

Behavioral and Financial Determinants of Cryptocurrency Investment Decisions: The Role of Cognitive Biases, Spiritual Beliefs, and Financial Literacy

Ignatius Edward Riantono

¹*Digital Business Department, Binus Business School, Bina Nusantara University, Jakarta 11480, Indonesia*

Email address:

Email: iriantono@binus.edu

**Corresponding author*

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Abstract: This study aims to analyze the influence of overconfidence bias, representativeness bias, loss aversion bias, mental accounting, spiritual beliefs, and financial literacy on investment decisions among Generation Z cryptocurrency investors. The research is designed as explanatory research employing a quantitative approach to identify causal relationships between behavioral, psychological, and literacy-related factors and investment decision-making. Data were collected from Generation Z investors domiciled in DKI Jakarta, reflecting a rapidly growing demographic within the cryptocurrency market that is characterized by high digital engagement and risk exposure. Given that the exact population size of Generation Z cryptocurrency investors is unknown, this study applies the sampling guidelines proposed by Hair et al., utilizing purposive sampling to ensure respondents meet specific criteria relevant to the research objectives. Data analysis was conducted using SmartPLS 4 software, enabling robust assessment of structural relationships and variable significance within the proposed model. The empirical results reveal that overconfidence bias, representativeness bias, loss aversion bias, mental accounting, and financial literacy significantly influence investment decisions. These findings highlight the dominant role of behavioral biases and financial knowledge in shaping how young investors perceive risk, process information, and allocate resources within cryptocurrency markets. Conversely, spiritual beliefs were found to have no significant effect on investment decisions, suggesting that investment behavior in this context is primarily driven by cognitive and rational considerations rather than personal belief systems. For future research, it is recommended to broaden the literature framework, refine sample selection criteria, apply more diverse Likert scale measurements, and incorporate additional variables that may further explain investment decision behavior.

Keywords: Cryptocurrency, Generation Z, Emotional Bias, Cognitive Bias, Investment Decision.

INTRODUCTION

In the current era of the Industrial Revolution 4.0, developments in communication, information technology, and digital technology are progressing rapidly and significantly facilitating investment activities for society. Investment represents an individual's commitment to allocate resources, such as money, with the expectation of generating returns or profits in the future. In making investment decisions, individuals must select

investment instruments that align with their needs, expected returns, time horizons, and carefully calculated risk levels (Kurniadi et al., 2022). Along with the growth of the global economy and the rapid advancement of digital technology, people today have access to a wider range of investment instruments. These include gold, property, time deposits, stock investments through mutual funds, bonds, and capital markets. Among these options, the investment instrument that has gained the most popularity in recent years is cryptocurrency (Perayunda & Mahyuni, 2022).

According to a Finder survey, there are ten countries with the highest levels of cryptocurrency ownership worldwide. Indonesia ranks fourth, with a cryptocurrency ownership rate of 22.4%. Vietnam ranks first with 28.6%, followed by India in second place at 23.4% and Australia in third place at 22.9% (Dihni, 2022). Chuen et al. (2017) define cryptocurrency as a subset of digital currency based on blockchain technology that is highly integrated, offers maximum capacity, operates within a strict security system, and enables fast transaction settlement (Hafishina et al., 2023). In accordance with the Decree of the Coordinating Ministry for Economic Affairs Number S-302/M.EKON/09/2018, cryptocurrency has been officially recognized in Indonesia as an investment instrument and is permitted to be traded on futures exchanges. As a result, cryptocurrency investment has recently gained significant popularity in Indonesia.

Based on the figure above, it can be observed that the number of investors from 2018 to 2022 experienced a drastic increase. In 2018, the number of investors was only 921 thousand, whereas in 2022 the number of cryptocurrency investors surged significantly to 16.4 million. In addition, as reported by the Commodity Futures Trading Regulatory Agency (Badan Pengawas Perdagangan Berjangka Komoditi/Bappebti), the number of cryptocurrency investors in Indonesia continued to show a positive trend in early 2024. According to Bappebti data, the total number of cryptocurrency investors reached 18.83 million as of January 2024, whereas in 2019 the number of cryptocurrency investors in Indonesia was only 3 million. This increase indicates a growth of 627% in cryptocurrency investors since 2019. The rapid growth in the number of cryptocurrency investors reflects the rising public interest in digital assets (Bappebti, 2023). As a result of the significant increase in cryptocurrency investors in Indonesia, the number of cryptocurrency trading platforms has also expanded. Many of these platforms have been officially registered with the Commodity Futures Trading Regulatory Agency (Bappebti) and are supervised by the Financial Services Authority. These platforms include Pintu, Tokocrypto, Indodax, Luno, Upbit, Incrypto, Pluang, Bitocto, Zipmex, Bittime, Vonix, and many others (CNBC Indonesia, 2022).

With the availability of various cryptocurrency trading platforms in Indonesia, Generation Z has emerged as the dominant group using cryptocurrency for investment activities. This is supported by Databoks data, which shows that 57.04% of cryptocurrency investors are under the age of 27, a demographic classified as Generation Z (Databoks, 2023). The growth in the number of cryptocurrency investors has also influenced the level of cryptocurrency asset trading activity, which gradually increased. In 2019, Bitcoin data recorded on TradingView showed that cryptocurrency reached an all-time high of USD 10,000. However, within a five-week period, Bitcoin prices entered a bearish phase, experiencing a significant decline of 47.48% to USD 5,344 in 2019. As a result, throughout 2020, the cryptocurrency market remained relatively inactive and exhibited a consistent downward trend until early 2021.

At the beginning of 2021, Bitcoin experienced a spectacular bullish rally, reaching a new all-time high above USD 60,000. Toward the end of 2021, however, the

cryptocurrency market underwent a major correction following the extreme bullish surge. Bitcoin and most altcoins recorded significant price declines, with Bitcoin falling to USD 49,243, reflecting the highly volatile and speculative nature of the cryptocurrency market. Subsequently, throughout 2022 and 2023, the cryptocurrency market entered a phase of recovery and consolidation. Bitcoin managed to regain a substantial portion of the losses incurred during the major correction in 2021, although the market remained relatively stable and moved within a more controlled price range.

In 2023, Bitcoin demonstrated strong performance throughout the year, surging significantly and reaching a peak of USD 44,000 by early 2024. Based on data from the Commodity Futures Trading Regulatory Agency (Bappebti), the value of cryptocurrency transactions in January 2024 amounted to IDR 21.57 trillion. This figure declined by 20.8% compared to December 2023 but increased by approximately 77.7% compared to the same period in the previous year, which stood at IDR 12.14 trillion (Bappebti, 2024). These figures illustrate that cryptocurrency asset transactions are characterized by high risk and high return, making them particularly attractive to investors, especially those from Generation Z. As a younger demographic with relatively limited investment experience, Generation Z investors are more vulnerable to engaging in high-risk investments driven by the promise of substantial returns. This condition increases the likelihood of rapid financial losses, which may ultimately lead to psychological distress and emotional instability among investors.

Investors who experience substantial financial losses and psychological trauma may face serious obstacles in achieving their long-term financial goals, potentially disrupting their overall financial stability if they do not exercise caution in making investment decisions. Traditional financial theories, such as Modern Portfolio Theory (MPT) and the Efficient Market Hypothesis (EMH), as explained by Markowitz and Fama in Ahmed et al. (2021), suggest that for the same level of expected return, investors tend to avoid risk and prefer portfolios with lower risk rather than higher risk. Accordingly, through risk and return analysis within Modern Portfolio Theory, investors are encouraged to minimize risk while maintaining expected returns by selecting well-diversified, lower-risk portfolios. Thus, MPT indirectly shapes investor behavior to become more rational, structured, and attentive to risk management in investment decision-making (Hu, 2022). In contrast, the Efficient Market Hypothesis is a financial theory stating that current market prices fully reflect all available information. Under this framework, future information is not influenced by past information, and price movements are often described as random variables that follow a normal distribution, making future returns unpredictable based on historical data (Malini, 2019).

