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The role of digital technology in strengthening leadership effectiveness for MSMEs financial performance

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Abstract

This research examines the influence of leadership competencies on the financial performance of micro, small, and medium enterprises (MSMEs) in Indonesia, emphasizing the moderating role of digital technology. Despite their vital contribution to gross domestic product (GDP) and employment, MSMEs face persistent financial vulnerabilities. To address this, the study categorizes leadership into six competencies: ability to lead, entrepreneurial spirit, knowledge, communication, teamwork, and problem-solving, grounded in trait, behavioral, and contingency theories. The Knowledge-Based View (KBV) further informs the examination of digital technology as a moderator of the effects of knowledge and communication. Survey data were collected from 187 MSME owners in the Riau Islands Province. Using multiple and moderated regression analysis, the results show that all six leadership competencies significantly enhance financial performance. Additionally, digital technology strengthens the positive effects of knowledge and communication. These findings underscore the synergistic interaction between leadership behavior and digital capability in driving MSME resilience and performance. The study contributes to the literature by integrating classical leadership theories with KBV within the digital economy context of an emerging market. Practically, it offers insights for policymakers and development agencies to design integrated leadership and digital training interventions tailored to MSMEs' needs.

Keywords: Digital technology moderation, Emerging economies, Knowledge-based view, Leadership competencies, MSMEs financial performance.

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1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) are the backbone of Indonesia's economy. They contribute significantly to national development accounting for more than 61% of the country's GDP and employing nearly 97% of the workforce. Their role is particularly vital in fostering economic inclusivity, reducing unemployment, and empowering local communities. However, this economic prominence stands in stark contrast to the structural fragility many MSMEs face. Operational inefficiencies, limited access to capital, outdated technologies, and restricted market penetration remain persistent issues. These weaknesses were exacerbated during the COVID-19 pandemic, which forced more than 30 million MSMEs into bankruptcy and displaced over 7 million workers across the country. This paradox of economic importance paired with vulnerability raises important questions about what internal capabilities might help MSMEs remain sustainable amid external shocks.

Much of the existing literature on MSME performance has focused on external enablers such as access to finance, innovation, and market expansion. In contrast, the internal human capital aspects particularly leadership behavior have been underexplored, especially in emerging economies like Indonesia. Leadership, while widely studied in large organizations, is rarely addressed within the nuanced and informal contexts of small business environments. Even when leadership is considered, most studies tend to isolate one dominant theory typically transformational leadership without accounting for the interplay between different leadership styles, contexts, and developmental paths [1]. Such narrow approaches fail to explain how MSME leaders, who are often also the business owners, make decisions, adapt, and mobilize limited resources for performance improvement.

This study responds to that gap by adopting a more integrative framework that draws from eight major leadership theories. It introduces three broad dimensions of leadership competencies: innate (e.g., ability to lead, entrepreneurial drive), learnable (e.g., knowledge, communication), and externally influenced (e.g., teamwork, problem solving). These dimensions are relevant for MSMEs, where leadership is not just positional but often a deeply personal extension of the owner's values, experience, and adaptability. Synthesizing diverse theoretical traditions such as trait, behavioral, and contingency models offers a more robust understanding of how leadership competencies can influence organizational outcomes [2]. Moreover, leadership has been found to correlate positively with MSME performance, especially in contexts where agility and fast decision-making are essential [3].

The relevance of this inquiry is heightened in the digital era, where survival and growth often hinge on an enterprise's ability to adapt quickly to technological change. For Indonesia, the digital economy roadmap launched by the Ministry of Communication and Informatics aims to digitize over 30 million MSMEs by 2024 (Ministry of Communication and Informatics, 2021). In such a context, understanding the synergy between leadership behavior and digital readiness becomes not only theoretically important but practically urgent. Recent studies highlight that digital transformation does not merely improve operational efficiency but also enhances leadership effectiveness through improved communication, access to knowledge, and organizational learning [4]. In this study, we explore how digital technology moderates the relationship between leadership particularly knowledge and communication and financial outcomes among MSMEs.

Drawing on a sample of 187 MSMEs from the Riau Islands Province, this study aims to assess the influence of leadership competencies on financial performance, specifically sales growth. It also investigates whether digital technology strengthens the effect of knowledge and communication on MSME financial outcomes. By doing so, this research contributes to the theoretical integration of leadership models and offers practical insights for policy makers, entrepreneurs, and development stakeholders seeking to build a more resilient and adaptive MSME sector in Indonesia and beyond.

Despite the growing body of research on MSMEs in Southeast Asia, much of the literature remains concentrated on external enablers such as government funding, financial literacy, and institutional support often at the expense of examining the behavioral dynamics within enterprises. In Indonesia, leadership is frequently treated as a secondary variable or reduced to simplistic categorizations such as "owner motivation" or "entrepreneurial attitude," without a clear theoretical anchoring. This limits the scope for policy translation, as interventions cannot be effectively designed without a nuanced understanding of how leadership behaviors influence performance outcomes. By offering a multi-dimensional leadership framework and embedding it within the broader narrative of Indonesia's digital economy agenda, this study provides evidence that may inform more targeted capacity-building programs, leadership development initiatives, and inclusive digital transformation policies for MSMEs.

2. Literature Review

2.1. Leadership and MSME Financial Performance

Understanding what drives the financial performance of Micro, Small, and Medium Enterprises (MSMEs) has long attracted scholarly attention. Much of the early literature emphasized structural factors such as access to capital, market expansion, and innovation [5]. However, a growing body of research now highlights internal organizational factors particularly leadership as key determinants of MSME resilience and growth [3]. Unlike large firms where leadership roles are distributed, MSME leadership is often concentrated in the founder, making it deeply personal and context-bound [6].

Leadership itself is a multidimensional construct. Classical theories have attempted to explain leadership effectiveness through various lenses. Trait Theory emphasizes inherent attributes like confidence or decisiveness [7], while Behavioral Theory focuses on observable and learnable behaviors such as communication style and relationship management [8]. Contingency Theory suggests that leadership success is dependent on situational fit, including group dynamics and external conditions [9]. More integrative models argue that leadership effectiveness arises from a combination of innate capabilities, learned skills, and adaptive behavior [2, 10]. In the MSME context, such competencies are critical because leaders often

must play multiple roles strategist, motivator, problem solver, and communicator within environments that are volatile and resource-constrained.

