating exposure to fraud and digital scams. These findings highlight the growing urgency of strengthening cybersecurity awareness within digital financial services.

Concurrently, financial prudence constitutes a vital dimension of rational investment behavior. Prudence reflects an individual's inclination to exercise caution, avoid excessive risk-taking, and engage in deliberate evaluation prior to making financial decisions (Almansour, Elkrghli, & Almansour, 2023; Bawalle, Lal, Khan, & Kadoya, 2026; P. Kumar, Islam, Pillai, & Sharif, 2023). For Generation Z who are extensively exposed to investment-related content through social media platforms and financial influencers (finfluencers) financial prudence functions as a protective mechanism against speculative investment practices and herd behavior (Warkar & Durai, 2025).

Central Java, as one of Indonesia's provinces with a substantial Generation Z population and rapid digital economic expansion, offers a pertinent context for this investigation. Its demographic profile, high internet penetration rate, and expanding fintech ecosystem create a distinctive environment for examining the investment behavior of digital natives. Despite this relevance, empirical studies that simultaneously integrate

cybersecurity literacy and financial prudence within a comprehensive investment decision-making framework remain limited.

Addressing this gap, the present study incorporates a cybersecurity perspective into the traditional behavioral finance framework. By examining the influence of cybersecurity literacy and financial prudence on the investment decisions of Generation Z, this research seeks to contribute both theoretically and practically to the advancement of investor education, the design of secure digital investment platforms, and the formulation of investor protection policies in the digital era (Fu, Fraser, & Arcodia, 2024; Netshiunda & Madzvamuse, 2025).

Specifically, this study aims to analyze how cybersecurity literacy shapes investment decision-making among Generation Z within an increasingly complex digital risk environment. Drawing upon behavioral finance and risk perception theories, it evaluates the direct effects of cybersecurity literacy and financial prudence on investment decisions. Furthermore, the study investigates whether risk perception functions as a mediating variable linking cybersecurity literacy to investment behavior. Finally, it explores the interaction effect between cybersecurity literacy and financial prudence in explaining how Generation Z navigates digital investment uncertainty and cyber-related risks.

2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

This study integrates multiple theoretical perspectives to construct a comprehensive conceptual framework.

2.1 Behavioral finance theory

Behavioral Finance Theory integrates psychological insights with financial economics to explain anomalies and biases in investment decision-making. The theory posits that investors are not always fully rational and may be influenced by cognitive and emotional biases such as overconfidence, herding, anchoring, and availability bias (Calzadilla, Bordonado-Bermejo, & González-Rodrigo, 2021; DeBondt, Forbes, Hamalainen, & Gulnur Muradoglu, 2010). Within this framework, financial prudence can

be conceptualized as a protective trait that mitigates the adverse effects of behavioral biases and enhances rational investment decision-making (P. Kumar *et al*., 2023).

2.2 Technology acceptance model (TAM)

The Technology Acceptance Model (TAM), introduced by Davis (1989), explains how users adopt and utilize technology. The model posits that perceived usefulness and perceived ease of use influence users' attitudes and behavioral intentions toward technology adoption (Jain & Raman, 2023; Loe, Ratnawati, & Pristiana, 2024). In digital investment settings, cybersecurity literacy may shape perceptions of platform security, which constitute essential components of perceived usefulness and perceived ease of use. TAM is therefore relevant for understanding how Generation Z adopts digital investment platforms while considering cybersecurity aspects (Chong, Ong, & Tan, 2021; Sembel, Widjaja, & Antonio, 2024).

2.3 Cybersecurity literacy

Cybersecurity literacy is defined as an individual's capacity to understand, identify, and respond effectively to cybersecurity threats in digital activities, including financial transactions and online investment practices. This concept extends beyond general digital literacy by emphasizing security, privacy, and data protection dimensions (Buenestado-Fernández, Ramírez-Montoya, Ibarra-Vazquez, & Patiño, 2023; Jose & Ghosh, 2025). In the context of digital investment, cybersecurity literacy includes knowledge of encryption mechanisms, multi-factor authentication, phishing schemes, malware threats, and secure practices when utilizing online investment platforms (Buenestado-Fernández *et al*., 2023).

Empirical evidence suggests that although Generation Z are digital natives, they do not inherently possess adequate cybersecurity literacy. A study conducted in India found that determinants of information security awareness among Generation Z vary significantly and require structured educational interventions (Fu *et al*., 2024; Netshiunda & Madzvamuse, 2025). Similarly, research in Romania involving Generation Z university students revealed that while 81.9% of respondents were aware of cybercrime risks, 53%

did not implement specific protective measures (Hasan *et al*., 2022). These findings highlight a substantial gap between awareness and actual protective behavior.

2.4 Financial prudence

Financial prudence refers to a personality trait characterized by caution, deliberation, and the avoidance of excessive risk in financial decision-making. Rooted in behavioral finance and economic psychology, this concept recognizes that financial decisions are shaped not only by rational-economic considerations but also by individual psychological characteristics (Hassan *et al*., 2025; P. Kumar *et al*., 2023). In the investment domain, financial prudence encompasses several key dimensions decision cautiousness the tendency to gather sufficient and relevant information before making investment decisions, avoidance of excessive risk a preference for investments with measurable and manageable risk profiles, long-term orientation a focus on long-term financial objectives rather than short-term speculative gains, and financial discipline the ability to regulate impulses and emotions when making investment decisions (Qi, Chatterjee, Worthy, Herndon, & Wojdynski, 2024).

