

# Entrepreneurial and Firm Determinants of SME Growth through Behavior Based Financial Technology Innovation

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## ABSTRACT

This paper empirically explores the relationship between the characteristics of the business and the characteristics of the entrepreneur and the growth of the business in Small and Medium Enterprises (SMEs), with behavior-based financial technology innovation as the mediator. The theories of financial technology, the Resource Based View, and the Theory of Planned Behavior are incorporated uniquely with the theory of Behavior-Based Financial Technology Innovation for SMEs, and the significance of behavioral innovation in the development of the SMEs is shown to be substantial. A quantitative approach is used to design the research, and the Structural Equation Model is used to analyze the data with the assistance of the WarpPLS software. A total of 595 SMEs operating in the province of North Sumatra are taken as the sample, and the survey results are collected from the owners. A total of thirteen hypotheses are formed and validated to detect the direct and indirect relationship between the characteristics of the business, namely size and years, the characteristics of the entrepreneur, namely education and experience, the innovation variable, and the SMEs' growth. The results show that the ages of the firm, education, and the experience of the entrepreneur have a significant effect on the growth of the SMEs. Additionally, the variable also proves to be positively significant to the overall effect. Finally, the variable acted as the mediating agent between the size of the firm, the ages of the firm, and the experience of the entrepreneur and the overall effect, and as the non-mediating agent between the education level and the overall effect. The findings have significant implication to the use of behavioral financial technology as the SBPs' strategy to ensure behavioral and sustainable growth.

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## 1. INTRODUCTION

The escalating pace and intensity of global economic competition pose a direct challenge to the long-term viability of Micro, Small, and Medium Enterprises (MSMEs) operating in Indonesia. Nevertheless, MSMEs continue to hold a critical position within the national economic structure, given their substantial contribution to output, job creation, and export earnings [1]. Data released by the Ministry of Cooperatives and MSMEs (2023) indicate that this sector generates roughly 61 percent of the country's gross domestic product (equivalent to IDR 9,580 trillion), provides employment for nearly 97 percent of the workforce, and represents close to 99 percent of total business establishments—figures that reinforce its status as a fundamental pillar of

Indonesia's economy. Fintech adoption among Indonesian SMEs is further shaped by regulatory frameworks such as Bank Indonesia's digital payment roadmap and the Financial Services Authority's (OJK) fintech and SME financing regulations, both aimed at strengthening financial inclusion, consumer protection, and digital transformation [2–4].

Beyond their local significance, MSMEs serve as a global catalyst for employment, income generation, and poverty reduction in developing economies, while also enhancing the competitiveness of larger partner corporations [3, 5], even as they continue to face structural challenges related to capacity, finance, ownership, marketing, and competitiveness [4]. From a resource-based perspective, sustainable growth requires the acquisition and integration of distinctive resources, including financial capital, managerial talent, and knowledge, without which firms struggle to achieve long-term growth [6], consistent with the Resource-Based View's emphasis on the effective management of internal resources as a driver of firm performance. Prior studies further suggest that MSME performance is jointly shaped by firm-level and entrepreneurial factors: larger and older firms benefit from greater assets, organizational capacity, accumulated market experience, and stakeholder trust [7], while entrepreneurial traits such as education and experience strengthen financial and risk-decision-making capabilities, market acumen, professional networks, and adaptability to changing business conditions [3, 8].

MSME growth, however, does not depend solely on firm and entrepreneurial characteristics. A further obstacle lies in the low adoption of financial technology, as many MSME actors remain reluctant to embrace fintech innovation despite evidence that behavior-aligned fintech solutions can substantially improve the accessibility, efficiency, and effectiveness of MSME finance [9, 10]. This study therefore proposes the concept of Behavior-Based Financial Technology Innovation for SMEs, integrating Financial Technology theory, the Resource-Based View, and the Theory of Planned Behavior [11, 12]. The concept refers to fintech solutions explicitly aligned with SME owners' behavioral characteristics attitudes toward technology, perceived behavioral control, and experiential capability emphasizing user-centered innovation that incorporates behavioral readiness, decision-making patterns, and digital literacy as core determinants of effective fintech utilization and business growth.

Behavior-based fintech innovation mediates the relationship between firm and entrepreneurial characteristics and MSME growth by improving financial access, operational efficiency, and customer satisfaction through digital financial services [3, 6]. Unlike conventional fintech adoption models, this study conceptualizes behavior-based fintech as a mediating capability that strengthens the translation of these characteristics into sustainable MSME growth in emerging economies [12].

