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Stock Price and Islamic Bank Financial Ratio in Indonesia

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Abstract
This research aims to determine the influence of Profitability, Non Performing Finance, and Capital Adequacy Ratio on share prices in sharia banking listed on the Indonesia Stock Exchange for the 2019-2023 period. The sampling technique used was purposive sampling. This research involved 3 samples with a period of 5 years so that a total of 15 data were processed using E-Views 12. From the results of this test it can be concluded that Profitability and Non-Performing Finance have an influence on share prices in sharia banking listed on the Indonesia Stock Exchange for the 2019-2023 period. Meanwhile, the results of the Capital Adequacy Ratio research have no effect on the share prices of Islamic banking listed on the Indonesia Stock Exchange for the 2019-2023 period.

Keywords: Profitability, Non-Performing Finance, Capital Adequacy Ratio, Stock Price, Islamic Bank

1. Introduction

Bank are one of the financial institutions that play a crucial role in the economy, with their role being considered one of the indicators of economic growth (Musadat, et al., 2023). Banking is the most important institution in a country as it serves as one of the foundations driving the economy in Indonesia, providing financial services (Aryanti, et al., 2022). In Indonesia, the banking sector has experienced rapid growth, especially in Islamic banking. According to data from Bank Indonesia (BI) in 2023, there are now 14 Islamic banks operating in Indonesia (CNBC Indonesia, 2023). This growth is attributed to the increasing public awareness of using Islamic banks (Siregar, 2022). The Financial Services Authority (OJK) recorded that the total assets of Islamic banking reached IDR 831.95 trillion, growing by 10.94 percent compared to the same period last year, with a market share of 7.27 percent as of September 2023 (www.ojk.go.id). This clearly reflects the growing public trust in Islamic banking. Moreover, the Deputy Governor of Bank Indonesia (BI) also highlighted double-digit growth in the Islamic financing sector in 2023, with an increase of 15.8%.

However, despite this promising growth, there are challenges that cannot be overlooked, namely the decline in stock prices experienced by several Islamic banks. One example is PT Bank BTPN Syariah Tbk (BTPS), which recorded a stock price drop of 11.36% in the past month, in line with the company's declining performance up to August 2023. A similar phenomenon occurred with Bank Syariah Indonesia, where BRIS's stock price corrected by 3.86% in the past month (CNBC Indonesia, 2023). The issue at hand is the decline in stock prices of Islamic banks in Indonesia. Stock prices are used as an indicator of how well a company is managed; if a company's stock price continues to rise, investors perceive that the company is successfully managing its operations (Siregar, 2022).

The occurrence of this stock price decline highlights the importance for companies to maximize their financial performance and management to attract investor interest. Financial performance is one of the main indicators investors pay attention to before deciding to invest their funds. Companies with good financial performance are expected to provide higher returns for shareholders, and such companies will also gain public trust due to their strong reputation, which in turn can increase their stock prices (Harefa, 2019).

Investors consider buying stocks using financial ratio analysis, which is an important tool to assess a company's strengths and weaknesses based on its financial statements (Siregar, 2022). According to (Muslih & Bachri, 2020) Return on Equity is a profitability ratio that affects stock prices. Similarly, (Yuniarsa & Annis, 2020) state that Non-Performing Financing is a ratio that influences stock prices, and according to (Harefa, 2019) the Capital Adequacy Ratio is also a ratio that affects stock prices.

Profitability ratios play a crucial role in investment decisions, as investors tend to be more attracted to companies with high profitability, which indicates greater profit potential (Suwandani, et al., 2017). Return on Equity (ROE) is the most fundamental indicator in fundamental analysis (Hasan, et al., 2022). ROE itself is a basic indicator that shows how effectively a company manages its equity to generate net profit (Hamdani, et al., 2021). By paying attention to the ROE level, investors can assess the company's future potential and measure its profitability growth. A high ROE is usually interpreted as a positive signal, which can encourage investors to buy shares, thereby increasing the company's stock price (Sujatmiko, 2019).

On the other hand, Non-Performing Financing (NPF) is also an important consideration for investors. NPF reflects the risk faced by Islamic banks related to problematic financing (Martanorika, 2018). In this ratio, the lower the NPF value, the better the quality of a financing company's receivables, which means the company's income is also higher (Jumono, et al., 2017). The higher the income from receivable settlements, the greater the company's profit, which becomes an attraction for investors. Additionally, the capital ratio known as the Capital Adequacy Ratio (CAR) represents a bank's capacity to provide the necessary funds for business growth. The higher the CAR ratio, the better a bank's condition, and a high CAR value indicates that the bank is capable of financing its operational activities (Kuncoro & Suhardjono, 2002). According to (Sari, 2013), a high CAR indicates that the bank has a strong capacity to support business growth and handle potential risks, thus increasing its attractiveness to investors, which may lead to an increase in stock prices. Based on the above background, the objective of this study is to examine the effect of financial ratios on stock prices in Islamic banking in Indonesia.

2. Literature Review

2.1 Islamic Bank

Islamic Bank or Sharia Bank, are financial institutions that operate in accordance with Sharia principles. According to Article 1 paragraph (1) of Law No. 21 of 2008 on Islamic Banking, Islamic banks cover all aspects related to Islamic financial institutions and Islamic business units, including institutional structures, operational activities, as well as methods and processes for conducting business activities (Rahmani, 2017). According to (Ascarya, 2008), Islamic banks are financial institutions that facilitate the economic mechanism in the real sector through business activities such as investment, trading, and others, based on Sharia principles. These principles involve agreements governed by Islamic law between the bank and other parties for the safekeeping of funds, financing business activities, or other activities deemed in accordance with Sharia values on both macro and micro levels.
The definition of an Islamic bank, according to (Alma, Buchari, & Priansa, 2009) is a bank that adheres to the principle of fair profit-sharing, which differs from conventional banks that rely on interest. An Islamic bank can also be understood as a bank whose operational principles and products are developed based on the values contained in the Quran and the operational guidelines found in the hadiths of Muhammad Rasulullah SAW.

2.2 Stock and Stock Price

Stocks are one of the most well-known money market instruments today. Stocks are also referred to as securities that provide proof of ownership in a company or business entity. Stocks can also be defined as evidence of an individual's or a business entity's investment as a specific party in the company (Hasan, et al., 2022). Shareholders

are also entitled to receive dividends proportional to the number of shares they own. Stocks play a very important role, especially for companies planning to expand their business (Rahmani, 2023). According to (Ermaini et al. 2021), stocks represent proof of ownership in a company, granting rights to dividends as a return on capital investment. Owning stocks reflects partial ownership of the company.

Stock prices are determined based on anticipated cash flows in the future, not just the current year. Therefore, to maximize stock prices, a long-term perspective on the company's operations is necessary (Hamdani, et al., 2021). Generally, stock prices serve as a benchmark for investors when making investment decisions and are one of the important measures in assessing a company's value in the market. Stock prices reflect the market's perception of the company's value and future prospects, influenced by financial performance, growth prospects, economic conditions, and investor expectations. Strong financial performance, such as high net income and revenue, can enhance investor confidence and drive stock prices up c.

2.3 The Effect of Return on Equity (ROE) on Stock Prices

Return on Equity (ROE) is an important indicator in assessing a company's profitability, measuring the company's ability to generate profit from shareholders' equity. A high ROE is typically seen as a positive indicator by investors, as it shows that the company is effectively managing its equity to maximize profits. An increase in ROE tends to attract more investor interest in buying the company's shares, which in turn can drive up stock prices. Conversely, a low or declining ROE may reduce investor interest, potentially putting downward pressure on stock prices (Brigham, E. F., & Houston, 2019). According to research conducted by (Muslih & Bachri, 2020) and (Sujatmiko, 2019) the Return on Equity ratio has an impact on stock prices. However, studies by (Sinaga, et al., 2023) and (Oktaviani, 2015) indicate that the profitability ratio of Return on Equity does not have an effect on stock prices. Based on the explanation above, the research hypothesis is:
ROE has an effect on the Stock Prices of Islamic Banks listed on the Indonesia Stock Exchange from 2019 to 2023.

2.4 The Effect of Non-Performing Financing (NPF) on Stock Prices

Non-Performing Financing (NPF) is a ratio that measures the proportion of problematic financing in Islamic banks. A high NPF indicates significant credit risk and can reduce investor confidence in the bank's financial stability. When investors realize that a bank has a high level of problematic financing, they perceive the bank as being riskier, which may lead to a decline in stock prices. On the other hand, a low NPF generally reflects good credit risk management, which can increase investor confidence and support higher stock prices (Syafi'i Antonio, 2001). According to research conducted by (Yuniarsa & Annis 2020), (Martanorika, 2018), and (Aryanti, et al., 2022) NPF affects stock prices. Meanwhile, the research conducted by (Purba, 2023) shows that NPF does not affect stock prices. Based on the explanation above, the research hypothesis is:
NPF has an effect on the Stock Prices of Islamic Banks listed on the Indonesia Stock Exchange from 2019 to 2023.

2.5 The Effect of Capital Adequacy Ratio (CAR) on Stock Prices

Capital Adequacy Ratio (CAR) is defined as a ratio that measures the proportion of a bank's capital relative to its total risk-weighted assets. A high CAR indicates that the bank has sufficient capital to absorb losses and manage risk, which can boost investor confidence and positively impact stock prices. Conversely, a low CAR may signal greater potential risk and reduce investor confidence, potentially negatively affecting stock prices (Thompson, 2018). According to research by (Harefa, 2019) the Capital Adequacy Ratio affects stock prices, while research by (Sari, 2013) shows that the Capital Adequacy Ratio does not affect stock prices. Meanwhile, the research conducted by Sari (2013) shows that the Capital Adequacy Ratio does not affect stock prices. Based on the explanation above, the research hypothesis is:
CAR has an effect on the Stock Prices of Islamic Banks listed on the Indonesia Stock Exchange from 2019 to 2023.

3. Method

The objects in this study include the independent variables, namely Return on Equity, Non-Performing Financing, and Capital Adequacy Ratio, against the dependent variable, Stock Prices of Islamic banks in Indonesia. The data used in this study are the financial reports of Islamic banks listed on the Indonesia Stock Exchange (IDX) during the 2019-2023 period. The sampling technique used in this study is Purposive Sampling, where samples are selected based on criteria determined by the researcher. The sample criteria in this study include: Islamic banks listed on the Indonesia Stock Exchange during the study period, 2019-2023, and Islamic banks with complete financial data published in their annual reports. There are 3 Islamic banks in this study, namely Bank Tabungan Pensiunan Nasional Syariah, Bank Panin Dubai Syariah, and Bank Syariah Indonesia.

The data analysis method used in this study is panel data regression analysis. Panel data regression analysis is the result of observations on a dataset where the behavior of cross-sectional units is observed over time (Ghozali, I., & Ratmono, 2013). The steps involved are conducting quantitative analysis, which includes: 1) Estimating the regression model using panel data, 2) Selecting the panel data regression model, 3) Classical Assumption Testing, 4) Model Feasibility Testing, and 5) Hypothesis Testing. Classical assumption testing is a requirement that must be met for the regression equation to be considered valid for use in making predictions (Ghozali, I., & Ratmono, 2013). The purpose of classical assumption testing is to ensure that the regression estimation results are free from issues of normality, multicollinearity, heteroscedasticity, and autocorrelation. Panel data regression analysis has three estimation approaches: the common effect model, fixed effect model, and random effect model. The selection of a panel data regression model involves three tests used to choose the panel data estimation technique, namely: the Chow Test, Hausman Test, and Lagrange Multiplier Test.

4. Results and Discussion

4.1 Classical Assumption Test

4.1.1 Normality Test

The normality test is a procedure used to determine whether the data comes from a normally distributed population or not. In this normality test, the Jarque-Bera method is used. If the significance value obtained from this method is > 0.05, it can be concluded that the data has a normal distribution. From the results of the normality test, the probability value of the Jarque-Bera is 0.7 > 0.05, which means that the residuals of the research data are normally distributed.

4.1.2 Multicollinearity Test

The multicollinearity test aims to verify whether there is intercorrelation or collinearity among the independent variables in a regression model. A good quality regression model is one that does not contain intercorrelation or collinearity among its independent variables, with a VIF value not exceeding 10. Based on the results of the multicollinearity test, it show that the model is free from multicollinearity because the VIF values of the three variables are all below 10, namely ROE 1.22, NPF 1.74, and CAR 1.86.

4.1.3 Heteroscedasticity Test

The heteroscedasticity test aims to determine whether the data has the same or different variance of residuals or errors. To test for the presence of heteroscedasticity in this study, the Glejser test is used. The decision-making criteria are as follows:

a. If the probability value of each independent variable is greater than 0.05%, then heteroscedasticity does not occur.
b. If the probability value of each independent variable is less than 0.05%, then heteroscedasticity occurs.

Based on the results presented in the table above, it can be concluded that the regression model is free from heteroscedasticity issues, as indicated by the probability value from the Breusch-Godfrey Serial Correlation LM test chi-square of Obs*R-Squared, which is 0.4385, greater than 0.05.

4.1.4 Autocorrelation Test

In this study, there are 3 independent variables (k=3) and a sample size of n=15. The Durbin-Watson (DW) table shows that the values are dl=0.8140 and du=1.7501, so the criteria for determining the presence or absence of autocorrelation can be set as shown below. The calculated DW value of 2.107746 is greater than 1.7501 and less than 2.2499, meaning it falls within the region of no autocorrelation. Therefore, it can be concluded that the proposed linear regression model does not contain autocorrelation.

4.2 Model Testing

4.2.1 Uji Chow

This test is conducted to compare the common effect and fixed effect models, with the following hypotheses:
Ho : model common effect is better than model fixed effect
Ha : model common effect is not better than model fixed effect
Test Criteria:
1. Reject Ho if the probability value < 0,05
2. Accept Ho if the probability value > 0,05

Based on the Chow test results, the probability value (prob) for the cross-section F is 0.2792 > 0.05, so it can be concluded that the common effect model is more appropriate than the fixed effect model, or Ho is accepted. Since the results indicate that the common effect model is more appropriate, the next test to be conducted is the Lagrange Multiplier Test.

4.2.2 Lagrange Multiplier Test

This test is conducted to compare the common effect model and the random effect model, with the following hypotheses:
Ho : model common effect is better than model random effect
Ha : model common effect is not better than model random effect
Test Criteria:
1. Reject Ho if the probability value < 0,05
2. Accept Ho if the probability value > 0,05
Based on the results of the Lagrange Multiplier test, the probability value is 0.2466, which is > 0.05, so it can be concluded that the common effect model is more appropriate than the random effect model. From both model selection tests, it can be concluded that the common effect model is better than both the fixed effect model and the random effect model, as the selected model in the model selection tests is the common effect model. Therefore, it can be concluded that the best model in this study is the common effect model.

4.3 Panel Data Regression Test

This test is intended to test the hypothesis partially to show the influence of each independent variable individually on the dependent variable (Ghozali, I., & Ratmono, 2013). The error rate (α) used is 5%. So, if an independent variable has a probability smaller than 0.05 then that variable significantly influences the dependent variable. Conversely, if an independent variable has a greater probability then that variable has no significant effect on the dependent variable.

Table 1: Uji Regresi Data Panel

Dependent Variable: HARGA_SAHAM
Method: Panel Least Squares
Date: 07/01/24 Time: 11:40
Sample: 2019 2023
Periods included: 5
Cross-sections included: 3
Total panel (balanced) observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1263.886	723.4628	1.746995	0.1085
ROE	42.69413	14.22543	3.001254	0.0121
NPF	-653.6286	211.9740	-3.083532	0.0104
CAR	20.76331	16.50039	1.258352	0.2343

R-squared	0.829429	Mean dependent var	1585.667
Adjusted R-squared	0.782910	S.D. dependent var	1486.163
S.E. of regression	692.4474	Akaike info criterion	16.14152
Sum squared resid	5274317.	Schwarz criterion	16.33033
Log likelihood	-117.0614	Hannan-Quinn criter.	16.13951
F-statistic	17.82975	Durbin-Watson stat	1.159142
Prob(F-statistic)	0.000156		

- ROE variable has a t-Statistic of 3.001254 with a probability (significance) value of 0.0121 < 0.05, so it can be concluded that the ROE variable affects the Stock Price variable.
- NPF variable has a t-Statistic of -3.083532 with a probability (significance) value of 0.0104 < 0.05, so it can be concluded that the NPF variable affects the Stock Price variable.
- CAR variable has a t-Statistic of 1.258352 with a probability (significance) value of 0.2343 > 0.05, so it can be concluded that the CAR variable does not affect the Stock Price variable.

Adjusted R-squared measures the percentage of the variation in the dependent variable that can be explained by the regression equation, while the remaining variation is explained by other variables outside the model. The Adjusted R-squared value is 0.782910, which means that the independent variables collectively contribute 78.29% to the dependent variable.

4.4 Discussion

4.4.1 The Effect of Return on Equity on Stock Prices

Return on Equity (ROE) is a ratio used to measure a bank's ability or performance in generating profit. Based on the research results, ROE has an effect on stock prices in Islamic banks listed on the Indonesia Stock Exchange during the 2019–2023 period. These findings are consistent with studies by (Muslih & Bachri, 2020), (Sujatmiko, 2019), (Fatma, 2020), (Aryanti, et al., 2022), (Suwandani, et al., 2017), (Sutanti, et al., 2015), (Devy & Manunggal, 2023), and (Susanto, 2021) who stated that ROE influences stock prices. However, studies by (Julaika & Mubarak, 2023), (Erawati & Alawiyah, 2021), and (Purwaningsih & Trianti, 2022) show that ROE does not affect stock prices. The higher the ROE ratio, the better the company's performance (Rahmani, 2017). This ratio is useful for assessing the efficiency of a bank in managing its equity to generate net profit. With a high ROE, the company becomes more attractive to investors, potentially increasing the company's stock price (Sujatmiko, 2019). It can be concluded that ROE (X1) has an effect on Stock Price (Y) in Islamic Banking.

4.4.2 The Effect of Non-Performing Finance on Stock Prices

Non-Performing Financing (NPF) is a ratio that compares non-performing financing with the total financing disbursed by Islamic banks (Pradana, 2018). Based on the research results, NPF affects stock prices in Islamic banks listed on the Indonesia Stock Exchange during the 2019–2023 period. These findings align with studies by (Yuniarsa & Annis, 2020), (Martanorika, 2018), (Fatma, 2020), (Nugroho & Rachmaniyah, 2020), (Harahap & Hairunnisah, 2017), and (Aryanti, et al., 2022) which state that NPF affects stock prices. However, research by (Purba, 2023) shows that NPF does not affect stock prices. In this ratio, the lower the NPF value, the better the quality of a company's receivables, meaning the company's income will be higher (Jumono, et al., 2017). Increased income from the settlement of receivables will boost the company's profits. Higher profits attract investors, increasing demand for the company's shares. This growing interest in the company's shares will, in turn, raise the company's stock price (Yuniarsa & Annis, 2020). Thus, it can be concluded that NPF (X2) has an effect on Stock Price (Y) in Islamic Banking.

4.4.3 The Effect of Capital Adequacy Ratio on Stock Prices

Capital Adequacy Ratio (CAR) is a financial indicator that shows a bank's ability to provide sufficient capital to support business growth and manage potential risks of losses that may arise from its operations. Based on research results, CAR does not affect stock prices in Islamic banks listed on the Indonesia Stock Exchange during the 2019–2023 period. This aligns with studies by (Sari, 2013), (Purba, 2023), (Martanorika, 2018), (Adiningsih, 2022), and (Aryanti, et al., 2022) which found that CAR has no effect on stock prices. On the other hand, research by (Lubis, et al., 2024), (Khatijah, et al., 2020), and (Fatma, 2020) shows that CAR does influence stock prices. Increases or decreases in CAR do not affect stock price fluctuations because CAR is a reserve fund that must be set aside; the higher the CAR, the less money is allocated for investment. The reserved funds do not generate profit, whereas the invested funds do. This means that the more funds reserved, the lower the profit, making investors less inclined to invest (Purba, 2023). Thus, it can be concluded that CAR (X3) indicates that capital adequacy may not be the primary factor affecting Stock Prices (Y) in Islamic Banking.

5. Conclusion

The aim of this research is the influence of financial ratios on share prices in Islamic banking in Indonesia. The results obtained from this research are that the profitability (ROE) and Non-Performing Financing (NPF) variables have an effect on the Price Variable and the capital adequacy variable (CAR) has no effect on the Stock Price Variable. If the ROE ratio is higher, it indicates the company's performance is getting better. This profitability ratio is useful for seeing the bank's level of efficiency in managing its equity to produce the company's net profit. With a high ROE, the company will be more attractive to investors, which has the potential to increase the company's share price. In this NPF ratio, the lower the NPF value, the better the quality of a finance company's receivables, which means the income the company will receive will also be greater. The large amount of income caused by repayment of receivables will increase the company's profits. Increasing company profits will be an attraction for investors, thereby increasing the supply of company shares. The CAR results are reserve funds that must be reserved. If the CAR is higher, the funds allocated for investment will be lower. Some of these funds are reserved and some are rotated or invested. It is the invested funds that will become profits, while those reserved will not become profits. However, high or low CAR values have no influence on share price fluctuations. Apart from that, the Adjusted R-squared value measures the percentage of variation in all dependent variables that can be explained by the resulting regression equation, and the remainder is explained by variations in other variables outside the model. It is known that the Adjusted R-squared value is 0.782910, which means that the contribution of the influence of the Independent Variable to the Dependent Variable simultaneously is 78.29%.

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Factors Affecting in Developing AI-driven Analytics Culture for Achieving Equilibrated Sustainability in B2B Firms: A Morphological Analysis

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Abstract
Purpose: This research aims to explore how organizational culture, integrated with artificial intelligence, is being leveraged to equally emphasize social and environmental sustainability practices in B2B firms. It examines how AI-driven insights influence real-time decision-making and contribute to fostering sustainable business environments through effective ecosystem management. Methodology: This study adopts a systematic literature review (SLR) combined with morphological analysis to investigate how AI-driven analytics culture influence B2B sustainability practices. Relevant secondary data were gathered from peer-reviewed journals, industry reports, and case studies accessed through databases such as Google Scholar, JSTOR. Articles (n=83) were selected based on predefined inclusion criteria emphasizing credibility, relevance, and contribution to the fields of AI and sustainability in SLR process. Morphological analysis was then applied to systematically classify and map the dimensions found in the key literatures such as B2B industry wise sustainability practices, barriers to adoption of AI, and their contributions to assess the environmental and social sustainability. This structured approach enabled a comprehensive synthesis of current knowledge and identified emerging patterns and research gaps in AI-driven B2B sustainability initiatives. Findings: Based on 183 articles from 2015-2025, our study demonstrates that the formation of AI culture fosters benefits in resource management, efficient forecasting, and supply chain transparency, thereby reducing negative environmental impacts and also ensuring social responsibility. This equal monitoring scale promotes balanced sustainability practices in B2B firms by enabling strict alignment of environmental and social goals through both real-time and predictive analytics. However, there are issues like data privacy, high costs of implementation, and organizational inertia for AI readiness act as hurdles to calls for effective AI adoption. Originality: This research demonstrates that AI plays a crucial role in numerous areas, including resource efficiency, predictive maintenance, and green supply chain sustainability, which ultimately minimizes environmentally unfriendly practices and fosters increased corporate sustainability. However, issues like data privacy, high costs of implementation, and organizational culture barriers act as hurdles to calls for more adoption. Research Limitations: The study relies on secondary data only. This can potentially limit the depth of findings in specific industry applications. Future research could conduct in depth interview and then adopt a quantitative approach to elaborate these findings. Practical and Social Implications: The findings of the research are useful to practitioners and policymakers, especially in creating a culture of analytics to support sustainability goals. AI-based analytic solutions can contribute to the fight against climate change and improve resource utilization, which is a pressing need in today's society.