Research focusing on Generation Z indicates that financial prudence significantly contributes to the formation of sound investment behavior. A study conducted in Indonesia demonstrated that financial literacy and prudent financial behavior positively influence Generation Z's investment decisions (Mahmud, Joarder, & Muheymin-Us-Sakib, 2022). However, this generation remains susceptible to behavioral biases such as overconfidence and herding, which may diminish cautious decision-making in investment contexts (Hanif, Nadlifatin, Hutama, Noor Ali, & Persada, 2024).

2.5 Investment decision

A digital investment decision refers to the process through which investors select among financial alternatives by evaluating expected returns against potential risks using online financial products and digital investment platforms (Bhatia, Chandani, Divekar, Mehta, & Vijay, 2022; Johri, Wasiq, Kaur, & Asif, 2023). For Generation Z, investment decisions exhibit distinctive characteristics shaped by the digital environment. The

availability of digital trading platforms, mobile applications, and real-time information facilitates easier participation in financial markets. However, these advantages also introduce new challenges, including information overload, fear of missing out (FOMO), and social pressure originating from social media networks (Sharma & Sengar, 2025; Warkar & Durai, 2025). Empirical studies indicate that financial literacy, risk tolerance, awareness, and risk perception significantly influence Generation Z's investment decisions (Mohta & Shunmugasundaram, 2024).

2.6 Generation Z as digital natives

Generation Z, born between 1997 and 2012, represents the first cohort to grow up entirely within the era of digital technology and mobile internet. Their status as digital natives shapes financial and investment behaviors that differ substantially from those of previous generations (Hasan *et al*., 2022; Mahmud *et al*., 2022). They are highly accustomed to technological tools, access information instantaneously, and conduct financial transactions primarily through digital platforms (Qi *et al*., 2024).

2.7 The effect of cybersecurity literacy on investment decisions

Cybersecurity literacy equips investors with the necessary knowledge and competencies to identify and manage cyber risks associated with digital investment activities. Individuals with higher cybersecurity literacy are better positioned to evaluate platform security, safeguard personal and financial data, and avoid cyber fraud and scams (J. Kumar *et al*., 2024). These capabilities enhance confidence and trust in digital investment platforms, thereby supporting more informed and rational investment decisions (Amalia, 2025; Judijanto & Husnayetti, 2024). Empirical studies indicate that security awareness and digital financial literacy positively influence digital investment decisions among Generation Z (Jose & Ghosh, 2025; Sembel *et al*., 2024). Based on these theoretical and empirical considerations, the first hypothesis is proposed:

H1: Cybersecurity literacy has a positive and significant effect on investment decisions among Generation Z in Central Java.

2.8 The effect of financial prudence on investment decisions

Financial prudence reflects a cautious and deliberate approach to financial decision-making. Investors with high levels of prudence are more likely to collect comprehensive information, conduct thorough risk assessments, and avoid impulsive or speculative investment choices (Johri *et al*., 2023). For Generation Z, who are exposed to abundant investment information and strong social media influence, financial prudence functions as a protective mechanism that promotes rational decision-making consistent with individual risk profiles (Warkar & Durai, 2025). Research demonstrates that prudent financial behavior, such as disciplined planning and risk evaluation, positively affects investment decisions (Khalisharani, Johan, & Sabri, 2022; Yahaya, Zainol, Abidin, & Ismail, 2019). Furthermore, risk aversion, a core component of prudence, significantly influences investment choices (Choung, Chatterjee, & Pak, 2023; Koskelainen, Kalmi, Scornavacca, & Vartiainen, 2023). Accordingly, the second hypothesis is formulated as follows:

H2: Financial prudence has a positive and significant effect on investment decisions among Generation Z in Central Java.

2.9 The mediating role of risk perception

Risk perception refers to an individual's subjective assessment of the probability and potential adverse consequences of a decision. In digital investment contexts, risk perception includes financial risk (potential losses), security risk (data breaches and fraud), and operational risk (system failures) (Fu *et al*., 2024; Netshiunda & Madzvamuse, 2025). Cybersecurity literacy influences how investors interpret and evaluate cybersecurity risks, which subsequently shapes their investment decisions (Hassan *et al*., 2025; Qi *et al*., 2024). Prospect Theory emphasizes the central role of risk perception in decision-making under uncertainty. Investors with higher cybersecurity literacy are likely to possess a more accurate understanding of cyber-related risks, enabling more realistic risk assessments and more informed investment decisions (Fu *et al*., 2024; Netshiunda & Madzvamuse, 2025). Empirical findings further suggest that risk perception mediates the

relationship between awareness and investment decisions (Hasan *et al*., 2022). Therefore, the third hypothesis is proposed:

H3: Risk perception mediates the relationship between cybersecurity literacy and investment decisions among Generation Z in Central Java.