The study is situated in North Sumatra, a province with substantial potential to contribute to Indonesia's economy, yet whose MSMEs remain less competitive than their counterparts in Java, hindered chiefly by low digital literacy, limited product innovation, and weak raw-material handling capacity that constrain their ability to compete internationally [13, 14]. Compounding this, prior empirical research shows inconsistent findings regarding the influence of firm and entrepreneurial variables on business growth, with mixed effects reported for firm size and age [15] as well as for education and experience [16, 17], pointing to a missing link that this study addresses by introducing behavior-based financial technology innovation as a mediating variable, thereby contributing to theoretical literature while offering practical implications for entrepreneurs, policymakers, and financial institutions supporting MSMEs in North Sumatra.

This study is aligned with the United Nations Sustainable Development Goals, particularly SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure). By examining how behavior-based fintech innovation supports SME growth, this research contributes to inclusive economic development and sustainable entrepreneurship in developing regions. This study also contributes directly to the domain of technopreneurship by demonstrating how behavior-oriented financial technology can be strategically leveraged as a growth mechanism for SMEs.

## 2. LITERATURE REVIEW

MSME growth is influenced by firm characteristics and entrepreneurial attributes [6]. Firm size supports growth through greater access to resources, finance, technology, and networks [18], while firm age contributes through accumulated experience and business relationships, although older firms may face organizational rigidity [19]. In addition, entrepreneurial education enhances decision-making and strategic capability [6], whereas entrepreneurial experience improves adaptability and business performance, thereby supporting MSME growth [3].

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While firm and entrepreneurial characteristics are well-established growth determinants, the literature suggests they are insufficient alone to explain variation in MSME growth outcomes, necessitating complementary theoretical perspectives. The Resource-Based View holds that firm growth and competitiveness stem from the effective deployment of valuable, rare, inimitable, and non-substitutable resources positioning technology, particularly financial technology, as a strategic resource for MSME growth [20]. Fintech has indeed opened new avenues for MSMEs to improve operational efficiency and financial mobilization, with recent studies emphasizing a shift toward user-centered, behavior-driven fintech innovation that aligns technological solutions with cognitive readiness, digital capability, and perceived usefulness [15, 21]. Fintech enables faster, cheaper, and more transparent transactions through digital payment systems, mobile banking, and technology-driven financing; however, adoption remains low due to behavioral constraints, limited digital literacy, and perceived risk making user behavior a critical consideration in fintech innovation for MSMEs [22–24].

This behavior-based perspective is grounded in the Theory of Planned Behavior, which holds that behavior is shaped by attitudes, subjective norms, and perceived behavioral control. For MSMEs, fintech adoption thus depends not merely on technology availability, but on owners' attitudes, perceived benefits, and capacity for effective use suggesting that behavior-aligned fintech innovation offers greater potential for adoption and effectiveness [25, 26]. Integrating Fintech theory, the Resource-Based View, and the Theory of Planned Behavior, Behavior-Based Financial Technology Innovation for SMEs emphasizes aligning fintech innovation with MSME actors' attributes and behaviors, positioning it as a strategic resource that catalyzes growth by helping MSMEs optimize internal resources, boost productivity, and expand access to markets and funds.

Within the conceptual framework of this study, behavior-based fintech innovation functions as a mediator between firm and entrepreneurial characteristics and business growth. Stronger entrepreneurial attributes are expected to enhance the influence of behavior-based fintech on growth, while fintech itself amplifies the effect of firm characteristics on growth outcomes giving behavior-based fintech a dual role as both a direct growth driver and a facilitating mechanism [27]. Based on this theoretical foundation and prior empirical evidence, the study hypothesizes that firm and entrepreneurial characteristics positively influence MSME business growth; that behavior-based fintech innovation positively affects business growth; and that behavior-based fintech mediates the relationship between the two. This framework aims to offer a more comprehensive understanding of the factors underlying successful MSME growth.

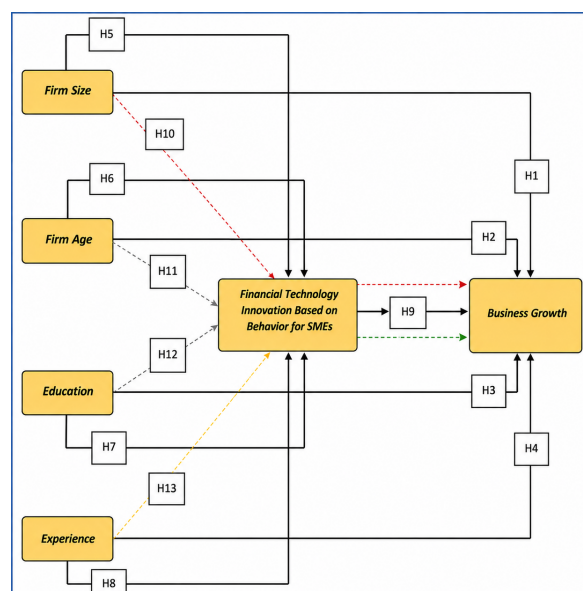


Figure 1. Conceptual Framework of the Study

The hypotheses proposed in this study, as illustrated in Figure 1, are as follows: **H1**: Firm size positively affects business growth. **H2**: Firm age positively affects business growth. **H3**: Education positively affects business growth. **H4**: Experience positively affects business growth. **H5**: Firm size positively affects behavior-based financial technology innovation in SMEs. **H6**: Firm age positively affects behavior-based

