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Research Article

Integrating Financial Literacy, Financial Technology, and MSME Performance with Moderated Networking to Support Sustainable Production Methods

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ABSTRACT

Purpose of the study: This study aims to analyze the influence of financial literacy and financial technology on the performance and sustainability of MSMEs, with performance as a mediating variable and networking as a moderating variable.

Methodology: The research method used was explanatory research with a quantitative approach. Data were obtained from 80 food and beverage MSMEs in Genuk District, Semarang, using a Likert-scale questionnaire and analyzed using multiple linear regression, the Sobel test, and Moderated Regression Analysis (MRA).

Main Findings: The research results show that financial literacy and financial technology have a positive and significant impact on the performance and sustainability of MSMEs. MSME performance has also been shown to improve business sustainability. However, networking does not strengthen the relationship between financial literacy and performance; instead, it only enhances the influence of financial technology on MSME performance.

Novelty/Originality of this study: This finding provides a theoretical contribution by emphasizing that the sustainability of MSMEs is not only determined by financial literacy and the use of fintech, but also by the synergy between business performance and the social networks owned by MSME actors.

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1. INTRODUCTION

Developments in information, communication, and technology have driven the emergence of various innovations aimed at simplifying human work. Technological transformation encompasses not only production and distribution but also financial management, which is now emerging in the form of financial technology (fintech) [1]-[3]. Fintech is a development of financial systems that enable buying and selling transactions, fund deposits, and financial management to be conducted digitally through tools such as e-banking and e-money [4], [5]. The presence of fintech offers a faster, more precise, and more efficient way to conduct business than conventional methods [6]-[8].

Furthermore, fintech extends beyond financial transactions; it also offers a variety of features that support business continuity [9], [10]. Some of these services include digital insurance (business insurance), crowdfunding (investment offerings for mutual benefit), and peer-to-peer lending (P2P), which makes it easier for businesses to obtain additional capital with less stringent requirements [10]-[12]. Through these services, MSMEs can expand financial access while increasing their business sustainability opportunities.

The Micro, Small, and Medium Enterprises (MSMEs) sector is one of the sectors that has benefited most from the development of fintech [13], [14]. Fintech makes it easier for MSMEs to conduct buying and selling transactions, manage cash flow through e-banking systems, and obtain additional financing without having to go through more complex conventional banking procedures [15], [16]. Data from the Financial Services Authority (OJK) in 2020 recorded 155 licensed fintech companies in Indonesia [17]-[19]. Meanwhile, the Indonesian Fintech Joint Funding Association (AFPI) reported that 60% of P2P lending users come from the MSME sector, making MSMEs a key driver of fintech growth in Indonesia.

In the context of this research, the focus is directed at MSMEs in the food and beverage sector in the Genuk area of Semarang City. This sector was chosen because it has a dominant number of business actors compared to other sectors and contributes significantly to the regional economy [20]-[22]. Based on Bank Indonesia data (2021), the revenue of food and beverage MSMEs in Semarang City reached IDR 2.84 billion in 2019, increased to IDR 3.52 billion in 2020, and then declined again to IDR 3.28 billion in 2021 [23]. This fluctuation indicates dynamics influenced by various factors, including financial literacy and fintech adoption.

Although several previous studies have examined the influence of financial literacy and fintech on MSME performance, the results have been inconsistent. A positive effect of financial literacy on MSME performance [24], [25]. However, financial literacy had no significant effect [5]. A similar finding is evident in a study on fintech, where [26] concluded a significant influence on MSME performance. This inconsistency in findings indicates a research gap and warrants further investigation by adding a moderating variable, namely networking. The novelty of this study lies in the integration of networking as a moderating factor in the relationship between financial literacy, fintech, and MSME performance. Networking, which encompasses social and professional networks, is believed to strengthen the utilization of financial literacy and financial technology to support business performance. This approach has not been widely explored in previous research, particularly in the food and beverage MSME sector in the Genuk region. Therefore, this study contributes to enriching academic perspectives on the factors driving MSME sustainability in the digital era.