2.10 The moderating role of financial literacy

Financial literacy refers to the ability to understand fundamental financial concepts, investment instruments, and principles of financial management. A high level of financial literacy enables investors to critically assess financial information, comprehend the risk-return trade-off, and align investment decisions with long-term financial objectives (Al-Adwan *et al*., 2023; Raut & Kumar, 2024). In the relationship between financial prudence and investment decisions, financial literacy may function as a moderating variable that strengthens the influence of prudence on decision quality (Adil, Singh, & Ansari, 2022). Investors who possess both high financial prudence and strong financial literacy are better equipped to translate cautious attitudes into optimal and well-informed investment decisions. Conversely, prudence without adequate financial knowledge may result in overly conservative or suboptimal choices. Prior research indicates that financial literacy moderates the relationship between behavioral biases and investment decisions, reinforcing the impact of psychological traits on investment behavior. Accordingly, the fourth hypothesis is formulated as follows:

H4: Financial literacy moderates the relationship between financial prudence and investment decisions among Generation Z in Central Java, such that higher financial literacy strengthens the positive effect of financial prudence on investment decisions.

3 RESEARCH METHOD

3.1 Research design

This study adopts a quantitative approach employing a cross-sectional survey design. The quantitative method is selected because it is appropriate for testing causal relationships among variables and for generalizing findings to a broader population. The

cross-sectional design enables data collection at a single point in time, thereby providing efficiency in measuring respondents' perceptions, attitudes, and behaviors related to cybersecurity literacy, financial prudence, and investment decisions. The research is explanatory in nature, aiming to examine and clarify the causal relationships among variables based on the proposed theoretical framework. This methodological approach aligns with prior studies investigating Generation Z's investment behavior through quantitative methods and structural modeling techniques (J. Hair, Sarstedt, Ringle, & Gudergan, 2024).

3.2 Population and sample

3.2.1 Population

The population of this study comprises Generation Z individuals residing in Central Java who have experience or interest in digital investment. Generation Z is defined as individuals born between 1997 and 2012, corresponding to an age range of 14–29 years in 2026. However, to ensure respondents possess sufficient legal capacity and relevant investment experience, this study limits the population to individuals aged 18–27 years. The inclusion criteria are as follows: (1) Residing in Central Java; (2) Aged between 18 and 27 years; (3) Having at least six months of experience investing through digital platforms (e.g., stocks, mutual funds, cryptocurrency, or other financial instruments), or demonstrating serious investment interest as evidenced by owning an investment account or participating in investment education programs; (4) Having internet access and actively using digital platforms for financial activities.

3.2.2 Sample and sampling technique

This study employs purposive sampling, a non-probability sampling technique in which respondents are selected based on specific criteria relevant to the research objectives. This approach allows the researcher to target individuals who possess characteristics aligned with the phenomenon under investigation. The required sample size is determined based on the criteria for Structural Equation Modeling–Partial Least

Squares (SEM-PLS). According to Hair *et al*. (J. F. Hair, Risher, Sarstedt, & Ringle, 2019), the minimum sample size for SEM-PLS should be at least ten times the maximum number of structural paths directed at any single latent construct within the model. In this study, the construct receiving the highest number of structural paths has four, resulting in a minimum required sample size of 40 respondents. To enhance statistical power, model stability, and generalizability, this study targets 330 respondents. This sample size is consistent with similar research examining investment behavior among Generation Z.

Although a small number of indicators fell slightly below 0.70, they remained above the acceptable minimum threshold of 0.50 and were retained due to their theoretical relevance and acceptable composite reliability values. All constructs achieved AVE values above 0.50 and composite reliability values above 0.70, confirming satisfactory convergent validity and internal consistency reliability. Discriminant validity was assessed using the Heterotrait–Monotrait ratio (HTMT), with all values below the recommended threshold of 0.90, indicating adequate construct distinctiveness.

3.3 Data analysis methods

3.3.1 Validity and reliability tests

Before conducting the main analysis, instrument validity and reliability are assessed. Convergent validity is evaluated using the Average Variance Extracted (AVE), with a minimum threshold of 0.50, and factor loadings, with a minimum acceptable value of 0.70. Discriminant validity is assessed using the Fornell–Larcker criterion and the Heterotrait–Monotrait Ratio (HTMT), with an upper threshold of 0.85. Reliability is examined using Cronbach's Alpha and Composite Reliability, both of which must exceed 0.70.

3.3.2 Descriptive analysis

Descriptive statistical analysis is conducted to describe respondents' demographic characteristics and the distribution of research variables. The descriptive statistics include mean, standard deviation, frequency, and percentage. This analysis provides an overview

of respondent profiles and the levels of cybersecurity literacy, financial prudence, risk perception, financial literacy, and investment decisions among Generation Z in Central Java.

3.3.3 Structural equation modeling-partial least squares (SEM-PLS)

The primary analysis utilizes SEM-PLS conducted with SmartPLS 4.0 software. SEM-PLS is selected for several methodological advantages: (1) It can accommodate complex research models involving multiple constructs and indicators. (2) It does not require strict assumptions of multivariate normality. (3) It is suitable for relatively small to moderate sample sizes. (4) It enables simultaneous testing of direct, mediating, and moderating effects. (5) It emphasizes prediction and theory development.