financial technology innovation in SMEs. **H7:** Education positively affects behavior-based financial technology innovation in SMEs. **H8:** Experience positively affects behavior-based financial technology innovation in SMEs. **H9:** Behavior-based financial technology innovation in SMEs positively affects business growth. **H10:** The relationship between firm size and business growth is mediated by behavior-based financial technology innovation in SMEs. **H11:** The relationship between firm age and business growth is mediated by behavior-based financial technology innovation in SMEs. **H12:** The relationship between education level and business growth is mediated by behavior-based financial technology innovation in SMEs. **H13:** The relationship between entrepreneurial experience and business growth is mediated by behavior-based financial technology innovation in SMEs.

### 3. RESEARCH METHOD

This study employs a quantitative research design grounded in explanatory methods, aiming to establish causal relationships among variables through systematic scientific measurement. Primary data serve as the principal source of information, collected via a structured online questionnaire administered through Google Forms to the target population. This methodological choice is justified by its capacity to generate empirically grounded evidence regarding the influence of firm-level and entrepreneur-level characteristics on MSME business growth, as mediated by behavior-based financial technology innovation [28].

For the population, this study encompasses all the MSME actors in the North Sumatra Province, numbering 1,166,918 business units. The type of sampling employed in conducting the study is purposive sampling, wherein the criteria are MSME actors willing to take part in the study as respondents, are engaged in operating active business units, belong to the North Sumatra Province, and are using financial technology. The size of the sample was determined using the Slovin formula set at a 5% level of error, requiring at least 595 MSME units. The variables employed in the study include firm attributes (X1), entrepreneurial attributes (X2), financial technology innovation on behavior for SMEs employed as the mediating variable (Z), and business growth, which is the dependent variable (Y).

The analytical procedure commenced with descriptive statistical analysis to characterize respondent profiles, prior to conducting validity and reliability assessments of the measurement constructs. Indicator-level validity was confirmed through factor loadings exceeding 0.50 accompanied by statistically significant values, whereas construct-level reliability was determined based on reliability coefficients exceeding 0.70 and an Average Variance Extracted (AVE) surpassing 0.50. Subsequently, Partial Least Squares Structural Equation Modeling (PLS-SEM) was applied using WarpPLS software to examine the hypothesized structural relationships. The evaluation of model performance encompassed the coefficient of determination ( $R^2$ ), path coefficients accompanied by  $t$ -statistics exceeding 1.96 at a 5% significance threshold, and several model fit indicators—namely the Average Path Coefficient (APC), Average  $R^2$  (ARS), and Average Adjusted  $R^2$  (AARS)—alongside AVIF and AFVIF values maintained below 5. Lastly, hypothesis testing was conducted through a bootstrap resampling procedure to derive standard error estimates and confidence intervals, thereby yielding robust estimations of both direct and mediating effects within the proposed research model [29].

### 4. RESULTS AND DISCUSSION

#### 4.1. Data Analysis and Inferential Statistics

Table 1. Validity Test Results

| No | Item | rCount | rTable | Description |
|----|------|--------|--------|-------------|
| 1  | Z1   | 0.340  | 0.361  | Not Valid   |
| 2  | Z2   | 0.552  |        | Valid       |
| 3  | Z3   | 0.528  |        | Valid       |
| 4  | Z4   | 0.512  |        | Valid       |
| 5  | Z5   | 0.565  |        | Valid       |
| 6  | Z6   | 0.762  |        | Valid       |

|    |     |       |           |
|----|-----|-------|-----------|
| 7  | Z7  | 0.699 | Valid     |
| 8  | Z8  | 0.678 | Valid     |
| 9  | Z9  | 0.812 | Valid     |
| 10 | Z10 | 0.409 | Valid     |
| 11 | Z11 | 0.662 | Valid     |
| 12 | Z12 | 0.507 | Valid     |
| 13 | Z13 | 0.468 | Valid     |
| 14 | Z14 | 0.555 | Valid     |
| 15 | Z15 | 0.785 | Valid     |
| 16 | Z16 | 0.629 | Valid     |
| 17 | Z17 | 0.803 | Valid     |
| 18 | Z18 | 0.781 | Valid     |
| 19 | Z19 | 0.150 | Not Valid |
| 20 | Z20 | 0.129 | Not Valid |