A study conducted by Dassani and Manda (2020) indicates that the abundance of information and news from various sources often confuses investors. This condition leads investors to make decisions based on incomplete information or rely solely on the most recent information available (Joedono & Evelyn, 2023). On the other hand, factors such as past experiences, emotions, and personal beliefs can negatively influence investors' investment decisions (Ahmed et al., 2021). As a result, investors frequently make irrational decisions (Mufidah et al., 2022). Ahmed et al. (2021) further explain that to better understand the factors influencing investor decision-making, a new field of study known as Behavioral Finance has emerged. This discipline focuses on examining the psychological and behavioral aspects of investors in order to explain deviations from rational decision-making predicted by traditional financial theories.

Joedono and Evelyn (2023) define behavioral finance as an interdisciplinary field that integrates finance, sociology, and psychology. An investor's past success tends to increase self-confidence when making future investment decisions. Investment decision-making refers to a series of actions undertaken by individual or corporate investors to formulate investment choices based on available information and resources, including capital (Ariefin Addinpujoartanto & Darmawan, 2020). Several factors are considered to influence investment decisions, including overconfidence bias, representativeness bias, loss aversion bias, mental accounting, spiritual beliefs, and financial literacy. Overconfidence bias reflects a level of excessive self-confidence in which investors overestimate their knowledge and abilities while underestimating the accuracy of their predictions (Bihari et al., 2022). According to behavioral finance concepts introduced by Fischhoff, Slovic, and Lichtenstein (1977), overconfidence bias is categorized as a cognitive bias in which individuals excessively evaluate their own skills and knowledge while disregarding public information. Some investors are overly confident that their investment decisions will generate profits, yet instead experience losses due to poor decision-making in the stock market (Febriyanti & Yuniningsih, 2023). Previous studies by Kartini and Nahda (2021) found a significant relationship between overconfidence bias and investment decisions. However, contrasting findings by Afriani (2019) indicate that overconfidence bias does not significantly influence investment decisions.

Investors who conduct rapid and superficial analyses are more likely to make investment errors. Many investors rely heavily on past experiences when making decisions, which can lead to misjudgments, a phenomenon known as representativeness bias (Puspawati & Yohanda, 2022). Kartini and Nahda (2021) found a significant effect of representativeness bias on investment decisions, whereas Puspawati and Yohanda (2022) reported no significant influence. When facing potential losses, investors tend to experience stronger emotional reactions than the satisfaction derived from equivalent gains. This phenomenon is known as loss aversion bias, which commonly affects investors and influences investment decision-making processes (Handranatan Tang & Asandimitra, 2023). Kartini and Nahda (2021) identified a significant relationship between loss aversion bias and investment decisions, while Nur Ainia and Lutfi (2019) found no significant effect. To mitigate irrational investment behavior, investors are encouraged to apply mental accounting in their decision-making. The concept of mental accounting was first introduced by Thaler (1980) and further developed by Tversky and Kahneman (1981) and Thaler (1985). Mental accounting refers to how individuals evaluate and respond to various possible outcomes (Abdani & Nurdin, 2019). Silva et al. (2023) found that mental accounting plays a significant role in influencing decisions related to saving, investing, debt, and consumption, whereas Mahadevi and Asandimitra (2021) reported an insignificant effect on investment decisions. Spiritual intelligence also plays an important role in investment planning by guiding individuals to think critically and develop a comprehensive sense of meaning and purpose (Manafe, 2021). Weber (1995) suggested that spiritual beliefs are relevant in determining an individual's risk-taking ability (Mohanty et al., 2023). Other studies indicate that spiritual beliefs influence investment patterns among certain respondents (G & N, 2020). However, Mohanty et al. (2023) found no significant relationship between spirituality and individual investment decisions. Investment decision-making is not solely influenced by behavior but also by financial knowledge, known as financial literacy.

Financial literacy is a crucial factor in making well-informed investment decisions (Adil et al., 2022). Fadilah et al. (2022) found a significant relationship between financial

literacy and investment decisions, while Wildan Mutawally and Asandimitra (2019) reported no significant effect. Therefore, overconfidence bias, representativeness bias, loss aversion bias, mental accounting, spiritual beliefs, and financial literacy are interrelated factors with the potential to influence cryptocurrency investment decisions. Based on the above discussion and inconsistencies found in previous studies, this research aims to examine the influence of overconfidence bias, representativeness bias, loss aversion bias, mental accounting, spiritual beliefs, and financial literacy on investment decisions among Generation Z cryptocurrency investors in DKI Jakarta. This study is inspired by Kartini and Nahda (2021), which significantly contributed to understanding psychological factors affecting investment decisions. However, their study focused only on overconfidence bias, representativeness bias, and loss aversion bias, with respondents aged above 17 years across Indonesia. This research extends the scope by incorporating mental accounting, spiritual beliefs, and financial literacy, focusing specifically on Generation Z investors and narrowing the research location to DKI Jakarta. Jakarta, as the capital city and the largest metropolitan area in Indonesia with approximately 10.5 million residents, serves as a major center for business, politics, and culture in Southeast Asia (Lingkungan Hidup.Jakarta.go.id, 2024).

LITERATURE REVIEW

Prospect Theory

Behavioral finance theories include bounded rationality theory, prospect theory, theory of mind, and the belief–action–outcome framework (Nkukpornu et al., 2020). In the article entitled “Prospect Theory: An Analysis of Decision Under Risk,” Kahneman and Tversky introduced prospect theory in 1979, which was later further developed in 1992. In constructing a descriptive model of decision-making under risk, this theory challenges the Expected Utility Theory (EUT) and proposes an alternative framework (Ariefin Addinpujoartanto & Darmawan, 2020). Investors tend to place greater emphasis on outcomes that are perceived as certain, a phenomenon known as the certainty effect. In the context of risk aversion and risk-seeking behavior, investors are more inclined to choose decisions that offer clearly defined gains or losses (Mufidah et al., 2022).

Kahneman and Tversky (1979) explain that Prospect Theory relates to how investors make decisions under conditions of risk, in which investors tend to avoid risk when experiencing gains and become risk-seeking when facing losses. The main objective of Prospect Theory is to describe actual human behavior, particularly decision-making behavior that is not always rational (Kartini & Nahda, 2021). Furthermore, Kahneman and Tversky (2013) state that Prospect Theory proposes that individual choices consist of two stages: framing and evaluation. In the framing stage, individual investors construct representations of actions, contingencies, and relevant outcomes for decision-making. In the evaluation stage, investors assess each prospect and subsequently make a decision (Nkukpornu et al., 2020).

Studies by Waweru, Munyoki, and Uliana (2008) as well as Ratnadi, Widanaputra, and Putra (2020) explain that Prospect Theory focuses on subjective decision-making influenced by investors’ value systems and describes several mental states that affect individual decision-making processes, including loss aversion and mental accounting (Ariefin Addinpujoartanto & Darmawan, 2020). Prospect Theory provides a strong theoretical foundation for understanding why loss aversion bias is highly dominant in investment decision-making. The concept of loss aversion bias lies at

the core of Prospect Theory, explaining that investors tend to assign greater weight to potential losses than to equivalent potential gains. This implies that the pain experienced by investors when incurring losses is stronger or more intense than the satisfaction derived from achieving gains of the same magnitude. Accordingly, this perspective aligns with Prospect Theory in explaining why investors are often more cautious in avoiding losses than in taking risks to achieve financial gains, even when the probability of obtaining higher returns is relatively favorable.

Furthermore, research conducted by Mahadevi and Asandimitra (2021) explains that Kahneman and Tversky (1979) proposed several key principles of Prospect Theory, including the value function, framing, psychological accounting, probability, and the certainty effect. The study also highlights that Prospect Theory is used to explain the concept of mental accounting. Prospect Theory provides a framework for understanding how investors evaluate gains and losses, while mental accounting describes how investors categorize and treat money differently. When investors apply mental accounting, they tend to divide their money into separate “mental accounts,” such as funds allocated for daily expenses, investment purposes, and other financial needs. Prospect Theory further explains how investors evaluate gains and losses within each mental account separately, which can lead to inconsistent decision-making. Consequently, investment decisions are often influenced by how investors emotionally perceive and manage gains and losses, as well as how they allocate their finances into various mental accounts. This process may result in suboptimal and inconsistent investment behavior.