3.3.4 Mediation test

Mediation analysis is conducted to test Hypothesis 3 concerning the mediating role of risk perception in the relationship between cybersecurity literacy and investment decisions. The bootstrapping procedure with 5,000 resamples is applied to estimate indirect effects and construct confidence intervals. Mediation is considered statistically significant when the confidence interval does not include zero.

3.3.5 Moderation test

Moderation analysis is performed to examine Hypothesis 4 regarding the moderating role of financial literacy in the relationship between financial prudence and investment decisions. The moderating variable is operationalized by creating an interaction term through multiplying financial prudence and financial literacy. Moderation is considered significant if the path coefficient of the interaction term is statistically significant ($p < 0.05$).

3.3.6 Assumption and robustness tests

To ensure the robustness and validity of the findings, several additional tests are conducted: (1) Multicollinearity test, using the Variance Inflation Factor (VIF), with a maximum acceptable value of 5. (2) Common method bias test, assessed using Harman's single-factor test. (3) Sensitivity analysis, performed by comparing results across different subgroups (e.g., gender and level of investment experience) to evaluate the consistency of the findings. (4) These procedures collectively ensure the reliability, validity, and robustness of the empirical results.

4 RESULTS AND DISCUSSION

4.1 Descriptive statistics of research variables

Table 1 presents the descriptive statistics for the main research variables.

Table 1

Descriptive Statistics of Research Variables

Variables	Mean	Std. Deviation	Min
Cybersecurity Literacy	3.68	0.72	1.85
Threat Awareness	3.82	0.68	2.00
Protection Knowledge	3.65	0.78	1.60
Security Behavior	3.58	0.81	1.40
Security Attitude	3.68	0.75	1.80
Financial Prudence	3.72	0.69	2.00
Decision Prudence	3.85	0.66	2.25
Excessive Risk Avoidance	3.62	0.74	1.75
Long Term Planning	3.78	0.71	2.00
Financial Discipline	3.63	0.76	1.50
Risk Perception	3.45	0.68	1.91
Risk Financial	3.52	0.71	2.00
Security Risk	3.58	0.72	1.75
Operational Risk	3.25	0.75	1.67
Financial Literacy	3.56	0.74	1.86
Basic Financial Knowledge	3.68	0.70	2.00
Investment Product Knowledge	3.52	0.78	1.60
Financial Management Skills	3.48	0.76	1.75
Investment Decisions	3.64	0.66	2.12
Instrument Selection	3.72	0.68	2.00
Asset allocation	3.58	0.72	1.67
Transaction Frequency	3.48	0.75	2.00
Investment Horizon	3.75	0.69	2.00

Risk Management	3.68	0.71	1.75

The results show that, overall, respondents have a fairly good level of cybersecurity literacy (M = 3.68, SD = 0.72), with threat awareness being the highest-rated dimension (M = 3.82) and security behavior the lowest (M = 3.58). This indicates that, although Generation Z is aware of cyber threats, the implementation of security practices in actual behavior still needs improvement.

Respondents' financial prudence is also at a fairly good level (M = 3.72, SD = 0.69), with decision-making caution as the highest-rated dimension (M = 3.85) and financial discipline as the lowest (M = 3.63). This suggests that Generation Z tends to be careful in decision-making, but still faces challenges in maintaining long-term financial discipline.

Respondents' risk perception was at a moderate level (M = 3.45, SD = 0.68), with security risk perceived as the highest (M = 3.58) and operational risk as the lowest (M = 3.25). Respondents' financial literacy was also at a moderate level (M = 3.56, SD = 0.74), with basic financial knowledge higher than financial management skills.

Overall, respondents' investment decisions were at a fairly good level (M = 3.64, SD = 0.66), with investment horizon as the highest-rated dimension (M = 3.75) and transaction frequency as the lowest (M = 3.48). This indicates that Generation Z tends to have a long-term investment orientation, but is still in an exploratory stage, with transaction frequency not yet very active.

4.2 Hypothesis testing

4.2.1 Evaluation of the measurement model (Outer Model)

Before testing the hypotheses, an evaluation of the measurement model was conducted to ensure the validity and reliability of the constructs. Table 2 presents the results of the measurement model evaluation. The results show that all constructs have Cronbach's Alpha and Composite Reliability values above 0.7, and AVE values above 0.5, indicating good convergent validity and reliability. All factor loadings were above 0.7 (not shown in the table for efficiency). Discriminant validity tests using the Fornell-

Larcker criterion and HTMT also yielded satisfactory results, with all HTMT values below 0.85, indicating that the constructs are conceptually distinct. Multicollinearity tests indicated that all VIF values were below 5 (ranging from 1.82 to 3.45), suggesting no serious multicollinearity issues. The common method bias test using Harman's single factor test showed that a single factor explained 38.6% of the variance, below the 50% threshold, indicating that common method bias is not a serious concern in this study.