Table 1 indicates that there were three items declared invalid, namely Z1, Z19, and Z20, as the calculated correlation values were less than the critical value of 0.361. Since the items were not capable of measuring the respective constructs, they were declared invalid and thus not used for further analysis. However, the indicators of Financial Technology (Z1-Z6), Theory of Planned Behavior (Z7-Z12), and the Resource-Based View (Z13-Z20) contained an adequate number of valid indicators to measure each construct. Consequently, the validity of the instrument still remained acceptable for further analysis.

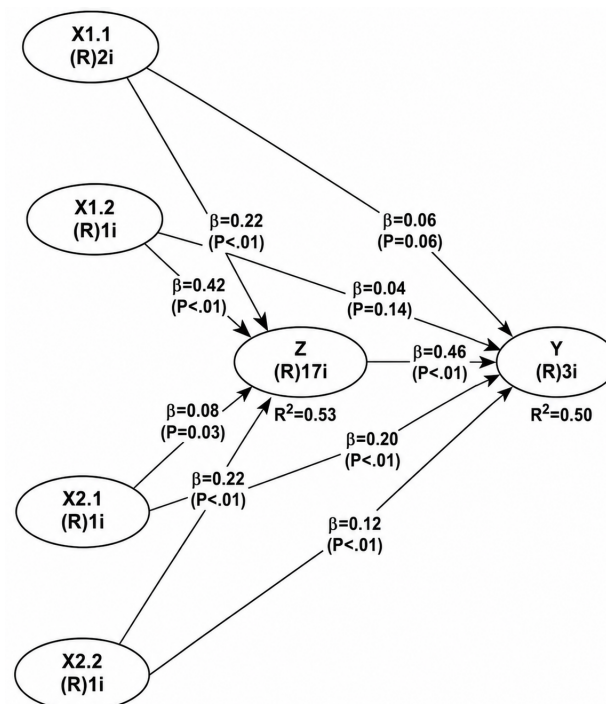


Figure 2. Outer Model Before Outer Loading Testing

As shown in Figure 2, although several indicators were removed due to insufficient loading values, the retained indicators continue to reflect the core behavioral dimensions underlying the construct. These dimensions include perceived usefulness and control over fintech usage (TPB), experiential capability derived

from prior technology interaction (Human Capital perspective), and the strategic utilization of fintech as an organizational resource (RBV). Thus, the refined measurement model maintains conceptual consistency with the theoretical foundation of behavior-based fintech innovation.

Table 2. Reliability Test Results

| <b>Cronbach's Alpha</b> | <b>Cut-Off</b> | <b>Description</b> |
|-------------------------|----------------|--------------------|
| 0.902                   | 0.700          | Reliable           |

As shown in Table 2 above, the value of Cronbach's alpha for all the constructs was above 0.70. This means that the research instrument applied in this research has a level of reliability that ensures the achievement of consistent findings.

Table 3. Loading Factor Results

| <b>No.</b> | <b>Item</b> | <b>Loading Factor</b> | <b>Cut-Off</b> | <b>Description</b> |
|------------|-------------|-----------------------|----------------|--------------------|
| 1          | X1.1.1      | 0.984                 | 0.500          | Valid              |
| 2          | X1.1.2      | 0.984                 | 0.500          | Valid              |
| 3          | X1.2        | 1.000                 | 0.500          | Valid              |
| 4          | X2.1        | 1.000                 | 0.500          | Valid              |
| 5          | X2.2        | 1.000                 | 0.500          | Valid              |
| 6          | Y1          | 0.639                 | 0.500          | Valid              |
| 7          | Y2          | 0.817                 | 0.500          | Valid              |
| 8          | Y3          | 0.741                 | 0.500          | Valid              |
| 9          | Z2          | 0.653                 | 0.500          | Valid              |
| 10         | Z3          | 0.630                 | 0.500          | Valid              |
| 11         | Z4          | 0.551                 | 0.500          | Valid              |
| 12         | Z5          | 0.539                 | 0.500          | Valid              |
| 13         | Z6          | 0.825                 | 0.500          | Valid              |
| 14         | Z7          | 0.632                 | 0.500          | Valid              |
| 15         | Z8          | 0.522                 | 0.500          | Valid              |
| 16         | Z9          | 0.668                 | 0.500          | Valid              |
| 17         | Z10         | 0.477                 | 0.500          | Not Valid          |
| 18         | Z11         | 0.496                 | 0.500          | Not Valid          |
| 19         | Z12         | 0.400                 | 0.500          | Not Valid          |
| 20         | Z13         | 0.408                 | 0.500          | Not Valid          |
| 21         | Z14         | 0.444                 | 0.500          | Not Valid          |
| 22         | Z15         | 0.714                 | 0.500          | Valid              |
| 23         | Z16         | 0.507                 | 0.500          | Valid              |
| 24         | Z17         | 0.712                 | 0.500          | Valid              |
| 25         | Z18         | 0.690                 | 0.500          | Valid              |