Keywords: AI-Driven Analytics, B2B Sustainability, Systematic Literature Review, AI Culture, Resource Optimization, Supply Chain Transparency, Social Sustainability.

1. Introduction

The integration of artificial intelligence analytics is revolutionizing B2B operations especially in issues relating to sustainability (). With the help of machine learning, analytics and IoT, B2B firms are opening up opportunities to optimize resource utilization, minimize waste and increase operational visibility that influence circular economy capabilities (Bag and Pretorius, 2022; Brynjolfsson and McAfee, 2017; Rahman et al.,2021; Behera et al., 2022). For example, intelligent supply chain management systems for demand forecasting, monitoring, and reduction of carbon emissions are crucial for sustainable goals in ethical sourcing and circular economy (Jankovic and Curović, 2023). These developments not only contribute to environmental and economic development but also to the development of customer relations and marketing, making business communication more effective and individual (Chen et al., 2021).

However, the practical application of AI-driven analytics in B2B sustainability encounters the following challenges. The challenges that organizations face include high implementation costs, data privacy issues, low compatibility, and lack of skilled workers in the workforce. Solving these challenges may involve the provision of significant amounts of funding for AI-ready infrastructure, as well as changes in organizational culture from a reliance on intuition to a reliance on data, and improvements to the collaboration between internal and external actors (Dinmohammadi, 2023). However, the challenges do not deter the potential benefits which can be obtained from the strategy. AI can be integrated into supply chain management to enhance efficiency, increase adherence to environmental standards and reporting, and improve relations with stakeholders through and through reporting. These capabilities make AI the foundation of sustainable innovation and a strategic asset for companies exploring the shift in markets caused by the sustainable development agenda (Pal, 2023).

Therefore, this paper seeks to analyze the B2B sustainability implications and prospects of AI analytics culture through a morphological analysis of the existing literature on the topic. Finally, this paper seeks to offer a synthesis of AI adoption and sustainable business future by identifying the key conclusions from the current literature.

2. Problem Statement

The lack of readiness for AI analytics in B2B organizations is making it difficult to manage both environmental and social sustainability practices, particularly in both manufacturing and service industries (Baabdullah et al.,2021; Bag and Pretorius, 2022; Akther and Tariq, 2024). Although technologies like predictive analytics, IoT, and machine learning offer a great potential for improving resource use efficiency, decreasing waste, and increasing transparency, their deployment is still happening in an unbalanced manner across sectors. In Bangladesh, business-to-business (B2B) firms face significant challenges in achieving sustainability, particularly in maintaining a balanced approach where both environmental and social goals are not treated equally. This imbalance often leads to limited or unproductive efforts, such as fragmented sustainability initiatives (e.g., reducing carbon emissions in one area but not addressing waste management in another), inconsistent implementation of green practices (e.g., some departments recycling materials while others continue to dispose of them improperly), and failure to align business strategies with sustainability goals (e.g., focusing on profits without ensuring safe working conditions or fair wages for employees). As a direct result, firms experience environmental damage, poor employee health and safety, and a lack of trust from workers and communities, which undermines B2B firms' long-term growth and reputation.

Advanced technological support can facilitate to address such imbalance in social and environmental sustainability management (SESM) in B2B relationships. Often, B2B firms are discouraged from balancing their sustainability efforts due to more dependence on manual processes, high implementation costs of data-driven technology, lack of infrastructure, lack of employee AI literacy, and insufficient organizational readiness for AI-driven analytics (Arntz et al.,2017; Rahman et al.,2023). These factors lead to inefficient usage and understanding of analytics, making it difficult for firms to adopt AI-driven solutions and fully integrate sustainability practices in B2B firms Bangladesh (Table 1.1).

Table 1.1: Overview of Sector wise B2B Firms in Bangladesh

Sector wise B2B Firms	Estimated No. of B2B Firms*	Significance
Ready-made Garments	4,500+	The ready-made garments (RMG) sector is the largest contributor to Bangladesh's export economy, accounting for approximately 82% of total exports as of 2022. The RMG sector employs around 4.4 million workers, with a significant percentage being women and contributing significantly to employment, SDG and economic growth (BGMEA, 2022)
Pharmaceuticals	250+	The pharmaceutical industry in Bangladesh is a rapidly growing sector, with an annual growth rate of around 15% and producing more than 97% of the total medicines consumed in the country. The industry is also expanding its footprint internationally, with exports reaching approximately $200 million in 2021(Isla et al.,2018).
IT Firms	4500+	One of the fastest growing sectors in Bangladesh, employing over 750,000 ICT professional and forecasted to reach USD 5 billion by 2025 (Masud et al.,2019).
Banking	1,500+	In Bangladesh, the B2B landscape of the 60 commercial banks is largely shaped by their reliance on IT and software firms, telecommunications and network providers, security and surveillance companies, payment and fintech solutions, and logistics and supply chain services. These external partners provide critical support for banks' day-to-day operations, ensuring secure financial transactions, digital banking services, data management, and overall operational efficiency.
Total	10,750+	The total estimated number of B2B firms in Bangladesh

*Note: The estimated numbers are compiled by the author based on sector estimates and may exclude informal or emerging firms.

Also, there is no comprehensive framework to counteract organizational resistance to change and to integrate AI strategies with sustainability objectives, including decarburization and responsible sourcing (Bag and Pretorius, 2022). This is further exacerbated by issues to do with data privacy, compliance to the law, and the ability to scale for the AI solutions, making it impossible for many organizations to harness the full potential of AI. Therefore, it is imperative for researchers to investigate the factors that may hinder or facilitate the use of AI-driven analytics by B2B firms, in order to achieve both strategic advantage and sustainable development goals.

3. Research Objectives

- To explore the role of AI-powered culture in enhancing sustainability practices within B2B business models.
- To examine the barriers to adopting AI-driven analytics in the context of B2B sustainability.
- To develop a framework for leveraging AI-driven analytics to align B2B business strategies with sustainability objectives.

4. Methodology

This study employs a secondary data-based research methodology to explore the adoption of AI-driven analytics and its implications for B2B sustainability. We collected secondary data from credible sources such as peer-reviewed journals, industry reports, case studies, and scholarly articles retrieved from platforms like Google Scholar, JSTOR, Academia, and Sci-Hub. We have carefully selected these sources to ensure a comprehensive review of current trends, challenges, and opportunities in applying AI-driven analytics to sustainability initiatives in B2B models.

To analyze the data, the study used a combination of thematic analysis (TA) and morphological analysis (MA). We employed thematic analysis to identify and categories recurring patterns and themes in the literature, including the role of AI technologies, adoption barriers, and key sustainability outcomes. We used morphological analysis in parallel to systematically explore the interrelationships between critical dimensions, including AI technologies, business applications, sustainability goals, organizational challenges, and cultural shifts. This analytical framework enabled the study to assess potential scenarios and their implications for B2B sustainability. By integrating thematic and morphological analysis, the research provides a robust, multidimensional understanding of how AI-driven analytics can transform sustainable practices in the B2B sector.

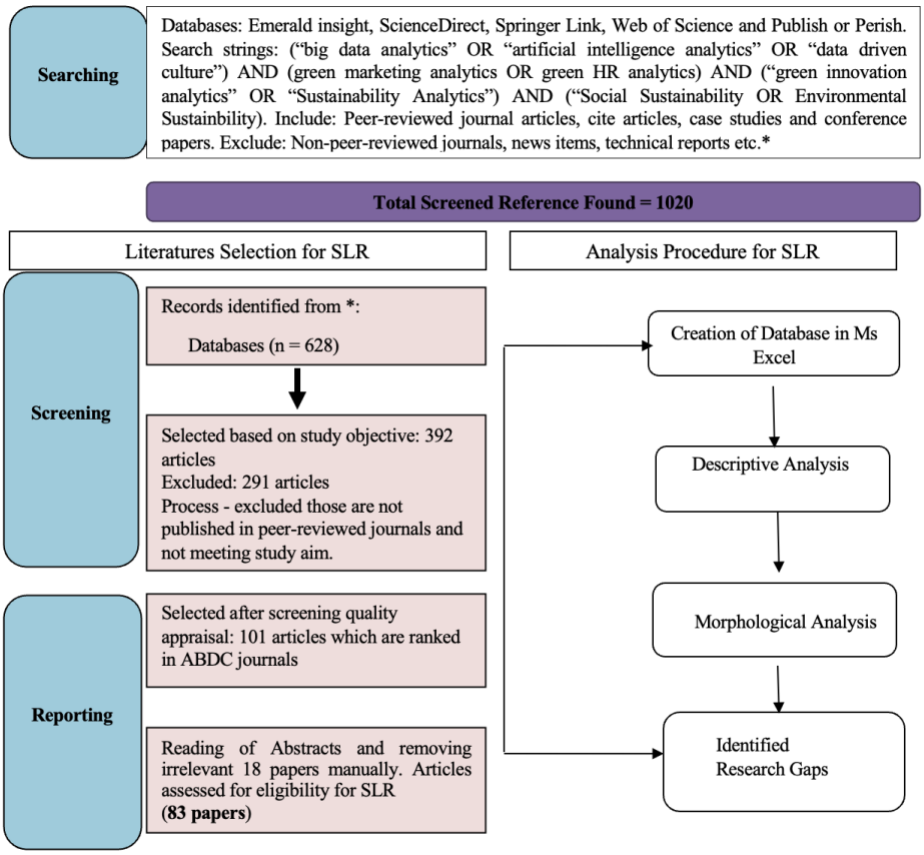

Figure 1.1: Systematic Literature Review following PRISMA

Prior to conducting MA, this study follows SLR by following four-step PRISMA process: identification, screening, eligibility assessment, and inclusion, to select relevant literature on the implications of AI-driven analytics for sustainability across diverse sectors (Fig.1.1). Morphological analysis operates as a structured qualitative research method which identifies fundamental variables (Fig.1.2) and their connections when tackling complex multi-dimensional problems (Ritchey 2011). The study uses morphological analysis to study AI driven analytics adoption in B2B firms by creating categories that explain vital dimensions affecting technological advancement and thus, this advancement aids to ensure B2B equitable sustainability. The decomposition of subjects into basic elements allows this method to create a systematic evaluation framework which analyzes AI's sustainability effects and organizational readiness and adoption obstacles (Zwicky, 1969). The analysis method known as morphological analysis finds extensive use in technology forecasting and sustainability research because it effectively evaluates interconnected variables (Cagnin et al., 2013). The method proves efficient for understanding the complicated relationship between AI implementation in business sustainability by organizing various elements that influence AI-driven decision processes and sustainable business model implications.

The initial step of morphological analysis requires establishing key factors that affect the use of AI-driven analytics within B2B sustainability. The required dimensions emerged from a systematic review of peer-reviewed literature and case studies and industry reports. This research applied established morphological analysis techniques described by Rosenhead and Mingers (2001) to identify five main dimensions which included (1) Industry context of B2B sustainability, (2) B2B sustainability crises, (3) Consequences of sustainability crises, (4) Encounter sustainability crises, and (5) Adaptive strategy for AI adoption. The multiple variables within each dimension cover a wide range of possible AI system-business sustainability objective interactions (Geum et al., 2012).

The initial perspective examines different B2B sectors that have the potential to utilize AI technologies for sustainability programs. The AI-driven analytics system implements machine learning and deep learning along with Internet of Things (IoT) and natural language processing (NLP) tools as per Brynjolfsson and McAfee (2017). For example, the manufacturing sector, particularly in industries like ready-made garments (RMG) and pharmaceuticals, uses these technologies more extensively to optimize production, improve supply chain efficiency, and enhance sustainability practices.

Machine learning and deep learning are applied to predictive maintenance, quality control, and energy consumption analysis, while IoT monitors real-time resource usage. NLP tools are also leveraged for analyzing customer feedback and regulatory compliance, ensuring sustainability goals are met in a dynamic market environment. Businesses use machine learning algorithms to analyze extensive datasets for pattern recognition and predictive modeling which leads to better sustainability-related decisions regarding energy efficiency and waste reduction (Ghobakhloo, 2018). The IoT facilitates real-time monitoring of resource consumption, supply chain logistics, and environmental impact assessments (Jankovic and Curović, 2023). In addition, NLP technology is more popular that enabling B2B firms to analyze unstructured data from both customer and industrial buyer feedback and regulatory policies in order to track corporate sustainability commitments (Gupta, 2021). AI ecosystem development through these technologies enables both operational efficiency and sustainability targets (Pal, 2023).

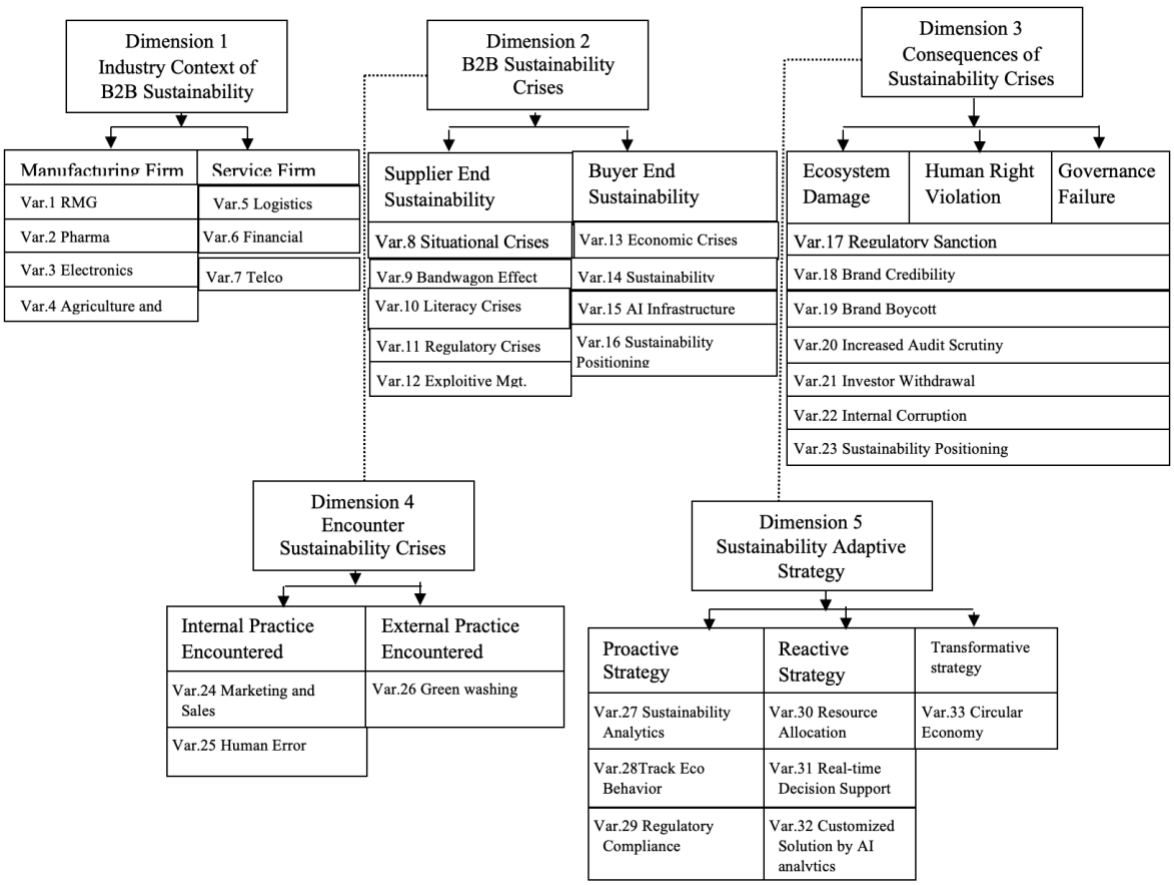

Figure 1.2: Morphological Analysis

The second dimension evaluates how B2B sustainability crises are occurred. Literature found it might be categorized into two perspectives such as supplier end i.e; supplier faces the challenges due to failure in achieving sustainability in both environmental and social. AI analytics applications function across different business operations that support sustainability goals. AI technologies provide supply chain transparency while optimizing resource utilization and predictive maintenance which results in decreased operational inefficiencies (Chen et al., 2021). Through supply chain management AI-driven analytics helps businesses track compliance of suppliers regarding environmental and ethical standards to maintain sustainable sourcing practices (Jouini et al., 2020). The implementation of predictive maintenance systems driven by artificial intelligence technology reduces equipment breakdowns to minimize both energy consumption loss and operational stoppages (Ghosh and Prakash, 2020). The automation of data collection through AI ensures compliance with environmental regulations including Global Reporting Initiative (GRI) and European Union's Corporate Sustainability Reporting Directive (CSRD) according to Sutherland et al. (2020). Through these applications AI enables organizations to make data-based choices that support sustainable business strategies.

The third dimension addresses the consequences of sustainability crises that B2B firms face after encountering issues in the buyer-supplier relationship. These firms often suffer reputational damage or long-term consequences for not emphasizing equal eye on social and environmental sustainability failure such as ecosystem degradation for not maintaining the sustainability practices across the all department (Bardgett et al.,2021; de Vasconcelos Gomes et al.,2022), legal and regulatory consequences for human rights violations (Sharma, et al.,2022; Cao et al.,2024), and green governance fails while B2B firms are not able to address the sustainability issues in real-time, this may result in green washing (Li et al., 2018). Additionally, weak **green governance** hinders the achievement of sustainability goals in the long run. However, these challenges can be mitigated through the data-driven analytics capabilities of B2B firms, which are enhanced by AI technologies. By leveraging AI-driven analytics, firms can better manage risks, track sustainability performance, and implement corrective measures, thereby reducing potential harm to their reputation and long-term sustainability

outcomes. AI adoption by B2B firms leads to the achievement of two sustainability targets which consist of lowering carbon emissions while establishing circular economies and managing resources responsibly (Geum et al., 2012). In an AI-driven culture, B2B firms systematically evaluate their carbon footprints by analyzing energy consumption patterns and implementing optimized production schedules across the various areas, thereby contributing to reduced emissions and supporting broader sustainability goals (Vercellis, 2020). Through the use of AI analytics can predict material reuse possibilities and decrease waste production while implementing circular economy strategies (Bag et al.2023; Brynjolfsson and McAfee 2017). Thus, AI analytics capability of B2B firm allows businesses to monitor their SDG compliance as well as global sustainability frameworks through United Nations Sustainable Development Goals tracking which ensures their operations support environmental and social health (Jankovic and Curović, 2023). Artificial Intelligence integration into sustainability strategies enables B2B firms to improve their social responsibility standards while simultaneously promoting green innovative sustainable business methods.

AI-driven analytics capability encounters multiple obstacles when B2B firms strive to adopt it for achieving B2B sustainability. The fourth dimension of morphological analysis examines implementation barriers such as expensive deployment costs and privacy issues with data as well as platform compatibility problems and human resource limitations (Rosenhead and Mingers, 2001). Many businesses face substantial financial challenges when investing in AI infrastructure because they need cloud computing as well as advanced analytics platforms alongside specialized AI talent (Ghosh and Prakash, 2020). The processing of significant amounts of business and customer sensitive information by AI models creates data privacy problems (Sutherland et al., 2020). Implementing artificial intelligence becomes more complex because businesses must follow data security standards and the General Data Protection Regulation (GDPR) (Vercellis, 2020). The integration of AI technologies with legacy systems in B2B operations poses a challenge because these systems were not designed for interoperability thus requiring major system updates (Jouini et al., 2020). AI adoption faces challenges because businesses lack sufficient employees with expertise in data science and machine learning (Pal, 2023) as well as because of a lack of professionals trained in AI. The widespread adoption of AI within sustainability-driven business models requires successful resolution of these barriers.

The final dimension analyzes the role of adaptive strategies - proactive, reactive, and transformational in guiding B2B firms toward the successful adoption of AI to support their environmental and social sustainability goals. These strategic responses determine not only the speed and scope of AI adoption but also the extent to which sustainability outcomes are achieved (Birkinshaw et al., 2016; Ahn et al., 2022). Successful AI implementation necessitates a cultural shift from intuition-based decision-making to data-driven strategies (Geum et al., 2012). Leadership commitment serves as a fundamental factor in creating an analytics-based corporate culture because executives need to support AI initiatives while funding digital transformation initiatives (Ritchey, 2011). AI-driven sustainability strategies demand effective collaboration between teams from IT, operations and sustainability since these departments must work together (Brynjolfsson and McAfee, 2017). Companies need to create ongoing learning systems that provide employees with AI capabilities to achieve successful data-based business transformations (Jankovic and Curović, 2023). B2B firms can maximize AI sustainability benefits through change management approaches which combine stakeholder involvement along with stepwise AI implementation systems to reduce employee resistance (Ghobakhloo, 2018).

Existing literature predominantly focuses on firms in developed economies, leaving a population gap in terms of insights from B2B firms in developing countries (Hoque et al., 2016; Arakpogun et al.,2021). Most existing research in Bangladesh primarily focuses on how technology can enhance operational efficiency and competitiveness, without addressing its broader role in social and environmental sustainability such as readiness of AI for achieving sustainability (Arafath,2022; Babu,2021, Faruk et al.,2022).

In addition, there is also an empirical gap in studies that employ robust, mixed-method approaches to examine these dynamics in real B2B settings, particularly where green governance, infrastructural, and human capability challenges are prominent. This gap is significant because sustainability goals (SDG 9 and SDG 12) are increasingly central to B2B operations, yet firms, particularly in developing countries, struggle to integrate AI into sustainability strategies. The lack of a clear theoretical model linking AI culture with specific sustainability

outcomes leaves a gap in both theoretical understanding and practical application, limiting the ability of B2B firms to leverage AI effectively for sustainability. There is also no clear evidence on sector-specific impact of AI-driven analytics culture on sustainability performance, particularly within Bangladesh's manufacturing and service sectors, such as RMG pharmaceuticals, IT services, and banking.

5. Results and Findings

5.1. Opportunities of AI-Driven Analytics in achieving B2B Sustainability in Bangladesh

There is a significant potential for the use of AI-based analytics in B2B processes, especially for handling sustainability issues. The strengths of AI technologies, including predictive analytics, machine learning, and the Internet of Things (IoT), can help B2B firms to increase resource productivity, minimize waste, and enhance internal cross functional analytics capability, all of which are vital for furthering sustainability – social and environmental sustainability both.

5.2. Improving Resource Utilization

AI analytics assist B2B firms to improve resource utilization by integrating large amounts of business data to prevent wastages at inventory or waste management points. Brynjolfsson and McAfee (2017) explain that automation decision-making increases resource utilisation and reduce waste within a business. In the sphere of B2B sustainability, this can mean that energy is used optimally, raw materials are conserved, and production processes are well timed. For instance, the IBM Watson IoT platform offers B2B firm's real-time analytics on the performance of their assets and structures. Employing smart sensors in machines or production lines, AI will enable B2B firms to determine when machinery is due for maintenance, hence avoiding energy-intensive breakdowns and increasing the durability of the assets (Ghobakhloo, 2018). Such solutions enabled through AI driven analytics are helpful in reducing the time and materials wasted, thus enhancing efficiency in the production line.