The urgency of this research is based on the importance of strengthening MSME competitiveness amidst intense business competition and rapid technological developments. Effective implementation of financial literacy and fintech, supported by adequate networking, is expected to increase MSME efficiency, productivity, and business sustainability. Therefore, this study aims to analyze the influence of financial literacy and financial technology on the performance of MSMEs with the role of networking as a moderating variable in the food and beverage sector in the Genuk area, Semarang City.

2. RESEARCH METHOD

This research uses a quantitative approach with explanatory research, aiming to explain causal relationships between variables through hypothesis testing [27], [28]. The independent variables in this study are financial literacy and financial technology. The dependent variable is MSME sustainability, with MSME performance as an intervening (mediating) variable and networking as a moderating variable. This research design was chosen because it is suitable for analyzing both direct and indirect relationships between variables.

Based on the analysis and discussion of the relationships between the research variables, it can be hypothesized that to improve MSME performance and sustainability, optimization and improvement of financial literacy and financial technology variables are required, with networking as a moderating factor. Therefore, the research framework established in this study is as follows figure 1.

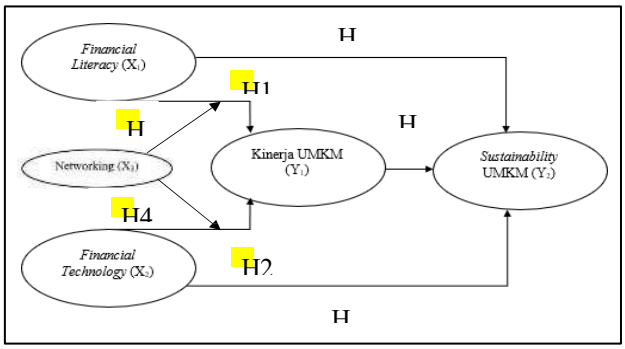

Figure 1. Research Framework

The population in this study was all MSMEs in the food and beverage sector operating in the Genuk area of Semarang City. The sampling technique used the snowball sampling method, a sequential sampling technique starting with an initial number of respondents and then expanding to a predetermined number.

The sampling criteria were as follows: 1). MSMEs produce their own food and beverage products. 2). MSMEs have a minimum net income of IDR 1,500,000.00 per month; 3) MSMEs have a minimum of two employees; 4) MSMEs use financial technology (e.g., mobile banking, online transactions, or other fintech applications) in their business operations. Based on these criteria, a sample size of 80 MSMEs met the requirements.

Table 1. Research Criteria and Sample Size

Sample Criteria	Requirements	Number of Selected Respondents
Independent food/beverage production	Mandatory	80
Income ≥ Rp 1,500,000/month	Mandatory	80
Number of employees ≥ 2 people	Mandatory	80
Using fintech (Mobile Banking, online applications, etc.)	Mandatory	80

Data collection methods were conducted using two techniques 1). Questionnaire: The main instrument was a closed-ended questionnaire with a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The questionnaire was used to measure respondents' perceptions of the research variables; 2). Literature Review: Secondary data collection through books, journal articles, and official reports related to financial literacy, fintech, MSME performance, and networking to strengthen the research's conceptual framework. The Likert scale used was table 2.

Table 2. Likert scale

Score	Description
1	Strongly Disagree (STS)
2	Disagree (TS)
3	Neutral / Don't Understand (N)
4	Agree (S)
5	Strongly Agree (SS)

The main instrument in this study was a structured questionnaire designed to measure the research variables. The questionnaire consisted of six sections: (1) respondent identity, including age, gender, length of business, and number of employees; (2) questions related to financial literacy; (3) questions regarding the use of financial technology; (4) questions regarding MSME performance; (5) questions regarding networking; and (6) questions regarding MSME sustainability. The questionnaire used a five-point Likert scale to facilitate measuring respondents' level of agreement with each indicator [29]-[31]. In addition to the questionnaire, this study also included a short interview guide and observation sheets to strengthen the validity of the field data and provide a more comprehensive understanding of the respondents' actual conditions.