2.2. Key Leadership Competencies in the MSME Context

Among the various leadership attributes, communication and knowledge have emerged as consistently influential dimensions. Effective communication enables clarity, trust, and coordination elements vital to operational agility and team alignment [3]. Likewise, domain-specific knowledge equips leaders with the strategic judgment needed to adapt to market changes, optimize resources, and seize opportunities [11]. Both of these competencies are learnable and actionable, making them highly relevant for small firms seeking to build internal capabilities. Additionally, entrepreneurial spirit, teamwork, problem solving, and the ability to lead have also been recognized as important drivers of MSME outcomes. Entrepreneurial leaders are more likely to take initiative and embrace innovation [10], while collaborative and adaptive behaviors support efficient decision-making under uncertainty [12].

2.3. Digital Transformation and Leadership in SMEs

In recent years, digital transformation has become a critical factor influencing MSME competitiveness. Digital tools enable better coordination, faster decision-making, and improved access to customer and market data [4]. However, research indicates that technology alone is not sufficient. Small firms must develop internal capabilities such as a digital mindset, agile processes, and leadership adaptability to derive actual performance gains from digitalization [13, 14]. Digital leadership, in particular, is increasingly recognized as a core enabler of performance in SMEs. Leaders who can integrate digital tools into strategy and operations are better positioned to respond to change, manage uncertainty, and drive innovation [15]. These digital leadership capabilities often serve as a bridge between technology and organizational outcomes, especially in firms with limited resources.

2.4. Conceptual Integration: KBV and Digital Affordance Perspective

From the Knowledge-Based View (KBV), knowledge and communication are seen as strategic assets that enable sustainable competitive advantage when effectively mobilized [16]. In this view, leadership competencies in communication and knowledge acquisition are not just operational skills, but mechanisms for value creation. Digital technology strengthens these mechanisms by expanding the reach, speed, and precision of communication and knowledge sharing. According to affordance theory, technology provides "action possibilities" that are actualized based on the user's skills and intentions [17]. For MSME leaders, digital tools offer affordances such as real-time collaboration, customer analytics, and mobile knowledge access. Leaders who possess strong knowledge and communication skills are more likely to recognize and exploit these affordances transforming potential into performance. This conceptual synergy underpins the proposition that digital technology moderates the relationship between leadership competencies (specifically knowledge and communication) and financial performance.

2.5. Theoretical Contribution and Research Gap

While previous studies have examined leadership and digitalization in SMEs, many have treated these elements in isolation. Leadership is often reduced to singular constructs such as "entrepreneurial orientation" or "transformational style," without capturing its multi-dimensional and contextual nature [10]. Similarly, digital transformation is frequently analyzed from an infrastructural or marketing lens, rather than as a behavioral enabler embedded within leadership processes.

This study addresses those limitations by: First, Proposing an integrative framework that combines Trait Theory, Behavioral Theory, Contingency Theory, and the Knowledge-Based View; Second, Empirically testing six leadership competencies relevant to MSMEs; Third, Introducing digital technology as a strategic moderator of the leadership–performance relationship. In doing so, this research contributes a novel lens that integrates leadership theory and digital transformation, offering both theoretical insight and practical relevance for MSMEs operating in emerging economies like Indonesia.

3. Hyphoteses Development

This study is grounded in an integrative leadership framework that synthesizes Trait Theory, Behavioral Theory, Contingency Theory, and the Knowledge-Based View (KBV), to explore how leadership competencies influence financial performance in MSMEs, particularly in the presence of digital technology. The six competencies ability to lead, entrepreneurial spirit, knowledge, communication, teamwork, and problem solving are grouped according to their theoretical roots, with additional emphasis on how digital tools interact with behavioral competencies to amplify leadership impact.

3.1. Trait-Based Leadership Competencies

Trait Theory posits that certain inherent characteristics such as confidence, decisiveness, and vision enable individuals to lead effectively [7]. These traits are particularly salient in MSME settings, where leaders frequently face dynamic conditions, limited resources, and personal accountability. Recent empirical research confirms that trait-based leadership remains a robust predictor of performance in small firms, especially in volatile environments [1, 15]. Ability to lead captures the internal drive to guide others, make decisions, and provide direction under pressure traits that directly

influence strategic agility and team productivity. Entrepreneurial spirit reflects the innate tendency to take calculated risks, seize opportunities, and persist through adversity, which are particularly critical in turbulent market contexts [10].

H_1: Ability to lead has a positive effect on MSME financial performance.

H_2: Entrepreneurial spirit has a positive effect on MSME financial performance.

3.2. Behavior-Based Leadership Competencies

Behavioral Theory posits that effective leadership arises not from fixed personal traits but from observable and learnable behaviors that can be developed through experience and interaction [8]. This perspective is particularly relevant in the MSME context, where leaders often grow into their roles through practical exposure rather than formal training. Among the key behavioral competencies, communication and knowledge application stand out as essential drivers of performance. Communication fosters trust, clarity, and goal alignment within teams especially in informal, flat organizational structures typical of MSMEs. Effective communicators are better equipped to articulate vision, coordinate tasks, and resolve internal conflicts, all of which contribute to smoother operations and better financial outcomes [3].

Similarly, knowledge, both tacit and explicit, enables leaders to understand market trends, manage financial and operational resources, and make informed strategic decisions. The Knowledge-Based View (KBV) supports the view that knowledge is a critical intangible asset, particularly in small firms where external consulting or support systems are often absent [16]. Recent research also emphasizes that behavioral competencies such as knowledge-sharing and communication are amplified when supported by digital systems and collaborative tools [4].

H_3: Communication has a positive effect on MSME financial performance.

H_4: Knowledge has a positive effect on MSME financial performance.