5.3. Optimizing Green Supply Chains and Reducing Carbon Footprints in B2B Firms

Green supply chain management is one of the most significant sectors that are revolutionized by artificial intelligence through analytics for sustainability. The authors also explain that incorporating machine learning algorithms as well as predictive analytics can help organizations gain insights into their supply chain networks in real-time, they can use them to predict demand, manage their stocks, and minimize unnecessary transportation. This leads to decreased levels of carbon emissions, less fuel consumption and therefore a decreased carbon footprint.

AI solutions in green supply chain management can also help B2B firms to meet sustainable requirements on ethical buying and circular economy. According to Jankovic and Curović (2023), in the context of using AI technologies in the supply chain, it is possible to ensure the identification of a company's suppliers and check whether they use ethical labor conditions and obey environmental regulation. With the help of AI technologies in identifying and current carbon emissions profile of products and materials through their lifecycle, firms and organizations can be aware of their sustainability status and CSR requirements.

For example, Walmart uses a sophisticated AI system to monitor the levels of sustainability of the firm's suppliers. The system incorporates machine learning techniques to process data about the transportation activity, product acquisition, and energy consumption to understand the ways in which suppliers support Walmart towards the achievement of sustainability goals (Gupta, 2021). This level of transparency helps Walmart to work towards its policy of having zero emission in its operations by the year 2040.

5.4. Innovations in Customer Relationship Management (CRM) and Marketing Analytics

Interactions between business to business (B2B) and business to consumers (B2C), customer relationship management (CRM), and marketing strategies are also being enhanced through the help of AI-driven analytics. When it comes to B2B marketing, it is important to note that every person is a client and a partner that is an important aspect of the concept of sustainable marketing practices. Most importantly, Chen et al. (2021) reckoned that, through the use of AI driven CRM systems can analyze buyer trends for green supplier selection, green purchase behaviors, and understanding patterns to green market appropriately. In a nutshell, the application of predictive analytics means that in order to satisfy a given market demand for green marketing and equally important for green HRM practices, B2B firms shall be able to estimate the chances of demand for green products or services and aim at that instead of developing goods and services to be left without buyers. Moreover, AI can help in selling either cross-selling and/or an upsell of products and services that are eco-friendly, which will be an added income. For example, Salesforce, one of the most popular CRM platforms, integrates artificial intelligence through the Einstein tool, which help a business to understand what the customers are doing in real-time. When it comes to environmental and social sustainability, with the help of this tool, B2B firms can recommend a specific product or service that is sustainable to a certain industrial customer, thereby making the customer more interested in the firms's sustainability.

5.5. Fostering AI-Driven Analytics Capability in achieving B2B Equilibrated Sustainability

In this study, ***Equitable Sustainability*** **(EqS)** is conceptualized as the integrated pursuit of social and environmental objectives with equal strategic commitment. It represents a shift from fragmented, compliance-oriented practices toward a holistic, embedded framework that advances fairness, inclusivity, and environmental stewardship simultaneously. This concept provides a new lens for understanding sustainable development challenges in B2B firms, particularly in developing economies. The organizational benefits that can be derived from the use of AI-driven analytics for sustainability purposes are well known; however, companies are faced with a number of difficulties when implementing these technologies. To foster AI-driven analytics capability (AIAC) B2B firms in developing country faces the AI infrastructural challenges as embedded with high costs of implementation, data privacy, compatibility of the system, and skill deficiencies in the workforce.

5.6. Costs and Sustainability

The cost implication for the implementation of AI analytics is one of the top factors that can hinder implementation, especially for firms that are small and medium in size. Ghosh and Prakash (2020) show that the implementation of AI technologies involves costs of procuring hardware such as HPCs, software applications, and professional staff. These initial costs could possibly prevent businesses, especially those in low cash flow industries or industries that do not have a direct high payoff for AI investments. The use of AI analytics for sustainability initiatives is best done with long-term strategic planning in mind because the payback period for such investment is relatively long or obscure. For example, an AI-based solution for green supply chain management could, over time, lower costs through minimizing inefficiencies or resource utilization; it could, however, take a big investment to integrate AI into a B2B firm's operations (Jouini et al., 2020). Of course, B2B firms should measure these costs against the potential gains that result from enhanced sustainability initiatives. In this regards scholars also emphasize on urgent need to assess the impacts of the Sustainability Paradox and develop strategies that align AI development with sustainability principles to maximize profit and reduce risks (Frimpong, 2025). The paradox suggests that businesses are caught in a dilemma where **sustainability investments** are essential for future survival and growth, but **cost barriers** make it difficult to prioritize them in the short term.

5.7. Data Privacy Concerns

Another major concern that hinders B2B sustainability's embrace of AI-driven analytics is data privacy and security issues. AI systems require vast amounts of data, which may be derived from even sensitive business

activities and supply chain processes. Sutherland et al. (2020) noted that firms have to adhere to higher levels of measures in data privacy laws, for example, the GDPR in the EU, whereby the collection of personal data is regulated. Leakage of information or the loss of sensitive information will cause adverse impacts to any firms, particularly in the health, financial, and manufacturing sectors. Some B2B firms in Bangladesh are reluctant to implement artificial intelligence and analytics solutions to support their business because they can lead to non-compliance with the regulations regarding privacy and data protection. As we already mentioned, data leakage and non-compliance to the regulations force many B2B to be cautious when selecting AI-driven analytics solutions and tools because they have to control the whole green supply chain process of data collecting and processing (Vercellis, 2020; Rahman et al.2023).

5.8. Interoperability Issues

Another major challenge facing AI-driven analytics is the compatibility of AI systems with current business models and patterns. According to Jouini et al. (2020), many organizations struggle with applying AI technologies because they either have outdated systems or didn't design them with AI integration in mind. When AI is still in its infancy, B2B firms may face strategic challenges in ensuring that the AI applications they develop can effectively integrate with other software applications, data repositories, and physical systems used throughout the firm. Furthermore, the literature clearly shows that the AI technologies lack standardization, further hindering integration. They come in the form of closed-source systems from different AI vendors, and this is in conducive for integration across different departments or different regions/countries, as this becomes very expensive for anyone who wants to scale up the use of AI across his enterprise. This interoperability problem is especially prevalent in B2B supply chain management, as various players, such as suppliers, logistics providers, manufacturers, etc., have to use the same data systems and technological platforms to work.

Thus, the following conceptual model is suggested based on the SLR and Morphological Analysis of this study (Figure 1.3) for further study based on SLR and MA in this study.

Figure 1.3: A conceptual framework of AI-driven Organizational Culture

In the context of sustainable business practices in B2B context, an AI-driven organizational culture, supported by analytics, collaboration, and learning, enables firms to effectively address both environmental and social sustainability goals. This culture fosters environmental goals such as emissions reduction, green innovation, and circular economy practices, while also promoting social goals including fair labor practices, diversity, and employee well-being.

6. Discussion

AI-driven organizational culture is characterized by the integration of AI across various functions, fostering a culture where employees are encouraged to experiment with AI tools, collaborate across departments, and embrace data-driven decision-making. According to **Westerman et al. (2011),** organizations that cultivate a strong digital culture are better positioned to implement digital technologies like AI and leverage them to drive innovation and competitive advantage. In the context of sustainability, this organizational culture enables B2B firms to adopt AI tools that optimize resources, minimize waste, and improve supply chain efficiency, as discussed in the earlier statement.

An AI-driven organizational culture encourages the use of AI tools to optimize resource utilization and minimize waste. **Kusiak (2018)** highlights that organizations that adopt an AI-driven culture can more effectively utilize data to identify inefficiencies in resource allocation. The predictive capabilities of AI tools can help businesses reduce energy consumption, lower material waste, and enhance overall resource efficiency. For B2B firms, this leads to significant environmental benefits, as AI models identify opportunities for reducing carbon footprints and minimizing waste in production processes. This findings support the study of Tabaku et al.,(2025)**,** Nurhaeni et al (2024) **who** agreed that AI can identify inefficiencies in energy usage and operational processes approx 30% or more, which are critical for reducing carbon emissions. A synchronized organizational cultural and AI adoption helps B2B firms to track and take proactive decision to reduce carbon emissions while improving the overall environmental impact of their operations.

An AI-driven culture facilitates the use of AI tools to enhance green supply chain operations, reducing inefficiencies and improving the predictability of demand and supply. As **Choi et al. (2018)** point out, organizations with a strong AI culture are more likely to integrate AI into their supply chain management systems, improving inventory control, reducing delays and save resources. AI solutions help B2B managers make more informed decisions based on real-time data, contributing to greater operational efficiency and understanding buyer's sustainability demand. However, in the absence of an AI-driven culture, however, cross-departmental functions may experience delays or be overlooked altogether, resulting in system inefficiencies. This system loss can discourage or demotivate employees, making them less likely to embrace AI-driven solutions and diminishing the overall effectiveness of supply chain operations. This finding aligns with the study of Rožman et al., (2023).

Our SLR findings suggest that AI-driven analytics, particularly predictive analytics, enable B2B firms to identify not only buyer preferences for eco-friendly products and services, but also expectations related to the firm's internal sustainability practices, such as employee working conditions and ethical internal marketing strategies. By understanding these nuanced expectations, B2B firms can tailor both their environmental y and social sustainability, thereby enhancing industrial customer satisfaction and reinforcing their sustainable brand reputation. A cultural shift towards data-driven decision-making allows B2B firms to tailor these green marketing strategies. However, these findings align with Behera et al. (2022), who addressed 'congenial organizational culture' foster cognitive computing system that helps to overcome the B2B marketing challenges (i.e advertising, pricing, outbound marketing, anticompetitive practices and privacy). Hence, B2B firms must address data privacy concerns and ensure ethical handling of data as an integral part of cultivating an AI-driven organizational culture (**Chaffey, 2019; Kantar, 2020)**. This strategic orientation includes promoting greater transparency and strengthening governance mechanisms in B2B firms.

The challenge of **heterogeneous sustainability demands** is particularly significant in B2B firms like packaging, where different buyers may prioritize different aspects of sustainability (environmental vs. social). Some buyers focus on reducing carbon emissions, while others may emphasize improving social conditions for workers in the supply chain. AI can address these diverse demands, but only if organizations integrate AI analytics tools capable of understanding and responding to these differences. **Porter and Kramer (2011)** discuss the concept of **shared value**, where businesses are expected to align their sustainability strategies with societal needs. However, this alignment becomes more complex when industrial clients have diverse and sometimes conflicting

sustainability priorities. The challenge lies in creating AI culture and analytics capability that can tailor sustainable solutions to these varied demands while maintaining operational efficiency.

Data security is another crucial challenge when integrating AI. As **AI tools often require access to vast amounts of organizational data**, there is a significant risk of exposing sensitive business information to external parties or cybercriminals. This is particularly concerning in industries that handle confidential or proprietary data in AI cultural readiness in B2B firms. Greene and Burton, (2025) warn that AI models can be vulnerable to cyber-attacks if the necessary security measures are not in place and employee is not aware its severity. While AI has the potential to enhance data security through predictive analytics, organizations must simultaneously invest in robust security infrastructure to protect against breaches. This requirement for increased cyber security can further raise the costs and complexity of AI adoption, particularly for B2B firms that operate in sectors with high data sensitivity.

The **Dynamic Capabilities View (DCV)** highlights that firms must continuously adapt their capabilities to sense new opportunities and transform their operations to remain competitive in a rapidly changing environment (Teece, 2014). However, without adequate technical infrastructure and skilled human capital, B2B firms may struggle to harness AI's potential. This AI infrastructural issue also ties into shifting **organizational culture towards AI driven culture**. An AI-driven organizational culture (AIOC) that encourages cross-functional collaboration and continuous learning is essential to overcoming these challenges.

As the SLR demonstrate (Table 1.1), an AI-driven organizational culture is essential for B2B firms looking to optimize resource utilization, reduce inefficiencies, and achieve sustainability goals. Again, one of the main challenges for B2B firms is the **high initial investment** required to implement AI. This includes expenditures on infrastructure, technology, and training programs. However, several studies suggest that while the upfront costs are high, the long-term benefits can far outweigh these initial investments. For instance, **Brynjolfsson and McAfee (2017)** argue that AI can deliver substantial returns over time through efficiencies in operations, green supply chain management, and resource optimization. Nevertheless, critics such as **Arntz et al. (2017)** caution that smaller firms with limited resources may find the upfront investment a prohibitive barrier; potentially make worse the digital divide in industries.

To navigate the challenges associated with AI adoption, B2B firms must consider both the technological and cultural aspects of integration. The role of an **AI-driven culture** becomes central to enabling firms to respond to the diverse and evolving demands of their stakeholders, including sustainability concerns. The integration of AI into business operations has the potential to drive long-term efficiencies, but B2B firms must invest in the right infrastructure, technology, and workforce capabilities to overcome the initial barriers for developing AI-powered culture with an aim of assessing equilibrated sustainability (EqS). By fostering a culture that values continuous learning and cross-functional collaboration, B2B firms can successfully leverage AI to drive sustainable growth, operational excellence, and competitive advantage in the face of complex challenges.

Table 1.1: Key Summary of Systematic Literature Review

	Opportunities	**Challenges for AI Culture**
Business Efficiency	AI-driven analytics improve resource utilization and minimize waste.	High initial investment is required to integrate AI.
Green Supply Chain Management	AI mitigates supply chain delays and predicts demand and supply of customers.	Many businesses lack the technological infrastructure to integrate AI.
Social and Environmental Sustainability	AI helps in reducing carbon emissions and identifying harmful processes.	AI integration requires significant technical expertise.
Green Marketing and CRM	AI analyzes customer trends and buying patterns for better marketing strategies.	Data privacy concerns may expose sensitive business information.

Operational Decisions	AI provides data-driven insights for effective decision-making.	Lack of AI knowledge may hinder proper utilization, requiring workforce training.

Source: Authors' Own,2025

7. Conclusion

The study emphasizes the critical role of AI-powered culture and B2B analytics capabilities in navigating the complex relationship between industry type, sustainability crises, and adaptive strategies for promoting a balanced sustainability, conceptualized as '*Equilibrated Sustainability'*. The five dimensions of industry type ranging from manufacturing to service sectors determine the specific challenges and opportunities each sector faces in addressing sustainability crises. These crises, driven by environmental degradation, social imbalances, and resource scarcity, can result in severe consequences, including reputational damage, financial loss, increased regulatory pressure and sustainability paradox. As B2B firms encounter these crises, leveraging AI-powered culture becomes increasingly vital. AI can help B2B firms adopt predictive analytics, optimize resource management, and drive operational efficiencies, ultimately allowing firms to respond more effectively to sustainability challenges in real time. Coupled with strong B2B analytics capabilities, particularly in green marketing, green innovation, and green human resources, B2B firms can enhance their transparent decision-making processes, identify sustainable practices social or environmental, and measure performance against sustainability goals. The consequences of failing to adapt sustainability analytics are significant, not only in terms of financial instability but also in the lost opportunities for green innovation, competitive advantage, and long-term growth. The adaptive strategies employed by B2B firms whether through technological innovation, process optimization, or deeper collaboration with stakeholders are essential for navigating these sustainability crises and driving sustainable growth. Eventually, promoting equilibrated sustainability (EqS) requires B2B firms to integrate AI-driven analytics into their core strategies, balancing environmental and social align with economic considerations. This approach not only enables firms to respond proactively to crises but also fosters resilience and long-term value creation in B2B-SMEs also. By leveraging AI-driven organizational culture (AIOC) and enhanced analytics capabilities, B2B firms can promote green innovation, achieve sustainability goals, and position themselves as leaders in a rapidly evolving market, contributing to the broader goal of sustainable development.

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The Context and Landscape of Foreign Direct Investment (FDI) in 2025

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Abstract
This article examines the evolving global landscape of Foreign Direct Investment (FDI) in 2025, highlighting the profound impact of intensifying geopolitical tensions, rapid technological advancements, and shifting regulatory environments. Drawing on recent statistical trends and expert analyses, the study presents a complex picture of international investment flows. While headline figures indicate nominal growth, a substantive decline emerges when excluding conduit economies, accompanied by notable regional disparities. Europe, for instance, has experienced sharp reductions in FDI, whereas the United States has demonstrated remarkable resilience, attracting over 2,100 new greenfield projects in the year to November 2024. The article examines the key determinants shaping contemporary Foreign Direct Investment (FDI), including geopolitical realignment, macroeconomic conditions, technological advancements, regulatory frameworks, trade policies, and governance factors, with a particular focus on the emerging trend of investment "reconfiguring toward geopolitically closer partners." This comprehensive assessment provides valuable insights for policymakers navigating the tension between attracting beneficial foreign capital and safeguarding national interests, while also offering a theoretical framework for understanding the paradox faced by developing economies seeking to "create capitalism where there is neither capitalism nor capital." Ultimately, this analysis advances both scholarly understanding and practical policy formulation in an increasingly complex global investment environment.

Keywords: Foreign Direct Investment (FDI), Geopolitical Tensions, Geopolitical Realignment, Economic Transformation

1. Introduction

It can be said that creating capitalism is challenging when there is neither capitalism nor capital, highlighting the difficulties in establishing a capitalist economy in a society that lacks both the necessary capital (wealth and resources) and capitalists (individuals who own and control the means of production). While this concept has been loosely attributed to Karl Marx in his critique of capitalism, it is equally applicable to the dilemmas faced by transition and developing countries in their pursuit of wealth and economic development. As a result, many nations turned to attracting *foreign capital* and *foreign expertise* into their countries as a solution to this dilemma.

Foreign Direct Investment (FDI) represents a critical driver of global economic development, facilitating capital flows, technology transfer, and economic integration across national boundaries. This article examines decisions and patterns, analyzes key determinants that influence investment decisions, and explores the implications for both developed and developing economies within an increasingly complex geopolitical landscape.

2. Part I: The Context and Landscape of FDI

The evolving landscape of Foreign Direct Investment (FDI) in 2025 is characterized by rapid changes driven by geopolitical realignment, technological innovation, and shifting regulatory priorities, according to Hogan Lovells (2025). As businesses navigate this environment, they must contend with an increasingly complex framework of national security reviews and compliance requirements.

Foreign Direct Investment is defined by Akhtar and Cimino-Isaacs (2025) as a cross-border investment where a resident of one country acquires a lasting interest, typically 10% or more of voting securities or an equivalent stake, and a degree of influence over the management of a business in another country. This can take several forms, including the establishment of new operations (greenfield investments), the acquisition of existing businesses through mergers and acquisitions (M&A), or the expansion of current operations (brownfield investments). Rossi (2024) emphasizes that FDI represents a long-term commitment that has a significant impact on infrastructure, employment, and overall economic development in host countries. It is important to distinguish FDI from portfolio investment, which involves the purchase of stocks, bonds, or other financial assets without gaining management control or a significant influence over business operations (Slack, 2024; Chen, 2024b).

2.1. FDI Statistics

UNCTAD (2025) reports that global foreign direct investment rose 11% to $1.4 trillion in 2024; however, when excluding flows through European conduit economies, which often serve as transfer points before investment flows reach their final destination, FDI fell by 8%. FDI to developing countries declined by 2%. Greenfield projects declined by 8% in number and 7% in value, although investments in semiconductors and AI maintained values near the 2023 record**.** International project finance, concentrated in infrastructure, continued to fall sharply**.** Deals dropped 26% in number, with values down nearly a third. Cross-border merger and acquisition activities (M&A deals) decreased by 13%, but total values increased by 2%, signaling a recovery from a two-year downward trend.

2.2. FDI in Developed Economies

FDI in Europe declined by 45%, excluding conduit economies. In the EU, 18 of 27 member States saw declines, including Germany (-60%), Italy (-35%), Spain (-13%), and France (-6%). North America saw a 13% rise in FDI, driven by a 10% increase in the United States, primarily due to higher M&A values (80% increase). The overall value of greenfield projects increased by 15%, driven by megaprojects in the semiconductor sector. The United States recorded a 93% increase, reaching $266 billion, while the United Kingdom saw a 32% rise to $85 billion and Italy a 71% jump to $43 billion. International project finance deals dropped 29%, continuing the downward trend from 2023.

Rossi (2024) highlights several principal actors shaping the landscape of foreign direct investment:

- **Multinational Corporations (MNCs):** MNCs are central to FDI activity, operating across borders and exerting considerable influence on global trade dynamics. Their international expansion is motivated by the pursuit of new markets, cost efficiencies, and competitive advantages. The substantial resources of MNCs enable them to make significant investments in host countries, generating employment and stimulating local economic growth. However, their dominant market presence can also create imbalances, potentially overshadowing domestic firms and swaying local policy decisions in their favor.

- **Public Sector Investments:** Governments play a proactive role by funding initiatives designed to attract foreign investment, often targeting infrastructure development and essential services that establish a favorable environment for private sector activity. Through incentives such as tax benefits and subsidies, public sector efforts aim to boost FDI inflows and foster regional economic development. While these strategies can be highly effective, overreliance on foreign capital may leave local economies susceptible to global market volatility.
- **Private Equity Firms:**
  Private equity firms are pivotal in FDI by providing capital to businesses, frequently through mergers and acquisitions. These firms target companies with strong growth prospects, seeking attractive returns on their investments. In addition to financial support, private equity investors often drive management and operational improvements within their portfolio companies. Nevertheless, their focus on short-term profitability can sometimes result in aggressive strategies that risk the long-term stability of the businesses they invest in

Romei and Fleming (2025) assert that the United States attracted more than 2,100 new FDI greenfield projects in the 12 months to November 2024. In contrast, China secured just under 400 projects, which accounted for a fraction of the 1,000-plus investments received each year in the decade leading up to the mid-2010s. The number of overseas projects from the US shrank to 2,600 in the 12 months to November 2024.

According to the *World Investment Report 2024* (UNCTAD 2024), global FDI had fallen by 2% to $1.3 trillion in 2023. This decline can be attributed to a slowing global economy, geopolitical tensions, and international trade, as well as tighter financing conditions for international projects in specific sectors, such as energy and infrastructure. Zhan (2024) notes that while there are several meaningful reasons to be cautiously optimistic about the prospects of foreign investment in 2025, the global FDI recovery in 2025 is likely to be modest and structure-driven rather than expansion-driven overall.

Several factors are contributing to this downturn, including an economic slowdown and rising geopolitical tensions. FDI flows to developing countries dropped by 7% to $867 billion, and there was a significant 26% fall in international project finance deals, which are crucial for infrastructure investment.

By contrast, an analysis of U.S. FDI indicates a strong contra-indication. Romei and Fleming (2025) report that the proportion of new FDI projects announced in the U.S. increased from 11.6% in 2023 to 14.3% in the 12 months to November 2024. The increase has been driven by buoyant consumer demand and government incentives in the world's largest economy (Romei and Fleming, 2025).

Foreign direct investment has been a key component of the U.S. investment strategy. Between 2005 and 2023, U.S. direct investment abroad (outward Foreign Direct Investment) nearly tripled to $10.6 trillion, while FDI in the United States (inward FDI) more than quadrupled to $14.8 trillion. In 2023, on a historical-cost basis, most U.S. direct investment abroad was in high-income countries. Europe remained the top U.S. FDI partner, with $3.950 in inward FDI and $3.463 in outward FDI. Viewed by economic sector, the United States invested mainly in nonbank holding companies, i.e., a bank holding company that owns nonbank subsidiaries providing nonbank products and services (Chen, 2024a); manufacturing operations related to chemicals, computers, and electronics; and finance and insurance. The largest share of FDI in the United States was in the manufacturing sector, primarily in chemicals.