The data obtained in this study were processed through several stages of analysis. The first stage was descriptive analysis, aimed at describing the characteristics of respondents and the tendency of responses to each variable by examining the average, minimum, maximum, and standard deviation values. Next, instrument testing was conducted, including validity testing using the Pearson Product Moment technique and reliability testing using Cronbach's Alpha to ensure the reliability of the research instrument. Following this, classical assumption tests, including normality, multicollinearity, and heteroscedasticity tests, were conducted to ensure the data met the requirements for regression analysis. The next stage was multiple linear regression analysis to examine the influence of financial literacy and fintech on the performance and sustainability of MSMEs. The Sobel test was used to examine the role of MSME performance as a mediating variable, while the role of networking as a moderating variable was analyzed using Moderated Regression Analysis (MRA). Hypothesis testing was conducted at a 5% significance level ($\alpha = 0.05$), ensuring statistically reliable results.

3. RESULTS AND DISCUSSION

This research aims to identify the impact of financial literacy and financial technology on the performance and sustainability of MSMEs, with networking as a moderating factor and MSME performance as an intervening variable. The research covered 80 MSMEs, selected using a snowball sampling method. A complete description of the respondents is presented in the following table 3.

Table 3. Description of Research Respondents

MSME Criteria	Total	Percentage
Gender: Male	35	44
Female	45	56
Age: 19-24 Years	33	41
25-30 Years	23	29
31-35 Years	11	14
36-40 Years	4	5
41-45 Years	5	6
Above 45 Years	4	5
Average Monthly Income: Rp 500,000 – Rp 1,500,000	4	5
Rp 1,600,000 – Rp 5,500,000	66	83
Rp 5,600,000 – Rp 10,000,000	10	12
Business Operational Period: 1-5 Years	67	84
6-10 Years	12	15
11-15 Years	1	1

Based on the respondent description table 3, it was identified that the number of MSMEs in the Genuk area who responded was predominantly female compared to male. This information indicates that MSME activities are predominantly carried out by female entrepreneurs. In terms of age, the majority of MSMEs, totaling 33, are between 19 and 24 years old. This information indicates that most MSMEs are young, thus fostering new and innovative thinking patterns in producing products for consumers.

Regarding average income, most MSMEs have an average monthly income of 66. This indicates that the income of MSMEs is still relatively low because most MSMEs are still home-based and have not significantly expanded over time. In terms of business operating period, most MSMEs have been operating for one to five years. This means that the majority of the MSMEs studied are still young, or the businesses they started are relatively new, resulting in low or limited revenue and business experience [9]. The results of the descriptive analysis of MSME performance variables are outlined in the table 4.

Table 4. Descriptive Analysis of MSME Performance

Variable Indicators	Average value of variables
Product Sales Increase	4.08
Net Profit Level	3.95
Consumer Growth	4.08
Product Marketing Scope	4.08
Overall Average Value	4.04

Based on the descriptive table 4 of MSME performance, the average score for all MSME performance indicators ranges from 3.67 to 5.00. This indicates that MSMEs' assessments or assumptions regarding their achieved performance are classified as high or good. This indicates that MSMEs are capable of sustainably increasing product sales, increasing net profit, sustainably increasing the number of customers, and expanding their product marketing reach. The results of the descriptive analysis of MSME performance variables are outlined in the table 5.

Table 5. Descriptive Sustainability of MSMEs

Variable Indicators	Average value of variables
BEP Achievement	4.20
MSME Asset Value Growth	4.03
MSME Production Capability Improvement	4.15
Overall Average Value	4.13

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Based on the descriptive sustainability table, the average value for all MSME sustainability indicators ranges from 3.67 to 5.00. This indicates that the assessment or assumptions of MSMEs regarding the level of sustainability or resilience of their businesses are high or good. This indicates that in operating their businesses, MSMEs are able to achieve a Break-even Point (BEP) value, thus avoiding ongoing losses, and experiencing continuous asset growth, increasing the production capability of the MSME products offered to consumers.