Behavioural Finance Theory

Since the introduction of Prospect Theory by Kahneman and Tversky (1979), which established a new foundation for explaining decision-making processes, many descriptive theories have sought to analyze how the use of heuristics and behavioral biases can influence decision-making. This development led to the emergence of a promising field of study known as Behavioral Finance (Silva et al., 2023). Ricciardi and Simon (2000) define behavioral finance as a theory that helps explain the extent to which investment decisions are influenced by investors’ reasoning patterns and emotional tendencies (Afriani & Halmawati, 2019). Hirshleifer (2015) further explains that behavioral finance examines how individuals fail to make optimal decisions and how markets become inefficient under certain conditions (Ariefin Addinpujoartanto & Darmawan, 2020).

Moreover, Sachdeva et al. (2022) describe behavioral finance as one of the key elements in contemporary accounting and financial management issues, which examines financial market behavior through a psychological perspective and recognizes that individual characteristics play a crucial role in decision-making (Silva et al., 2023). Nofsinger (2001) also explains that there are two primary psychological factors influencing investor behavior, namely cognitive bias and emotional bias.

Cognitive bias refers to errors in thinking that occur when individuals collect, process, and interpret information. These errors may arise due to misleading information or rushed decision-making, which can ultimately lead to flawed investment decisions. One example of cognitive bias is representativeness bias, which is explained within behavioral finance theory to illustrate its influence on investment decision-making. In behavioral finance theory, representativeness bias demonstrates how psychological factors can affect investment decisions. This theory explains that psychological and emotional influences often cause investors to behave irrationally. Representativeness bias

occurs when investors place excessive confidence in the belief that the past performance of a particular market or asset will continue into the future, without adequately considering relevant factors or changing market conditions.

Behavioral finance theory suggests that representativeness bias can lead to suboptimal decisions and unnecessary risk exposure, as investors often fail to evaluate information objectively and comprehensively, relying instead on patterns that may be irrelevant or merely coincidental. In contrast, emotional bias refers to deviations that occur when individuals rely on emotions in making decisions, which can result in erroneous judgments (Putriana et al., 2023). One example of emotional bias is overconfidence bias, which is explained through behavioral finance theory to illustrate its impact on investment decision-making. Overconfidence bias refers to an individual's tendency to overestimate their ability to make investment decisions, thereby leading to irrational investment behavior. In the investment context, investors influenced by overconfidence bias tend to underestimate risks while overestimating their capacity to generate returns.

As a result, investors may take overly aggressive positions or disregard expert advice. Behavioral finance theory explains that biases such as overconfidence bias are inherently human and can influence investment decisions even among experienced investors. Moreover, behavioral finance theory indicates that overconfidence bias not only distorts objective judgment but also leads to excessive and irrational investment behavior. Therefore, behavioral finance theory concludes that investors do not always act rationally, and their investment decisions can be influenced by psychological factors, including emotional factors such as overconfidence bias and cognitive factors such as representativeness bias.

Modern Portfolio Theory

The originator of Modern Portfolio Theory is Harry Markowitz, who introduced portfolio investment analysis in his article "Portfolio Selection," published in the *Journal of Finance* in 1952. Modern Portfolio Theory is a widely used investment approach aimed at optimizing the relationship between risk and return through portfolio diversification. Within Modern Portfolio Theory, it is explained that for the same level of expected return, investors tend to avoid risk and prefer portfolios with lower risk rather than those with higher risk (Hu, 2022). In developing portfolio theory, Markowitz (1952) proposed the assumption that all investors exhibit rational behavior in their decision-making processes. Consequently, it is anticipated that every investment choice made will aim to maximize utility through the use of rational analytical methods (Kartini & Nahda, 2021).

Modern Portfolio Theory encompasses the construction of portfolios by considering the levels of expected return and risk desired by investors and measuring their relationships through correlation. Within Modern Portfolio Theory, Markowitz demonstrated how portfolios can be improved by accounting for the correlation among returns of different investments (Hu, 2022). As a result, MPT (Modern Portfolio Theory) has indirectly influenced investor behavior to become more rational, structured, and attentive to risk management in investment decision-making (Hu, 2022). In this study, Modern Portfolio Theory is regarded as a representation of the financial literacy variable, as investment decisions based on financial literacy reflect more rational investor behavior. MPT proposes that investors can maximize returns for a given level of risk or minimize risk for a desired level of return through portfolio diversification.

Modern Portfolio Theory focuses on optimizing asset allocation based on the correlations among various investments in order to reduce overall risk. Financial literacy enables investors to understand the fundamental concepts embedded in MPT, such as diversification, risk, and return. With a high level of financial literacy, investors are better equipped to make rational investment decisions by constructing diversified portfolios that align with their risk profiles and investment objectives, thereby achieving optimal outcomes. In contrast, without adequate financial literacy, individuals may not fully understand or properly apply the principles of Modern Portfolio Theory. This lack of understanding can lead to poor investment decisions, such as insufficient diversification or the selection of assets that do not match their financial goals and risk tolerance. Therefore, Modern Portfolio Theory is employed in this study to explain and represent the financial literacy variable.

Investment Decision

Investment decision refers to a series of procedures undertaken by investors, including both individuals and firms, to formulate or implement investment choices based on available resources, such as capital, and the information they possess (Ariefin Addinpujoartanto & Darmawan, 2020). Subash (2012) defines investment decision-making as the careful selection of investments among various alternatives, often shaped by historical investment performance and anticipated future returns (Kartini & Nahda, 2021). There are two primary mechanisms that influence investors when determining investment choices: rational and irrational decision-making. Rational decision-making involves making choices based on logical reasoning and investment-related information. In contrast, irrational decision-making arises when choices are driven by psychological aspects, leading to biases in investment decisions (Anggini et al., 2020).

The indicators of investment decision according to Khan et al. (2018) are as follows:

1. Understanding life goals: A clear understanding of life goals helps individuals determine the type of investments that align with their needs and the level of risk they are willing to take.
2. Understanding financial management: This indicator highlights an individual's ability to manage personal finances effectively.
3. Understanding stocks and investments: This indicator reflects an individual's basic knowledge of capital markets and various investment instruments, such as stocks, bonds, mutual funds, and cryptocurrencies, as well as how these instruments function.
4. Understanding how to invest large sums of money: This indicator emphasizes an individual's capability to make investment decisions involving substantial amounts of capital.
5. Understanding stock price fluctuations: This indicator shows that individuals are aware that stock prices can fluctuate and that investments inherently involve risk.
6. Understanding investment principles: This indicator refers to knowledge of fundamental investment principles, including diversification, rebalancing, and investment time horizons.
7. Understanding effective financial budgeting: This indicator further emphasizes the importance of sound financial management (Puspawati & Yohanda, 2022).

Overconfidence Bias

Overconfidence bias refers to an individual's tendency to possess an excessively high level of confidence in the decisions they make and to overestimate their own abilities in accomplishing tasks (Kartini & Nahda, 2021). Agrawal (2012) explains that overconfidence bias is among the most fundamental and widely observed biases; however, it carries negative consequences for investors, such as lower expected utility, higher market exit tendencies, excessive trading, and lower investment returns (Nkukpornu et al., 2020). Fischhoff, Slovic, and Lichtenstein (1977) describe overconfidence bias as a trap in the investment world. Investors who fall into this cognitive bias become overly confident in their abilities, knowledge, and information. They tend to ignore public information and believe that their investment decisions are superior to those of other investors. Ironically, this belief often leads to losses due to poor decision-making (Febriyanti & Yuniningsih, 2023).

According to Shefrin (2007), overconfidence bias can be divided into two categories: overconfidence in one's abilities and overconfidence in one's knowledge. Individuals who are overly confident in their abilities assume that they are more capable than others who may have greater expertise in investment. Meanwhile, individuals who are overly confident in their knowledge believe that they possess more information and superior understanding compared to others (Puspawati & Yohanda, 2022). The indicators of overconfidence bias according to Baker et al. (2019) include, first, investors perceiving themselves as having extensive experience. Individuals with overconfidence bias often believe that their experience in the stock market is sufficient to make sound investment decisions without conducting thorough analysis. Second, investors believe that their average investment performance is better than the overall stock market index. Individuals with overconfidence bias tend to compare their investment performance with the market index and assume that they outperform the market. Third, when they make profitable investments, investors believe that their knowledge directly influences the outcome. Individuals with overconfidence bias tend to attribute investment success to their own abilities and expertise. Fourth, investors place greater confidence in their own analyses than in formal financial analysis.