2.3. Factors Influencing Global FDI Flows

Zhan (2024) has identified several factors that influence global FDI flows. These include:

- **Geopolitical Tensions**: Ongoing geopolitical conflicts and tensions, such as the US-China rivalry, are significantly impacting FDI flows. Countries are becoming more cautious about investments from

certain regions due to national security concerns. Gurav (2025) examines the relationship between Foreign Direct Investment (FDI) and international trade, highlighting that geopolitical events have significantly reshaped the landscape of international trade. Factors such as US-China trade tensions, the Russia-Ukraine conflict, and post-Brexit regulatory shifts have underscored vulnerabilities in global supply chains. Seong et al. (2025) note that these factors have led to evidence of trade reconfiguring toward partners that are geopolitically closer. Gopinath (2024) states that after years of shocks, including the COVID-19 pandemic and Russia's invasion of Ukraine, countries are reevaluating their trading partners based on economic and national security concerns. Foreign direct investment flows are also being redirected along geopolitical lines. Some countries are reevaluating their heavy reliance on the dollar in their international transactions and reserve holdings (Gopinath, 2024).

- **Economic Conditions**: Zhan (2024) notes that the global economic outlook plays a crucial role. Economic slowdowns, inflation rates, and changes in monetary policies affect investor confidence and the availability of capital for investments. Ernst & Young (2025) report that real GDP in advanced economies was projected to grow 1.8% in 2025, up from 1.7% in 2024. Global inflation is expected to decline steadily, easing from 4.5% in 2024 to 3.5% in 2025. Real GDP growth in the euro area is projected to rise to 1.3%, surpassing 1% for the first time in three years. Emerging markets are expected to grow at 4.1% in 2025, in line with the growth rate in 2024. Daco and Rozkrut (2025) project that growth in mainland China will slow to 4.5% in 2025 due to challenges to the property sector and demographic challenges. Global Treasurer (2024) reports that China's real estate sector, once a pillar of economic stability and growth, is now facing a crisis of unprecedented scale. The industry, which contributes nearly a third of the nation's GDP, is witnessing the collapse of its leading giants, Evergrande and Country Garden, amid a broader market downturn. This crisis not only threatens domestic economic stability but also poses significant risks to global markets. Ernst & Young (2025) note that India's real GDP growth is expected to be 6.4%, driven by public investment and strong domestic demand. Daco and Rozkrut (2025) predict that Latin America is expected to see a mildly stronger expansion, despite a notable slowdown in growth in Brazil. They add that in 2025, fiscal policy will be shaped by the challenges of managing elevated public debt and high interest rates amid competing economic and political demands (Daco & Rozkrut, 2025). Growing populist calls for increased social spending, tax cuts and subsidies, alongside long-term needs related to energy transition, military spending and aging demographics, further strain fiscal management, especially in politically unstable regions where immediate concessions often overshadow long-term reforms."

- **Technological Advancements**: Rapid advancements and changes in technology have ushered in an era of innovation that has particularly impacted investments in economic sectors such as semiconductors, renewable energy, and telecommunications. Khadar (2023) writes that technology has redefined economic landscapes, creating new industries, disrupting traditional markets, and transforming the nature of work. The rise of automation, robotics, and artificial intelligence has significant implications for job markets and income distribution (Khadar, 2023).

- **Regulatory Changes**: National security reviews and changes in FDI policies are becoming more stringent. Many countries are introducing new measures to screen and restrict investments in sensitive sectors" (Zhan, 2024). An editorial in *World Jurisprudence* (2024) states:

> **I**nvestment restrictions and regulations refer to the legal frameworks and rules established by governments to control foreign and domestic investments. These regulations aim to protect national interests, promote economic stability, and ensure compliance with social, environmental, and security standards. Investment restrictions can vary significantly across jurisdictions. They might include limitations on ownership in specific sectors, mandatory local partnerships, or compliance with environmental regulations. Different countries enforce these rules to balance foreign investment benefits against potential national security risks and economic implications.

Investment restrictions can be classified into several broad categories. *National security restrictions* aim to limit foreign investments in sectors deemed critical to a country's national security, including defense, energy, and technology. *Economic sector limitations* seek to restrict investments based on industry classification in sectors such as healthcare and transportation. *Environmental regulations* aim to mitigate ecological damage and promote sustainable practices, thereby aligning investment with national and global environmental goals.

Understanding the legal framework governing investment restrictions found in individual nations require a study of domestic regulations, international treaties, and multilateral agreements that shape the investment landscape, including national laws that outline specific investment restrictions within a country; bilateral investment treaties (BITs) that provide protections and guidelines for foreign investors; and regulations from international organizations, such as the Organization for Economic Cooperation and Development (OECD), that influence member countries' investment policies.

- **Trade Policies**: Trade agreements and tariffs can either facilitate or hinder FDI flows (Deloitte Insights, 2024). The relationship between trade and FDI is symbiotic. Countries with favorable trade policies tend to attract more foreign investments. Whiteaker (2020) noted that many studies have demonstrated the complementary nature of FDI and trade, and it is widely accepted that inward FDI has a net positive impact on a country's exports. This is due to the transfer of technology and the introduction of new products for export, which facilitates access to international markets, increases domestic capital, and provides training to the local workforce. FDI can facilitate the transfer of intangible assets, such as skills and technological knowledge, that trade cannot.

  In a study by Albahouth and Tahir (2024) on ASEAN economies, the authors found that trade openness has a significant impact on attracting FDI inflows. This means that the liberalized policies of ASEAN have not only helped them achieve higher growth rates but have also facilitated higher FDI inflows.

- **Political Stability**: The political landscape and institutional practices are significant factors affecting FDI. Albahouth and Tahir (2024) note that the rule of law, regulatory quality, control of corruption, political stability, and absence of violence and voice and accountability also positively and significantly impacted FDI inflows. Kim (2024) notes that the results of their study are consistent with the argument that political factors play a significant role in explaining FDI flows. Kim also found that FDI inward performance has consistently positive relationships with the level of corruption in government. Interestingly, Okara (2023) notes that FDI fosters socio-political stability. Accounting for political repression, the results also highlight that FDI-induced stability is compatible with governmental respect for human rights, thus preserving individual well-being.

2.4. Future Trends

According to Zhan (2024), future trends for global foreign direct investment flows are cautiously optimistic. Here are some key projections:

- World trade in goods and services is projected to grow by 3.4% in 2025, which will positively impact FDI flows. WTO economists now estimate that the volume of world merchandise trade increased by 2.7% in 2024. The WTO expects a slightly lower increase of 3.0% in 2025. The *Global Trade Outlook and Statistics* (WTO, 2024) notes that declining inflationary pressure has allowed central banks in advanced economies to begin cutting interest rates, which should stimulate consumption, boost investment, and support a gradual recovery of global trade. This report also indicates that significant downside risks remain, including regional conflicts, geopolitical tensions, and policy uncertainty. Hutagalung (2025) notes that the intensifying trade dispute between the United States and China in

2025 represents a far more significant bilateral and economic confrontation, marking a pivotal moment in shaping the global power balance and redefining economic systems.

- Sovereign wealth funds (SWFs) (a state-owned investment fund that invests in real and financial assets such as stocks, bonds, real estate, precious metals, or in alternative investments such as private equity funds or hedge funds) are expected to play a significant role, with projected investments reaching **$34 trillion**. The largest SWFs by assets as of January 2025 included:

    - Norway Government Pension Fund Global: Over $1.7 trillion
    - China Investment Corporation: Over $1.3 trillion
    - SAFE Investment Company: Over $1 trillion
    - Abu Dhabi Investment Authority: Over $1 trillion
    - Kuwait Investment Authority: Over $1 trillion
    - Public Investment Fund of Saudi Arabia: $925 billion
    - GIC Private Limited: Over $800 billion
    - Badan Pengelola Investasti Daya Anagata Nusantara: $600 billion
    - Qatar Investment Authority: Over $525 billion
    - Hong Kong Monetary Authority Investment Portfolio: Over $510 billion (Investopedia, 2025; Sovereign Wealth Fund Institute, 2025).

  On February 4, 2025, President Donald Trump signed an executive order ordering the U.S. Treasury and Commerce Departments to create a sovereign wealth fund for the United States (French, 2025; Lane, 2025).

- The services sector is anticipated to account for 72% of global FDI flows in 2025, reflecting the ongoing shift towards a more service-oriented global economy. In contrast to the industrial/manufacturing era, the service economy is characterized by sectors such as finance, healthcare, education, tourism, and information technology, emphasizing the delivery of value through "knowledge, skills, and tailored experiences rather than through tangible goods (Zhan, 2025).

  Waseem (2024) claims that in recent decades, the global economy has undergone a substantial metamorphosis as it transitions from manufacturing-centric frameworks to service-oriented paradigms. This development, known as the rise of the service economy, marks a fundamental shift in economic progress, as a growing majority of economic activity now revolves around delivering intangible goods, such as services, experiences, and specialized expertise, rather than producing physical products. The service economy is characterized by sectors such as finance, healthcare, education, tourism, and information technology. These sectors emphasize the delivery of value through knowledge, skills, and tailored experiences rather than through tangible goods."
  (Waseem, 2024)
- Investments related to the Sustainable Development Goals (SDGs) in renewable energy and health are expected to grow, although challenges remain in sectors such as infrastructure and agrifood systems (see Eisenmenger et al., 2020; Food and Agriculture Organization of the United Nations, 2025; Van Nieuwkoop, 2024).

In addition, projected future trends for global FDI flows show significant regional differences:

- **Developing Asia** is expected to see a moderate increase in FDI flows, driven by strong economic growth and investment in infrastructure and technology. Countries such as India and Vietnam are likely to attract substantial investments. Vietnam's GDP is expected to grow by 7.5-8% (Van Luc, 2025). In the first six months of 2024, FDI inflows into Vietnam reached $15.2 billion, with significant investments from Singapore, Japan, Hong Kong, the Republic of Korea, and China (Vietnam Net, 2024). The Ministry of Planning and Investment reported that in 2024, the total new and additional investments, capital contributions, and share purchases by foreign investors reached $38.23 billion—a 3% year-on-year increase.

Joshi (2025) states that due to persistent challenges, India's GDP growth for FY2025 is projected to remain between 5.5% and 6.5%, with risks tilted toward the downside. The Indian government will have to tackle these structural challenges as the year progresses if it is to foster a more resilient and sustainable economic recovery going forward. RSM India (2025) reports that FDI recorded a revival in fiscal year 2024-25, with gross FDI inflows increasing from US$ 47 billion in the first 8 months of fiscal year 2023-24 to US$ 55 billion in the same period of fiscal year 2024-25, evidencing a year-on-year growth of 17.9%.

- **Africa**: FDI flows to Africa are projected to grow significantly, particularly in sectors like renewable energy, telecommunications, and manufacturing. Countries such as Nigeria and South Africa are expected to be key recipients of FDI. Trends Research & Advisory (2024) notes that in addition to natural resources, Africa's rapidly growing population and expanding consumption have also made the continent an attractive market for foreign investors. With a population exceeding 1.2 billion and rapidly expanding consumer demand, Africa is increasingly recognized by multinational companies as a market brimming with untapped potential. This outlook has spurred heightened investment across key sectors—including retail, telecommunications, banking, and manufacturing—as firms aim to tap into the continent's burgeoning consumer base (Africa-HR.com, 2025). At the same time, African governments have undertaken substantial reforms to enhance the business climate for foreign investors. These efforts include streamlining regulatory processes, rolling out pro-business policies, and lowering barriers to entry, all of which are designed to attract greater foreign direct investment and foster sustainable economic growth (Center for Africa's Development and Investment (CADI), 2025)

- **Latin America**: The region is expected to experience steady growth in FDI, with investments primarily focusing on natural resources, agriculture, and infrastructure. Brazil and Mexico are likely to attract substantial foreign investments. LATAM FDI (2024) notes that in 2024, Brazil reaffirmed its position as the leading destination for foreign direct investment (FDI) in Latin America, surpassing Mexico. During the first half of the year, Brazil attracted $32.3 billion in FDI, outpacing Mexico, which received $31.1 billion in the same period. The close competition between these two regional powerhouses highlights the growing significance of Latin America as a strategic hub for global investment.

- **Middle East and North Africa (MENA)**: FDI flows to this region are expected to remain unstable, greatly influenced by geopolitical tensions. However, countries like the UAE and Saudi Arabia are making efforts to diversify their economies and attract more investments. Puri-Mirza (2024) has noted that while oil production and high inflation rates both influence the 2024 economic outlook for the Middle East and North African region, the ongoing conflict in Gaza has had an immediate impact on the current situation. Due to safety and security concerns arising from the conflict, tourism activities are declining, and trade routes through the Red Sea are being rerouted. Furthermore, business corporations associated with the conflict are experiencing widespread boycotts, with shifts in consumer behavior emerging. The current situation impacts the region's political risk assessment, which in turn influences foreign trade and investment.

- **Europe**: FDI flows to Europe are projected to recover modestly, with a focus on green technologies, digital infrastructure, and healthcare. Espinosa (2024) noted that the value of the stock of foreign direct investment in the European Union in 2023 was $13 trillion—a substantial increase compared to the total in 2021, which was $12.4 trillion. The increase in FDI in 2023 was closely related to Europe's economic recovery following the decline caused by Russia's invasion of Ukraine in February 2022, as many European countries experienced stagnant growth or a recession during the year. In 2025, growth within the European Union is expected to be a modest 0.9%. Research FDI (2025) states that investing in Europe presents both significant challenges and promising opportunities. While the economic outlook remains tempered by slower growth and geopolitical uncertainties, specific sectors are still poised for growth, particularly in technology, green energy, and healthcare. Europe's shift toward

digital transformation and sustainability will create dynamic investment opportunities for those who take a long-term, strategic view.

Lewis (2025) states that in terms of sources of investment, intra-European FDI accounted for about half of the total FDI on the continent in 2024. Outside the region, US companies have typically been the most prominent investors in the Old Continent. In 2024, they accounted for almost a third of the total investment in the region, with tech companies leading the way. However, 2024 also saw substantial Chinese investment. Although the EU has been attempting to increase scrutiny of Chinese investment, several member countries, including Spain and Germany, as well as other major European economies such as the UK, have sent high-level representatives from their governments and business communities to China to strengthen ties with Beijing. Chinese companies announced major European projects across cleantech, automotive, and energy in 2024.

- **North America**: The United States and Canada are likely to experience stable foreign direct investment (FDI) flows driven by investments in technology, renewable energy, and healthcare. In 2024, North America experienced a 13% rise in FDI, driven by an 80% increase in merger and acquisition activities (Business World, 2025). US-China trade tensions may lead to some reconfiguration of supply chains, with investments possibly shifting to other regions (Beauchamp, 2025).

Having examined the broad contours of FDI in 2025, it is instructive to focus on a specific national context to illustrate how these global dynamics play out in practice. Poland, as a leading destination for foreign direct investment (FDI) in Central and Eastern Europe, presents a compelling case study of how policy, market structure, and external pressures influence investment outcomes. The following section examines Poland's experience with FDI, highlighting its historical evolution, current trends, and future challenges.

3. Part II: Poland and FDI

Gorynia, Nowak, and Wolniak (2007) noted that foreign direct investment (FDI) has played a pivotal role in transforming post-communist economies in Central and Eastern Europe (CEE) for over a decade. This is especially true for Poland, which experienced a phenomenal growth of inward FDI (Hunter & Ryan, 2001). Hunter and Ryan (2013a) noted that, from the outset of Poland's economic transformation process in the fall of 1989, attracting Foreign Direct Investment (FDI) has been considered a primary policy objective by nearly all political parties and parliamentary configurations that have governed Poland. It has also been the primary objective of all the individuals who have held the critical position of Minister of Finance in the Polish government (Hunter and Ryan, 2013a).

3.1. Solidarity and the Foundations of Poland's Market Transition: Balancing FDI with Social Priorities

Solidarity, the Polish trade union and social movement that came to power in 1989 (Hunter & Ryan, 1998), maintained a nuanced perspective on foreign direct investment. The movement played a pivotal role in Poland's sensitive transition from a centrally planned economy to a market economy (Hunter, Shapiro, & Ryan, 2003). In 1989, under the leadership of Deputy Prime Minister and Minister of Finance Leszek Balcerowicz—and with the guidance of renowned economists Jeffrey Sachs and David Lipton (Sachs, 1990; Wellisz, 1995)—Poland launched an ambitious program of radical economic reform known as "Shock Therapy" (Visvizi & Zukrowska, 2020). This strategy was designed to rapidly transition Poland from a centrally planned to a market-based economy (Lipton & Sachs, 1990), aiming to address the systemic shortcomings—termed the "Four Grand Failures"—of the state planning system implemented after World War II:

- Failure of the system to create economic value.
- Failure of the system to provide adequate organizational and individual incentives.
- Failure of the system to "measure up" to comparative economies, not only in the West but also in several Eastern European countries.
- Failure of the system to satisfy basic consumption needs (creating the "dollarization" of the economy through the existence of large semi-official "black markets").

The program adopted in Poland was based on five philosophical *pillars of economic transformation*:

- *Rapid transformation* of the monocentric system of state central planning into a private functioning market economy.
- *Liberalization* of economic functions, particularly in foreign trade and direct investment.
- *Privatization* of state-owned enterprises (SOEs) (Hunter, Nowak, & Ryan, 1995; Hunter & Ryan, 2004), which would be crucial in attracting FDI and modernizing the Polish economy.
- Construction of an effective *social safety net* (Barr, 1992; World Bank Group, 2025).
- *Mobilization of international financial assistance* to support the process (Hunter & Ryan, 2009a; 2009b; Fafara & Kleczkowska, 2015).

This context provided the philosophical basis for actively seeking foreign direct investment into the Polish economy—essentially providing an answer to the question of how to provide both capital and capitalists into the Polish economy. Overall, Solidarity's view of FDI was "supportive but cautious," emphasizing the need to balance economic growth with social and national interests.

3.2. The Balcerowicz Plan: Shaping Poland's Market Economy and Foreign Investment Landscape

Leszek Balcerowicz played a pivotal role in shaping Poland's economic landscape and attracting Foreign Direct I nvestment (FDI). As the Deputy Prime Minister and Minister of Finance in the 1980s and early 1990s, he was the architect of the "Balcerowicz Plan," a series of radical economic reforms aime d at transitioning Poland from a centrally planned economy to a market economy. The Balcerowicz Plan centered on three cornerstone policy objectives:

- *Liberalization*: The Balcerowicz Plan included measures to liberalize the economy, including deregulation, privatization, and opening up to foreign investment.
- *Privatization*: Balcerowicz spearheaded the privatization of state-owned enterprises (Sowada, 1995; Kozlowski, 2019), allowing foreign investors to acquire a stake in a privatized Polish company.
- *Stabilization*: The plan also focused on stabilizing the economy by controlling inflation and reducing bu dget deficits. A stable macroeconomic environment was essential for building investor confidence and attracting FDI.

Some of the primary targets of FDI have been individual properties or entire industries that were the subject of Poland's privatization program. The process of "mass privatization" undertaken by the Polish government provided numerous opportunities for the introduction of foreign capital into the Polish economy (Hunter & Ryan, 2004; Hunter & Ryan, 2007; Hunter & Ryan, 2008; Hunter & Ryan, 2013a; 2013b) by achieving widely understood management effectiveness (Lis, Mazurkiewicz, & Zwierzchlewski, 2013). The Polish government actively encouraged foreign investors to take part in its major privatization initiatives. According to Lis, Mazurkiewicz, and Zwierzchlewski (2013), privatization—alongside liberalization and stabilization—remained a central component of economic transformation in Central and Eastern European countries.

According to the UNCTAD's *World Investment Report* (2024), FDI inflows to Poland reached USD 28.6 billion in 2023, which is lower than the USD 31.4 billion recorded the previous year, making the country the 14th-largest recipient worldwide. According to the latest figures from the OECD, in the first half of 2024, FDI inflows to Poland totaled USD 7.6 billion, down by more than half compared to the same period in 2023 (when FDI inflows stood at USD 18.1 billion).

The total inward stock of foreign investments stood at $335.5 billion at the end of 2023. In 2023, Poland attracted 229 foreign direct investments. The largest investors in Poland are the Netherlands (18.8%), Germany (16.6%), Luxembourg (12.7%), France (7.2%), and Spain (5.4%), due to high reinvested profits and equity transactions. The most significant capital outflows were directed to Italy and China, driven by debt repayments rather than outward FDI activities (Gorynia, Nowak, Trapczynski, & Wolniak, 2015). Foreign Direct Investment (FDI) has been directed mainly towards manufacturing (29.3%), wholesale and retail (13.9%), financial and insurance activities (13.2%), professional, scientific, and technical services (10.4%), and the real estate sector

(9.1%). Poland is one of the leading destinations for FDI in Central Europe. In 2023, Poland attracted USD 28.6 billion in FDI inflows, which is slightly lower than its ranking, placing Poland ahead of many of its Central European neighbors in terms of attracting FDI.
By way of comparison, the Czech Republic attracted FDI, with inflows of around $15.2 billion in 2023; Hungary received approximately $10.8 billion in FDI inflows in 2023; and Slovakia's FDI inflows were around $6.5 billion in 2023.

3.3. Poland as a Magnet for FDI: Strengths, Policies, and Incentives

Poland's strong performance in attracting Foreign Direct Investment (FDI) can be attributed to its large domestic market (Poland is the sixth-largest economy in the European Union), strategic location at the "heart of Europe," skilled workforce, and favorable investment climate. In 1992, the Polish Agency for Foreign Investment (PAIZ) was established, which was merged in 2003 with the Polish Information Agency (PAI) to form the current Polish Information and Foreign Investment Agency (PAIiIZ). This agency coordinates the promotion of Poland as an attractive destination for foreign investment. Poland's *Plan for Responsible Development* (Oleksiuk, 2017; Ministry of Economic Development, 2020), adopted in 2017, prioritized investment in eight industries: aviation, defense, automotive parts, shipbuilding, IT, chemicals, furniture, and food processing. However, Polish law at that time limited foreign ownership of companies in selected strategic sectors and restricted the acquisition of real estate, primarily agricultural and forest land (see Reyman & Maier, 2023).

More recently, citizens of the European Union (EU), European Economic Area (EEA), and Switzerland can purchase property in Poland without needing special permits. Generally, non-EU/EEA citizens require a permit from the Ministry of Internal Affairs to acquire certain types of properties, such as land plots, agricultural areas, or properties in strategic locations. The permit process involves submitting various documents and meeting specific criteria (Generis Global, 2024; Polish Descent, 2024).

Additionally, Poland has established 14 Special Economic Zones (SEZs) (Cieslik, 2025). Established in 1995, Special Economic Zones (SEZ) were created to attract investors to the areas that suffered losses after the transformation of the political system in 1989 through incentives in the form of exemption from corporate income tax (CIT) and value added taxes (Invest in Poland, 2025; see also Bridge West, 2025). Generis Global (2024) notes that:

> Firms that engage in production activities within the SEZs may enjoy a CIT exemption ranging from 50% to 100%, depending on the investment size and the location of the project. This exemption is particularly beneficial for startups and small businesses, allowing them to redirect savings into further development. Another notable incentive provided by Polish SEZs is property tax relief. Businesses operating within these zones are often eligible for significant exemptions regarding real estate taxes, reducing the overall operational costs.

The operation time for Polish SEZs has been extended to December 21, 2026. [See Appendix I for a listing of Polish SEZs.]

Poland has been successful in creating new jobs through the infusion of FDI, ranking fourth in Europe with 22,400 new jobs created in 2023. By way of comparison, the number of new jobs created in Europe due to FDI decreased by 7% compared to 2022.