Table 2

Measurement Model Evaluation Results

Contruct	Cronbach's Alpha	Composite Reliability	AVE	Description
Cybersecurity Literacy	0.912	0.926	0.648	Valid & Reliabel
Financial Prudence	0.895	0.918	0.652	Valid & Reliabel
Risk Perception	0.878	0.905	0.638	Valid & Reliabel
Financial Literacy	0.889	0.912	0.642	Valid & Reliabel
Investment Decision	0.908	0.924	0.656	Valid & Reliabel

4.2.2 Evaluation of the measurement model (Inner Model)

After confirming that the measurement model is valid and reliable, the structural model was evaluated to test the research hypotheses. Table 3 presents the results of the hypothesis testing.

Table 3

Hypothesis Testing Results

Hypothesis	Path Coefficient (β)	T-Statistics	P-Value	Result
H1	Cybersecurity Literacy → Investment Decision	0.312	5.847	0.000***
H2	Financial Prudence → Investment Decision	0.287	5.423	0.000***
H3	Cybersecurity Literacy → Risk Perception → Investment Decision (Indirect Effect)	0.156	3.245	0.001**
H4	Financial Prudence × Financial Literacy → Investment Decision	0.128	2.687	0.007**

Note: $p < 0.001$; $p < 0.01$; $p < 0.05$

4.2.2.1 Hypothesis testing 1

The analysis results indicate that cybersecurity literacy has a positive and significant effect on investment decisions ($\beta = 0.312$, $t = 5.847$, $p < 0.001$). Thus,

Hypothesis 1 is supported. This finding suggests that Generation Z individuals with higher cybersecurity literacy tend to make better, more measured, and rational investment decisions. The effect size (f^2) for this relationship is 0.185, which falls into the medium category, indicating that cybersecurity literacy has a substantial impact on investment decisions.

4.2.2.2 Hypothesis testing 2

The analysis results show that financial prudence has a positive and significant effect on investment decisions ($\beta = 0.287$, $t = 5.423$, $p < 0.001$). Thus, Hypothesis 2 is supported. This indicates that Generation Z individuals with higher financial prudence tend to make more careful, planned, and risk-aligned investment decisions. The effect size (f^2) for this relationship is 0.168, which is also in the medium category.

4.2.2.3 Hypothesis testing 3

To test the mediation, an analysis of the indirect effect was conducted using bootstrapping with 5,000 subsamples. The results show that risk perception mediates the relationship between cybersecurity literacy and investment decisions (indirect effect $\beta = 0.156$, $t = 3.245$, $p < 0.01$, 95% CI [0.062, 0.258]). Since the confidence interval does not include zero, the mediation is considered significant. Thus, Hypothesis 3 is supported.

Further analysis shows that cybersecurity literacy has a positive and significant effect on risk perception ($\beta = 0.425$, $t = 8.234$, $p < 0.001$), and risk perception has a positive and significant effect on investment decisions ($\beta = 0.367$, $t = 6.892$, $p < 0.001$). These findings indicate that cybersecurity literacy influences investment decisions both directly and indirectly through risk perception. Generation Z individuals with high cybersecurity literacy have more accurate and realistic risk perceptions, which in turn facilitate more informed investment decisions. The type of mediation observed is partial mediation, as both the direct effect ($\beta = 0.312$, $p < 0.001$) and the indirect effect ($\beta = 0.156$, $p < 0.01$) are significant. The proportion of mediation (VAF = Variance Accounted For) is 33.3%, indicating that 33.3% of the effect of cybersecurity literacy on investment decisions is mediated by risk perception.

4.2.2.4 Hypothesis testing 4

To test the moderation, an interaction term was created by multiplying financial prudence and financial literacy (after mean-centering). The results show that the interaction term has a positive and significant effect on investment decisions ($\beta = 0.128$, $t = 2.687$, $p < 0.007$). Thus, Hypothesis 4 is supported.

To understand the nature of the moderation, a simple slope analysis was conducted by dividing financial literacy into two groups (high and low, based on a median split). The results show that for the high financial literacy group, the effect of financial prudence on investment decisions is stronger ($\beta = 0.398$, $p < 0.001$) compared to the low financial literacy group ($\beta = 0.176$, $p < 0.05$). These findings indicate that financial literacy strengthens the positive effect of financial prudence on investment decisions. In other words, financial prudence is more effective in producing optimal investment decisions when accompanied by adequate financial literacy.

4.2.3 Evaluation of the overall model

The structural model overall demonstrates good fit. The R-square value for investment decisions is 0.624, indicating that 62.4% of the variance in investment decisions is explained by cybersecurity literacy, financial prudence, risk perception, financial literacy, and the interaction term. The R-square value for risk perception is 0.181, indicating that 18.1% of the variance in risk perception is explained by cybersecurity literacy. The Q-square value (predictive relevance) for investment decisions is 0.398, which is greater than zero, indicating that the model has good predictive relevance. Overall, this research model demonstrates strong predictive capability and can explain a substantial proportion of the variance in Generation Z's investment decisions.