Individuals with overconfidence bias often underestimate market complexity and assume their personal analysis is more accurate than that of financial experts. Fifth, profitable investments in the past are believed to result from the investor's superior investment skills. Individuals with overconfidence bias tend to associate past success with exceptional personal competence. Sixth, they are confident that their skills and knowledge of the stock market enable them to predict market conditions. Individuals with overconfidence bias often believe they can forecast market movements with high accuracy (Puspawati & Yohanda, 2022).

Representative Bias

Representativeness bias refers to the tendency to make decisions based on misleading stereotypes or inappropriate analogies. This bias can cause investors to make poor financial decisions, particularly decisions that do not enhance the yield of their investments (Loris & Jayanto, 2021). Representativeness bias arises when investors categorize investments as either positive or negative based on their intrinsic or past

performance (Mufidah et al., 2022). This bias can lead to excessive reactions to stock price movements. Investors attempt to predict stock price fluctuations by relying heavily on previous price trends to guide their decision-making process, anticipating continuous price increases and, consequently, expecting substantial profits.

Loss Aversion Bias

Loss aversion bias refers to an investor's strong tendency to avoid losses rather than pursue gains. Loss aversion can be an indication of this bias, in which individuals categorize continuous variables in a way that causes them to perceive even small losses as significant (Ariefin Addinpujoartanto & Darmawan, 2020). Loss aversion bias leads investors to place greater emphasis on avoiding losses than on achieving equivalent gains (Anwar et al., 2023). Aversion to losses has been widely documented in psychology and economics, with findings consistently showing that losses are perceived as more impactful than gains of the same magnitude (Merkle, 2020).

According to Chun and Ming (2009), the indicators of loss aversion bias include the following. First, focusing more on large potential losses than on large potential gains in stocks. Individuals with loss aversion bias tend to pay greater attention to potential losses rather than the possible returns from an investment. Second, experiencing anxiety when the price of invested stocks declines. When stock prices fall, individuals with loss aversion bias often feel intense worry and concern. Third, choosing not to increase investment when market performance is poor. During unfavorable market conditions, individuals with loss aversion bias are generally reluctant to add to their investments. Fourth, in investment decisions, avoiding capital loss is considered more important than obtaining profits. For individuals with loss aversion bias, preventing losses becomes the primary priority. Fifth, avoiding selling stocks that have declined in value while selling stocks that have increased in value. They tend to hold onto losing stocks in the hope that prices will recover, while selling winning stocks to secure gains. Lastly, exercising extreme caution toward potential losses (Nur Ainia & Lutfi, 2019). Investors become highly cautious in the face of possible losses and tend to avoid risks that could result in financial setbacks.

Mental Accounting

Thaler (1999) defines mental accounting as a set of cognitive strategies used by individuals and households to manage, evaluate, and monitor their financial activities effectively. Within this framework, assets are categorized and organized into different "mental accounts," each with its own rules and purposes (Silva et al., 2023). Mental accounting occurs when individuals perceive money that is obtained easily as having a lower value than money earned through effort or hard work, which in turn leads to more careless spending behavior. This happens because mental accounting biases individuals into believing that easily obtained money is less valuable than income earned through labor, making it psychologically easier to spend (Calzadilla et al., 2021). The importance of mental accounting lies in its ability to explain individual economic behavior and decision-making processes. Statman (1999) explains that when individuals aim to manage their expenditures and increase their savings, they tend to create mental accounts, which can be beneficial for investors who struggle with self-discipline. Mental accounts are commonly used as a form of self-regulation in financial behavior (Mahapatra & Mishra, 2020). Several indicators are used to describe mental accounting behavior. First, investors tend to allocate their income into multiple accounts, with each account governed by

different usage rules. Second, investors treat their monthly income and bonuses differently. Regular income is often perceived as money for essential expenses, while bonuses are considered additional funds that can be spent more freely, including on high-risk investments. Third, investors carefully calculate expenses derived from their monthly income, demonstrating greater caution and detailed budgeting. Fourth, investors do not always calculate expenses derived from bonus income in the same careful manner (Santi et al., 2019). Bonus money is often spent more impulsively without thorough consideration of long-term consequences. Additional indicators of mental accounting include the tendency to make investment purchases when excess funds are available. Individuals with mental accounting behavior are more likely to invest in instruments such as cryptocurrency when they perceive having “extra money” beyond daily needs. Furthermore, cryptocurrency transactions are often conducted using remaining funds from monthly living expenses. Finally, when investment instruments are purchased using funds allocated for daily activities, investors tend to carefully consider costs and benefits (Pandji et al., 2024). In such cases, greater attention is given to risk and potential returns before making investment decisions.

Spiritual Beliefs

Spiritual beliefs are an important parameter in determining the quality of life as well as the physical and psychological health of investors (Mohanty et al., 2023). Spirituality is a very general concept and is closely related to various aspects of mental health. Regular spiritual beliefs can facilitate consistency in general behavior and reduce impulsive reactions to losses and gains (Rosmarin et al., 2023). Cultivating religion-based spirituality can enhance decision-making, as it influences behavior by complementing existing moral and ethical guidelines in resolving ethical dilemmas (G & N, 2020). Spirituality has two main indicators: existential and religious dimensions. Existential spirituality refers to an individual’s self-expression with particular reference to ethical and moral truths related to the Supreme Being and the universe. Religion, on the other hand, is an organized system of beliefs, practices, and forms of worship (Mohanty et al., 2023). In addition, other indicators of spirituality include, first, the importance of spirituality, which reflects how important spirituality is in an individual’s daily life. Second, belief in God (spirituality), which measures the level of an individual’s belief in the existence of God. Third, belief in prayer (spirituality), which assesses the extent to which individuals believe in the power of prayer. Fourth, perceived benefits of prayer (spirituality), which measure the individual’s personal experiences regarding the benefits of engaging in prayer. Finally, the importance of personal prayer (spirituality) reflects the role of private prayer in an individual’s life (Rosmarin et al., 2023). Prayer can help investors cope with anxiety that often arises in volatile market conditions.

Financial Literacy

According to the Financial Services Authority (Otoritas Jasa Keuangan/OJK), financial literacy refers to the knowledge, skills, and confidence that influence attitudes and behaviors in order to improve financial decision-making and financial management, ultimately achieving economic well-being for society. Similarly, the Organization for Economic Cooperation and Development (OECD, 2011) defines financial literacy as a combination of skills, awareness, knowledge, attitudes, and behaviors required to make sound financial decisions and achieve financial goals (Kurniadi et al., 2022). Financial literacy consists of two main dimensions: basic financial literacy and advanced financial

literacy. Basic financial literacy includes knowledge of financial calculations and formal financial products, while advanced financial literacy focuses on investment-related knowledge (Fadilah et al., 2022).

Al-Tamimi and Kalli (2009) explain that investors with a high level of financial literacy tend to apply appropriate and effective techniques when making investment decisions (Ahmed et al., 2021). The indicators of financial literacy include, first, an understanding of financial concepts, such as market capitalization, trading volume, blockchain, cryptocurrency, tokens, and smart contracts. Second, an understanding of interest and credit, which helps investors assess risks associated with cryptocurrency-related borrowing. Third, knowledge of savings and investment concepts, including the differences between holding assets long-term (hodling), short-term trading, and staking. Fourth, financial literacy is reflected in an individual's ability to manage personal finances, including budgeting for investments, tracking expenses, and aligning investment decisions with financial goals. Fifth, financially literate investors are able to make appropriate decisions by analyzing market information, news, and trends rationally. Sixth, maintaining financial records is an essential indicator, as recording transactions, profits, and losses allows investors to monitor portfolio performance and improve future investment decisions. Finally, confidence in planning future financial needs effectively reflects a high level of financial literacy, enabling investors to develop long-term financial plans that include cryptocurrency investments (Kurniadi et al., 2022).