The analysis of the research instrument, a questionnaire, included validity and reliability tests, which are explained in the following sub-chapters. The results of the validity test analysis for each variable instrument are outlined in the table 6.

Table 6. Results of Instrument Validity Test Analysis

Instrumen Variabel	Calculated r value	Table r value	Description
	Financial Literacy (X1)		
Instrumen 1.1	0.719	0.219	Instrumen
Instrumen 1.2	0.809		Valid
Instrumen 1.3	0.727		
Instrumen 1.4	0.786		
	Financial Technology (X2)		
Instrumen 2.1	0.741	0.219	Instrumen
Instrumen 2.2	0.846		Valid
Instrumen 2.3	0.784		
	Networking (X3)		
Instrumen 3.1	0.772	0.219	Instrumen
Instrumen 3.2	0.749		Valid
Instrumen 3.3	0.793		
	MSME Performance (Y1)		
Instrumen 4.1	0.845	0.219	Instrumen
Instrumen 4.2	0.828		Valid
Instrumen 4.3	0.782		
Instrumen 4.4	0.847		
	Sustainability MSME (Y2)		
Instrumen 5.1	0.830	0.219	Instrumen
Instrumen 5.2	0.802		Valid
Instrumen 5.3	0.818		

Based on the validity test analysis results table, with the calculated r value for 80 respondents set at 0.219, it was identified that all research variable instruments had a higher calculated r value than the table r value. This means that all variable instruments were proven valid or appropriate in explaining the analyzed research variables. The results of the reliability test analysis for each variable instrument are outlined in the table 7.

Table 7. Results of Instrument Reliability Test Analysis

Research variables	Nilai Crombach Alpha variabel	Cronbach Alpha Minimum Limit	Description
Financial Literacy	0.802	0.60	
Financial Technology	0.821	0.60	
Networking	0.813	0.60	Reliable instrument
MSME Performance	0.823	0.60	
Sustainability MSME	0.833	0.60	

Based on the reliability test analysis results table, with a minimum Cronbach's alpha value of 0.60, it was identified that all research variables had Cronbach's alpha values higher than 0.60. Therefore, it can be concluded that all research variable instruments were proven reliable in producing consistent answers from respondents. The classical assumption test analysis for this study included multicollinearity, normality, and heteroscedasticity. The results of the multicollinearity test analysis for each variable instrument are outlined in the table 8.

Table 8. Results of Multicollinearity Test Analysis

Research regression model	VIF value	Maximum limit of VIF value	Information
	Model 1		
Financial literacy	1.670		
Financial technology	1.670	10.00	Free from multicollinearity problems
Literacy*Networking	7.155		
Financial technology*Networking	5.308		
	Model 2		
Financial literacy	1.990		
Financial technology	1.950	10.00	Free from multicollinearity problems
MSME performance	1.978		

Based on the multicollinearity test results table, with a maximum VIF value of 10.00, it was identified that all independent variables in the study had VIF values less than 10.00. Therefore, we can conclude that both regression models 1 and 2 are free from multicollinearity. The results of the normality test analysis for each variable instrument are outlined in the table 9.

Table 9. Results of Normality Test Analysis

Research registration models	Sig. Kolmogorov Smirnov test	Minimum significance level for normality test	Description
Model 1	0.644	0.05	Free from normality
Model 2	0.831		Description

Based on the results of the normality test analysis with a minimum threshold value of 0.05, it was identified that all quantitative data in both regression models 1 and 2 were normally distributed. The results of the heteroscedasticity test analysis for each research model are outlined in the table 10.

Table 10. Results of Heteroscedasticity Test Analysis

Research regression model	Heteroscedasticity sig. value	Minimum limit of heteroscedasticity sig.	Information
	Model 1		
Financial literacy	0.234	0.05	Free from heteroscedasticity problems
Financial technology	0.329		
Literacy*Networking	0.757		
Financial technology*Networking	0.085		
	Model 2		
Financial literacy	0.650	0.05	Free from heteroscedasticity problems
Financial technology	0.592		
MSME performance	0.409		

Based on the heteroscedasticity test analysis results table with a minimum significance threshold of 0.05, it was identified that all independent variables in each regression model had values greater than 0.05, thus concluding that both regression models 1 and 2 were free from heteroscedasticity or diversification of residual variance values from the data analysis. The results of the mediation test analysis, or Sobel test, are explained in the Sobel test in figure 2.