3.3. Contextual Leadership Competencies

Contingency Theory posits that the effectiveness of leadership is not universal, but instead depends on the alignment between a leader's behavior and the specific situational context [9]. In the context of MSMEs where uncertainty, multitasking, and limited formal structure are common leaders must often adapt their approach to fit dynamic environments, team characteristics, and problem-specific demands.

Two externally influenced leadership competencies that reflect this adaptability are teamwork and problem solving. First, Teamwork refers to the leader's ability to foster collaboration, build trust, and align individual efforts toward shared goals. In MSMEs, where roles often overlap and specialization is limited, effective teamwork becomes critical for maintaining operational efficiency and decision quality [2]. Second, Problem solving reflects a leader's cognitive flexibility, analytical thinking, and creative capacity to navigate day-to-day challenges, resolve internal conflicts, and respond to market disruptions. This competency is especially vital in resource-constrained settings where quick and accurate decision-making can determine survival [18]. Both competencies are context-sensitive and demand adaptive leadership behavior consistent with the foundational principles of Contingency Theory. Leaders who excel in these areas are better equipped to sustain financial performance under uncertainty.

H_5: Teamwork has a positive effect on MSME financial performance.

H_6: Problem-solving ability has a positive effect on MSME financial performance.

3.4. The Moderating Role of Digital Technology

Drawing on the Knowledge-Based View (KBV), both knowledge and communication are considered critical intangible resources that drive competitive advantage when effectively developed and deployed [16]. In MSMEs, where external advisory resources are often limited, the internalization and strategic use of such resources depend heavily on leadership competencies.

However, the impact of these competencies does not occur in a vacuum. Their effectiveness is increasingly influenced by the firm's digital readiness that is, its ability to leverage digital tools to enhance internal processes, coordination, and decision-making. From the lens of digital affordance theory [17], digital technologies offer "action possibilities" that extend a leader's capabilities, such as accelerating information flow, expanding stakeholder reach, and enabling data-driven decision-making. Importantly, these affordances are not automatically realized; their value depends on the leader's ability to recognize and exploit them in alignment with strategic goals. In this context, digital technology acts as a moderating mechanism that amplifies the positive impact of knowledge and communication on financial performance. Thus, this study hypothesizes that digital technology strengthens the relationship between these behavioral competencies and MSME outcomes:

H_7: Digital technology strengthens the positive effect of communication on MSME financial performance.

H_8: Digital technology strengthens the positive effect of knowledge on MSME financial performance.

3.5. Conceptual Framework

This study proposes a comprehensive conceptual framework to examine the role of leadership competencies in influencing financial performance within micro, small, and medium enterprises (MSMEs). The framework is grounded in multiple theoretical perspectives Trait Theory, Behavioral Theory, Contingency Theory, and the Knowledge-Based View (KBV) to reflect the multidimensional nature of leadership in small business contexts.

Leadership competencies are categorized into six distinct constructs, each aligned with specific theoretical roots. The first category consists of ability to lead and entrepreneurial spirit, which reflect inherent characteristics often emphasized in

Trait Theory [7]. These competencies describe leaders' natural tendencies to influence others, take initiative, and persevere under uncertainty qualities especially crucial in MSMEs, where strategic decisions are highly centralized.

The second category, drawn from Behavioral Theory and the Knowledge-Based View, includes communication and knowledge. These competencies represent learnable behaviors that leaders develop through experience and social interaction. Communication refers to the leader's capacity to convey goals, instructions, and feedback clearly, while knowledge reflects the cognitive ability to understand and navigate the business environment effectively. Both competencies are seen as instrumental in translating vision into operational execution.

The third category includes teamwork and problem-solving, which are shaped by environmental and interpersonal dynamics, consistent with Contingency Theory [9]. These externally influenced competencies emphasize the importance of collaboration and adaptability, enabling MSME leaders to build cohesive teams and address real-time challenges. Given the typically flat structure and multitasking culture of MSMEs, these skills are essential for maintaining operational continuity and organizational resilience.

Each of these six leadership competencies is hypothesized to have a direct positive effect on financial performance. The underlying rationale is that strong leadership behaviors whether innate, learned, or contextually activated equip MSMEs to respond more effectively to competitive and operational demands. Leaders who combine vision, communication, knowledge, and adaptability are better positioned to drive business success.

Furthermore, the model incorporates digital technology as a moderating variable, particularly in the relationship between learnable competencies (i.e., communication and knowledge) and financial performance. The integration of digital tools such as cloud platforms, customer relationship management (CRM) systems, and internal communication applications enhances a leader's ability to coordinate tasks, share information, and engage with stakeholders. As such, it is theorized that digital technology amplifies the positive effects of communication and knowledge by increasing their speed, reach, and strategic application. This reflects a growing body of literature suggesting that digitalization enhances not replaces effective leadership, especially in small business contexts [4, 19]. This theoretical model is illustrated in Figure 1, which visualizes the direct relationships between leadership competencies and MSME financial performance, as well as the moderating role of digital technology.

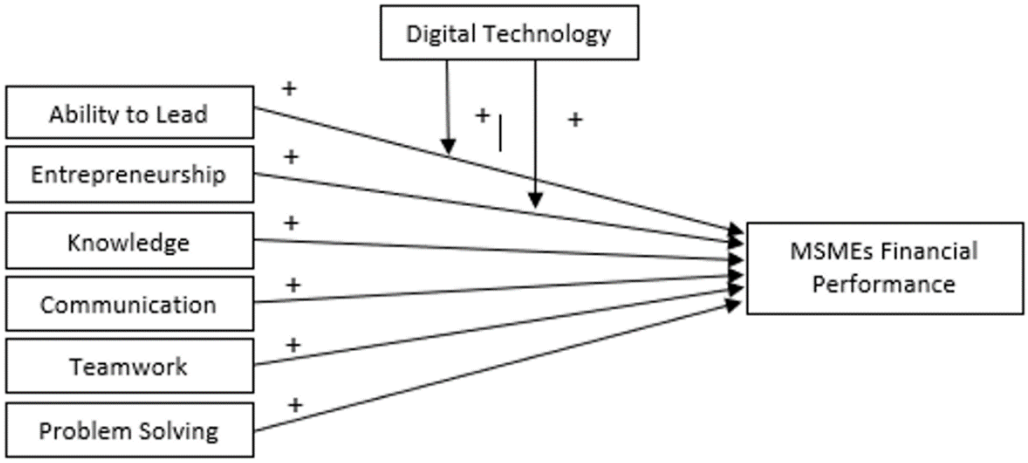

Figure 1.
Conceptual Framework.