RESEARCH METHODS

The research method is a series of actions involving the collection, examination, and explanation of data in relation to the research objectives (Sugiyono, 2023:2). This study employs an explanatory research method. Explanatory research is a type of research that aims to explain the causal relationships among the variables under investigation (Sugiyono, 2023). Therefore, the author uses this type of research to test the hypotheses proposed in this study, with the expectation that the research can explain the relationships and effects between the independent and dependent variables.

The researcher employs an explanatory research method using a quantitative approach. According to Sugiyono (2023:16), quantitative research methods are research methodologies based on the epistemological framework of positivism, used to investigate different populations or samples by utilizing various research instruments for data collection and conducting quantitative/statistical data analysis, all with the aim of testing predetermined hypotheses. In its implementation, the research design used is a survey. Survey research is a type of quantitative research employed to collect data related to past or present events, including beliefs, opinions, characteristics, behaviors, and relationships among variables. This type of research also functions to evaluate hypotheses concerning sociological and psychological variables within samples drawn from a particular population.

The conceptual framework explains the pattern of relationships among the variables to be examined, namely the relationship between the independent and dependent variables. Therefore, in this study, the independent variables examined are overconfidence bias, representative bias, loss aversion bias, mental accounting, spiritual beliefs, and financial literacy. Meanwhile, the dependent variable examined is investment decision in cryptocurrency. The following is the research framework used in this study:

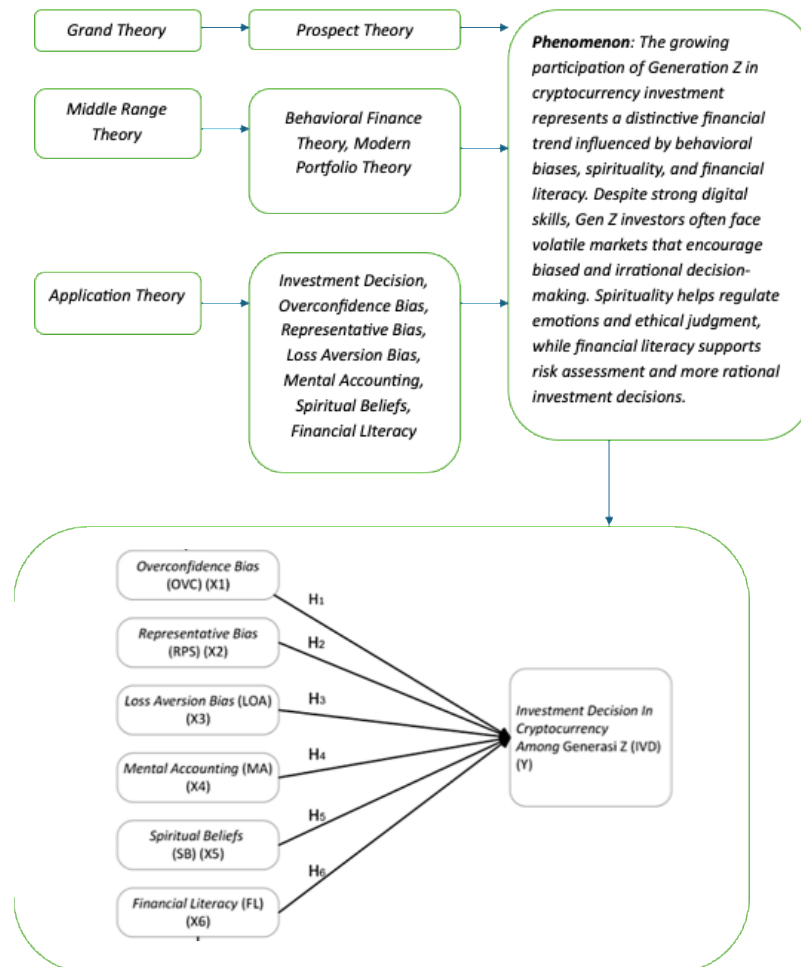


Figure 1. Conceptual Thinking Building a Framework

Based on the research objectives that have been described, the hypotheses to be tested in this study are as follows:

1. The effect of Overconfidence Bias on investment decisions.

Behavioral finance theory represents overconfidence bias. Overconfidence bias refers to an individual's tendency to overestimate their ability to make investment decisions, which can lead investors to make irrational investment decisions. Agrawal (2012), in his study, explains that overconfidence is one of the most fundamental and pervasive biases; however, it has negative consequences for investors, such as lower expected utility, a higher tendency to exit the market, excessive trading, and lower investment returns (Nkukpornu et al., 2020). This is consistent with behavioral finance theory, which reveals that investors are often overly confident in the accuracy of their predictions about the market or asset values, potentially leading to irrational investment behavior. Behavioral finance theory further explains that biases such as overconfidence bias are inherently human and can influence investment decisions even among experienced investors.

2. The effect of Representative Bias on investment decisions.

Representative bias reflects behavioral finance theory. Representative bias arises from investors' actions of categorizing investments as positive or negative based on their

intrinsic performance (Mufidah et al., 2022). Within behavioral finance theory, representative bias is an example of how psychological factors can influence investment decisions. Behavioral finance theory explains that psychological and emotional factors often cause investment decisions to become irrational. It also shows that this bias can lead to irrational investment decisions, such as ignoring diversification or becoming trapped in trend-based investments, which can increase risk and reduce the potential for optimal returns.

3. The effect of Loss Aversion Bias on investment decisions.

Prospect theory represents loss aversion bias. Pompian (2006) explains that loss aversion bias reflects a tendency to avoid losses rather than to seek equivalent gains (Anwar et al., 2023). Prospect theory, developed by Daniel Kahneman and Amos Tversky, states that individuals tend to experience greater discomfort from losses than pleasure from equivalent gains, creating a phenomenon known as loss aversion bias. This bias causes individuals to be more inclined to avoid risk in order to prevent losses rather than pursue potential gains, which is consistent with prospect theory that decisions are often influenced by differences in the perception of gains and losses relative to a reference point, rather than by the absolute final value of outcomes.

4. The effect of Mental Accounting on investment decisions.

Prospect theory represents mental accounting. Mental accounting focuses on how individuals should perceive and evaluate possible outcomes (Abdani & Nurdin, 2019). Mental accounting, introduced by Richard Thaler, refers to the way people divide their money into different categories or “mental accounts.” Prospect theory also explains how investors evaluate gains and losses in each mental account separately, which can result in inconsistent decisions. Therefore, investment decisions are often influenced by how investors emotionally perceive and manage losses and gains, as well as how they categorize their finances into various mental accounts, which can lead to suboptimal and inconsistent investment behavior.

5. The effect of Spiritual Beliefs on investment decisions.

Prospect theory represents spiritual beliefs. Spiritual beliefs are an important parameter in determining the quality of life as well as the physical and psychological health of investors (Mohanty et al., 2023). Prospect theory indicates that individuals are more sensitive to losses than to equivalent gains, leading them to avoid risk in order to prevent losses. However, spiritual beliefs can modify the way individuals respond to risk and loss. Thus, spiritual beliefs can adjust or reinforce the principles of prospect theory in decision-making, influencing how individuals perceive and react to risk and losses in a financial context.

6. The effect of Financial Literacy on investment decisions.

Modern portfolio theory represents financial literacy. According to the Financial Services Authority (Otoritas Jasa Keuangan/OJK), financial literacy is a combination of knowledge, skills, and confidence that influences attitudes and behavior in order to improve financial decision-making and financial management to achieve public financial well-being. Modern Portfolio Theory (MPT), developed by Harry Markowitz, emphasizes the importance of diversification in a portfolio to optimize the risk–return trade-off. To apply the principles of MPT effectively, investors need a strong understanding of basic financial concepts such as risk, return, asset correlation, and how to construct a balanced portfolio. Without adequate financial literacy, individuals may be unable to interpret investment data correctly or understand how to select and combine assets to achieve an optimal portfolio. Conversely, strong financial

literacy enables investors to better understand and apply MPT principles, make more informed and strategic decisions in managing their portfolios, and maximize investment returns while efficiently managing risk..