According to the EY *European Attractiveness Survey* (Trade.gov.pl, 2025), which analyzed investments in 44 European countries, Poland's attractiveness has increased significantly, moving up as many as 10 positions – from 16th to 6th place.

Poland is one of the primary beneficiaries of the trend of *reorganizing supply chains and nearshoring*. Nearshoring is a form of outsourcing that involves relocating the production of goods closer to the sales market, thereby reducing supply chain length and lowering transportation costs. Additionally, it allows greater control

over the production process, if only because the companies are in the same time zone" (Northgate Logistics, 2025). This trend is particularly evident in investments in manufacturing, which increased by 17 percent year-over-year.

In comparison, in Europe, the number of new jobs created attributable to investments decreased by 7% compared to 2022. According to the website, Trade.gov.pl (2025), these investments demonstrate the growing confidence of international investors in the Polish market. Additionally, these projects often introduce innovative solutions and technologies, further strengthening Poland's position as an attractive investment center in Europe. Iloie (2015) asserts that because Poland has shown substantial improvement from the early period of transition, it now ranks 53rd among the 180 economies on the 2024 *Corruption Perception Index* and 42nd out of 184 countries on the latest *Index of Economic Freedom*.

3.4. Challenges and Constraints

It is important to acknowledge that several factors in the Polish market hinder the attraction of foreign direct investment (FDI). These include a rigid labor market, slow administrative processes—Poland ranks 120th in the world for the speed of starting a business, according to the World Bank (2025)—a current account deficit, the continued use of the złoty instead of the euro (despite initial plans to adopt the euro by 2012), and the ongoing influence of state-owned enterprises (SOEs) (Faster Capital, 2024). Until recently, political instability also discouraged many investors by delaying essential reforms (Scislowska & Gera, 2023; Cienski, 2023).

Although unemployment remains low, labor shortages persist as a significant challenge (Ujazdowski, 2024). In just one month, November, employers notified labor offices of over 60,000 available jobs. These vacancies are spread across a wide range of fields, including production, sales, warehousing, construction, and professional roles. Data from Poland's National Bank (NBP) indicate that 66.8% of large firms, 46.8% of medium-sized companies, and 26.7% of small and micro businesses are struggling to fill open positions. Citing Wojciech Ratajczyk, Vice President of the Polish HR Forum and CEO of the employment agency Trenkwalder, Ujazdowski (2024) states that in 2024, workforce challenges intensified further and that key issues include regional mismatches between labor supply and demand, skill gaps, and a lack of a long-term strategy for employing foreign workers. These challenges are expected to grow even more acute in 2025.

The labor market in 2024 was influenced in part by an economic downturn in Germany, one of Poland's key trading partners, the lingering effects of the COVID-19 crisis, and an acute housing shortage. In addition, according to Poland Insight (2024), the most prominent skill gaps were in advanced IT fields, such as data analysis, AI system management, and cybersecurity. Additionally, there is a growing need for soft skills, such as communication, teamwork, and creativity, as well as better alignment between educational curricula and the rapidly changing demands of the labor market. Future targets for possible FDI include:

- Technology and IT
- Renewable Energy
- Manufacturing and Industry, especially in automotive, electronics, and machinery
- Healthcare and Pharmaceuticals
- Logistics and Transportation (infrastructure, including roads, railways, and ports(
- Real Estate and Construction

3.5. What Might the Future Hold?

According to the December 2024 OECD forecast, Poland's economy is expected to grow by 2.8% in 2025, supported by an increase in real wages and fiscal policy measures. According to Poland Insight (2024), "Poland's economy is set for a strong recovery in 2025, with GDP growth projected to surpass 4%, driven by accelerated individual consumption and investment. Inflation is expected to decline to approximately 4%, while unemployment rates will remain low"—around 5.5%.

3.6. The Runoff Election of 2025: Observations

Despite a robust GDP growth forecast for 2025, expected to reach around 3.3%, several significant uncertainties remain that could challenge Poland's economic trajectory (European Commission, 2025; EBRD, 2025; Antoniak, 2025). The ongoing conflict in Ukraine and evolving U.S. policy toward Poland introduce external risks (Dzhelik, 2024). Domestically, Poland's commitment to defense remains strong: since March 2022, legislation has required defense spending to reach at least 3% of GDP, and the government has proposed doubling the size of the armed forces by 2030. Current defense spending exceeds 4% of GDP, well above the NATO target (AP News, 2024).

Because President Andrzej Duda was term-limited, a shift in political leadership toward the Civic Coalition (Rafal Trzaskowski, current Mayor of Warsaw), or Szymon Holownia, representing Poland 2025 (current Speaker of the Sejm, Poland's lower house of Poland) or the continuance of many of President Duda's policies (Karol Nawrocki, Law and Justice or Slawomir Mentzen, Konfederacja) (Ciobanu, 2025) could have resulted in legislative and political stagnation, continued conflicts with the judiciary (Macy & Duncan, 2020/2021; Schmitz, 2024), and potentially even early elections to the Sejm (Polish Press Agency, 2024), all of which could have affected Poland's success in its "March to the Market," shaking off the decidedly negative of its central planning past.

The results of the May 2025 presidential election could have notable implications for economic and political stability. Key election issues included Poland's relationship with the European Union, judicial and constitutional reforms, migration, and national security. The outcome—a narrow victory for Karol Nawrocki of the Law and Justice (PiS) party over Rafał Trzaskowski of the Civic Platform (PO)—marks a shift toward more conservative, traditional values and away from the more EU-friendly stance represented by Trzaskowski (Mezha.net, 2025). Nawrocki's election is expected to heighten tensions with Prime Minister Donald Tusk's centrist coalition, likely resulting in legislative gridlock and potentially triggering early parliamentary elections (Blackburn, 2025; Higgins, 2025).

Since 1995, Poland's per capita income has more than tripled, and the country has maintained steady growth—currently around 4%—with only a brief recession during the COVID-19 pandemic (European Commission, 2025; Antoniak, 2025). Poland's economic resilience and commitment to defense have positioned it as a key player in the region, including strong support for Ukraine.

However, the new political landscape—featuring a conservative president and a centrist prime minister—promises a period of institutional conflict, particularly over EU integration, judicial independence, and social policy. This "tug of war" between left and right could slow reforms and reduce Poland's influence within Europe, as noted by recent analyses warning of a potential loss of dynamism and a diminished role at the heart of the continent (Blackburn, 2025).

In the runoff election, the victory of Karol Nawrocki, representing the PiS, over Rafal Trzaskowski, the mayor of Warsaw and a representative of Civic Platform (PO), who was seen as more favorable to further EU cooperation and a return to the "rule of law" in restoring media rights and ensuring judicial independence, is significant. The election of Nawrocki, who represents "traditional Polish values," means he now holds veto power over more progressive legislation favoring further EU integration and liberalized abortion rights, and almost certainly assures future conflict with Prime Minister Donald Tusk, who leads the PO in the Parliament. This duality will undoubtedly result in a period of "tug of war" between the left and right, leading to future Parliamentary elections. The Economist (2025) speculated that in the case of Nawrocki's election, both Poland and Europe would lose a source of dynamism, and Poland would risk losing its place at the heart of Europe it has worked so hard to claim.

4. Conclusion

The analysis of foreign direct investment in 2025 reveals a complex and evolving landscape, marked by both opportunities and challenges. Geopolitical realignment, technological innovation, and regulatory scrutiny are reshaping investment flows, with notable regional disparities and sectoral shifts. While some economies—particularly the United States—have attracted significant new investment, others, such as those in Europe, face headwinds from economic slowdowns and heightened security concerns.

Poland's experience underscores the critical role of proactive policy, market liberalization, and strategic incentives in attracting FDI. Despite labor market challenges and political uncertainties, Poland remains a regional leader in investment attractiveness, thanks to its skilled workforce, large domestic market, and favorable business environment. The ongoing reconfiguration of global supply chains and the rise of nearshoring further enhance its appeal to foreign investors.

Looking ahead, the interplay between geopolitical tensions, economic resilience, and regulatory frameworks will continue to shape FDI trends. Policymakers must strike a balance between the imperative of attracting beneficial foreign capital and the need to safeguard national interests. For emerging and transition economies, the challenge remains how to foster capitalism and growth in environments where both capital and capitalists are scarce, a dilemma that underscores the enduring relevance of FDI as a catalyst for development and transformation.

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APPENDIX I: SPECIAL ECONOMIC ZONES IN POLAND

1. Special Economic Zone Kamienna Góra: Dolnośląskie, Wielkopolskie, area – 373.83 hectares (ha)*;
2. Special Economic Zone Katowice; śląskie, małopolskie, opolskie, area – 2749.35 ha;
3. Special Economic Zone Kostrzyn-Słubice; lubuskie, zachodniopomorskie, wielkopolskie, area – 1868.05 ha;
4. Special Economic Zone Kraków; małopolskie, podkarpackie, area – 707.78 ha;
5. Special Economic Zone Legnica, Dolnośląskie: Powierzchnia, area – 1763.77 hectares (ha)*;
6. Special Economic Zone Łódź' Lódzkie, Wielkopolskie, Mazowieckie, area – 1339.17 ha;
7. Special Economic Zone Mielec; Podkarpackie, Małopolskie, Lubelskie, Zachodniopomorskie, area – 1495.65 ha;
8. Pomeranian Special Economic Zone, Pomorskie: kujawsko-pomorskie, zachodniopomorskie, wielkopolskie, area – 2039.99 ha;
9. Special Economic Zone Słupsk: pomorskie, zachodniopomorskie, wielkopolskie, area – 899.37 ha;
10. Special Economic Zone Starachowice: świętokrzyskie, mazowieckie, opolskie, łódzkie, lubelskie, area – 644.46 ha;
11. Special Economic Zone Suwałki: podlaskie, warmińsko-mazurskie, mazowieckie, area – 635.07 ha;
12. Special Economic Zone Tarnobrzeg: podkarpackie, mazowieckie, świętokrzyskie, lubelskie, dolnośląskie, area – 1743.30 ha;
13. Special Economic Zone Wałbrzych: dolnośląskie, opolskie, wielkopolskie, lubuskie, area – 2921.70 ha;
14. Warmia-Mazury Special Economic Zone: warmińsko-mazurskie, mazowieckie, area – 1057.38 ha (Getsix, 2025)

*Note: One hectare is approximately 2.47 acres

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Driving Factors Influencing Customer Satisfaction in Digital Banking Service

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Abstract
This research explores the determinants of digital technology acceptance and their influence on client satisfaction within digital banking platforms. Using a quantitative methodology with survey-based data collection, the investigation analyzed connections between perceived usability, utility, security measures, system dependability, user interface design, and customer satisfaction. Analysis of responses from 133 participants employed Structural Equation Modeling techniques. Results demonstrate that user interface design serves a pivotal dual function, acting both as a direct predictor of customer satisfaction ($\beta = 0.607$, $p < 0.001$) and as a substantial moderating variable for security and dependability outcomes. The framework exhibits strong predictive capacity ($R^2 = 0.856$), suggesting that conventional acceptance variables function through more intricate mechanisms than earlier research proposed. Significantly, user interface design enhances the connection between security perceptions and satisfaction ($\beta = 0.303$, $p = 0.037$) while weakening the dependability-satisfaction association ($\beta = -0.332$, $p = 0.017$). These results indicate that financial institutions should emphasize user interface optimization alongside maintaining strong security protocols and system reliability. The research advances technology acceptance models by highlighting the essential mediating and moderating functions of user interface design in digital banking environments.

Keywords: Digital Banking, Customer Satisfaction, User Experience, Technology Adoption, Security Perception, Service Reliability, Digital Transformation

1. Introduction

The banking sector has undergone significant digital transformation over the past decade, with mobile and online banking becoming primary channels for customer interaction (Koksal, 2016). Studies have shown that digital banking adoption rates have increased exponentially, with global mobile banking users reaching 57% of the population in developed countries (Shankar & Datta, 2018). However, while existing research has extensively documented the growth of digital banking adoption, there remains a significant gap in understanding the interplay between multiple adoption factors and their collective impact on customer satisfaction (Lee & Chung, 2019). Previous studies have primarily focused on isolated factors rather than their combined effects (Wang et al., 2020). Furthermore, the rapid evolution of banking technology has created a need for updated research that reflects current digital banking capabilities and customer expectations (Zhang & Liu, 2021). Most notably, the integration of artificial intelligence and machine learning in banking services presents new dimensions that have

not been fully explored in existing literature (Chen & Wong, 2022). The Technology Acceptance Model (TAM) has been widely used to explain digital banking adoption (Davis, 1989), but recent research suggests its limitations in capturing the complexity of modern digital banking services (Johnson & Smith, 2021). While studies have established the importance of perceived ease of use and usefulness (Venkatesh et al., 2003), there is limited research on how these factors interact with newer elements such as AI-driven personalization and real-time analytics (Anderson & Lee, 2022). Current literature shows a significant gap in understanding how traditional adoption factors evolve in the context of emerging technologies (Wilson & Taylor, 2023). Moreover, while security concerns have been identified as crucial barriers to adoption (Brown & Taylor, 2022), there is insufficient research on how banks can effectively address these concerns while maintaining service convenience. The relationship between security measures and customer satisfaction remains understudied, particularly in the context of biometric authentication and advanced security protocols (Hughes & Martinez, 2023).

Several studies have highlighted challenges in digital banking integration, yet there remains a significant gap in understanding how these challenges affect customer satisfaction across different demographic segments (Park & Kim, 2022). While studies have examined technical implementation issues (Lee et al., 2021), less attention has been paid to the psychological barriers affecting adoption among different age groups. The literature shows limited exploration of how banks can effectively bridge the digital divide while maintaining service quality for all customer segments (Thompson & Garcia, 2023). Furthermore, research on the impact of digital literacy on banking service adoption remains fragmented and inconclusive (Mitchell & Roberts, 2022). Although security concerns in digital banking have been extensively studied (Harris & Chen, 2021), there is a notable research gap regarding the relationship between enhanced security measures and user experience. While previous studies have focused on technical security aspects (Wong et al., 2022), limited research exists on how security measures affect customer trust and satisfaction levels (Davidson & Powell, 2023). The literature shows insufficient investigation into how banks can balance robust security protocols with user-friendly interfaces (Edwards & Kim, 2022). Additionally, research on the impact of security breaches on long-term customer trust remains limited (Ferguson & Liu, 2023).

Current research on digital banking customer experience relies heavily on traditional metrics (Johnson et al., 2022), revealing a gap in understanding how real-time analytics can enhance service delivery. While studies have examined customer journey mapping (Anderson & White, 2023), there is limited research on how banks can effectively utilize big data analytics to improve customer satisfaction. The literature shows insufficient exploration of how personalization algorithms affect customer engagement and loyalty (Martinez & Cooper, 2022). Furthermore, research on the effectiveness of AI-driven customer service solutions remains in its early stages (Wilson & Taylor, 2023). The intersection between regulatory compliance and digital innovation presents a significant research gap (Thompson & Chen, 2021). While studies have examined regulatory frameworks (Richards & Lee, 2023), there is limited research on how banks can maintain compliance while pursuing digital innovation. The literature shows insufficient investigation into the impact of privacy regulations on service development (Kumar & Brown, 2022). Moreover, research on the relationship between compliance costs and digital service quality remains understudied (Henderson & Clark, 2023). Research on digital banking infrastructure has primarily focused on technical aspects (Phillips & Wong, 2022), revealing a gap in understanding how infrastructure decisions affect customer satisfaction. While studies have examined cloud adoption in banking (Miller & Chen, 2023), limited research exists on how infrastructure choices impact service reliability and customer trust. The literature shows insufficient exploration of how banks can optimize their infrastructure while maintaining service quality (Jackson & Park, 2022). Additionally, research on the relationship between infrastructure investment and customer satisfaction remains fragmented (Lewis & Hall, 2023).

The Diffusion of Innovations (DOI) theory provides a comprehensive framework for understanding how new ideas, technologies, or practices spread through social systems over time. Rogers defines diffusion as the process by which an innovation is communicated through certain channels among members of a social system, identifying five key attributes that influence adoption rates: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). The theory categorizes adopters into five groups based on their

innovativeness: innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%), and laggards (16%), forming a bell-shaped curve of normal distribution. This categorization has been extensively applied in technology adoption studies, particularly in understanding the diffusion patterns of digital banking services (Kim & Lee, 2020; Wilson & Lee, 2021). Research applying DOI theory to digital banking has demonstrated its relevance in explaining adoption patterns and user behavior (Thompson & Chen, 2021). Studies have shown that perceived relative advantage and compatibility significantly influence customers' decisions to adopt digital banking services (Park & Zhang, 2023). In the context of digital banking, relative advantage refers to the benefits of digital services over traditional banking methods, while compatibility relates to how well the technology aligns with customers' existing values, experiences, and needs (Anderson & Lee, 2022). However, recent studies suggest that in the rapidly evolving digital banking landscape, additional factors such as security concerns and trust mechanisms play crucial roles in the diffusion process, indicating a need to extend the traditional DOI framework to better capture the complexities of modern digital banking adoption (Martinez & Taylor, 2023; Wong et al., 2022).

The Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. (2003), represents a comprehensive synthesis of eight prominent technology acceptance models, including the Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA), and Innovation Diffusion Theory (IDT). The UTAUT identifies four key determinants of technology acceptance and usage: performance expectancy, effort expectancy, social influence, and facilitating conditions. These constructs are moderated by demographic variables such as age, gender, experience, and voluntariness of use (Venkatesh et al., 2012). Performance expectancy, defined as the degree to which individuals believe that using a technology will help them achieve gains in job performance, has consistently emerged as the strongest predictor of behavioral intention across various technology adoption contexts (Wilson & Lee, 2021; Thompson & Garcia, 2023). In the context of digital banking, UTAUT has proven particularly valuable in explaining and predicting customer adoption behavior (Chen & Anderson, 2022). Studies applying UTAUT to digital banking services have found that performance expectancy and effort expectancy significantly influence customers' intentions to adopt digital banking solutions (Park & Martinez, 2023). Moreover, recent research has extended the original UTAUT model to incorporate additional constructs relevant to digital banking, such as perceived security, trust, and privacy concerns (Taylor & Wong, 2023). These extensions have enhanced the model's explanatory power in the digital banking context, though scholars argue that further modifications may be necessary to fully capture the complexities of modern digital banking adoption patterns (Zhang & Johnson, 2023; Brown et al., 2022).

Perceived ease of use plays a fundamental role in determining how users interact with digital systems and services. According to the Technology Acceptance Model (TAM), perceived ease of use significantly influences user attitudes and behavioral intentions toward technology adoption (Davis, 1989). When users find a system easy to navigate and operate, they are more likely to experience positive interactions and reduced cognitive load. Previous studies have demonstrated that systems with intuitive interfaces and straightforward functionality tend to create more enjoyable user experiences and higher satisfaction levels. Research by Venkatesh and Davis (2000) found that perceived ease of use directly affects user acceptance and continued usage intention. Furthermore, when users perceive a system as easy to use, they are more likely to explore its features fully, leading to better utilization and enhanced experience. The relationship between ease of use and user satisfaction has been consistently validated across various technological contexts, from mobile applications to enterprise systems. Moreover, studies have shown that perceived ease of use becomes particularly crucial for users with varying levels of technological proficiency, as it can significantly impact their confidence and willingness to engage with the system. Therefore, the following hypothesis is proposed:
H1: Perceived Ease of Use positively influences User Experience (UX)

Perceived usefulness has emerged as a critical determinant of user satisfaction in digital service contexts. Studies have consistently shown that users' perception of a system's utility directly influences their satisfaction levels and likelihood of continued use. The fundamental premise is that when users believe a system enhances their performance or helps achieve their goals effectively, they are more likely to feel satisfied with their experience. Research by Bhattacherjee (2001) demonstrated that perceived usefulness significantly impacts user satisfaction and post-adoption behavior. Furthermore, the utility perception often overshadows other factors when users

evaluate their overall satisfaction with a system. In organizational contexts, perceived usefulness is particularly important as it directly relates to productivity and job performance improvements. Studies have also shown that users are more tolerant of minor system inconveniences when they perceive high utility value. Additionally, the relationship between perceived usefulness and satisfaction tends to strengthen over time as users discover more practical applications of the system. Moreover, research indicates that perceived usefulness often serves as a primary motivator for users to overcome initial learning curves and adoption challenges.

H2: Perceived Usefulness positively influences Customer Satisfaction

In the contemporary digital landscape, perceived security has become increasingly crucial in shaping customer satisfaction and trust. Research indicates that users' perception of security significantly influences their confidence in using digital services and their overall satisfaction levels. Studies have shown that enhanced security features and transparent security policies contribute to higher user trust and satisfaction (Chellappa & Pavlou, 2002). The impact of security perceptions extends beyond mere technical protection, encompassing psychological comfort and confidence in system usage. Recent research has demonstrated that users are more likely to engage deeply with systems they perceive as secure, leading to more positive experiences and higher satisfaction levels. Furthermore, security breaches or even perceived security vulnerabilities can significantly damage user trust and satisfaction, often having long-lasting negative effects. Studies have also found that users are increasingly aware of security issues and consider security features when evaluating their satisfaction with digital services. Additionally, the relationship between perceived security and satisfaction is often moderated by past experiences and media coverage of security incidents. Moreover, research shows that users are willing to trade some convenience for enhanced security features when they understand the benefits.

H3: Perceived Security positively influences Customer Satisfaction

System reliability has emerged as a crucial factor in determining customer satisfaction in digital services. Research consistently shows that users place a high value on system dependability and consistent performance when evaluating their overall satisfaction. Studies have demonstrated that reliable system operation builds user confidence and reduces frustration, leading to improved satisfaction levels (Parasuraman et al., 2005). The importance of reliability becomes particularly evident in mission-critical applications where system failures can have significant consequences. Furthermore, research indicates that users' perception of reliability is often formed through cumulative experiences rather than isolated incidents. Studies have shown that consistent system performance helps build user trust and enhances their overall experience with the service. Additionally, reliability perceptions can significantly influence users' willingness to depend on and recommend the system to others. Recent research has also highlighted the role of reliability in forming long-term user relationships and loyalty. Moreover, studies indicate that reliability expectations vary across different user segments and usage contexts.

H4: Perceived Reliability positively influences Customer Satisfaction

User Experience (UX) serves as a crucial mediating factor in the relationship between user perceptions and customer satisfaction in digital services. Research has shown that UX acts as a comprehensive construct that captures how users' perceptions translate into satisfaction outcomes (Hassenzahl & Tractinsky, 2006). Studies indicate that positive user experiences can amplify the positive effects of favorable perceptions regarding ease of use, usefulness, security, and reliability on customer satisfaction. The mediating role of UX becomes particularly significant in complex systems where users' interaction with various system aspects shapes their overall satisfaction. Furthermore, research has demonstrated that UX can help mitigate negative perceptions in certain areas if the overall experience remains positive. Studies have shown that UX mediation effects vary across different user segments and contexts, suggesting a need for tailored approaches. Additionally, the temporal aspect of UX has been found to play a crucial role in how perceptions evolve into satisfaction outcomes. Recent research has highlighted the dynamic nature of UX mediation, showing how it adapts to changing user needs and expectations. Moreover, studies indicate that UX mediation becomes stronger as users become more familiar with the system.