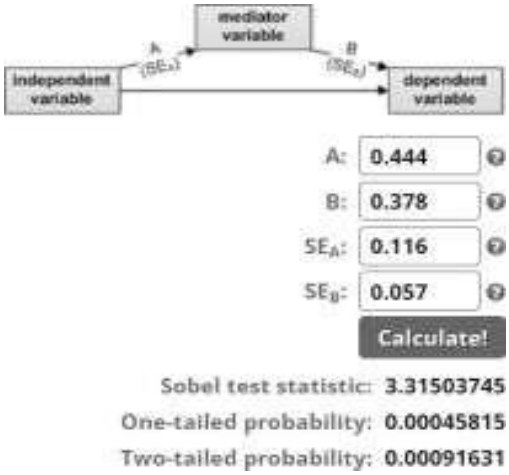

Figure 2. Sobel Test Analysis Results Chart

Based on the Sobel Test analysis results chart, the two-tailed probability value for the Sobel Test chart is 0.000. This indicates that MSME performance mediates the indirect effect of financial literacy on MSME sustainability. Higher financial literacy scores for MSMEs will lead to higher MSME performance scores. This increase in MSME performance boosts MSME sustainability, particularly in the face of increasingly complex business dynamics, as MSMEs gain a better understanding of financial literacy and are therefore better able to analyze financial management.

Furthermore, the influence of financial technology on MSME sustainability, mediated by MSME performance, is examined.

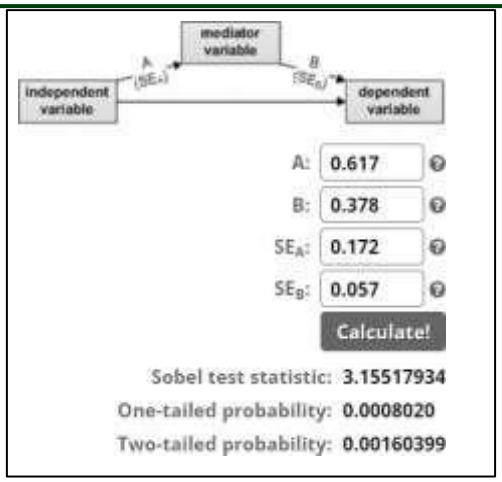

Figure 2. Sobel 2 Test Analysis Results Chart

Based on the Sobel 2 test analysis results chart, the two-tailed probability value of the Sobel 2 test chart is 0.001. This indicates that the MSME performance variable is capable of mediating the indirect effect of financial technology on MSME sustainability. The higher the value of financial technology used by MSMEs to support business operations, the higher the MSME performance value. Sustainable improvements in MSME performance then drive the level of sustainability or resilience of MSMEs in facing increasingly complex business dynamics over time because MSMEs are able to optimally utilize financial technology, which can be beneficial for business continuity, such as digital financial transfers to speed up transactions and the use of financial technology to facilitate buying and selling.

The results of the study indicate that financial literacy has a positive and significant impact on MSME performance. MSMEs with high levels of financial literacy are able to make more informed decisions in managing business operations, such as cash flow management, cost control, and investment decisions. This situation encourages improved business performance, both in terms of efficiency and profitability. Conversely, low financial literacy makes it difficult for business owners to plan their finances, which results in decreased productivity and profits. These results reinforce the findings of [32], [33] that financial literacy is a crucial factor in improving MSME performance. Further findings confirm that financial technology (fintech) also has a positive and significant impact on MSME performance. The implementation of fintech, such as the use of mobile banking, e-wallets, and digital transactions, facilitates business owners in making payments, recording transactions, and marketing products. The use of fintech has been shown to accelerate transaction processes, reduce operational costs, and improve financial efficiency. This has a direct impact on increasing sales volume and business profits [34]-[37]. This research supports thewhich emphasize the role of fintech in strengthening MSME competitiveness [38]-[40].