Table 4

Summary of Structural Model Evaluation

Endogen Construct	R-Square	R-Square Adjusted	Q-Square
Risk Perception	0.181	0.178	0.112
Investment Decision	0.624	0.618	0.398

4.2.4 Discussion of findings

4.2.4.1 The effect of cybersecurity literacy on investment decisions

The findings of this study indicate that cybersecurity literacy has a positive and significant effect on the investment decisions of Generation Z in Central Java ($\beta = 0.312$, $p < 0.001$). This result is consistent with previous research showing that security and digital financial literacy influence cryptocurrency investment experiences (Fadli, M., 2025). It also aligns with studies demonstrating that awareness of cybersecurity risks affects investment intention (Alhanatleh, Khaddam, Abudabaseh, Alghizzawi, & Alzghoul, 2024).

The positive influence of cybersecurity literacy on investment decisions can be explained through several mechanisms. *First*, cybersecurity literacy enhances investors' confidence in using digital investment platforms. Generation Z individuals who understand cyber threats and protective measures feel safer and more comfortable conducting online investment transactions (Hasan *et al*., 2022). *Second*, cybersecurity literacy equips investors with the ability to evaluate the security of investment platforms, enabling them to select more trustworthy and secure platforms (Chong *et al*., 2021; Sembel *et al*., 2024). *Third*, cybersecurity literacy reduces vulnerability to fraud and cyber threats that may lead to significant financial losses. Investors who understand phishing techniques, social engineering, and malware are better able to identify and avoid such threats (J. Kumar *et al*., 2024; Raut & Kumar, 2024). *Fourth*, cybersecurity literacy facilitates good security practices such as using strong passwords, enabling multi-factor authentication, and regularly updating software, all of which help protect investment accounts and sensitive financial data (Al-Adwan *et al*., 2023).

These findings have important implications in the Indonesian context, where digital investment adoption among Generation Z continues to grow. Although Generation

Z are digital natives, their awareness and implementation of cybersecurity practices in financial contexts still need improvement (Buenestado-Fernández *et al*., 2023). Research conducted in Romania revealed that although 81.9% of Generation Z students were aware of cybercrime risks, 53% did not take specific protective measures (Hasan *et al*., 2022). A similar situation is likely to occur in Indonesia, where a significant gap may exist between cybersecurity awareness and actual protective practices.

4.2.4.2 The effect of financial prudence on investment decisions

The findings of this study indicate that financial prudence has a positive and significant effect on the investment decisions of Generation Z in Central Java ($\beta = 0.287$, $p < 0.001$). This result is consistent with previous research demonstrating that prudent financial behavior positively influences investment decisions. It also aligns with studies showing that risk aversion, a key component of prudence, significantly affects investment choices (Choung *et al*., 2023; Koskelainen *et al*., 2023). The positive effect of financial prudence on investment decisions can be explained through the perspective of behavioral finance. Prudence functions as a protective mechanism that helps investors avoid detrimental behavioral biases (Khalisharani *et al*., 2022; Yahaya *et al*., 2019). Investors with higher levels of prudence tend to be more deliberative, gather sufficient information, and evaluate risks comprehensively before making investment decisions (Khalisharani *et al*., 2022; Yahaya *et al*., 2019).

4.2.4.3 The mediating role of risk perception

The findings of this study indicate that risk perception mediates the relationship between cybersecurity literacy and investment decisions (indirect effect $\beta = 0.156$, $p < 0.01$). The type of mediation identified is partial mediation, meaning that cybersecurity literacy influences investment decisions both directly and indirectly through risk perception. This finding is consistent with previous research demonstrating that risk perception serves as a mediator in the relationship between awareness and investment decisions (Fu *et al*., 2024; Netshiunda & Madzvamuse, 2025).

The mediating mechanism can be explained through Prospect Theory. According to this theory, individuals evaluate decisions under conditions of uncertainty based on their perception of risk and return (Fu *et al*., 2024; Netshiunda & Madzvamuse, 2025). Cybersecurity literacy shapes how investors perceive cyber-related risks in digital investment activities. Investors with higher cybersecurity literacy possess a more accurate understanding of cyber threats, their likelihood, and potential consequences (Hassan *et al*., 2025; Qi *et al*., 2024).

Accurate and realistic risk perception facilitates more informed investment decisions. Investors who understand cybersecurity risks are better able to implement appropriate mitigation strategies, select more secure platforms, and evaluate the trade-off between risk and return more comprehensively. Conversely, investors with low cybersecurity literacy may develop inaccurate risk perceptions, either underestimating risk, which may lead to excessive risk-taking behavior, or overestimating risk, which may discourage participation in digital investment (Al-Adwan *et al*., 2023; Raut & Kumar, 2024).

These findings suggest that interventions aimed at improving the quality of Generation Z's investment decisions should not focus solely on enhancing cybersecurity literacy but also on calibrating risk perception. Educational programs should help young investors develop balanced and accurate risk perceptions, neither overly optimistic nor excessively pessimistic, so that they can make optimal investment decisions (Al-Adwan *et al*., 2023; Raut & Kumar, 2024). In this study, the security risk dimension recorded the highest mean score within the risk perception construct (M = 3.58), indicating that Generation Z in Central Java is relatively aware of cybersecurity risks. However, operational risk showed the lowest mean score (M = 3.25), suggesting that awareness of system failures and platform-related risks still requires further improvement.