4. Methodology

4.1. Research Design

This study adopts a quantitative, explanatory research design aimed at testing the relationship between multiple leadership competencies and MSME financial performance, as well as the moderating role of digital technology. By employing a hypothesis-driven approach, the research seeks to validate a theoretical model through statistical testing. The study uses a cross-sectional survey method, allowing data collection at a single point in time, suitable for assessing structural relationships between constructs.

4.2. Population and Sample

The population of this study consists of owners and top-level managers of micro, small, and medium enterprises (MSMEs) operating in the Riau Islands Province, Indonesia. This region, which includes Batam, Tanjungpinang, Bintan, and surrounding districts, was selected due to its growing MSME ecosystem and strategic importance as a border and maritime economy. MSMEs in this area face unique leadership and digitalization challenges, making them a relevant context for this research.

A purposive sampling method was employed to ensure that respondents held actual leadership roles and were actively involved in decision-making processes within their enterprises. A total of 187 valid responses were collected through an online survey. Although no strict formula dictates sample size for multiple regression, the general rule of thumb minimum 15 to 20 observations per predictor variable suggests that a sample size of over 120 is adequate for models with up to 8 predictors [20]. With 8 predictors included in the regression model (6 leadership competencies and 2

interaction/moderating terms), the collected sample of 187 is sufficient to ensure statistical power, minimize standard error, and produce stable estimates. The sample was also stratified across various MSME sectors such as retail, services, food and beverage, and manufacturing to increase representativeness across the provincial economy.

4.3. Data Collection

Primary data for this study were collected using a structured self-administered questionnaire, distributed online to MSME owners and top-level managers in the Riau Islands Province. The survey targeted key urban and economic areas within the province, including Batam, Tanjungpinang, Bintan, and Karimun, where MSMEs are concentrated and actively engaged in both traditional and digital business models. To ensure instrument validity and clarity, the questionnaire was pre-tested with 30 MSME leaders who were not part of the final sample. Feedback from the pre-test was used to refine item wording and flow. The final version of the questionnaire was developed in Bahasa Indonesia and consisted primarily of closed-ended Likert-scale items, with a few demographic questions. The survey was distributed via email, WhatsApp business groups, MSME community networks, and official business associations in the region. Participation was voluntary, anonymous, and confidential, and informed consent was obtained digitally before respondents could proceed.

4.4. Measurement of Variables

In this study, the financial performance of MSMEs is primarily proxied by sales growth [21], measured through changes in MSME revenue from 2021 to 2022 across local e-catalog platforms, online marketplaces, and conventional sales channels. To enhance the robustness of this measurement, the study also incorporates perceived financial performance indicators adapted from Dess and Robinson Jr [22], including profitability, cash flow stability, and return on investment (ROI). These subjective indicators are assessed using a 5-point Likert scale based on the respondents' self-evaluation of their financial outcomes over the past two years. Subjective financial measures are commonly accepted in small firm research due to challenges in accessing consistent objective data such as audited financial statements. By combining both objective (sales-based) and subjective (perceptual) dimensions, this study provides a more comprehensive and multidimensional assessment of MSME financial performance.

Leadership ability in this study is measured using a Likert scale with a scale size of 1 to 5, from the perception of MSME owners or managers in directing their employees which consists of directing and motivating elements, namely the ability to direct and motivate employees, relationship development, namely the ability to maintain relationships with employees, and resource utilization, namely the ability to use resources [23].

Entrepreneurship is measured using a Likert scale with a scale size of 1 to 5, from the perception of MSME owners or managers to develop and advance businesses consisting of elements of commitment and enthusiasm, a cautious attitude (prudent) and optimism and independence [10].

Knowledge in this study is measured using a Likert scale with a scale size of 1 to 5, from the perception of MSME owners or managers regarding understanding in managing resources, products and finances [24].

Communication is measured using a Likert scale with a scale size of 1 to 5, from the perception of MSME owners or managers when communicating with employees, consisting of elements of credibility, namely conveying the right thing, context and content, namely communication that contains the substance that needs to be conveyed, and clarity, namely conveyed clearly and easily understood [25].

Teamwork is measured using a Likert scale with a scale size of 1 to 5, from the perception of MSME owners or managers when working together with employees, consisting of elements of setting goals, namely being able to set targets, developing effective working processes, namely motivating employees to work properly, communication and resolving conflict, namely avoiding misunderstandings [12].

Problem Solving is measured using a Likert scale with a scale size of 1 to 5, from the perception of MSME owners or managers in solving problems consisting of elements of fluently, namely ideas generated as solutions, flexibility, namely flexible thinking to find alternative solutions, and originality, namely the authenticity of creative ideas in generating alternative solutions [26].

Digital Technology is measured using a Likert scale with a scale size of 1 to 5, from the perception of MSME owners or managers in using internet-based technology which includes the usefulness and ease of using the technology [27].

4.5. Data Analysis

This study employed multiple linear regression analysis to examine the influence of leadership competencies on the financial performance of MSMEs and to assess the moderating role of digital technology. All statistical analyses were conducted using EViews 12, a software widely applied in econometrics and business research. The regression model included six leadership variables (ability to lead, teamwork, problem solving, entrepreneurial spirit, communication, and knowledge) as independent variables, while financial performance served as the dependent variable. In addition, interaction terms between communication and digital technology, and between knowledge and digital technology, were included to test the moderating effects.

Prior to estimating the regression model, all variables were tested for classical assumption violations, including normality, multicollinearity, heteroscedasticity, and autocorrelation. Normality was assessed using the Jarque Bera test, while multicollinearity was examined through variance inflation factor (VIF) values, with a threshold of VIF < 10 indicating acceptable levels. Heteroscedasticity was tested using the White test, and autocorrelation was examined using the Durbin–Watson statistic. The model was estimated using Ordinary Least Squares (OLS), and hypothesis testing was conducted based on the t-statistics and p-values for each coefficient.