Convergent validity was used to determine the relationship between the constructs based on the values of the loading factors, which had to exceed 0.50. Based on the results contained in Table 3, it was clear that some items had values that were not acceptable and had to be deleted. The testing process was done in four phases.

Table 4. Cross-Loading Result

|        | <b>X1.1</b>  | <b>X1.2</b>  | <b>X2.1</b>  | <b>X2.2</b>  | <b>Z</b>     | <b>Y</b>     |
|--------|--------------|--------------|--------------|--------------|--------------|--------------|
| X1.1.1 | <b>0.984</b> | -0.045       | 0.000        | -0.019       | 0.026        | -0.003       |
| X1.1.2 | <b>0.984</b> | 0.045        | 0.000        | 0.019        | -0.026       | 0.003        |
| X1.2   | 0.000        | <b>1.000</b> | 0.000        | 0.000        | 0.000        | 0.000        |
| X2.1   | 0.000        | 0.000        | <b>1.000</b> | 0.000        | 0.000        | 0.000        |
| X2.2   | 0.000        | 0.000        | 0.000        | <b>1.000</b> | 0.000        | 0.000        |
| Z2     | -0.007       | 0.167        | 0.170        | -0.153       | <b>0.631</b> | 0.135        |
| Z3     | -0.121       | 0.333        | 0.103        | -0.125       | <b>0.576</b> | -0.089       |
| Z6     | -0.050       | -0.086       | -0.081       | 0.174        | <b>0.878</b> | -0.014       |
| Z7     | -0.047       | 0.384        | -0.077       | -0.359       | <b>0.612</b> | 0.101        |
| Z9     | 0.090        | 0.136        | 0.038        | -0.222       | <b>0.717</b> | -0.081       |
| Z15    | 0.011        | -0.110       | 0.043        | 0.035        | <b>0.804</b> | -0.069       |
| Z17    | 0.046        | -0.266       | -0.019       | 0.228        | <b>0.818</b> | -0.033       |
| Z18    | 0.045        | -0.314       | -0.120       | 0.228        | <b>0.794</b> | 0.072        |
| Y1     | -0.011       | 0.533        | 0.352        | -0.382       | -0.100       | <b>0.639</b> |
| Y2     | -0.028       | -0.009       | -0.099       | 0.110        | 0.088        | <b>0.817</b> |
| Y3     | 0.040        | -0.450       | -0.195       | 0.208        | -0.011       | <b>0.741</b> |

From Table 4, all indicators had a higher correlation with their respective construct rather than indicators from other constructs. This result shows that the indicators employed in this research have high discriminant validity.

Table 5. Average Variance Extracted (AVE) Result

| <b>Variable</b> | <b>Average Variance Extracted (AVE)</b> |
|-----------------|-----------------------------------------|
| X1.1            | 0.969                                   |
| X1.2            | 1.000                                   |
| X2.1            | 1.000                                   |
| X2.2            | 1.000                                   |
| Z               | 0.542                                   |
| Y               | 0.542                                   |

The Average Variance Extracted test further validated convergent validity, where values of 0.50 and above demonstrate that the construct is explaining more than 50 percent of the variance of its indicators. As can be seen in Table 5, the AVE of all variables is at 0.50 and above, ensuring that the variables are indeed valid and can be further analyzed.

Table 6. Composite Reliability Result

| <b>Variable</b> | <b>Cronbach's Alpha</b> | <b>Composite Reliability</b> |
|-----------------|-------------------------|------------------------------|
| X1.1            | 0.968                   | 0.984                        |
| X1.2            | 1.000                   | 1.000                        |
| X2.1            | 1.000                   | 1.000                        |
| X2.2            | 1.000                   | 1.000                        |

|   |       |       |
|---|-------|-------|
| Z | 0.875 | 0.903 |
| Y | 0.572 | 0.778 |

The study used composite reliability as a measure of the internal consistency of the measurement instrument; a cut-off point of 0.70 was used in this study. From Table 6, all variables exceeded a composite reliability measure of 0.70, having a measure of 0.778 in Business Growth, thus finding that the measurement instrument is reliable. The reliability of the measurement instrument was indicated by high levels of cronbach's alpha among all variables; high to perfect reliability was established among all variables except Business Growth because its reliability was acceptable based on its composite reliability measure.