However, the results indicate that networking is unable to moderate the effect of financial literacy on MSME performance. This indicates that business owners' financial knowledge is primarily managed individually, without being shared widely with their business networks. This situation limits the potential for collaboration to improve performance. Conversely, research has found that networking can strengthen the influence of financial technology on MSME performance. A strong business network facilitates the exchange of information related to financial technology, expands collaboration opportunities, and improves market access. These results align with research which emphasized the importance of networking in maximizing the benefits of fintech [41]-[46].

Furthermore, this study found that financial literacy and financial technology have a positive effect on MSME sustainability. Financial literacy helps business owners maintain sustainability through sound financial management, achieving the break-even point (BEP), and consistently increasing assets. Meanwhile, the continued use of fintech simplifies financial record-keeping, improves transaction accuracy, and strengthens business resilience to market dynamics. This aligns with the findings which emphasize that financial literacy and fintech adoption are foundational to MSME sustainability [47]-[51]. Furthermore, this study shows that MSME performance positively influences business sustainability. MSMEs with high performance are able to maintain sales stability, manage inventory effectively, and optimize operational costs, thus generating profits that can be used for further business development. Good performance has been shown to increase business resilience in the face of market competition and changes in the business environment. This finding aligns with , who emphasized the crucial role of performance as a determinant of MSME sustainability.

In relation to previous research, this study reaffirms the importance of financial literacy and fintech in improving MSME performance and sustainability. However, this study provides novelty through its networking moderation analysis, which demonstrates the differential influence of financial literacy and financial technology

on MSME performance. The finding that networking does not moderate the relationship between financial literacy and fintech, but rather strengthens the influence of fintech, is a significant distinction from previous research. Thus, this study adds new insight into the role of networking in the context of implementing financial literacy and fintech in MSMEs.

Implementationally, this study emphasizes the need for MSMEs to improve financial literacy and consistently adopt fintech, as well as build more productive business networks. The government, financial institutions, and MSME associations can facilitate financial literacy training, provide outreach on fintech use, and expand access to business networks. However, this study has limitations, particularly the limited sample size and the use of a questionnaire that focused on respondents' perceptions. Future research could expand the scope, use a longitudinal approach, and explore other factors such as product innovation and digital marketing, which also have the potential to influence MSME performance and sustainability.

4. CONCLUSION

This study concludes that financial literacy and financial technology have a positive impact on the performance and sustainability of MSMEs. MSMEs with good financial literacy are able to manage their finances effectively, thereby driving improved performance and maintaining business resilience in the face of business dynamics. Similarly, the implementation of fintech has been shown to accelerate transactions, increase efficiency, and strengthen business sustainability. Furthermore, MSME performance itself has been shown to play a crucial role in strengthening sustainability, where higher business performance, greater business resilience, is also maintained. Other results indicate that networking does not strengthen the effect of financial literacy on performance, but rather successfully strengthens the influence of fintech on MSME performance, making the role of networking more evident in the context of business digitalization.

Based on these findings, it is recommended that MSMEs improve their ability to make rational financial decisions, maintain detailed bookkeeping, and be more adaptive to changing consumer preferences. The use of fintech needs to be optimized, both in payment transactions and digital record-keeping, to accelerate financial flows and improve the accuracy of business data. In terms of networking, MSMEs are advised to strengthen relationships with suppliers, consumers, and fellow business owners through better communication and the use of e-commerce. In addition, to improve performance and profitability, MSMEs need to review their business capital, cost structure, and pricing strategy to minimize unproductive expenses and maximize net profit.

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AUTHOR CONTRIBUTIONS

Conceptualization, methodology, software, investigation, validation, M.A.W; formal analysis, S.J.L writing original draft preparation, data curation, writing review and editing, M.A.W and S. J. L.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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