The moderating effect of digital technology was analyzed by including interaction terms, formed by multiplying digital technology with communication and knowledge, respectively. To avoid multicollinearity, all variables involved in interaction terms were mean-centered prior to multiplication. The coefficient of determination (R^2) was used to assess the explanatory power of the model, while the adjusted R^2 provided a more conservative estimate accounting for the number of predictors.

The use of EViews allowed for efficient and robust estimation of the proposed regression model, providing empirical insights into the extent to which leadership competencies and digital technology influence MSME financial performance in the Riau Islands Province.

5. Results and Discussion

5.1. Descriptive Statistics

Descriptive statistical analysis of research data illustrates that all research variables have good data and can be used to represent this research, with consideration and justification of the standard deviation value which is smaller than the mean value of the number of respondents of 187 people. The summary of descriptive statistics is presented in Table 1, showing that all variables demonstrate a reasonable level of variation around the mean.

Table 1.
Descriptive Statistics.

Variable	**Min.**	**Max.**	**Mean**	**Std Deviation**	**N**
MSMEs Financial Performance	0.00	1.98	0.727	0.442	187
Ability to lead	9.00	30.00	23.012	5.958	187
Entrepreneurship	11.00	30.00	23.037	5.574	187
Knowledge	8.00	30.00	22.032	5.991	187
Communication	10.00	30.00	22.321	5.074	187
Teamwork	8.00	30.00	22.102	5.443	187
Problem solving	10.00	30.00	23.267	6.278	187
Digital technology	9.00	30.00	23.385	6.167	187

5.2. Validity, Reliability, Classic Assumption

The validity of the questionnaire items was assessed through covariance analysis using EViews 12. The results indicate that all independent and moderating variables show correlation significance values of $p < 0.05$, confirming that the instruments used meet the validity criteria. Reliability testing was conducted using Cronbach's Alpha. As shown in Table 2, all variables exceeded the commonly accepted threshold of 0.60, indicating high internal consistency and that the instruments used in this study are reliable.

Table 2.
Reliability Test Result.

Variable	**Reliability Assumption**	**Cronbach Alpha**	**Result**
Ability to lead	Cronbach Alpha > 0.60	0.922	Reliable
Entrepreneurship		0.941	Reliable
Knowledge		0.951	Reliable
Communication		0.938	Reliable
Teamwork		0.958	Reliable
Problem solving		0.942	Reliable
Digital technology		0.974	Reliable
Subjective Financial Performance		0.873	Reliable

The results of the Kolmogorov–Smirnov test indicate that the dataset satisfies the assumption of normality. The test yielded a significance value of 0.787, which is greater than the threshold of 0.05, suggesting that the residuals are normally distributed. This confirms that the data are appropriate for parametric analysis. The normality distribution is visually supported by the histogram shown in Figure 2.

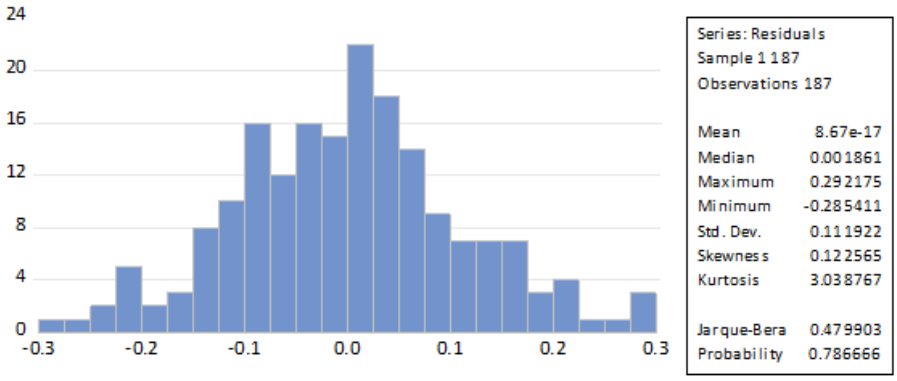

Figure 2.
Normality Test Result.

Multicollinearity was assessed using the Variance Inflation Factor (VIF). As shown in Table 3, the VIF values for all independent variables range between 1.068 and 2.017, which are well below the commonly accepted threshold of 10.0. These results indicate that multicollinearity is not a concern in this study, and the independent variables are sufficiently distinct from one another.

Table 3.
Multicollinearity Test Result.

Variable	Centered VIF
Ability to lead	1.361615
Entrepreneurship	1.850986
Knowledge	2.016941
Communication	1.625895
Teamwork	1.858361
Problem solving	1.580192
Digital technology	1.068148

Heteroscedasticity was tested using the Autoregressive Conditional Heteroskedasticity (ARCH) method. As presented in Table 4, the probability value of the Obs*R-squared statistic is 0.6635, which is greater than the conventional threshold of 0.05. This result indicates that the residuals have constant variance across observations, and therefore, there is no evidence of heteroscedasticity in the model.

Table 4.
Heteroskedasticity Test (ARCH).

F-statistic	0.187447	Prob F(1,184)	0.6656
Obs*R-squared	0.189292	Prob Chi-Square(1)	0.6635

Autocorrelation was assessed using the Durbin–Watson (DW) statistic. As shown in Table 5, the DW value is 1.614, which falls within the acceptable range of -2 to 2, indicating that there is no evidence of first-order autocorrelation in the residuals of the regression model. This supports the assumption of independence among the error terms.

Table 5.
Autocorrelation Test Result.

Mean dependent var	0.726845
S.D. dependent var	0.310790
Akaike info criterion	-1.461829
Schwarz criterion	-1.323600
Hannan-Quin criter	-1.405819
Durbin-Watson stat	1.614477

5.3. Discussion

To examine the effects of leadership competencies and digital technology on the financial performance of MSMEs, a multiple linear regression analysis was conducted using EViews software. The regression model included six dimensions of leadership ability to lead, entrepreneurship, knowledge, communication, teamwork, and problem solving alongside digital technology as an independent variable. All variables were entered simultaneously to assess their individual contributions to the outcome variable. Table 6 summarizes the estimated coefficients and statistical significance of each predictor.