RESULTS AND DISCUSSION

1. Respondent Demographics

Data collection in this study was carried out using an online questionnaire distributed via Google Forms and disseminated through social media platforms such as Instagram, LinkedIn, Line, Twitter, TikTok, and the website kudata.id. A total of 349 respondents were collected in this study, all of whom were cryptocurrency investors. The initial target number of respondents was 230, and the number of responses collected exceeded this target. Subsequently, from the 349 respondents, those who did not meet the characteristics required for this study were eliminated. As a result, 119 questionnaires could not be analyzed, while 230 questionnaires were eligible for analysis. The following section presents the number of respondents and the response rate:

As a preliminary stage of the study, a pilot test was designed and implemented to evaluate the validity and reliability of the research instruments. This pilot study served as a crucial step prior to distributing the instruments to the full sample and involved at least 30 respondents who reflected the characteristics of the target population. Participants were drawn from varied backgrounds to ensure broad representation of the population's diversity.

During the pilot phase, questionnaires and other data collection tools were administered, and participants were invited to provide feedback on the clarity of the questions, the instructions, and the overall structure of the instruments. The pilot results offered several important insights. Some respondents encountered difficulties in understanding certain items, indicating the need for revisions to improve clarity and relevance. Variations in responses were also observed, offering early indications of potential patterns that could emerge during the main data analysis.

Based on these findings, the researcher refined the research instruments and data collection procedures. Adjustments included eliminating ambiguous questions, clarifying instructions, and reorganizing selected variables. Drawing on the outcomes of the pilot test, the researcher concluded that the revised instruments achieved satisfactory levels of validity and reliability for measuring the intended variables. Overall, the pilot study played a vital role in strengthening the research design by identifying and addressing potential issues before the primary data collection phase. The analysis and participant feedback further indicated that the instruments were highly valid and reliable, as reflected in the strong consistency of responses across participants.

Data Analysis Results and Respondent Profile.

Data collected from 265 small and medium-sized enterprises (SMEs) indicate that a large proportion of these firms possess sufficient knowledge and internal capabilities related to both digital and financial literacy. The findings reveal that most SME owners are proficient in using a range of digital devices, such as personal computers, smartphones, and tablets. Survey responses from business owners and key stakeholders further demonstrate a generally positive perception of digital innovation, with many agreeing that owners' attitudes align closely with the advantages offered by digital tools in business operations.

Respondents emphasized that SME owners not only accept ongoing digital developments but also display openness and readiness to embrace future changes. This reflects a strong confidence in the ability of digital innovation to enhance business performance. Such optimism is evident in the belief that adopting up-to-date technologies can improve efficiency, productivity, and competitive positioning in an increasingly dynamic market environment. Moreover, respondents highlighted that business owners recognize digital innovation as a means to broaden market access and capitalize on new business opportunities.

The willingness of SME owners to explore and maximize the potential of technology illustrates a clear commitment to growth and to keeping pace with evolving industry trends. Overall, this positive mindset suggests that digital innovation is perceived not merely as an operational necessity but as a strategic opportunity for business development. Consequently, SME owners show a strong inclination to modify existing practices, develop new competencies, and integrate digital technologies into their business strategies in order to strengthen competitiveness and secure sustainable advantages in the digital era.

Convergence Validity Test. In table 1, convergent validity is assessed through the Cronbach's alpha value and Average Variance Extracted (AVE). The criterion for Cronbach's alpha is a minimum value of 0.70. For Average Variance Extracted (AVE), the criterion is a minimum value of 0.50 (Bujang et al., 2018).

Table 1. Results of Convergent Validity Test

| Construct reliability and validity - Overview | | | | |
|---|------------------|-------------------------------|-------------------------------|----------------------------------|
| | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
| BCO | 0.805 | 0.808 | 0.866 | 0.568 |
| BNO | 0.828 | 0.842 | 0.875 | 0.542 |
| DLO | 0.902 | 0.906 | 0.922 | 0.629 |
| FLDBO | 0.938 | 0.939 | 0.948 | 0.697 |
| GIO | 0.823 | 0.828 | 0.872 | 0.532 |
| GOO | 0.829 | 0.849 | 0.871 | 0.532 |
| OADIO | 0.908 | 0.925 | 0.927 | 0.645 |
| SDIO | 0.926 | 0.928 | 0.941 | 0.694 |

The Cronbach's alpha coefficients for all examined constructs, including Business Complexity, Business Networking, Digital Literacy, Financial Literacy, Digital Benefit, Government Intervention, Growth Orientation, Owners' Attitudes toward Digital Innovation, and SMEs' Digital Intensity are above the recommended threshold of 0.70. These results indicate strong internal consistency across the measurement items for each variable. Cronbach's alpha values exceeding 0.70 confirm that the constructs are measured reliably, demonstrating the robustness of the instruments used to capture these dimensions. The reliability evidenced by these alpha values further supports the consistency of the data with the underlying theoretical concepts. In addition, the high reliability results obtained from the outer loading assessment strengthen confidence that the indicators accurately and consistently represent the constructs analyzed in this study. With both validity and reliability adequately established, subsequent analyses can be conducted with assurance that the data are dependable.

Further evaluation of the measurement model shows that all variables meet the criteria of the outer loading test, enabling more in-depth and credible analysis of the

relationships among constructs. As reported in Table 1, the Average Variance Extracted (AVE) values for all variables exceed the commonly accepted minimum threshold of 0.50, indicating satisfactory convergent validity.

Discriminant Validity – Fornell Larcker Criterion.

The results of the discriminant validity assessment using the Fornell–Larcker criterion indicate that all constructs in this study demonstrate strong discriminant validity. This approach evaluates the extent to which each construct can be clearly differentiated from other constructs within the measurement model. Establishing discriminant validity is essential to ensure that each variable represents a unique concept and is not excessively correlated with other variables. Compliance with the Fornell–Larcker criterion confirms that each construct independently explains variation in the model, with no significant overlap or ambiguity among the measured variables. The confirmation of discriminant validity indicates that the constructs examined are conceptually distinct and independent. This strengthens confidence that each variable makes a unique contribution to understanding the phenomena under investigation and supports the reliability of the findings for drawing meaningful conclusions about the relationships among variables in the model.

Table 2. Discriminant Validity using the Fornell-Larcker Criterion

| Discriminant validity - Fornell-Larcker criterion | | | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|-------|--|
| | BCO | BNO | DLO | FLDBO | GIO | GOO | OADIO | SDIO | |
| BCO | 0.754 | | | | | | | | |
| BNO | 0.638 | 0.736 | | | | | | | |
| DLO | 0.469 | 0.601 | 0.793 | | | | | | |
| FLDBO | 0.564 | 0.671 | 0.749 | 0.835 | | | | | |
| GIO | 0.577 | 0.671 | 0.530 | 0.647 | 0.730 | | | | |
| GOO | 0.579 | 0.588 | 0.585 | 0.567 | 0.535 | 0.730 | | | |
| OADIO | 0.299 | 0.449 | 0.525 | 0.386 | 0.408 | 0.597 | 0.803 | | |
| SDIO | 0.556 | 0.669 | 0.751 | 0.771 | 0.567 | 0.498 | 0.424 | 0.833 | |

The discriminant validity assessment using the Fornell–Larcker criterion indicates that all variables in this study possess strong discriminant validity. This is demonstrated by the square root of each construct’s Average Variance Extracted (AVE) being higher than its correlations with other constructs in the model. These results confirm that the constructs measured by each variable are clearly defined and distinct from one another. The higher proportion of variance captured within each construct shows that it explains more variation in its associated indicators than in its relationships with other variables, thereby reinforcing the uniqueness and independence of each construct in the model.

Path Coefficient.

Path Coefficient Analysis, commonly referred to as Path Analysis, is a statistical method derived from regression analysis that is used to evaluate the relative influence of independent variables on a dependent variable within a model. This technique helps clarify the magnitude of both direct and indirect effects that each variable has on other variables in the analytical framework.