4.2.4.4 The moderating role of financial literacy

The findings of this study indicate that financial literacy moderates the relationship between financial prudence and investment decisions ($\beta = 0.128$, $p < 0.007$). Specifically, financial literacy strengthens the positive effect of financial prudence on investment decisions. Among respondents with high financial literacy, the effect of financial prudence

on investment decisions is stronger (β = 0.398) compared to those with low financial literacy (β = 0.176).

This finding is consistent with previous research demonstrating that financial literacy moderates the relationship between behavioral biases and investment decisions (Al-Adwan *et al*., 2023; Raut & Kumar, 2024). It also aligns with studies indicating that financial literacy reinforces the influence of psychological factors on investment behavior (Hassan *et al*., 2025; Qi *et al*., 2024).

The moderating mechanism can be explained as follows. Financial prudence without adequate financial literacy may result in overly conservative or suboptimal decisions. Investors who are prudent but lack financial literacy may avoid investment opportunities that actually match their risk profile due to a limited understanding of investment products and risk management strategies (Al-Adwan *et al*., 2023; Raut & Kumar, 2024).

Conversely, investors who possess both high prudence and strong financial literacy are better able to translate their cautious attitude into concrete and optimal investment decisions. They are more capable of selecting appropriate financial instruments, implementing effective diversification strategies, and managing risk using suitable approaches (Hassan *et al*., 2025; Qi *et al*., 2024).

These findings have important implications for the design of investor education programs. Programs that focus solely on improving financial literacy without addressing psychological traits such as prudence may not effectively enhance investment decision quality. Instead, integrated programs that combine financial literacy education with the development of financial prudence are likely to produce better outcomes (Al-Adwan *et al*., 2023; Raut & Kumar, 2024).

In the context of this study, respondents' financial literacy was at a moderate level (M = 3.56), with basic financial knowledge scoring higher (M = 3.68) than financial management skills (M = 3.48). This indicates that although Generation Z demonstrates a relatively good understanding of fundamental financial concepts, their practical financial management skills still require further improvement (Al-Adwan *et al*., 2023; Raut & Kumar, 2024).

5 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study investigates the influence of cybersecurity literacy and financial prudence on investment decisions among Generation Z in Central Java, incorporating the mediating role of risk perception and the moderating role of financial literacy. Based on the analysis of data obtained from 330 respondents using the SEM-PLS approach, several key conclusions can be drawn.

First, cybersecurity literacy has a positive and statistically significant effect on investment decisions among Generation Z in Central Java ($\beta = 0.312$, $p < 0.001$). Individuals with higher levels of cybersecurity literacy tend to make more rational, measured, and well-considered investment decisions. This finding underscores the critical role of cybersecurity awareness as a fundamental determinant in digital investment decision-making.

Second, financial prudence also demonstrates a positive and significant influence on investment decisions ($\beta = 0.287$, $p < 0.001$). Generation Z individuals who exhibit higher levels of prudence are more likely to engage in cautious, well-planned investment behavior aligned with their individual risk profiles. Financial prudence functions as a protective mechanism that mitigates behavioral biases and reduces the likelihood of speculative decision-making.

Third, risk perception is found to mediate the relationship between cybersecurity literacy and investment decisions (indirect effect $\beta = 0.156$, $p < 0.01$). Cybersecurity literacy influences investment decisions both directly and indirectly through risk perception. Individuals with stronger cybersecurity literacy exhibit more accurate and realistic assessments of risk, which subsequently facilitate more informed investment decisions. The mediation effect identified is partial, with approximately 33.3% of the total effect of cybersecurity literacy on investment decisions transmitted through risk perception.

Fourth, financial literacy moderates the relationship between financial prudence and investment decisions ($\beta = 0.128$, $p < 0.007$). Specifically, financial literacy strengthens the positive impact of financial prudence on investment decisions. Among

individuals with higher financial literacy, prudence more effectively translates into optimal investment decisions compared to those with lower levels of financial literacy. This finding suggests that prudence is most effective when supported by adequate financial knowledge.

The structural model demonstrates substantial explanatory power, with an R-square value of 0.624 for investment decisions, indicating that 62.4% of the variance in investment decisions is explained by cybersecurity literacy, financial prudence, risk perception, financial literacy, and the interaction term. The Q-square value of 0.398 further indicates strong predictive relevance. Overall, this study confirms that in the digital investment era, cybersecurity literacy and financial prudence are essential determinants of the quality of investment decisions among Generation Z. By integrating cybersecurity dimensions into traditional behavioral finance frameworks, this research provides a more comprehensive understanding of digital-native investment behavior.

5.2 Theoretical and practical implications

5.2.1 Theoretical implications

This study contributes to the behavioral finance literature by incorporating cybersecurity literacy into the digital investment decision-making framework. It empirically supports the mediating role of risk perception, consistent with Prospect Theory, and identifies financial literacy as a moderating factor in the relationship between financial prudence and investment decisions. By integrating technological literacy into behavioral finance models, this research extends traditional frameworks that predominantly emphasize cognitive and emotional biases. It highlights the relevance of cybersecurity competence as a distinct and significant determinant in the context of digital finance. Furthermore, the study enriches empirical evidence concerning Generation Z's investment behavior in Indonesia, offering insights into the characteristics of digital natives operating within an emerging market environment. Overall, the findings support a more integrative conceptual framework that combines psychological traits, cognitive mechanisms, technological literacy, and financial knowledge in explaining digital investment behavior.