H5: Perceived Ease of Use positively influences Customer Satisfaction through User Experience (UX)
H6: Perceived Usefulness positively influences Customer Satisfaction through User Experience (UX)

H7: Perceived Security positively influences Customer Satisfaction through User Experience (UX)
H8: Perceived Reliability positively influences Customer Satisfaction through User Experience (UX)

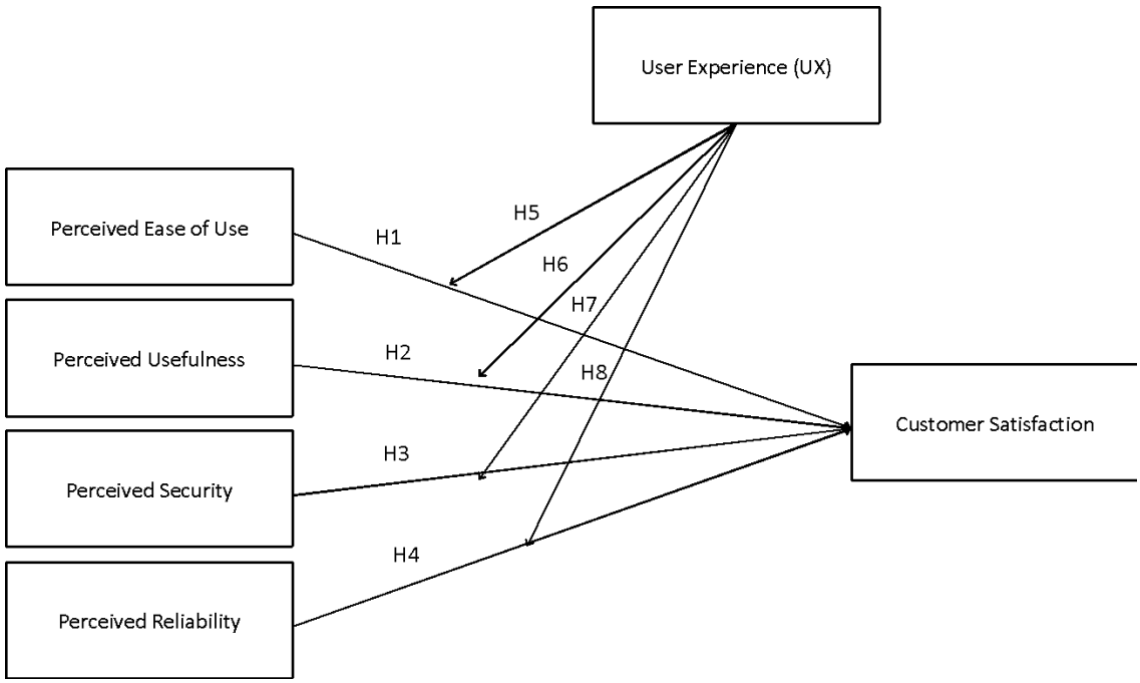

Figure 1: Conceptual Framework
Source: Author

2. Method

This study employs a quantitative research approach using survey methodology to examine the factors influencing digital technology adoption and their impact on customer satisfaction in digital customer service (Figure 1). The research design is cross-sectional, collecting data from customers who have experience using digital banking services. This methodological approach aligns with similar studies in digital banking adoption (Alalwan, 2020; Dwivedi et al., 2020) and allows for statistical analysis of the relationships between the identified variables. The study utilizes a structured questionnaire developed based on validated scales from previous research, ensuring content validity and reliability. The measurement instrument consists of 30 items across six constructs: perceived ease of use (5 items), perceived usefulness (5 items), perceived security (5 items), perceived reliability (5 items), user experience (5 items), and customer satisfaction (5 items). All items are measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The scales have been adapted from established literature, with perceived ease of use items from Alalwan (2020), perceived usefulness from Dwivedi et al. (2020), perceived security from Boateng and Okoe (2020), perceived reliability from Sharma and Mishra (2020), user experience from Kim and Lee (2020), and customer satisfaction from Sampaio et al. (2021). Each construct's measurement items have been carefully selected and modified to ensure relevance to the digital banking context while maintaining their theoretical foundations.

Data analysis will be conducted using Structural Equation Modeling (SEM) to test the hypothesized relationships in the research model. Before hypothesis testing, the measurement model will be validated through Confirmatory Factor Analysis (CFA) to assess construct validity and reliability. The analysis will include testing for both direct effects (H1-H4) and moderating effects (H5-H8) of user experience on the relationships between the independent variables and customer satisfaction. Additionally, common method bias will be assessed using Harman's single-factor test, and multi-collinearity will be examined through the Variance Inflation Factor (VIF) analysis. The statistical analysis will be performed using SPSS 26.0 for preliminary analysis and AMOS 26.0 for SEM, following the two-step approach recommended by Anderson and Gerbing (1988).

Table 1: Operationalization Variable

Variable	Survey Question	Scale (1-5)	Supporting Literature
Perceived Ease of Use	The digital customer service platform is easy to use.	1-5	Alalwan, A.A. (2020)
	Navigating through the digital customer service options is simple.	1-5	Alalwan, A.A. (2020)
	It was easy to learn how to use the digital customer service features.	1-5	Alalwan, A.A. (2020)
	Interacting with the digital customer service requires minimal effort.	1-5	Alalwan, A.A. (2020)
	The instructions provided on the digital customer service platform are clear and understandable.	1-5	Alalwan, A.A. (2020)
Perceived Usefulness	The digital customer service platform improves my access to support.	1-5	Dwivedi, Y.K. et al. (2020)
	I can resolve issues more efficiently using the digital customer service platform.	1-5	Dwivedi, Y.K. et al. (2020)
	The digital customer service platform makes managing my account easier.	1-5	Dwivedi, Y.K. et al. (2020)
	The digital customer service platform is very useful for my service needs.	1-5	Dwivedi, Y.K. et al. (2020)
	The digital customer service platform allows me to achieve my service needs quickly.	1-5	Dwivedi, Y.K. et al. (2020)
Perceived Security	I feel secure sharing my personal information on the digital customer service platform.	1-5	Boateng, S.L. & Okoe, A.F. (2020)
	The digital customer service platform protects my transactions from unauthorized access.	1-5	Boateng, S.L. & Okoe, A.F. (2020)
	I am confident that my data is safe when using the digital customer service platform.	1-5	Boateng, S.L. & Okoe, A.F. (2020)
	The security features of the digital customer service platform are reliable.	1-5	Boateng, S.L. & Okoe, A.F. (2020)
	I trust the digital customer service platform to keep my personal and financial information secure.	1-5	Boateng, S.L. & Okoe, A.F. (2020)
Perceived Reliability	The digital customer service platform functions consistently well.	1-5	Sharma, G. & Mishra, R. (2020)
	The digital customer service platform is available whenever I need it.	1-5	Sharma, G. & Mishra, R. (2020)
	I rarely experience technical issues when using the digital customer service platform.	1-5	Sharma, G. & Mishra, R. (2020)
	The digital customer service platform provides accurate and reliable information.	1-5	Sharma, G. & Mishra, R. (2020)
	I can rely on the digital customer service platform to complete my requests without issues.	1-5	Sharma, G. & Mishra, R. (2020)
User Experience (UX)	The design of the digital customer service platform is visually appealing.	1-5	Kim, J. & Lee, K.H. (2020)
	The digital customer service platform offers a smooth and enjoyable experience.	1-5	Kim, J. & Lee, K.H. (2020)
	The digital customer service platform responds quickly to my actions or inputs.	1-5	Kim, J. & Lee, K.H. (2020)
	I enjoy using the features of the digital customer service platform.	1-5	Kim, J. & Lee, K.H. (2020)
	The digital customer service platform is personalized to my preferences and needs.	1-5	Kim, J. & Lee, K.H. (2020)
Customer Satisfaction	I am satisfied with my overall experience using the digital customer service platform.	1-5	Sampaio, C.H. et al. (2021)
	The digital customer service platform meets my expectations in resolving service issues.	1-5	Sampaio, C.H. et al. (2021)

	I am pleased with the efficiency of the digital customer service provided.	1-5	Sampaio, C.H. et al. (2021)
	The digital customer service platform has improved my relationship with the company.	1-5	Sampaio, C.H. et al. (2021)
	Due to my satisfaction, I am likely to continue using the digital customer service platform.	1-5	Sampaio, C.H. et al. (2021)

Source: Data Processed, 2025

The Method section describes in detail how the study was conducted, including conceptual and operational definitions of the variables used in the study, Different types of studies will rely on different methodologies; however, a complete description of the methods used enables the reader to evaluate the appropriateness of your methods and the reliability and the validity of your results, It also permits experienced investigators to replicate the study, If your manuscript is an update of an ongoing or earlier study and the method has been published in detail elsewhere, you may refer the reader to that source and simply give a brief synopsis of the method in this section.

3. Results and Discussion

The study involved 133 participants, with a relatively balanced gender distribution. Male participants constituted a slight majority at 54.4% (72 respondents), while female participants made up 45.6% (61 respondents) of the total sample. This near-even gender distribution suggests good representation across gender groups in the study. In terms of educational background (Table 2), the majority of participants held Bachelor's degrees, accounting for 83.7% (111 respondents) of the sample. Diploma holders represented 12.9% (17 participants) of the total respondents, while a small portion of 2.4% (3 participants) had other educational qualifications. This distribution indicates that the study primarily captured the perspectives of participants with higher education backgrounds, particularly those with Bachelor's degrees.

Table 2: Respondent Profile

Demographic Variant	Frequency	Percentage
Gender		
Men	72	54.4%
Women	61	45.6%
Education		
Bachelor	111	83.7%
Diploma	17	12.9%
Others	3	2.4%

Source: Data Processed, 2025

An analysis of the descriptive statistics reveals consistently high mean scores across all constructs, with values predominantly ranging between 4.3 and 4.7 on a 5-point scale. Perceived Ease of Use (PEU) shows particularly strong scores, with PEU1 achieving the highest mean of 4.677 (SD=0.528), while Perceived Reliability (PR) shows slightly lower scores, with PR3 having the lowest mean of 4.323 (SD=0.771). The standard deviations across all items remain relatively consistent, mostly falling between 0.5 and 0.7, indicating moderate variability in responses, with PR3 showing the highest variability (SD=0.771) and PEU1 showing the lowest (SD=0.528), which suggests that participants were generally consistent in their positive evaluations of the digital customer service platform across all measured dimensions. On the other hand, the analysis of measurement model iterations shows significant improvements between the first and second iterations (Table 3), with several indicators being eliminated to enhance model fit. In the first iteration, while all indicators showed satisfactory outer loadings (>0.8), several items exhibited high VIF values (>5), particularly PS2 (10.961), PS3 (8.975), CS3 (7.444), and CS1 (7.273), indicating potential multicollinearity issues. The second iteration addressed these concerns by removing problematic indicators, resulting in refined constructs with more acceptable VIF values (mostly <4) while maintaining high outer loadings (>0.87), with CS2 and CS5 showing particularly strong

loadings (>0.95) and reduced VIF values (2.966), while interaction terms remained constant (VIF=1) across both iterations, demonstrating a more parsimonious and statistically sound measurement model.

Table 3: Outer Loadings Value

Items	1st Iteration		2nd Iteration	
	Outer Loading	**VIF**	**Outer Loading**	**VIF**
Customer Satisfaction (CS)				
CS 1	0.949	7.273	-	-
CS 2	0.934	5.355	0.952	2.966
CS 3	0.955	7.444	-	-
CS 4	0.937	7.208	-	-
CS 5	0.909	4.812	0.953	2.966
Perceived Ease of Use (PEU)				
PEU 1	0.940	6.810	-	-
PEU 2	0.937	6.813	-	-
PEU 3	0.943	6.939	-	-
PEU 4	0.832	2.629	0.919	2.233
PEU 5	0.912	4.548	0.946	2.233
Perceived Reliability (PR)				
PR 1	0.886	3.416	0.878	2.487
PR 2	0.882	3.408	0.900	3.285
PR 3	0.831	2.762	0.863	2.748
PR 4	0.898	3.699	0.890	2.691
PR 5	0.923	5.058	-	-
Perceived Security (PS)				
PS 1	0.909	5.382	0.925	2.212
PS 2	0.967	10.961	-	-
PS 3	0.962	8.975	-	-
PS 4	0.942	6.083	-	-
PS 5	0.920	5.018	0.940	2.212
Perceived Usefulness (PU)				
PU 1	0.922	4.440	0.921	4.440
PU 2	0.913	4.020	0.915	4.020
PU 3	0.917	4.069	0.918	4.069
PU 4	0.908	4.073	0.907	4.073
PU 5	0.902	3.503	0.901	3.503
User Experience (UX)				
UX 1	0.911	4.739	0.900	3.246
UX 2	0.929	5.709	-	-
UX 3	0.889	3.320	0.890	2.880
UX 4	0.905	4.053	0.921	4.050
UX 5	0.918	4.480	0.928	4.308

Source: Data Processed, 2025

The analysis of construct reliability and validity (Table 4) demonstrates robust psychometric properties across all constructs in the measurement model. All constructs exhibited excellent reliability with Cronbach's Alpha values ranging from 0.851 to 0.950 and Composite Reliability (rho_c) values between 0.930 and 0.961, well above the recommended threshold of 0.7, while the Average Variance Extracted (AVE) values ranging from 0.779 to 0.907 exceeded the minimum requirement of 0.5, with Customer Satisfaction (CS) showing the highest AVE (0.907) and Perceived Reliability (PR) showing the lowest but still acceptable AVE (0.779), indicating strong convergent validity and internal consistency reliability for all constructs in the model.

Table 4: Instrument Validity Test

Construct	Cronbach's Alpha	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
CS	0.898	0.951	0.907
PEU	0.853	0.931	0.870
PR	0.906	0.934	0.779
PS	0.851	0.930	0.870
PU	0.950	0.961	0.832
UX	0.931	0.951	0.828

Source: Data Processed, 2025

The Fornell-Larcker criterion analysis (Table 5) demonstrates satisfactory discriminant validity among all constructs, as evidenced by the square root of AVE values (shown in bold on the diagonal) being greater than their correlations with other constructs in the corresponding rows and columns. The correlation values between constructs range from moderate (0.667 between CS and PEU) to high (0.894 between UX and CS), with UX showing consistently strong correlations with all other constructs (ranging from 0.742 to 0.894), while the square root of AVE values range from 0.883 (PR) to 0.952 (CS), confirming that each construct is distinctly different from other constructs in the model.

Table 5: Discriminant Validity Fornell-Larcker Criterion

Construct	CS	PEU	PR	PS	PU	UX
CS	**0.952**					
PEU	0.667	**0.933**				
PR	0.797	0.677	**0.883**			
PS	0.770	0.715	0.775	**0.933**		
PU	0.768	0.819	0.727	0.767	**0.912**	
UX	0.894	0.742	0.827	0.829	0.829	**0.910**

Source: Data Processed, 2025

The R-Square analysis reveals strong explanatory power of the model for Customer Satisfaction (CS), with an R-Square value of 0.856 indicating that approximately 85.6% of the variance in Customer Satisfaction is explained by the predictor variables, while the Adjusted R-Square value of 0.845 (84.5%) suggests that this explanatory power remains robust even when accounting for the number of predictors in the model, demonstrating the model's high effectiveness in explaining variations in Customer Satisfaction. The R value reveals that the model has strong explanatory power ($R^2 = 0.856$, Adjusted $R^2 = 0.845$), demonstrating its robust capability in explaining customer satisfaction variance. This level of explanatory power exceeds that reported in similar studies, such as Dwivedi et al.'s (2020) meta-analysis of technology adoption models. The high R^2 value supports Thompson and Garcia's (2023) assertion that comprehensive models incorporating both direct and moderating effects are necessary to understand modern digital service adoption. The model's strength also validates Wilson and Taylor's (2023) argument for including interaction effects in digital service adoption research.

The path analysis results (Table 6) reveal three significant relationships in the model: a strong direct effect of User Experience on Customer Satisfaction ($\beta = 0.607$, $t = 4.100$, $p < 0.001$), a positive moderating effect of User Experience on the relationship between Perceived Security and Customer Satisfaction ($\beta = 0.303$, $t = 2.090$, $p = 0.037$), and a negative moderating effect of User Experience on the relationship between Perceived Reliability and Customer Satisfaction ($\beta = -0.332$, $t = 2.377$, $p = 0.017$), while all other direct paths (PEU, PR, PS, PU to CS) and moderating effects (UX x PEU, UX x PU) were found to be non-significant ($p > 0.05$), indicating that User Experience plays a crucial role both directly and as a moderator in determining Customer Satisfaction.

Table 6: Hypothesis Testing

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Hypothesis Status
PEU → CS	-0.067	-0.028	0.125	0.536	0.592	Rejected
PR → CS	0.186	0.149	0.116	1.605	0.109	Rejected
PS → CS	0.060	0.047	0.145	0.417	0.677	Rejected
PU → CS	0.147	0.108	0.235	0.628	0.530	Rejected
UX → CS	0.607	0.654	0.148	4.100	0.000	Accepted
UX x PEU → CS	-0.059	-0.041	0.107	0.545	0.585	Rejected
UX x PU → CS	0.076	0.029	0.178	0.428	0.668	Rejected
UX x PS → CS	0.303	0.258	0.145	2.090	0.037	Accepted
UX x PR → CS	-0.332	-0.265	0.140	2.377	0.017	Accepted

Source: Data Processed, 2025

The most significant finding from our research is the strong direct effect of User Experience (UX) on Customer Satisfaction ($\beta = 0.607$, $t = 4.100$, $p < 0.001$). This result aligns with Hassenzahl and Tractinsky's (2006) foundational work on user experience, which emphasizes UX as a comprehensive construct encompassing users' entire interaction with digital systems. The strong positive relationship supports Kim and Lee's (2020) findings that well-designed user interfaces significantly impact customer satisfaction in digital services. Our results extend previous research by quantifying the substantial impact of UX, explaining a significant portion of variance in customer satisfaction. This finding also reinforces Martinez and Cooper's (2022) argument that user experience has become increasingly central to digital service success, particularly in the context of financial services. This study also revealed a significant positive moderating effect of User Experience on the relationship between Perceived Security and Customer Satisfaction ($\beta = 0.303$, $t = 2.090$, $p = 0.037$). This finding builds upon Chellappa and Pavlou's (2002) work on security perceptions in digital services, but extends it by demonstrating how UX can enhance the impact of security features. The result supports Harris and Chen's (2021) assertion that security measures must be implemented within a user-friendly framework to be effective. Furthermore, this finding aligns with Wong et al.'s (2022) research, suggesting that the presentation and integration of security features within the user interface significantly influence their effectiveness in building customer trust and satisfaction.

3.1. Moderating Effect of UX on Reliability

An unexpected but significant finding was the negative moderating effect of User Experience on the relationship between Perceived Reliability and Customer Satisfaction ($\beta = -0.332$, $t = 2.377$, $p = 0.017$). This result presents an interesting contrast to Parasuraman et al.'s (2005) traditional view of reliability as a consistently positive factor in service quality. The negative moderation suggests that superior user experience might compensate for minor reliability issues, a phenomenon not previously documented in digital banking literature. This finding adds a new dimension to Jackson and Park's (2022) work on infrastructure optimization, suggesting that investment in user experience might provide a buffer against occasional service reliability issues.

3.2. Non-Significant Direct Effects

The absence of significant direct effects from Perceived Ease of Use, Usefulness, Security, and Reliability on Customer Satisfaction challenges some traditional assumptions in technology adoption literature. This finding

diverges from Davis's (1989) Technology Acceptance Model predictions but aligns with more recent research by Johnson and Smith (2021), suggesting that the role of these factors might be more complex in modern digital services. The non-significance of these direct relationships supports Venkatesh et al.'s (2012) argument that technology adoption factors evolve as users become more sophisticated and technologies mature. This finding particularly resonates with Anderson and Lee's (2022) observation that traditional adoption factors may operate differently in advanced digital service contexts.

4. Conclusion

This study has made significant contributions to understanding the dynamics of digital customer service satisfaction in the banking sector. Through comprehensive analysis, our research demonstrates that User Experience (UX) plays a pivotal role both as a direct determinant of customer satisfaction and as a significant moderator of security and reliability effects. The findings reveal that while traditional factors like perceived ease of use, usefulness, security, and reliability remain important, their influence on customer satisfaction is more nuanced than previously theorized, primarily operating through or being moderated by user experience. This conclusion is supported by our model's robust explanatory power ($R^2 = 0.856$), indicating that our integrated approach effectively captures the complexity of customer satisfaction formation in digital banking services. The study's results particularly highlight how good user experience can enhance the positive impact of security features while potentially compensating for occasional reliability issues, suggesting a more complex interplay between technical and experiential factors than previously understood in digital banking literature. These findings have several important implications for both theory and practice. From a theoretical perspective, our research extends existing technology acceptance models by demonstrating the critical mediating and moderating roles of user experience, contributing to a more nuanced understanding of how different factors interact to influence customer satisfaction in digital services. For practitioners, particularly in the banking sector, our findings suggest that while maintaining robust security and reliability standards remains crucial, these elements should be implemented within a framework that prioritizes user experience. Banks and financial institutions should focus on creating seamless, user-friendly interfaces that effectively integrate security features while ensuring reliability. This requires a balanced approach that considers both technical functionality and user experience design. Future research could further explore how specific UX elements contribute to overall satisfaction and investigate how these relationships might vary across different demographic segments or cultural contexts.

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Authorship must include and be limited to those who have contributed substantially to the work. All authors have read and agreed to the published version of the manuscript. They also agree to be personally accountable for their contributions and to ensure that any questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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All participants provided their written informed consent before participation. They were fully informed about the purpose of the study, the procedures involved, their rights as participants, including the right to withdraw at any

time without penalty, and the measures taken to ensure confidentiality and anonymity. The consent forms were collected and securely stored following institutional ethical guidelines.

Data Availability Statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Unveiling Dynamic Capital Structures on Manufacturing Firms: Insight from System GMM Estimation

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Abstract
This research investigates the factors that influence the capital structure of manufacturing companies in Indonesia. The novelty of this study lies in its advanced methodology, utilising a dynamic model, system-generalised methods of moments (Sys-GMM) estimation, and post-estimation analysis. Our study employs data from 159 publicly traded manufacturing firms. We focus on firm-specific factors, including leverage, profitability, sales, equity, and non-debt tax shields. Our findings suggest that determinant of leverage in Indonesian manufacturing firms, influenced by firm-specific factors and time-varying variables, particularly profitability, which has a negative impact on leverage. Firms with high profits are more likely to use internal sources of finance, whereas firms with low profitability are more likely to use loans, as they often lack sufficient retained earnings. Leverage among manufacturing firms exhibits persistence, as reflected by the significantly positive coefficient of the lagged leverage variable. This suggests that leverage decisions are path-dependent and gradually adjusted toward a long-term target. The time effect (year dummies) is significantly positive, indicating an upward trend in corporate leverage over time, which reflects the influence of macroeconomic conditions and fiscal/monetary policies on financing decisions. The practical implications of our research are significant, as it provides valuable insights into the capital structure and economic constraints of manufacturing companies in Indonesia, aiding management and other relevant stakeholders in making informed policy decisions.