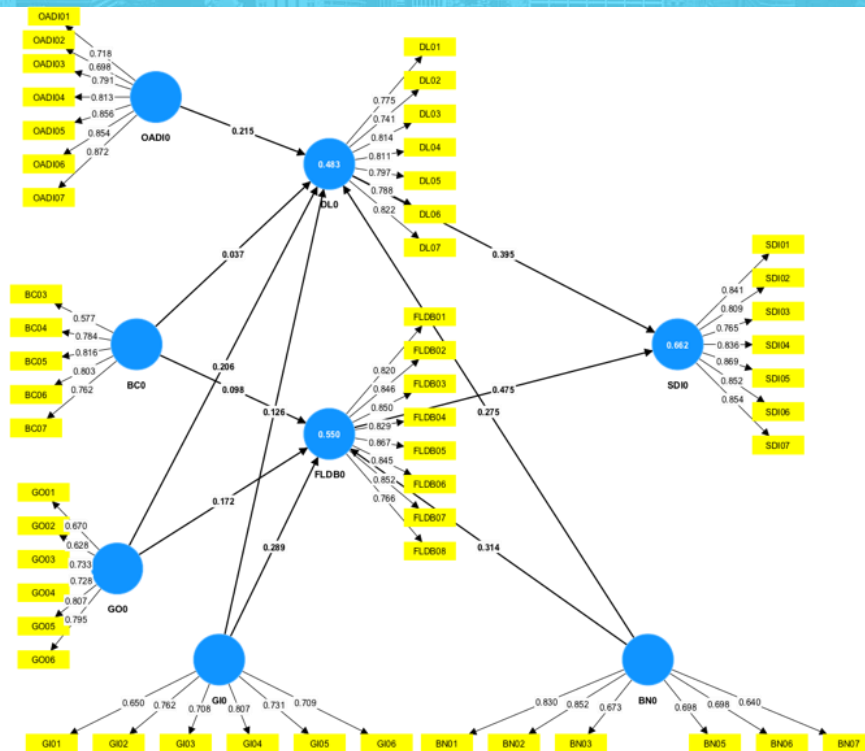


Figure 5. Path Coefficient

The path coefficient model applied in this study produced robust results for examining the relationships among variables. The coefficients clearly show how one construct influences another, indicating both the direction and magnitude of these effects, whether positive or negative. Higher path coefficient values reflect stronger influences between variables, suggesting that variations in one construct may be directly or indirectly associated with changes in others. Ensuring the validity and reliability of the path coefficients is critical for obtaining accurate model outcomes. The results of the analysis confirm that the estimated path coefficients are dependable and provide meaningful insights into the interactions among the examined variables. Moreover, coefficients that are consistent with established theoretical expectations further strengthen confidence in the model's ability to accurately represent the underlying dynamics within the research context.

Hypothesis Test.

Specific indirect effects are a core component of path analysis and structural equation modeling, referring to the influence an independent variable has on a dependent variable through one or more mediating variables (Fox, 1985). This approach enables researchers to uncover the mechanisms that explain complex relationships among constructs. Mediation analysis can be conducted using various analytical tools, with SmartPLS widely regarded as a suitable and effective platform for estimating path analysis models (Nitzl et al., 2016).

In meta-analytic research, examining specific indirect effects is particularly important, as it allows researchers to synthesize results across multiple studies and generate more robust and comprehensive evidence. Practically, mediation analysis involves estimating standardized direct and indirect effects through matrix-based

calculations using structural coefficients (Fox, 1985). This method enables the assessment of causal relationships between exogenous and endogenous variables, while accommodating multiple mediators or moderated mediation structures. In hypothesis testing, rejecting the null hypothesis indicates that the results are statistically significant. The p-value represents the likelihood of obtaining the observed results assuming that the null hypothesis is true, serving as a key indicator for determining statistical significance (Gil & Montoya, 2021; Montoya & Hayes, 2017).

Table 3. P Values (Indirect Effect)

| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | T statistics (O/STDEV) | P values |
|----------------------|---------------------|-----------------|----------------------------|--------------------------|----------|
| BCO -> DL0 -> SDIO | 0.036 | 0.037 | 0.038 | 0.935 | 0.175 |
| BCO -> FLDB0 -> SDIO | 0.023 | 0.027 | 0.036 | 0.638 | 0.262 |
| BNO -> DL0 -> SDIO | 0.135 | 0.135 | 0.051 | 2.666 | 0.004 |
| BNO -> FLDB0 -> SDIO | 0.131 | 0.132 | 0.049 | 2.670 | 0.004 |
| GIO -> DL0 -> SDIO | 0.062 | 0.059 | 0.042 | 1.477 | 0.070 |
| GIO -> FLDB0 -> SDIO | 0.134 | 0.134 | 0.038 | 3.523 | 0.000 |
| GOO -> DL0 -> SDIO | 0.079 | 0.078 | 0.038 | 2.072 | 0.019 |
| GOO -> FLDB0 -> SDIO | 0.077 | 0.077 | 0.036 | 2.165 | 0.015 |
| OADIO -> DL0 -> SDIO | 0.082 | 0.084 | 0.031 | 2.659 | 0.004 |

With respect to the specific indirect effects of digital and financial literacy on perceived digital benefits, the results of this study yield several important insights. As shown in Table 3, digital literacy does not significantly mediate the relationship between business complexity and SMEs' digital intensity. Likewise, financial literacy does not demonstrate a meaningful mediating role in the relationship between organizational complexity and digital intensity when linked to perceptions of digital benefits. In addition, digital literacy does not significantly mediate the effect of government support on SMEs' digital intensity.

Nevertheless, it is important to note that other factors, including owners' attitudes toward digital innovation, business networking, and growth orientation have a significant influence on SMEs' level of digital intensity. Both digital literacy and financial literacy play important roles in shaping perceptions of digital benefits, indicating that these factors are meaningfully connected to SMEs' digital intensity through the two mediating variables.

Overall, the findings reveal variations in how the independent variables (owners' attitudes toward digital innovation, business complexity, growth orientation, government intervention, and business networking) affect the dependent variable (SMEs' digital intensity) through the mediators of digital literacy and financial literacy in forming perceptions of digital benefits. While some relationships are not statistically significant through these mediating mechanisms, others demonstrate strong effects, highlighting the complexity and multidimensional nature of the relationships within the proposed research model.

Test Coefficient of Determination (R2).

The coefficient of determination (R2) on the de-pendent variable, namely MSME's Digital Intensity (SDI) is 0.660 or 66% or can be inter-preted as having a strong correlation. This demonstrates that the independent variables used in this study, namely Owner Attitudes toward Digital Innovation (OADI), Business Com-plexity (BC), Growth Orientation (GO), Government Intervention (GI), Business Net-working) and the mediating variables, namely Digital Literacy (DL) and Financial Literacy for Digital

Benefit (FLDB), affect the dependent variable, namely MSME's Digital Intensi-ty (SDI) by 66%, while the remaining 34% is influenced by other variables not used in.

Table 4. Coefficient of Determination (R2)

| R-square - Overview | | |
|---------------------|----------|-------------------|
| | R-square | R-square adjusted |
| DLO | 0.483 | 0.473 |
| FLDBO | 0.550 | 0.543 |
| SDIO | 0.662 | 0.660 |

Discussion

The acceptance of Hypothesis 1 indicates that owners' attitudes toward digital innovation significantly enhance SMEs' digital intensity when mediated by digital literacy. Prior research supports this finding by showing that SME owners' perceptions and levels of digital literacy play a critical role in driving digital adoption and innovation. Digital literacy has been shown to positively influence e-commerce adoption and overall SME performance (Suryani et al., 2022). In addition, organizational readiness has been identified as a mediating factor between digital culture and organizational capabilities, both of which are essential for fostering digital innovation (Martínez-Peláez et al., 2023). Collectively, these findings emphasize the importance of positive owner attitudes and strong digital literacy in accelerating digital innovation and technology adoption among SMEs.

In contrast, the rejection of Hypothesis 2 suggests that business complexity does not have a significant effect on SMEs' digital intensity when digital literacy acts as a mediator. Although digital literacy is widely recognized as a key driver of SME performance in the digital era, its role does not translate into a meaningful link between business complexity and digital intensity. Existing studies show that digital literacy supports e-commerce adoption and digital marketing capabilities, which in turn improve business performance (Putri, 2024). However, this study confirms that complexity alone does not significantly influence digitalization through digital literacy.