Table 7. R-Square Result

| Variable | R-Square | Adjusted R-Square |
|----------|----------|-------------------|
| Z        | 0.519    | 0.516             |
| Y        | 0.489    | 0.485             |

From Table 7, the value of the Adjusted R-squared for Financial Technology Innovation Based on Behavior for SMEs was 0.516, while that for Business Growth was 0.485. The results show that the variables in the model explained both constructs moderately, accounting for 51.6 percent and 48.5 percent of the total variance, and the rest was attributed to other variables not explained in this research.

Table 8. Model Fit and Quality Index Results

| No. | Model Fit and Quality Index                            | Fit Criteria                                      | Result                    |
|-----|--------------------------------------------------------|---------------------------------------------------|---------------------------|
| 1   | Average Path Coefficients (APC)                        | Accepted if $p < 0.05$                            | APC = 0.203; $p < 0.001$  |
| 2   | Average R-Squared (ARS)                                | Accepted if $p < 0.05$                            | ARS = 0.504; $p < 0.001$  |
| 3   | Average Adjusted R-Squared (AARS)                      | Accepted if $p < 0.05$                            | AARS = 0.501; $p < 0.001$ |
| 4   | Average Block VIF (AVIF)                               | Accepted if $AVIF \leq 5$                         | 1.923                     |
| 5   | Average Full Collinearity VIF (AFVIF)                  | Accepted if $AFVIF \leq 5$                        | 2.037                     |
| 6   | Tenenhaus Goodness-of-Fit (GoF)                        | Small $> 0.10$ ; Medium $> 0.25$ ; Large $> 0.36$ | 0.652                     |
| 7   | Simpson's Paradox Ratio (SPR)                          | Accepted if $\geq 0.70$                           | 1.000                     |
| 8   | R-Squared Contribution Ratio (RSCR)                    | Accepted if $\geq 0.90$                           | 1.000                     |
| 9   | Statistical Suppression Ratio (SSR)                    | Accepted if $\geq 0.70$                           | 1.000                     |
| 10  | Nonlinear Bivariate Causality Direction Ratio (NLBCDR) | Accepted if $\geq 0.70$                           | 0.944                     |

On the basis of the output presented in Table 8, the following results have been obtained for the fit and quality of the model.

- APC had an F value of 0.203 and  $p < 0.001$ , denoting the significance of the relationship between variables.
- ARS exhibited a value of 0.504 and  $p < 0.001$ , indicating that the model explains 50.4 percent of the variation in dependent variables.
- AARS gave a result of 0.501, which means the explanatory capability of the model is still good after adjusting for the complexity of the model.

- The value for AVIF was 1.923, meaning that there were no multicollinearities in the predictors.
- The value of AFVIF emerged at 2.037, indicating that full collinearity is still within acceptable levels.
- GoF attained a value of 0.652, signifying the presence of a good level of model goodness of fit.
- SPR has reached a value of 1.000, which validates that all paths are free from the Simpson's paradox.
- RSCR has a value of 1.000. This indicates that all paths are positively contributing to the R-squared values.
- The value of SSR was shown to be 1.000, which indicated there are no statistical suppression effects for the model paths.
- The result obtained for the NLBCDR was 0.944, which shows the direction of the nonlinear causality within the model.

Table 9. Results of Significance Testing of Intervariable Effects

| Variable | Coefficient | P-Value | Alpha |
|----------|-------------|---------|-------|
| X1.1 → Y | 0.055       | 87      | 0.05  |
| X1.2 → Y | 0.094       | 10      | 0.05  |
| X2.1 → Y | 0.199       | <0.001  | 0.05  |
| X2.2 → Y | 0.104       | 5       | 0.05  |
| X1.1 → Z | 0.271       | <0.001  | 0.05  |
| X1.2 → Z | 0.312       | <0.001  | 0.05  |
| X2.1 → Z | 0.081       | 23      | 0.05  |
| X2.2 → Z | 0.278       | <0.001  | 0.05  |
| Z → Y    | 0.428       | <0.001  | 0.05  |

The importance of the relationships between estimated variables is also evident in the path diagram, which is given below in the next figure.