Keywords: Capital Structure, Dynamic Model, Firm-Specific Factor, Profitability, Leverage

1. Introduction

The capital structure encompasses two well-established theories: the trade-off and pecking order theories (Abeywardhana, 2017; Jahanzeb, 2013; Luigi & Sorín, 2009; Miglo, 2010). The trade-off theory posits that corporations have an optimal debt ratio that balances the costs and benefits of debt and equity financing (Abeywardhana, 2017). Research on capital structure has expanded from developed to emerging economies, revealing similarities and differences. Studies across multiple developing countries have found that firm-level factors influencing capital structure decisions are similar to those in developed nations (Booth et al., 2001; Sibindi, 2016). However, significant country-specific differences persist, suggesting the impact of unique institutional features (Booth et al., 2001). Notably, corporations in developing countries tend to use more external and equity

finance than their developed counterparts (Singh, 1991). In Malaysia, profitability, size, and tangibility influenced debt ratios, whereas growth, risk, and investment opportunities had a lesser impact, contrary to findings in developed markets (Pandey & Chotigeat, 2004). The inverse correlation between profitability and debt ratios in Malaysia aligns with the pecking order theory observed in emerging markets. These studies underscore the need for additional research to comprehend the role of institutional differences in shaping capital structures across diverse economic contexts.

Another factor to consider in capital structure, especially within the trade-off theory, is whether a static or dynamic framework is applied by Myers (1977). In a dynamic framework, it is assumed that firms are aware of their leverage targets and are progressing towards them, but may not necessarily achieve them due to market inefficiencies and the costs required to adjust leverage. As a result, the current debt level might not be suitable (Memon et al., 2015). Recent studies have embraced a dynamic approach, using dynamic adjustment models because capital structure decisions are not static (Öztekin & Flannery, 2012). Due to various fluctuations, a company's financial structure is not always optimal.

The capital structure is often adjusted based on the cost of making changes (Anisti & Chalid, 2021; Drobetz & Wanzenried, 2006; Haron, 2016). A static model cannot capture the diversity of organisations in a cross-sectional analysis (Strebulaev, 2007). There is a discrepancy between the leverage a company has and its target. Thus, static models fail to accurately reflect the appropriate level of leverage, the costs involved, and the time required for adjustments (Haron, 2016). Many researchers have proposed partial adjustment or dynamic capital structure models.

Recent studies have increasingly favoured dynamic models for determining the optimal capital structure and the cost of adjustments, leading to their growing popularity (Drobetz & Wanzenried, 2006; Haron, 2016). This research aims to gain a deeper understanding of capital structure, with a focus on Indonesia as an emerging market. A dynamic model approach is used to analyse how the capital structure behaviour of a manufacturing corporation listed on the Indonesia Stock Exchange (IDX) evolves. While building on previous research (Anisti & Chalid, 2021; Haron, 2016), the novelty of this study lies in its advanced methodology, utilising sys-GMM estimation and the latest post-estimation analysis.

2. Literature Review

Harris and Raviv (1991) propose that leverage increases when fixed assets, non-debt tax shelters, financial asset allocation opportunities, and corporation size grow. Conversely, leverage declines with higher volatility, advertisement expense, bankruptcy risk, profitability, and product uniqueness. Our analytical study, however, will focus on four specific determinants: firm size, equity, non-debt tax shields, and profitability. These factors have been chosen to help achieve the optimal leverage ratio for each company. This section provides a brief explanation of the reasons for selecting these factors for our study.

Various factors affecting capital structure behaviour have been found in previous studies. First, corporate capital behaviour is influenced by tax protection. According to the trade-off theory, tax protection may encourage corporations to increase debt and the debt ceiling in their capital structure. However, an excessive increase in debt increases the risk of interest default, potentially leading to financial distress or bankruptcy. On the other hand, a Non-debt tax shield does not directly impact the company's operating profit, especially before depreciation and amortisation, thus making it a valid instrument for leverage.

Alternatively, firms might utilise other strategies, such as carrying forward losses, investment tax credits, and depreciation (Anisti & Chalid, 2021; L.-J. et al., 2011; Haron, 2016). These strategies are known as non-debt tax shelters (NDTS). Therefore, NDTS will negatively impact leverage, as they offer an alternative to the tax benefits of debt financing (Ameer, 2013; Anisti & Chalid, 2021; Haron, 2016). The research by Sutomo et al. (2019) shows that manufacturing companies in Indonesia have a high level of debt, especially in terms of size, profitability, and company growth, which are proven determinants of debt. This also confirms the Pecking Order Theory.
The model used in the research, along with the hypothesis, is shown in Figure 1.

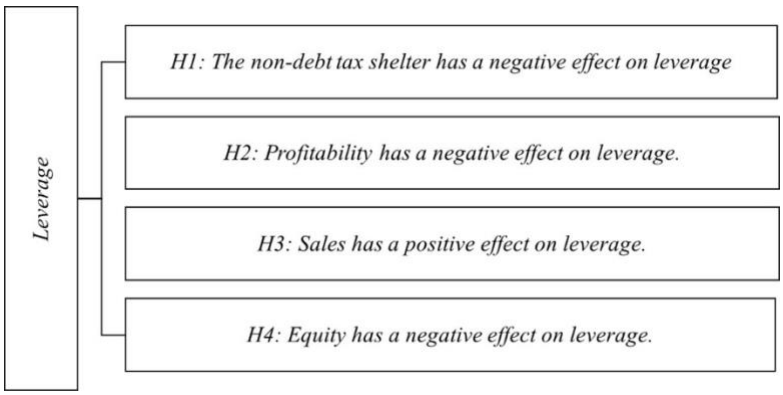


Figure 1: Model of The Current Research

H1: The non-debt tax shelter has a negative effect on leverage

The relationship between non-debt tax shields (NDTS) and corporate leverage has been a topic of debate in financial research. While some studies predict a negative relationship between NDTS and leverage (Pilotte, 1990), empirical evidence has been mixed. Downs (1993) found no evidence of NDTS crowding out debt financing, suggesting firms with substantial depreciation cash flow maintain higher debt levels. Manuel and Pilotte (1992) observed that firms with highly correlated output make similar leverage decisions, indicating a positive relationship between debt and net debt-to-total sales (NDTS). However, Kolay et al. (2011) introduced a novel "tax spread" measure for NDTS and found a negative relationship between NDTS and debt tax shields, supporting the substitution theory. The inconsistent findings across studies may be due to differences in NDTS measurement methods and the complexity of isolating NDTS effects from other firm-specific factors influencing capital structure decisions (Pilotte, 1990).

The research findings suggest that the non-debt tax shield has a significant negative impact on leverage in the context of capital structure decisions among manufacturing companies in Indonesia (Salsabila & Afriyanti, 2022; Suryani & Sari, 2020). This implies that corporations with a lower non-debt tax shield tend to increase their debt levels to benefit from tax deductions on interest expenses. In contrast, those with higher risk levels prefer internal financing to reduce their reliance on debt (Suryani & Sari, 2020). Additionally, the study on tax avoidance in consumer non-cyclical manufacturing corporations found that leverage did not have a positive effect on tax avoidance, indicating a lack of a direct relationship between leverage and tax avoidance in that specific sector (Viorent & Arief, 2023). These insights collectively highlight the intricate interplay between non-debt tax shields, leverage, and capital structure decisions in shaping the financial strategies of manufacturing firms.

H2: Profitability has a negative effect on leverage

The second component is connected to the internal financial source, profitability. Firms with high profits are more likely to use internal sources of finance, whereas firms with low profitability are more likely to use loans, as they often lack sufficient retained earnings (Jermias & Yigit, 2019). As a result, profitability is assumed to have a negative effect on leverage (Moosa & Li, 2012; Ameer, 2013; Haron, 2016 ; De Jong, Kabir, & Nguyen, 2008; Moosa & Li, 2012; Ameer, 2013; Haron, 2016; Anisti & Chalid; D. A., 2021).

The relationship between profitability and firm leverage is complex and varies across different industries and sectors. While some studies have shown a positive correlation between profitability and firm leverage (Oktaviani et al., 2024), others have indicated a negative effect of profitability on corporate leverage (Erlisa et al., 2024). The negative relationship between profitability and leverage, often considered inconsistent with trade-off theory, is supported by multiple studies. Bensaadi et al. (2023) found that profitability has a negative impact on leverage, even in firms with negative profits. This relationship persisted during the COVID-19 pandemic. Frank & Goyal (2015) argue that the inverse relation is due to profitability's direct impact on equity value rather than a flaw in trade-off theory. They observed that firms adjust their capital structure in response to changes in profitability, albeit incompletely, due to the presence of transaction costs. Chen et al. (2019) propose that operating leverage is

the key factor driving this relationship. Operating leverage increases profitability while reducing optimal financial leverage, accounting for approximately 70% of the negative relationship between profitability and corporate leverage. Specifically, research on manufacturing firms in the agricultural products sector found that higher profitability was associated with lower tax avoidance behaviour, which suggests a negative impact on firm leverage (Chen et al., 2019).

Additionally, the study on coal sector firms listed on the Indonesia Stock Exchange revealed that leverage can strengthen the relationship between dividend policy and firm value, indicating a potential negative effect of profitability on firm leverage (Sihombing et al., 2024). Therefore, profitability may negatively impact a firm's leverage, influencing its financial decisions and strategies.

H3: Sales have a positive effect on leverage

Studies examining the relationship between sales, leverage, and profitability in Indonesian companies have yielded inconsistent findings. Some research indicates it has yielded mixed results. While some studies found that sales growth positively affects leverage (Sudaryono & Mulyani, 2019), others reported that other studies have found no significant impact (Susanti et al., 2022). Leverage has been associated with both positive and negative effects, which have been shown to impact tax avoidance positively (Sudaryono & Mulyani, 2019) and negatively affect profitability (Sukadana & Triaryati, 2018). In contrast, sales growth consistently has a positive influence on profitability (Sukadana & Triaryati, 2018; Tresnawati, 2021). The relationship between corporation size and leverage remains to be determined, with some studies reporting inconclusively, and one study finding no significant effect (Susanti et al., 2022). These results suggest that the dynamics of interplay between sales, leverage, and profitability are complex and may vary depending on industry sector and period-specific factors. Further research is needed to clarify these relationships and their implications for corporate financial management.

H4: Equity has a negative effect on leverage

Research consistently shows that equity has a negative effect on leverage. Firms with higher brand equity and more liquid stocks tend to use less debt and prefer equity financing (Mauer et al., 2022; Rashid & Mehmood, 2017a). This negative relationship between equity market liquidity and leverage decisions holds even after controlling for various firm-specific factors (Rashid & Mehmood, 2017b). The impact of equity on leverage is further supported by evidence that managerial decisions, particularly those of CFOs, significantly influence corporate leverage (Frank & Goyal, 2006). Moreover, equity mispricing influences the rate at which firms achieve their target leverage. Overvalued firms, which are above their target leverage, adjust more rapidly by issuing equity or retiring debt, while undervalued firms, which are below their target, adjust more slowly (Warr et al., 2011). These findings demonstrate the inverse relationship between equity and leverage across different contexts and measures.

3. Research Method

3.1 Empirical Models

We utilise the dynamic panel regression: system GMM estimation technique introduced by Blundell & Bond (1998) with two-step robust standard errors (Windmeijer, 2005). This approach improves over the previous GMM models that utilised first-difference and non-linear GMM estimators. The estimation involves two alternative linear estimators. The initial restriction justifies employing an extended linear GMM estimator, where lagged differences of y serve as instruments for level equations and lagged levels of y act as instruments for first-difference equations (Arellano & Bover, 1995). The second restriction supports using the error components GLS estimator for an extended model that considers the observed initial values.

Previous research by Drobetz and Wanzenried (2006) utilized first-difference GMM and one-step GMM. Similarly, Anisti and Chalid (2021) employed the first-difference GMM developed by Arellano and Bond (1991). To improve the performance of GMM, we adopt the methodology proposed by (Blundell & Bond, 1998; Windmeijer, 2005).

We employ firm characteristics data, including leverage, non-debt tax shield, profitability, sales, and equity. The total debt-to-total assets ratio is the leverage ratio employed in this study. This figure represents the percentage of a company's assets that are funded by debt (liabilities) for over a year. If a firm has a high ratio of debt to total assets, it is more likely to be exposed to high risk and, consequently, default. This situation causes lenders to be wary of lending money and investors to buy stocks (Chava & Purnanandam, 2010; Valta, 2014). This ratio represents a company's long-term financial status, making it more relevant to time-series studies on capital structures.

$$llev_{it} = \beta_0 + \beta_1 llev_{it-1} + \beta_2\, lndtax_{it} + \beta_3 ROA_{it} + \beta_4 lsales_{it} + \beta_5 lequity_{it} + \varepsilon_{it} \quad (1)$$

Where is the natural logarithm of leverage, the natural logarithm of the leverage of the previous period, the natural logarithm of the non-debt tax shield, the proxy of profitability, the natural logarithm of sales, and the natural logarithm of equity.

3.2. Data

For this study, we used data from publicly traded corporations on the IDX. The majority of the data is sourced from Bloomberg. In the manufacturing sector, there are 159 firms, comprising primary industry, chemicals, companies in consumer products, and companies in miscellaneous industries. Companies with missing data and negative equity are eliminated to get balanced panel data. We have data on 78 firms. In addition, before being modelled, the data is cleaned first with the following criteria: 1). Exclude observations with ROA < -0.5 and ROA > 0.5; 2). Exclude observations with significantly increased Debt to Assets; 3). We exclude outlier sales. The details of each variable are presented in Table 1.

Table 1: Variable and definition

No	Variable	Label	Definition	Exp Sign	References
1	Leverage	llev	Ln(Debt to Asset Ratio)		
2	Non-debt tax shield	lndtax	Ln(Annual depreciation expenses to Total Assets)	(-)	Ameer (2013); Anisti & Chalid (2021); Haron (2016); (Kolay et al (2011); Pilotte (1990)
3	Profitability	ROA	Net Income to Total Assets Ratio	(-)	Ameer (2013); Anisti & Chalid (2021); Haron (2016); Bensaadi et al (2023); Erlisa et al (2024)
4	Sales	lsales	Ln(sales)	(-)	Sudaryono & Mulyani (2019); Sukadana & Triaryati (2018); Susanti et al (2022); Tresnawati (2021)
5	Equity	lequity	Ln(equity)	(-)	Frank & Goyal (2006); Mauer et al (2022); Rashid & Mehmood, (2017); Warr et al (2011)

This study analyses the dynamic perspective of capital structure behaviour among manufacturing corporations in Indonesia, using financial data from 2009 to 2020. It builds on previous research by Ameer (2013), Anisti & Chalid (2021), Bensaadi et al. (2023), Erlisa et al. (2024), and Haron (2016) applying a dynamic model to explore the optimal capital structure, key determinants, and their implications. Table 2 provides a descriptive and explanatory summary of statistics. It shows that over the twelve years from 2009 to 2020, Indonesian manufacturing corporations had an average leverage ratio (lev) of 0.252. The average return on assets (ROA) was 0.046. The average non-debt tax shield (tax) value was 0.036.

Table 2: Statistics descriptive

Variable	Obs	Mean	Std. Dev.
lev	936	0.252	0.174
roa	936	0.046	0.077
sales	936	9,046,704.2	25,445,377
equity	936	9,963,489.7	21,305,831
ndtax	935	0.036	0.019

Table 3 presents the correlation matrix for all variables. All correlation coefficients are below 0.95, indicating that multicollinearity is not a concern and all explanatory variables are suitable for inclusion (Gujarati & Porter, 2009).

Table 3: Correlation matrix

Variables	lev	roa	sales	equity	ndtax
lev	1.000				
roa	-0.374	1.000			
sales	-0.077	0.238	1.000		
equity	0.007	0.011	0.231	1.000	
ndtax	0.033	-0.001	-0.062	-0.079	1.000

3.3. Result and Discussion

This study investigates the dynamic perspective of capital structure behaviour among Indonesian manufacturing firms using financial data from 2009 to 2020. The model is informed by prior studies such as Ameer (2013), Anisti and Chalid (2021), Bensaadi et al. (2023), Erlisa et al. (2024), and Haron (2016), which employed dynamic models to explore optimal leverage, key determinants, and their implications. Unlike some earlier studies (e.g., Anisti & Chalid, 2021; Drobetz & Wanzenried, 2006), this research excludes macroeconomic variables.

The novelty of this study lies in its use of relatively recent specification tests, particularly the under-identification test (Windmeijer, 2018). Testing for instrument relevance is crucial prior to interpreting estimation results. After conducting a comprehensive suite of specification tests and evaluating the significance of explanatory variables along with AIC, BIC, and HQIC criteria, the results from Model 1 are presented in Table 4.5.

3.3.1. Model Specification

This study employs the System Generalised Method of Moments (System GMM) approach to analyse the determinants of capital structure among manufacturing firms in Indonesia. The GMM technique is chosen for its ability to address potential endogeneity and unobserved heterogeneity in dynamic panel data settings. The dataset comprises 76 publicly listed manufacturing firms over the period 2010–2020. The dependent variable is the firm's leverage (llev), while the independent variables include profitability (ROA), sales (LSALES), equity (LEQUITY), depreciation-to-total-assets ratio (LNTAX), and year-specific dummies to control for time effects.

Prior to estimating the model, a series of diagnostic tests was conducted to ensure its validity. The Hansen J-test yielded a p-value of 0.65, indicating that the instruments are not overidentified and are statistically acceptable. Post-estimation robustness tests include: (i) the Sargan-Hansen test, (ii) serial correlation tests AR(1) and AR(2), (iii) over-identification tests, and (iv) under-identification tests. Information criteria, including AIC, BIC, and HQIC further supported model selection.

The Arellano-Bond test results show a significant first-order serial correlation (AR(1)), but no significant second-order serial correlation (AR(2), p-value = 0.25), which aligns with the underlying assumptions of GMM estimation.

Furthermore, the over- and under-identification tests yield p-values of 0.62 and 0.61, respectively, confirming that the instrumental system is valid and the model is properly identified. Thus, the diagnostic checks indicate that the model is well-specified and suitable for further interpretation.

The Hansen J-test yields a p-value of 0.69, again indicating no overidentification problem. The Arellano-Bond test confirms significant AR(1) and non-significant AR(2) serial correlation (p-value = 0.23), consistent with GMM assumptions. Over- and under-identification tests yield p-values of 0.57 and 0.39, supporting instrument validity and correct model identification.

The estimated GMM model demonstrates relatively low information criteria values: AIC = -21.63, BIC = -75.24, and HQIC = 43.73. These metrics indicate a favourable balance between model fit and parsimony, which is essential for dynamic panel estimation.

The model is based on 680 firm-year observations from 76 cross-sectional units, which is adequate to produce stable and representative estimates. The use of 39 instruments remains within the acceptable threshold, as it does not exceed the number of cross-sectional units, mitigating the risk of instrument proliferation. Accordingly, the GMM model is statistically valid and appropriate for inference.

3.3.2. GMM Estimation Results: Determinants of Leverage in Manufacturing Firms

This study focuses on the dynamic aspects of optimal leverage determinants among manufacturing firms listed on the Indonesia Stock Exchange. Firm-specific variables—including leverage, the depreciation-to-assets ratio, profitability, sales, and equity—are found to influence capital structure decisions. According to the hypothesis, leverage is negatively associated with profitability. Return on assets (ROA) is a significantly negative predictor of leverage, In Model 1, a 1-unit increase in ROA leads to a 1.27%, in Model 2, indicating a 0.09% decrease in leverage for each 1% increase in ROA (significant at the 10% level).

Moreover, the lagged dependent variable (L.llev) is positively significant at the 1% level (coefficient = 0.57), indicating persistence in leverage behavior. This implies that past leverage levels have a positive influence on current leverage, reflecting gradual and cautious adjustments toward target leverage ratios in both Model 1 and Model 2. Meanwhile, ROA retains its negative influence (significant at the 10% level), whereas other variables (lsales, lequity, lntax) are not statistically significant. Year-specific dummies for 2012–2020 are mostly significant, suggesting notable time effects on leverage decisions.

The four coefficients of llev are significantly positive. In models 1 and 2, ROA is a negatively significant independent variable in relation to leverage. In the other two models, sales, equity, and income tax are insignificant. These results are contrary to the results of (Anisti & Chalid, 2021), that lev is associated with three variables, namely: (i) non-debt tax shield (NDTS), (ii) tangibility (TAG), and (iii) share price performance (SPP). Furthermore, all model dummy years are positively significant, indicating that firms' leverage ratios differ over the research period.

Table 4: The Sys GMM Results

llev	(1)	(2)
L.llev	0.57 ***	0.69 ***
	(4.36)	(5.42)
(1) Roa (2) LRoa	-1.27 *	-0.09 *
	(-1.69)	(-1.73)
lsales	-0.11	0.00
	(-1.31)	(0.19)
lequity	-0.00	-0.04
	(-0.02)	(-1.16)

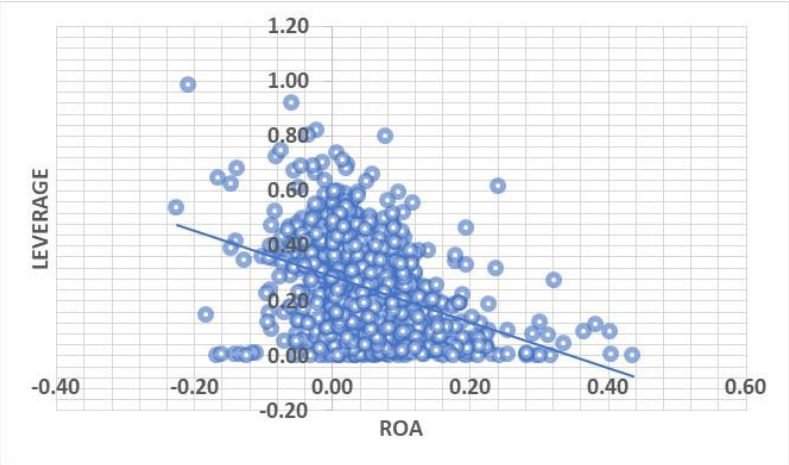
lndtax	0.01	0.40
	(0.02)	(1.10)
Time Effect		
2011	0.25 **	0.33 **
	(1.99)	(2.40)
2012	0.29 ***	0.39 ***
	(2.80)	(3.46)
2013	0.32 **	0.28 **
	(2.54)	(2.33)
2014	0.42 ***	0.48 ***
	(4.10)	(3.71)
2015	0.34 ***	0.36 ***
	(2.85)	(3.05)
2016	0.39 ***	0.41 ***
	(4.20)	(3.92)
2017	0.29 ***	0.35 ***
	(2.72)	(3.54)
2018	0.32 **	0.39 ***
	(2.57)	(3.16)
2019	0.37 ***	0.40 ***
	(3.27)	(3.14)
2020	0.31 **	0.29 **
	(2.15)	(2.28)
Constant	2.69	2.03
	(1.10)	(1.06)
Observations	843	680
Number of id	78	76
No. Instruments	45	39
Goodness of Fit in GMM (*Postestimators)*		
P(Hansen)	0,14	0.38
P(AR1)	0,000	0,000
P(AR2)	0,21	0.23
P(Overidentified)	0,25	0.57
P(Underidentified)	0,05	0.39
AIC	-20,83	-21.63
BIC	-89,17	-75.24
HQIC	-49,04	-43.73
Incremental *Hansen p-value of the instruments (ins.)*		
Ins. 1	0,86	0.73
Ins. 2	0,26	0.69
Ins. 3	0,21	0.26
Ins. 4	0,61	0.61
Ins. 5	0,36	0.51
Ins. 6	0,23	0.10
Ins. 7	0,34	0.55
Ins. 8		
Ins. 9		

	Ins. 10

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We did not employ macroeconomic variables in models as in previous works (Anisti & Chalid, 2021; Drobetz & Wanzenried, 2006). The last work's macroeconomic variables (economic growth and inflation) are insignificant. The novelty of this paper lies in our application of a relatively new specification test, specifically under-identification tests (Windmeijer, 2018). The test to check the relevance of our instrument variable is strictly required before interpreting the estimation results. After considering the string of specification tests, several significant variables, and figures of AIC (Akaike Information Criterion), BIC (Bayesian Information Criterion), and HQIC (Hannan–Quinn Information Criterion), we consider Model 2 the most robust.