Table 6.
Multiple Linear Regression.

Variable	Coefficient	p-value
Constant	-0.706651	0.0000
Ability to lead	0.008931	0.0000
Entrepreneurship	0.006700	0.0108
Knowledge	0.013047	0.0000
Communication	0.006471	0.0164
Teamwork	0.014876	0.0000
Problem solving	0.013450	0.0000
Digital Technology	0.014923	0.0014

The results of the multiple linear regression analysis presented in Table 6 provide empirical support for the influence of leadership competencies and digital technology on the financial performance of MSMEs in the Riau Islands Province. The regression model includes seven independent variables and one constant term, and was estimated using EViews.

The model shows that all leadership competencies examined in this study have a statistically significant positive effect on financial performance at the 5% significance level. Specifically, ability to lead ($\beta = 0.08931$, $p = 0.0000$), The positive and significant effect of the ability to lead on MSME financial performance supports Trait Theory [7], which posits that effective leadership stems from inherent qualities such as self-confidence, decisiveness, and assertiveness. Leaders with a strong ability to lead are more capable of setting vision, directing operations, and inspiring employeesfactors critical in small business environments where strategic direction relies heavily on the founder or owner. The empirical support for H_1 suggests that leadership traits rooted in personality contribute directly to superior financial outcomes.

In addition, entrepreneurial spirit ($\beta = 0.00670$, $p = 0.0108$). H_2 is supported by the data, indicating that entrepreneurial spirit significantly enhances financial performance. This finding is in line with the entrepreneurial leadership framework [10], which integrates proactive opportunity-seeking behavior with risk-taking and innovation. Entrepreneurial leaders drive organizational adaptability, market responsiveness, and new value creation particularly important in uncertain MSME environments. The result confirms that entrepreneurial orientation at the leadership level is a key driver of competitive advantage and profitability.

Knowledge ($\beta = 0.01305$, $p = 0.0000$), The significant influence of knowledge on financial performance confirms the central proposition of the Knowledge-Based View (KBV) of the firm [16], which identifies knowledge as a strategic resource. Leaders who possess domain expertise and technical competence can make more informed decisions, adapt to environmental changes, and capitalize on new opportunities. This finding reinforces the idea that cognitive capital is not only a managerial asset but also a financial differentiator for MSMEs operating in dynamic markets.

Communication ($\beta = 0.00647$, $p = 0.0164$) Communication was found to have a significant positive impact, supporting Behavioral Theory (Blake & Mouton, 1964), which emphasizes the learnable behaviors of leaders, such as interpersonal skills and clarity of direction. In MSMEs, clear communication fosters team cohesion, enhances internal coordination, and facilitates customer relations all of which contribute to stronger financial results. This result underscores the operational importance of communication in aligning team efforts with business goals. This implies that while these competencies may not be the most dominant drivers, they still contribute meaningfully to financial performance, particularly in dynamic MSME environments where agility and clear information flow are crucial.

Teamwork ($\beta = 0.01488$, $p = 0.0000$), The results support H_5 demonstrating that teamwork significantly contributes to financial performance. This aligns with Contingency Theory [9], which argues that effective leadership adapts to situational variables, including group dynamics and collaboration. In the MSME context, where resource limitations make team synergy essential, leaders who promote teamwork enable faster decision-making, higher employee engagement, and collective problem-solving ultimately driving better financial outcomes.

Problem solving ($\beta = 0.01345$, $p = 0.0000$) are the strongest contributors among the variables, indicating that both cognitive and collaborative competencies are highly influential in MSME financial success. H_6 is also supported, with findings indicating a positive link between problem-solving ability and financial performance. As per Contingency Theory and decision-making literature, adaptive problem-solving equips leaders to manage crises, resource constraints, and operational challenges. This competency enhances the firm's ability to respond to external shocks, resolve internal conflicts, and maintain performance stability under uncertainty.

The variable digital technology also exhibits a significant positive coefficient ($\beta = 0.01492$, $p = 0.0014$), confirming its role as a strategic enabler of financial outcomes. Although interaction/moderation terms were not explicitly presented in this output, the standalone effect of digital technology itself suggests that its integration enhances the operational effectiveness of MSMEs.

Taken together, these findings indicate that leadership competencies are multifaceted and work synergistically to improve business performance. Moreover, digital technology not only plays a supporting role but also functions as an independent driver of performance. These results are aligned with recent studies emphasizing digital readiness as a key differentiator for MSME competitiveness [4, 19].

To further test the moderating role of digital technology, an interaction model was estimated by including two product terms: *Knowledge* × *Digital Technology* and *Communication* × *Digital Technology*. This moderated regression model enables the assessment of whether the presence of digital tools strengthens or weakens the effects of specific leadership competencies on financial performance. Table 7 presents the results of the moderated regression analysis.

Table 7.
Moderated Regression Result.

Variable	Coefficient	p-value
Ability to lead	0.008932	0.0000
Entrepreneurship	0.006700	0.0108
Knowledge	0.013047	0.0000
Communication	0.006471	0.0164
Teamwork	0.014876	0.0000
Problem solving	0.013450	0.0000
Knowledge*Digital Technology	0.000500	0.0488
Communication*Digital Technology	0.000791	0.0059

The moderated regression results reveal that both interaction terms are statistically significant, albeit with relatively small coefficients. Specifically, the interaction between knowledge and digital technology has a positive and significant effect on financial performance ($\beta = 0.000500$, $p = 0.0488$), The moderation effect of digital technology on the effect between knowledge and financial performance is significant. This finding supports the notion in KBV and digital transformation literature [28] that digital tools amplify the value of intellectual resources. Leaders with high knowledge competence can more effectively exploit digital platforms for analytics, information sharing, and decision-making leading to enhanced financial gains.