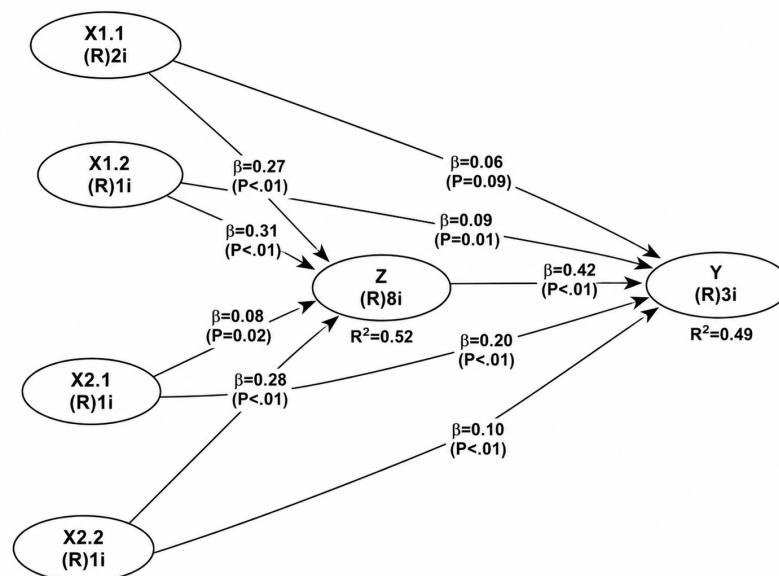


Figure 3. Path Diagram of the Significance Test Model

From Table 9 and Figure 3 above, the findings indicate that Firm Age, Education, and Experience have a positive and significant impact on Business Growth while the effect of Firm Size is not significant. Additionally, the findings indicate that Firm Size, Firm Age, Education, and Experience have a significant influence on Financial Technology Innovation Based on Behavior towards SMEs. Financial Technology Innovation Based on Behavior has a positive impact on Business Growth.

Table 10. Mediation Test Results

| Variable                             | Coefficient | P-Value | Alpha |
|--------------------------------------|-------------|---------|-------|
| X1.1 $\rightarrow$ Z $\rightarrow$ Y | 0.116       | <0.001  | 0.05  |
| X1.2 $\rightarrow$ Z $\rightarrow$ Y | 0.133       | <0.001  | 0.05  |
| X2.1 $\rightarrow$ Z $\rightarrow$ Y | 0.035       | 0.114   | 0.05  |
| X2.2 $\rightarrow$ Z $\rightarrow$ Y | 0.119       | <0.001  | 0.05  |

From Table 10, the result of the test of mediation effects shows that Firm Size, Firm Age, and Experience have positive and significant influences on Business Growth via the mediated variable, with p-values of less than 0.001. However, Education does not have a significant mediated effect, with a p-value of 0.114. Thus, there are three hypotheses that support the test of mediation, and one hypothesis for the mediated effect of Education that is not supported by the data.

#### 4.2. Hypothesis Testing

The hypothesis testing results indicate that **H1**, which proposed a positive effect of Firm Size on Business Growth, was not supported ( $\beta = 0.055$ ,  $p = 0.087$ ). In contrast, **H2** ( $\beta = 0.094$ ,  $p = 0.010$ ), **H3** ( $\beta = 0.199$ ,  $p < 0.001$ ), and **H4** ( $\beta = 0.104$ ,  $p = 0.005$ ) were supported, confirming that Firm Age, Education, and Experience positively influence Business Growth.

Regarding the determinants of Financial Technology Innovation Based on Behavior for SMEs, **H5** ( $\beta = 0.271$ ,  $p < 0.001$ ), **H6** ( $\beta = 0.312$ ,  $p < 0.001$ ), **H7** ( $\beta = 0.081$ ,  $p = 0.023$ ), and **H8** ( $\beta = 0.278$ ,  $p < 0.001$ ) were all supported, indicating that Firm Size, Firm Age, Education, and Experience significantly influence Financial Technology Innovation Based on Behavior for SMEs. Furthermore, **H9** was supported ( $\beta = 0.428$ ,  $p < 0.001$ ), demonstrating that Financial Technology Innovation Based on Behavior for SMEs has a positive effect on Business Growth.

The mediation analysis showed that **H10**, **H11**, and **H13** were supported ( $p < 0.001$ ), confirming that Financial Technology Innovation Based on Behavior for SMEs mediates the relationships of Firm Size, Firm Age, and Experience with Business Growth. However, **H12** was not supported because the mediation effect between Education and Business Growth was not statistically significant ( $p = 0.114$ ).

#### 4.3. Discussion

The findings indicate that business growth among SMEs is influenced more by firm age, education, experience, and behavior-based financial technology innovation than by firm size. **H1** was not supported, indicating that firm size alone does not significantly drive business growth, consistent with [30]. In the context of North Sumatra, SMEs appear to rely more on flexibility, innovation, and digital capability than organizational scale. Conversely, **H2**, **H3**, and **H4** were supported, confirming that firm age, education, and entrepreneurial experience positively contribute to business growth. These findings align with previous studies suggesting that organizational maturity, human capital, and accumulated managerial knowledge enhance business performance and long-term competitiveness [31–35].