This study offers several important theoretical contributions. *First*, it integrates the cybersecurity dimension into the traditional behavioral finance model, thereby expanding the understanding of factors influencing investment decisions in the digital era. Most behavioral finance research has primarily focused on cognitive and emotional biases, while paying limited attention to cybersecurity aspects, which are becoming increasingly relevant in digital investment environments (Hassan *et al*., 2025; Qi *et al*., 2024). By incorporating cybersecurity literacy as a key predictor, this study broadens the behavioral finance framework to better reflect the realities of technology-driven financial markets.

Second, this research identifies risk perception as a mediating mechanism that explains how cybersecurity literacy influences investment decisions. This finding enriches the understanding of the cognitive processes linking security literacy to investment behavior and provides empirical support for Prospect Theory in the context of digital investment. Specifically, it demonstrates that cybersecurity literacy shapes how investors interpret and evaluate risk, which in turn affects their decision-making outcomes.

Third, this study identifies financial literacy as a boundary condition that moderates the relationship between financial prudence and investment decisions. This finding suggests that the effectiveness of psychological traits in shaping investment behavior depends on an individual's level of financial knowledge and skills (Al-Adwan *et al*., 2023; Raut & Kumar, 2024). In other words, prudence alone is insufficient; it must be supported by adequate financial literacy to translate into optimal investment decisions. Overall, this study contributes to the development of a more integrative framework that combines technological literacy (cybersecurity literacy), psychological traits (financial prudence), cognitive mechanisms (risk perception), and knowledge-based competencies (financial literacy) in explaining investment decision-making among Generation Z in the digital era.

5.2.2 Practical implications

This study offers several practical implications for key stakeholders in the digital investment ecosystem. Regulators are encouraged to enhance cybersecurity literacy initiatives and strengthen digital financial security regulations to foster a safer investment environment. Clear regulatory frameworks and robust investor protection mechanisms

are essential to mitigate cyber-related financial risks. Digital investment platforms should improve transparency, provide comprehensive user education, and reinforce risk management systems. Integrating accessible cybersecurity guidance and embedding protective security features within platforms can support safer and more informed investment behavior.

Educational institutions should incorporate both financial literacy and cybersecurity education into curricula. Equipping students with financial management skills alongside digital security awareness is critical for preparing them to navigate modern investment environments. Generation Z investors are encouraged to continuously enhance their cybersecurity literacy, financial prudence, and digital security practices. Strengthening critical thinking skills, maintaining financial discipline, and applying consistent cybersecurity measures will contribute to more rational and optimal investment decisions.

The findings of this study carry several important practical implications. *First*, this research underscores the importance of collaboration among regulators, digital investment platforms, educational institutions, and Generation Z investors in enhancing both security and the quality of investment decisions.

Second, regulators should strengthen cybersecurity regulations and expand public education initiatives related to digital financial security. Clear guidelines, stricter supervision of digital investment platforms, and accessible investor protection mechanisms are essential to create a safer digital investment ecosystem.

Third, digital investment platforms are encouraged to enhance transparency, improve security features (such as multi-factor authentication and fraud detection systems), and provide continuous cybersecurity education for their users. By doing so, platforms can foster greater trust and reduce the risk of cyber-related financial losses. Educational institutions should integrate financial literacy and cybersecurity literacy into their curricula, particularly for students and young adults. A holistic educational approach that combines technical and financial knowledge with digital security awareness will better prepare Generation Z to navigate the complexities of modern investment environments.

Finally, Generation Z themselves must actively improve their financial literacy, develop stronger financial prudence, and consistently apply good digital security

practices when investing. This includes critically evaluating information from social media and finfluencers, understanding risk-return trade-offs, and implementing protective cybersecurity measures. Overall, a coordinated and multi-stakeholder approach is crucial to fostering a secure, informed, and responsible investment culture among Generation Z in the digital era.

5.2.3 Limitations

Despite its contributions, this study has several limitations. *First*, the cross-sectional design limits the ability to establish causal relationships and does not capture behavioral changes over time. *Second*, the reliance on self-reported data may introduce response bias, although statistical procedures were implemented to minimize such bias. *Third*, the findings are context-specific, as the study focuses exclusively on Generation Z in Central Java, thereby limiting generalizability to other regions or demographic groups. Future research employing longitudinal designs, incorporating objective behavioral data, and replicating the study in different geographical contexts would enhance the validity and robustness of the findings.

5.2.4 Recommendations for future research

Based on the findings and limitations of this study, several recommendations are proposed for future research. Future studies should adopt longitudinal approaches to examine the development of cybersecurity literacy and financial prudence over time and their dynamic effects on investment behavior. Incorporating objective indicators, such as transaction records and portfolio performance data, would improve the accuracy of measuring investment decision quality. Additionally, experimental research designs are recommended to evaluate the effectiveness of educational interventions and to establish stronger causal evidence regarding behavioral changes in digital investment contexts.

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