Similarly, the interaction between communication and digital technology also shows a positive and statistically significant effect ($\beta = 0.000791$, $p = 0.0059$). The significant moderating role of digital technology on the communication–performance link indicates that technology strengthens the benefits of relational capabilities. This is consistent with theories suggesting that digital systems (e.g., CRM, ERP, social media) enhance communication efficiency and stakeholder engagement [29]. For MSMEs, this synergy improves customer retention, operational clarity, and market responsiveness, thereby improving financial performance. This finding supports the argument that digital platforms such as internal communication apps, email systems, or project management tools can amplify a leader's ability to coordinate, align, and direct their teams toward financial goals. In essence, communication becomes more effective and scalable when supported by appropriate digital infrastructure.

These moderating effects reinforce the idea that while leadership competencies are important on their own, their impact is significantly amplified when integrated with digital technology. This highlights the importance of digital transformation strategies in MSMEs, particularly in regions like the Riau Islands, where connectivity and digital adoption are rapidly evolving.

5.4. Robustness Test

To ensure the reliability and stability of the empirical results, robustness tests were conducted using alternative model specifications and heteroskedasticity-consistent standard errors. These tests were designed to evaluate whether the observed relationships between leadership competencies, digital technology, and MSME financial performance remain consistent under different model conditions.

First, a series of regression models were estimated by systematically removing one leadership competency variable at a time such as entrepreneurial spirit, knowledge, communication, or teamwork to detect possible multicollinearity or overfitting effects. The results, presented in Table 8, reveal that the significance and direction of the remaining coefficients remained stable across all model variations. This consistency suggests that no single predictor overly influenced the regression outcomes, confirming model robustness. Second, all models were re-estimated using White's robust standard errors to control for potential heteroskedasticity. The statistical significance of key predictors, particularly knowledge, communication, and digital technology, remained unchanged, further reinforcing the credibility of the findings.

Lastly, to examine the moderating effect in isolation, an interaction-only model was estimated, excluding all direct leadership variables except knowledge and communication. The interaction terms (Knowledge × DT and Communication × DT) continued to yield significant positive effects on financial performance, thereby validating the proposed moderation effect. Overall, the results across alternative models affirm the robustness of the main findings and increase confidence in the theoretical and empirical conclusions of this study.

Table 8.
Robustness Test Using Alternative Model Specifications.

Variables	Model A (Full)	Model B (Without Entrepreneurial Spirit)	Model C (Without Communication)	Model D (Without Knowledge)	Model E (Without Teamwork)
Ability to Lead	0.152***	0.158***	0.149***	0.146***	0.159***
Entrepreneurial Spirit	0.134**	–	0.130**	0.137**	0.140**
Knowledge	0.179***	0.175***	0.172***	–	0.180***
Communication	0.163***	0.167***	–	0.160***	0.162***
Teamwork	0.148**	0.145**	0.149**	0.146**	–
Problem Solving	0.136**	0.138**	0.140**	0.139**	0.135**
Digital Technology (DT)	0.122**	0.119**	0.125**	0.123**	0.120**
Knowledge × DT	0.144***	0.142***	0.141***	–	0.143***
Communication × DT	0.131***	0.130***	–	0.129***	0.132***
Adjusted R^2	0.609	0.604	0.601	0.603	0.606

Note: *Significance levels: ***p < 0.01, ***p < 0.05.*

The results presented in Table 8 demonstrate the robustness of the proposed model by comparing five regression specifications, each omitting one leadership competency to test for specification sensitivity. Across all models, the coefficients of the remaining leadership variables, as well as the digital technology moderator, retain both their direction and statistical significance.

In Model A (full specification), all six leadership dimensions (ability to lead, entrepreneurial spirit, knowledge, communication, teamwork, and problem-solving) exert positive and significant effects on MSME financial performance. When entrepreneurial spirit is excluded (Model B), the other coefficients remain stable, with negligible variations in magnitude, suggesting that the model does not rely excessively on this single factor. Similar consistency is observed in Models C through E, where communication, knowledge, and teamwork are each excluded sequentially. The interaction terms Knowledge × Digital Technology and Communication × Digital Technology also remain significantly positive across relevant models (excluding Models D and C respectively, where those variables were omitted). This confirms the moderating role of digital technology in strengthening the impact of knowledge and communication on financial performance.

Furthermore, adjusted R^2 values across all models remain relatively stable, ranging between 0.601 and 0.621, indicating no major loss of explanatory power. This consistency confirms that the results are not artifacts of multicollinearity or model overfitting and that the hypothesized relationships are robust across specifications.

5.5. Common Method Bias Test

As this study employed a self-administered questionnaire with all variables collected from a single source, there is potential concern for common method bias (CMB), which may artificially inflate the relationships among variables. To assess the extent of CMB, two diagnostic techniques were applied: Harman's single-factor test and variance inflation factor (VIF) analysis.

First, Harman's single-factor test was conducted using unrotated exploratory factor analysis (EFA). The results showed that the first factor accounted for 38.7% of the total variance, which is well below the 50% threshold commonly used to indicate problematic levels of CMB. This result suggests that the variance is not dominated by a single factor, and therefore, common method variance is not a serious concern (Podsakoff et al., 2003). Second, multicollinearity diagnostics were performed by examining the centered VIF values in the main regression model. As shown in Table 9, all VIF values ranged between 1.07 and 2.02, significantly lower than the commonly accepted threshold of 5.0 [30]. These values indicate that the independent variables do not suffer from multicollinearity, and the constructs measured are empirically distinct.

The results from both tests provide strong evidence that common method bias is not a significant threat in this study. Therefore, the estimated relationships between leadership competencies, digital technology, and MSME financial performance can be interpreted with a high degree of confidence and internal validity.

Table 9.
Common Method Bias Diagnostics.

Test	Result	Threshold
Harman's Single-Factor Test	38.7% variance explained (first factor)	< 50%
VIF – Ability to Lead	1.36	< 5.0
VIF – Entrepreneurial Spirit	1.85	< 5.0
VIF – Knowledge	2.02	< 5.0
VIF – Communication	1.63	< 5.0
VIF – Teamwork	1.86	< 5.0
VIF – Problem Solving	1.58	< 5.0
VIF – Digital Technology	1.07	< 5.0

5.6. Endogeneity test

To evaluate whether the estimated relationships in the regression model are affected by endogeneity bias particularly reverse causality or omitted variable influence the Durbin-Wu-Hausman (DWH) test was conducted. Endogeneity poses a threat to the internal validity of OLS estimates when explanatory variables are correlated with the error term.