Hypothesis 3 is supported, demonstrating that growth orientation positively influences SMEs' digital intensity through digital literacy. Digital literacy enhances business owners' capacity to innovate, compete, and adapt to dynamic market conditions (Ifah Rofiqoh, 2023). SMEs with a strong growth focus are therefore more inclined to leverage digital tools as part of their development strategies.

The rejection of Hypothesis 4 indicates that government intervention does not significantly affect SMEs' digital intensity when mediated by digital literacy. While government policies and support programs are important for SME development, they do not directly translate into higher digital intensity through digital literacy alone. This finding suggests that other factors, such as business networking, growth orientation, or owners' attitudes toward digital innovation, may play a more decisive role. The limited impact of government intervention in this context highlights the need for more targeted initiatives that directly strengthen digital literacy and create enabling environments for effective technology use (Yanto et al., 2022).

Hypothesis 5 is accepted, confirming that business networking significantly enhances SMEs' digital intensity through the mediation of digital literacy. Strong

networks provide SMEs with access to digital resources, knowledge, and strategic partnerships that enhance their digital capabilities. Digital literacy enables business owners and employees to effectively utilize these networks for digital transformation. Through interactions with other firms, SMEs gain exposure to digital tools and practices, accelerating technology adoption and increasing overall digital intensity, which ultimately supports business growth and competitiveness (Sudrajad et al., 2023).

The rejection of Hypothesis 6 reveals that business complexity does not significantly influence SMEs' digital intensity when mediated by financial literacy in shaping perceptions of digital benefits. Although business complexity may introduce operational challenges, it does not directly determine the extent to which SMEs pursue digital transformation through financial literacy. Even with improved financial understanding, complex business structures do not substantially affect how SMEs perceive the benefits of digitalization. This suggests that other factors, such as networking or owners' attitudes, exert a stronger influence on digital intensity (Frimpong et al., 2022b).

Hypothesis 7 is supported, showing that growth orientation positively affects SMEs' digital intensity through financial literacy. SMEs with strong growth ambitions are more likely to adopt digital technologies as part of their expansion strategies (Surahman et al., 2023). Financial literacy equips business owners and managers with the ability to recognize the financial value of digital investments, thereby facilitating informed decision-making related to technology adoption. This relationship underscores the combined importance of financial literacy and a growth-oriented mindset in driving digital transformation within SMEs (Togun et al., 2022).

The acceptance of Hypothesis 8 demonstrates that government intervention positively influences SMEs' digital intensity when mediated by financial literacy. Government initiatives, such as infrastructure development, training programs, and financial incentives, encourage SMEs to adopt digital technologies. When supported by strong financial literacy, business leaders are better able to understand the costs, benefits, and long-term implications of digital investments. This combination enables SMEs to make sound decisions regarding technology adoption and resource allocation, ultimately strengthening digital intensity and improving business performance (Jayeola et al., 2022).

Finally, the acceptance of Hypothesis 9 confirms that business networking has a significant positive effect on SMEs' digital intensity through the mediation of financial literacy. Through strong networks, SMEs gain access to information, support, and opportunities related to digital technologies. Financial literacy helps business owners evaluate the financial feasibility of these opportunities, allowing them to capitalize on network-based resources effectively. As a result, business networking, supported by financial literacy, plays a vital role in enhancing digital intensity and advancing digital transformation in SMEs (Bakashaba et al., 2024).

The findings indicate that SMEs' digital intensity is strongly shaped by owners' attitudes toward digital innovation. In this relationship, digital literacy functions as a mediating factor that enables firms to better understand, adopt, and utilize digital technologies. From the perspective of entrepreneurial value creation theory, innovation and digital capabilities are central to generating business value. These results are also consistent with the Technology Acceptance Model (TAM), particularly the concept of perceived ease of use, which plays a key role in influencing technology adoption.

The study further reveals that business complexity does not significantly influence SMEs' digital intensity when digital literacy acts as a mediator. In contrast, growth

orientation emerges as a crucial driver that encourages firms to innovate and integrate digital technologies in order to enhance performance. Digital literacy is essential for optimizing the use of technology across multiple operational functions, such as inventory control and customer service. Accordingly, growth-oriented strategies should prioritize investment in digital literacy to enable SMEs to fully exploit digital tools, improve operational efficiency, and strengthen their competitive positioning.

Government intervention is identified as an external factor that can influence SME operations and potentially enhance productivity. However, the findings show that government intervention does not have a significant direct effect on SMEs' digital intensity when mediated by digital literacy alone. This suggests that digital literacy by itself may be insufficient to translate government initiatives into higher levels of digital adoption. A more integrated approach that aligns external government support with internal firm-level programs is therefore required to improve the performance of digital SMEs.

Drawing on social network theory and cooperation theory, the study highlights the role of interpersonal relationships and collaborative networks in supporting digital literacy development. Social networks facilitate access to information and resources necessary for digital advancement, while cooperation among firms strengthens knowledge sharing and capability building. Effective strategies should thus focus on improving operational efficiency, expanding market reach, enhancing digital knowledge, and reinforcing as well as diversifying business networks.

Financial literacy is also shown to be a critical enabler of digital adoption among SMEs. Sound digital strategies require adequate financial literacy, as it equips business owners with the ability to make informed investment decisions related to innovation and technology. The study demonstrates that government intervention significantly affects SMEs' digital intensity through financial literacy in shaping perceptions of digital benefits, as indicated by p-values below 0.05.

Overall, financial literacy contributes directly to higher digital intensity by improving SMEs' understanding and effective use of digital technologies, which in turn enhances productivity and business growth. When combined with strong business networks, financial literacy creates a supportive environment that encourages SMEs to adopt digital technologies and contribute to broader economic development. Therefore, policies and strategic initiatives should prioritize strengthening business networks and building digital and financial competencies to improve operational efficiency and expand market share.

CONCLUSIONS AND IMPLICATIONS

The study underscores the critical importance of digital and financial literacy in enabling SMEs to thrive within the digital economy. These capabilities support higher levels of digital engagement by allowing firms to effectively integrate and apply digital technologies in their operations. A solid understanding of digital tools, combined with sound financial management, enables SMEs to capitalize on digital transformation, fostering business growth and sustaining long-term competitiveness. Strengthening both digital and financial literacy is therefore essential for SMEs seeking to transition into digitally oriented organizations. Digital literacy extends well beyond basic technical abilities, encompassing skills such as navigating digital platforms, analyzing data, and maintaining cybersecurity awareness, competencies that are increasingly vital in a rapidly evolving digital environment. SMEs with strong digital literacy are better positioned to

adopt new technologies, respond swiftly to market dynamics, and satisfy customer expectations. The findings emphasize that enhancing digital capabilities among SME owners and managers is fundamental to building resilient and competitive enterprises in the digital era. Financial literacy likewise plays a decisive role in shaping digital intensity. Competence in managing cash flows, evaluating investments, and mitigating financial risks equips SMEs to address the financial challenges associated with digitalization. Effective financial management promotes optimal resource allocation, supports sustainable technology adoption, and improves overall business performance. Accordingly, the study recommends targeted financial training for SME owners to strengthen decision-making and facilitate the successful implementation of digital solutions.

Grounded in Entrepreneurial Value Creation Theory, the research examines how owners' attitudes toward digital innovation influence digital intensity, with digital literacy acting as a mediating factor. These results are reinforced by the Technology Acceptance Model (TAM), which highlights the importance of perceived ease of use in encouraging technology adoption. Although business complexity alone does not significantly affect digital intensity, a strong growth orientation motivates SMEs to embrace digital innovation as a means of improving efficiency and achieving competitive advantage. From a policy standpoint, the study advocates prioritizing digital literacy initiatives as a core strategy for SME development. While direct government intervention shows limited impact, a coordinated approach that integrates policy support with financial literacy and networking initiatives is essential. By drawing on Social Network Theory and Cooperation Theory, the research highlights the role of business networks in advancing digital literacy through information exchange, resource sharing, and skill development.

Overall, the study proposes a holistic framework that combines digital and financial literacy development with strong networking support to enhance SMEs' efficiency, competitiveness, and market reach. Such an integrated approach not only strengthens individual SMEs but also contributes to broader economic growth, emphasizing the importance of comprehensive strategies for advancing SME digitalization.

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