Regarding behavior-based financial technology innovation, **H5**, **H6**, **H7**, and **H8** were all supported, demonstrating that firm size, firm age, education, and experience positively influence fintech innovation among SMEs. These findings support Organizational Theory and the Theory of Planned Behavior, suggesting that organizational resources, accumulated experience, educational background, and managerial capability strengthen technology adoption and digital innovation [3, 11, 36, 37]. Furthermore, **H9** confirmed that behavior-based financial technology innovation significantly enhances business growth, supporting the Resource-Based View that digital capability represents a strategic organizational resource for improving competitiveness and performance [38, 39].

The mediation analysis confirmed that behavior-based financial technology innovation significantly mediated the relationships of firm size, firm age, and experience with business growth, supporting **H10**, **H11**, and **H13**, while **H12** was not supported, indicating that education alone is insufficient to enhance business growth through fintech adoption without complementary factors such as experience and technological readiness [3, 6, 40, 41]. Overall, the findings highlight the importance of integrating organizational characteristics, entrepreneurial human capital, and behavior-based fintech capability to achieve sustainable MSME growth and support the development of inclusive, behavior-oriented fintech ecosystems.

## 5. MANAGERIAL IMPLICATIONS

The findings suggest that SME managers should prioritize the development of behavior-based financial technology capabilities rather than relying solely on business expansion to achieve sustainable growth. While firm size does not directly influence business growth, entrepreneurial experience, firm age, and behavior-based fintech innovation significantly contribute to improving business performance. Therefore, SME owners should strengthen practical digital competencies through continuous training, experiential learning, and the adoption of fintech solutions that support efficient financial management and business decision-making.

From a broader managerial perspective, fintech providers and policymakers should collaborate to create user-centered financial technology ecosystems that match the behavioral characteristics and digital readiness of SME owners. Beyond expanding fintech accessibility, development programs should integrate digital literacy, entrepreneurial mentoring, and practical technology assistance to encourage effective fintech utilization. Such initiatives can enhance SME competitiveness, accelerate sustainable business growth, and support the achievement of SDG 8 and SDG 9 through inclusive digital transformation.

## 6. CONCLUSION

This study addresses inconsistent findings on the effects of firm size, firm age, education, and experience on MSME business growth by examining the mediating role of Behavior-Based Financial Technology Innovation for SMEs. Using SEM-WarpPLS on data from 595 respondents and drawing on Organizational Theory, Human Capital Theory, the Resource-Based View, and the Theory of Planned Behavior, the results confirm that behavior-based fintech innovation significantly mediates the relationship between firm and entrepreneurial characteristics and MSME business growth.

This study contributes theoretically by integrating firm and entrepreneurial characteristics with Behavior Based Financial Technology Innovation as a mediating variable, providing a clearer explanation of MSME growth. Practically, the findings highlight the importance of behavior-oriented fintech adoption in supporting MSME growth, particularly in developing regions such as North Sumatra, and offer guidance for policymakers, practitioners, and entrepreneurs to develop fintech policies, training, and adoption strategies aligned with SME owners' behavioral capabilities.

There are several limitations to this research. Firstly, due to its cross-sectional design, this research does not manage to cover the dynamic process of MSME acceptance and MSME growth as well as the dynamic process of fintech adoption behavior. Secondly, since this research is concentrated in North Sumatra MSMEs, the results of this research are not generalized. Additionally, this research does not use additional variables such as the degree of MSME acceptance for public policies and/or digital literacy of MSMEs in this study. Thus, future researchers are encouraged to use longitudinal research design and/or additional variables to gain deeper insights about the use of behavior-driven fintech for MSME business development. By promoting inclusive fintech adoption and entrepreneurial capability, this study contributes to achieving SDG 8 and SDG 9 through sustainable SME development.

## 7. DECLARATIONS

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## 7.2. Author Contributions

Conceptualization: ES and HM.; Methodology: WM and ES.; Software: WM.; Validation: HM.; Formal Analysis: WM.; Investigation: WM.; Resources: ES and HM.; Data Curation: HM.; Writing – Original Draft Preparation: WM and ES.; Writing – Review and Editing: WM, HM, and ES.; Visualization: WM. All authors have read and agreed to the published version of the manuscript.

## 7.3. Data Availability Statement

The dataset supporting the findings of this study is publicly available in the Zenodo repository at <https://doi.org/10.5281/zenodo.21253586>. Additional information is available from the corresponding author upon reasonable request.

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## 7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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