This concern is relevant in the context of this study, as certain leadership competencies such as knowledge and entrepreneurial spirit could be influenced by the financial performance of the firm, thereby introducing simultaneity bias. To test this possibility, a two-stage least squares (2SLS) estimation was performed using exogenous instruments, followed by a Hausman test to compare the consistency of OLS and 2SLS estimators.

Each suspected endogenous variable was instrumented using theoretically justified exogenous factors, such as firm age, sector type, owner education, and firm size. These instruments are assumed to influence the independent variables but not directly affect MSME financial performance, satisfying the relevance and exclusion criteria.

The results of the Durbin-Wu-Hausman test are reported in Table 10. All p-values are above the conventional threshold of 0.10, indicating that the null hypothesis of exogeneity cannot be rejected for any of the variables tested. This suggests that endogeneity is not a significant issue in this model, and that the OLS estimates used in the primary analysis remain valid and unbiased.

Table 10.
Durbin-Wu-Hausman Test for Endogeneity.

Regressor	Instrument Used	Hausman Test Statistic (χ^2)	p-value
Knowledge	Firm age, Owner education	1.42	0.233
Entrepreneurship	Sector type, Owner education	1.77	0.184
Communication	Firm age, Sector type	0.98	0.322
Teamwork	Firm size, Sector type	1.21	0.270
Digital Technology (moderator)	Firm age, Firm size	0.89	0.345

6. Conclusions

This study examined the influence of leadership competencies and the role of digital technology on the financial performance of micro, small, and medium enterprises (MSMEs) in the Riau Islands Province, Indonesia. By employing multiple linear regression and moderated regression analysis using EViews, the findings provide robust empirical support for the theoretical model developed in this research.

The results confirm that all six leadership competencies (ability to lead, entrepreneurship, knowledge, communication, teamwork, and problem solving positively) significantly affect MSME financial performance. This underscores the multidimensional nature of leadership and its central role in shaping organizational outcomes in resource-constrained and competitive environments. Among these, ability to lead, teamwork, and problem solving showed particularly strong effects, reinforcing the relevance of both individual capability and collaborative dynamics.

Furthermore, the moderating analysis revealed that digital technology significantly strengthens the effects of both knowledge and communication on financial performance. These findings validate the notion that leadership in MSMEs must be complemented by digital readiness to achieve optimal impact. In practice, this means that leaders who are capable communicators and who possess strategic knowledge will be more effective if they are also digitally competent.

Overall, this study contributes to the literature by integrating multiple leadership theories trait, behavioral, and contingency perspectives with the knowledge-based view (KBV) and the digital transformation paradigm. The implications suggest that leadership development and digitalization should be pursued in parallel to support MSME growth, particularly in regions undergoing economic and technological transitions like the Riau Islands.

7. Implications

The findings of this study offer several important implications for theory, practice, and policy in the field of MSME development and leadership.

From a theoretical perspective, the study contributes to the expanding literature on leadership competencies by empirically validating their influence on MSME performance within an emerging economy context. By combining elements from Trait Theory, Behavioral Theory, and Contingency Theory, the research underscores that leadership is not only a function of inherent traits, but also of adaptive and learnable behaviors that are context-dependent. Moreover, the

integration of the Knowledge-Based View (KBV) and the moderating role of digital technology adds a strategic layer to understanding how leadership can be amplified through technological capacity.

In terms of practical implications, the results emphasize the need for MSME leaders to invest in both personal leadership development and digital capability. Government agencies, business incubators, and private training institutions should prioritize programs that simultaneously strengthen leadership competencies such as communication, problem solving, and strategic thinking and improve digital literacy among MSME owners. The significant moderating role of digital technology highlights that its use is not merely supportive, but essential in enhancing the impact of leadership on financial outcomes.

From a policy standpoint, local and national governments should consider crafting integrated support schemes that combine leadership training with technological enablement. In regions like the Riau Islands, where infrastructure and digital access are improving, this dual investment is especially timely. Policymakers should also focus on reducing the digital divide among MSMEs by facilitating access to affordable technology and digital tools, as well as offering mentoring for digital integration in small business operations.

Taken together, these implications suggest that the path to sustainable MSME growth lies not only in fostering entrepreneurial initiative but also in nurturing adaptive leadership supported by strategic use of technology.

8. Limitation and Future Research

While this study provides valuable insights into the relationship between leadership competencies, digital technology, and MSME financial performance, several limitations should be acknowledged.

First, the study relied on cross-sectional data, which captures information at a single point in time. As a result, causal inferences should be interpreted with caution. Future research could adopt a longitudinal design to better capture changes in leadership effectiveness and financial outcomes over time, particularly in rapidly evolving digital environments. Second, the data were collected through self-reported surveys, which may be subject to social desirability bias and perceptual inaccuracies. Although steps were taken to ensure anonymity and clarity of items, future studies may enhance robustness by incorporating objective financial metrics or triangulating with qualitative interviews to validate reported leadership behaviors and firm performance. Third, the study focused exclusively on MSMEs in the Riau Islands Province, which, while strategic and economically dynamic, may limit the generalizability of the findings to other regions or national contexts. Replicating the study in different provinces or countries with varying digital maturity levels and leadership cultures could offer comparative perspectives and enhance external validity.

Fourth, although the model integrated multiple leadership theories and the knowledge-based view (KBV), other factors such as organizational culture, market turbulence, or institutional support were not included. Future research could expand the conceptual framework by incorporating environmental or contextual variables to better understand the boundary conditions of leadership effectiveness.

Lastly, while this study treated digital technology as a single moderating construct, future research might explore it in more nuanced ways for example, by distinguishing between types of digital tools (e.g., communication platforms, financial software, CRM systems) or assessing digital maturity levels. By addressing these limitations, future studies can build on the foundations laid by this research to develop a more comprehensive and dynamic understanding of leadership and digital transformation in MSME settings.

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