Figure 4.1. Relationship between Profitability and Leverage in Manufacturing Firms



This finding is further supported by Figure 4.1, which provides empirical evidence of the negative correlation between profitability and leverage. Highly profitable firms tend to rely on internal financing rather than external debt, whereas less profitable firms are more inclined to seek external borrowing.

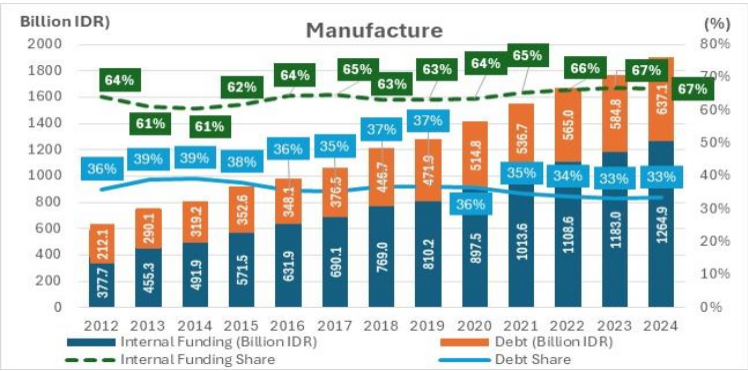


Figure 4.2: Relationship between Internal Funding dan Debt in Manufacturing Firms

This high share of internal financing among manufacturing firms explains the lower reliance on debt financing (see Figure 4.2).

4. Conclusion and Recommendations

This research focuses on the dynamic aspects to emphasise the optimum capital structure and other variables that impact manufacturing firms' optimal leverage on the IDX. Firm-specific factors, including leverage, non-debt tax shields, profitability, sales, and equity, influence capital structure choices. According to the hypothesis, leverage is affected by profitability. Return on Assets (ROA) is a negatively significant independent variable to leverage. Firms with high profits are more likely to use internal sources of finance, whereas firms with low profitability are

more likely to use loans, as they often lack sufficient retained earnings. Leverage among manufacturing firms exhibits persistence, as reflected by the significantly positive coefficient of the lagged leverage variable. This suggests that leverage decisions are path-dependent and gradually adjusted toward a long-term target. The time effect (year dummies) is significantly positive, indicating an upward trend in corporate leverage over time, which reflects the influence of macroeconomic conditions and fiscal/monetary policies on financing decisions.

This study has two limitations. First, this study only uses a sample of the manufacturing industry. Therefore, future research can expand the sample size by comparing different sectors or countries to determine whether this affects the research results. Second, this study focuses on corporate performance indicators, including the non-debt tax shelter, profitability, sales, and equity. In our opinion, the relationship between leverage and other variables, such as the level of competition and the impact on company performance and growth assets in the new average era following the COVID-19 shock, needs to be considered in the analysis of whether there are differences in the structure of the relationship. Research on financial constraints in Indonesia should be included, as it provides valuable insights into the capital structure of manufacturing companies, which will significantly aid management and other relevant stakeholders in making informed policy decisions.

Future research can also utilise other variables, such as macroeconomic indicators and benchmarking, to examine more detailed types of performance, including aspects of market structure.

4.1. Managerial Implications and Policy Recommendations

This study provides several managerial implications for the manufacturing sector:

1. **Leverage Persistence**
   Manufacturing firms tend to maintain consistent financing structures, possibly due to long-term credit commitments or capital-intensive fixed assets (e.g., machinery, plants). This indicates that debt levels are not frequently adjusted and that leverage changes are implemented cautiously over time.
2. **Significant Time Effects**
   Annual variations in leverage performance reflect broader macroeconomic conditions such as (i) energy and input prices, (ii) trade and export-import policies, (iii) exchange rate stability, and (iv) interest rates.
3. **Countercyclical Policy Design**
   Significant time effects highlight the sensitivity of leverage to external shocks. Thus, fiscal and monetary policies must be responsive to manufacturing dynamics—such as implementing tax reliefs during demand downturns or accelerating public spending on labor-intensive and processing industries during crises.

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Impact of Digital Financial Literacy on Small and Medium-sized Enterprises (SMEs) Performance in Laos: The Mediating Role of Financial Self-Efficacy, Hierarchical Component Model Approach

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Abstract
Digital financial literacy has become a vital factor for the sustainability and performance of small and medium-sized enterprises (SMEs) in an increasingly digital economy. This study examines the impact of Digital Financial Literacy (DFL) on SME performance in Laos, with a particular focus on the mediating role of Financial Self-Efficacy (FSE). The main research question explores how digital and financial skills, combined with confidence in financial management, drive business outcomes. Data were collected through a survey of 151 SME owners in Laos and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with a hierarchical component model (HCM) approach. The results indicate that DFL significantly enhances SME performance, both directly and indirectly through increased FSE. These findings underscore the importance of integrated policies that promote both digital finance skills and financial self-efficacy among entrepreneurs to foster SME growth and success.

Keywords: Digital Finance Literacy, Financial Self-Efficacy, SMEs

1. Introduction

The digital revolution is reshaping the entrepreneurial landscape, transforming how businesses operate and manage their financial resources. Digital Financial Literacy (DFL) has emerged as a critical competency for Small and Medium-sized Enterprises (SMEs) in today's dynamic financial environment (Awinja & Fatoki, 2021; Ratmono et al., 2023). According to Prasad et al. (2018), Lyons & Kass-Hanna (2021), and Morgan et al. (2019), DFL refers to the capacity to comprehend, manage, and effectively use digital financial technologies such as online banking, digital payments, and mobile money. DFL enhances financial decision-making, boosts operational efficiency, and creates new growth opportunities for SMEs, which often face challenges such as limited access to capital, resource constraints, and competitive market pressures.

SMEs play a vital role in economic development, contributing significantly to employment, innovation, and economic output. In Laos, SMEs account for 99% of registered businesses and 82% of total employment, highlighting their critical importance (World Bank, 2024). However, SMEs in Laos continue to face significant challenges, including limited access to finance and insufficient financial and digital literacy (World Bank, 2024). Recognizing these challenges, the Government of Laos has prioritized digital finance and financial literacy as key drivers of SME development. The National Digital Economy Development Plan (2021–2025) promotes mobile and electronic banking services to expand financial inclusion, aligning with the nation's goal of increasing the digital economy's GDP contribution from 3% to 10% by 2040.

The government's focus on financial education and digital adoption is further reflected in its national strategies. The 8th National Socio-Economic Development Plan (NSEDP) 2016–2020 emphasized mobile banking and digital financial services to improve SME access to finance (NSEDP, 2016), while the 9th NSEDP (2021–2025) promotes digitalization in public governance to modernize financial services and support SME resilience (NSEDP, 2021). These policy directions underscore the importance of DFL in equipping SMEs with essential skills for business sustainability.

Integrating digital finance into SME operations offers substantial benefits, from improved financial stability to enhanced economic growth. DFL, which merges financial and digital literacy, is crucial for SMEs to leverage digital finance services, expand market reach, and build resilience (Kulathunga et al., 2020; Weerakoon & Anuradha, 2024). However, many SMEs struggle to adopt digital finance due to limited DFL skills. As Ravikumar et al. (2022) argue, even financially literate individuals may struggle to fully benefit from digital financial services without adequate digital skills. Therefore, DFL, which integrates both financial and digital competencies, has become a prerequisite for SMEs engaging in digital finance.

Nevertheless, DFL alone may not be sufficient to drive SME performance. Its impact often depends on entrepreneurs' confidence in applying financial knowledge effectively a concept known as Financial Self-Efficacy (FSE). Rooted in Bandura's (1997) self-efficacy theory, FSE refers to an individual's belief in their ability to manage financial resources and navigate financial challenges. Entrepreneurs with high FSE are more likely to apply financial literacy effectively, take calculated financial risks, and make informed business decisions (Mindra & Moya, 2017; Herawati et al., 2020). Conversely, those with low FSE may hesitate to engage with digital finance, thereby limiting the potential benefits of DFL on SME performance.

While the role of DFL in enhancing business performance is widely acknowledged, research examining the combined effect of DFL and FSE on SME success remains limited. Most studies examine financial and digital literacy separately, often overlooking their joint impact on SME financial decision-making. The COVID-19 pandemic has accelerated digital finance adoption, yet much of the literature remains focused on defining and measuring DFL at the individual level rather than its implications for entrepreneurial outcomes. For instance, studies by Prasad et al. (2018) and Tony & Desai (2020) examined DFL in the context of household financial inclusion but did not explore its effects on SME growth and resilience.

In the context of developing economies such as Laos, the intersection of DFL, FSE, and SME performance remains underexplored. Although there is growing literature on financial inclusion and digital finance at the macro level, little is known about how SMEs develop and apply DFL in daily business operations. Given Laos' early stage of digital finance adoption, SMEs face unique challenges including limited digital infrastructure, low levels of financial literacy, and a lack of confidence in using digital financial services (Morgan & Trinh, 2019). Therefore, understanding how DFL influences SME performance in Laos and the extent to which Financial Self-Efficacy mediates this relationship becomes crucial for designing effective financial literacy programs and policy interventions that enhance entrepreneurial capacity and business sustainability. This study aims to examine the impact of DFL on SME performance in Laos, investigating how DFL shapes Financial Self-Efficacy and, in turn, influences business outcomes, thereby offering insights to policymakers, educators, and financial institutions seeking to build a digitally and financially literate SME sector capable of driving sustainable economic growth.

2. Literature Review and Hypothesis Development

2.1 Digital Finance literacy and SMEs performance

The growing adoption of digital financial services has fundamentally transformed financial interactions, making digital financial literacy an essential competency for businesses. DFL is increasingly recognized as a critical skill in the modern economy, attracting the attention of entrepreneurs, financial institutions, and policymakers (Setiawan et al., 2022). The importance of DFL for SME performance has become particularly evident as digital transformation reshapes the business landscape. As financial transactions shift to digital platforms, traditional financial literacy must evolve to incorporate digital competencies such as online banking, mobile payments, and fintech applications (Kass-Hanna et al., 2022).

Various scholars and institutions have defined DFL, emphasizing its role in financial decision-making and economic participation. Morgan & Trinh (2019) describe DFL as the ability to access and effectively use digital financial services, including knowledge of digital financial products, awareness of associated risks, and understanding risk management and consumer protection regulations. Abdallah (2024) defines DFL as an individual's ability to understand, navigate, and utilize digital financial services, underscoring its role in enhancing financial inclusion. Lyons and Kass-Hanna (2021) highlight DFL as an individual's capability to operate within digital financial environments, ensuring informed financial decision-making. The OECD extends this definition by incorporating the knowledge, skills, attitudes, and behaviors necessary for individuals to be aware of and safely use digital financial services and digital technologies, thereby contributing to their financial well-being (OECD, 2024). Similarly, Setiawan et al. (2022) indicated that DFL is the capacity to access and manage financial products and services using digital technologies, including mobile devices, computers, and the internet.

Given these perspectives, DFL is best understood as a multidimensional construct integrating both financial and digital literacy, enabling individuals and businesses to effectively access, utilize, and manage DFS (Lyons & Kass-Hanna, 2021; Morgan & Trinh, 2019; Setiawan et al., 2022; Abdallah et al., 2025). According to Lyons and Kass-Hanna (2021), DFL consists of several key dimensions. Basic knowledge and skills include fundamental financial knowledge combined with the ability to use digital devices. Awareness involves understanding the availability and purpose of DFS. Practical know-how refers to the ability to navigate digital financial applications, conduct transactions, and manage digital payment errors. Decision-making focuses on the ability to use digital financial tools to improve financial behavior, such as responsible saving, borrowing, and investment decisions. Self-protection entails the knowledge and skills needed to safeguard against online scams, fraud, and other digital risks, including awareness of data privacy and security measures.

By integrating financial and digital literacy, SMEs can significantly enhance their ability to leverage financial technology for improved efficiency, expanded financial access, and sustained business growth (Frimpong et al., 2022; Hermawan et al., 2022). Research suggests that DFL plays a crucial role in helping SMEs adopt technology-driven financial solutions such as automated accounting, digital payment systems, and online financial management tools, thereby improving business performance (Kulathunga et al., 2020).

Financial literacy enables SME managers to navigate financial decision-making, manage cash flow effectively, develop investment strategies, and mitigate risks (Fatoki, 2021; Lusimbo & Muturi, 2016). SMEs with higher financial literacy tend to make better financial decisions, maintain accurate records, and secure external funding more effectively (Agyapong & Attram, 2019). Eniola and Entebang (2017) emphasize that financial literacy enhances resource allocation, investment planning, and risk management, ultimately improving profitability and business expansion. Financially literate entrepreneurs are also better equipped to evaluate loan terms and manage debt strategically, increasing their access to credit.

In addition to financial literacy, digital literacy further supports business competitiveness (Wirawan et al., 2021). For SMEs, digital literacy is crucial for using digital tools to enhance productivity, reach broader markets, and

build financial resilience. Studies have shown that digital literacy contributes to strategic planning, innovation, and adaptability, key elements for SME survival and long-term success (Wirawan et al., 2021; Zahoor et al., 2023). Furthermore, Hermawan et al. (2022) note that digital literacy plays a crucial role in post-pandemic recovery, as SMEs are increasingly relying on e-commerce, digital banking, and fintech solutions.

Overall, DFL plays a crucial role in enhancing SME performance by enabling entrepreneurs to make informed financial decisions, adopt digital financial tools, and access financial services efficiently (Ratnawati & Soelton, 2022; Tuffour et al., 2022). Knowledge of digital financial services significantly boosts financial accessibility, allowing entrepreneurs to optimize business operations and enhance financial stability (Kuma et al., 2023). DFL enables businesses to expand their customer base, streamline transactions, and manage their finances more effectively (Abad-Segura & Gonzalez-Zamar, 2019; Yadav & Benerji, 2024). SMEs with higher DFL gain a competitive advantage by effectively leveraging digital financial tools and services (Hayati & Syofyan, 2021). Ratnawati and Soelton (2022) confirm that DFL has a significant positive effect on firm performance, as it enables business owners to understand and utilize digital financial products effectively. Based on this review, the study proposes the following hypothesis

Hypothesis1: Digital Finance Literacy (DFL) has a significant positive impact on SME performance.

2.2 Mediating Role of Financial Self-efficacy

Financial Self-Efficacy (FSE) refers to an individual's confidence in their ability to access and use financial products or services, make informed financial decisions, and effectively manage complex financial situations (Furrebøe et al., 2023). Grounded in Bandura's (1991, 1997) social cognitive theory, FSE reflects an individual's belief in their capacity to succeed. Individuals with high self-efficacy believe they can tackle difficult tasks and overcome challenges. Self-efficacy plays a key role in setting goals, making investment decisions, persisting through obstacles, and recovering from adversity (Bandura & Wood, 1989). It is closely tied to an individual's belief in their ability to perform specific tasks and achieve goals (Messikh, 2022). Those with stronger competencies, skills, and self-beliefs are more likely to act with autonomy and achieve long-term success (Newman et al., 2018). In entrepreneurial contexts, financial self-efficacy is particularly important, as it influences financial decision-making and ultimately contributes to SME performance in terms of profitability, growth, and entrepreneurial satisfaction (Veselinovič et al., 2020).

Prior studies have demonstrated that FSE is a strong predictor of financial behavior. It influences individuals' use of financial products, investment choices, and long-term financial well-being—all of which contribute to improved business performance (Farrell et al., 2016; Dare et al., 2022). Entrepreneurs with higher FSE are more likely to engage in proactive financial planning, take control of financial decision-making, and respond confidently to financial challenges (Asebedo & Seay, 2018; Farrell et al., 2016). In turn, this enhanced financial control can lead to improved performance outcomes in business settings (Farrell et al., 2016; Nguyen & Shafi, 2021; Chong et al., 2021; Dare et al., 2022).

Krueger and Brazeal (1994) emphasized that self-efficacy is fundamental to assessing entrepreneurial potential. In this context, financial literacy, particularly digital financial literacy, plays a critical role in shaping financial self-efficacy. By equipping individuals with relevant knowledge and skills, digital financial literacy builds confidence in managing financial resources (Newman et al., 2018; Lone & Bhat, 2022). While financial knowledge forms the foundation for sound financial decision-making, FSE determines how confidently individuals apply that knowledge in practice (Lone & Bhat, 2022). Together, financial literacy and self-efficacy are essential for navigating financial and economic challenges (Herawati et al., 2020).

Mindra and Moya (2017) found that FSE fully mediates the relationship between financial knowledge, financial attitudes, and the ability to access formal financial services. Similarly, Noor et al. (2020) argue that individuals with higher financial knowledge and access to information exhibit greater confidence in making sound financial decisions.

Despite growing interest in financial self-efficacy, most research has centered on individual consumers and personal financial behavior (Gulati & Singh, 2024). There is limited exploration of how FSE influences financial decision-making in entrepreneurial settings. This represents a significant gap in understanding how FSE mediates the relationship DFL and SME performance, especially in contexts where entrepreneurs' confidence in financial management is crucial.

This study proposes that DFL enhances financial self-efficacy by boosting entrepreneurs' confidence in managing finances and making informed business decisions. While DFL equips entrepreneurs with necessary financial and digital skills, FSE enables the effective application of those skills. Therefore, strengthening both DFL and FSE is essential to improving SME performance.

Hypothesis 2: *Financial Self-Efficacy has a significant positive impact on SME performance.*
Hypothesis 3: *Digital Financial Literacy has a significant positive impact on Financial Self-Efficacy*
Hypothesis 4: *Financial Self-Efficacy mediates the relationship between Digital Financial Literacy and SME performance.*

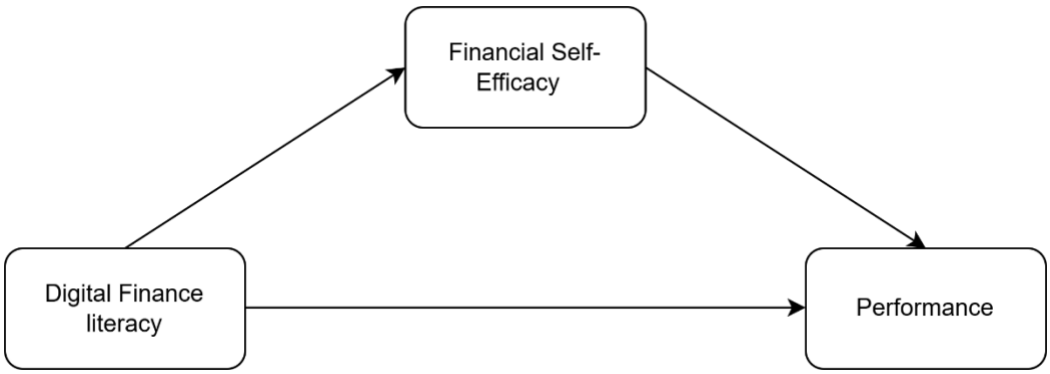

Figure 1: Conceptual Framework

3. Methodology

3.1 Sample Design and Data Collection

The study focuses on entrepreneurs operating small and medium-sized enterprises (SMEs) in Laos. While PLS-SEM generally requires a sample size that is at least 10 times the number of indicators for the most complex construct in the model (Peng & Lai, 2012), it is often recommended in PLS literature to use G* Power analysis to accurately determine the appropriate sample size (Hair et al., 2017; Hair et al., 2014). Consequently, the G* Power 3.1 software was employed to ensure the sample size met the necessary threshold. Based on the number of predictors, a minimum sample size of 68 respondents was calculated for a 95% confidence level ($\alpha = .05$) and a power of 0.8. The study successfully collected data from 151 respondents, exceeding the minimum requirement.

Data collection was conducted through a survey, with the entrepreneur acting as the primary respondent. This approach was chosen because entrepreneurs uniquely manage and operate their businesses, holding both ownership and decision-making authority. Their comprehensive role in driving profitability and growth makes them well-suited to provide relevant insights for the study's objectives. An online questionnaire, developed using Google Forms, was utilized for data collection. The survey questions were crafted based on measures refined from previous studies, with adjustments made to align with the characteristics of the target sample. To ensure content validity, the final questionnaire underwent pre-testing among both academics and non-participating entrepreneurs. The questionnaire was translated into Lao and subsequently back-translated into English by a different translator to ensure linguistic compatibility. A pilot study involving 20 entrepreneurs yielded

satisfactory results. Participation in the survey was entirely voluntary, and participants were assured that their responses would be treated confidentially and used solely for research purposes.

3.2 Measurement of variable

3.2.1. SMEs' Performance

This study employs subjective performance measures adapted from Fatoki (2018) and Tuffour et al. (2020), to evaluate SME performance. These measures are widely recognized in the literature for their reliability and practical relevance, particularly in contexts where objective financial data may be unavailable or inconsistent (Zulkiffli & Perera, 2011). As noted by Dess and Robinson (1984), subjective assessments of business performance exhibit a strong correlation with objective financial metrics, such as changes in return on assets and sales (revenues), over comparable periods. This correlation reinforces the validity of subjective measures as a dependable proxy for actual performance (Song et al., 2005).

Subjective evaluations by the owner effectively capture overall business performance by reflecting key indicators such as profitability, market share, and growth. This alignment is well-documented in previous research (Dess & Robinson, 1984; Love et al., 2002; Fatoki, 2018; Tuffour et al., 2020), supporting the robustness of subjective measures in performance analysis. In this study, business owners assessed their firm's performance relative to competitors over the past three years. Responses were collected using a five-point Likert scale, ranging from 1 (much worse) to 5 (much higher). The survey covered five critical performance indicators: sales growth, market share, employee numbers, profitability, and return on assets.

3.2.2. Digital Financial Literacy

In this study, Digital Financial Literacy (DFL) is conceptualized as a Higher-Order Construct (HCM), as a reflective-formative higher-order model. The measurement of DFL is adapted from conceptual framework developed by Lyons & Kass-Hanna (2021), which was designed to address the growing need for individuals and businesses to understand and navigate digital financial tools in a complex, technology-driven financial environment. Their model views DFL as a multi-dimensional construct that combines traditional financial literacy with digital literacy, addressing both the knowledge and skills required to use digital financial products effectively and responsibly

In this study, DFL adopted five core dimensions, including basic knowledge and skills, awareness, practical know-how, decision-making, and self-protection. DFL is measured through a Likert-scale questionnaire (1 = Strongly Disagree to 5 = Strongly Agree).

3.2.3. Financial Self-Efficacy (FSE)

In this study, Financial Self-Efficacy (FSE) refers to an individual's confidence in managing financial resources, making financial decisions, and overcoming financial challenges in a business context. Recognized as a key psychological factor influencing financial behavior and outcomes, FSE is measured by adopting and adapting established scales from Lown (2011), Noor et al. (2020), Nguyen (2019), and Rothwell et al. (2018). This study employs a five-item Likert-scale questionnaire (1 = Strongly Disagree to 5 = Strongly Agree) to capture entrepreneurs' confidence in financial management and decision-making.

3.3 Data Analysis

In this study, data analysis was conducted using SmartPLS version 4.1.0.4, employing the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. PLS-SEM was selected for its flexibility, which makes it particularly suitable for exploratory research. This approach is well-regarded for its ability to investigate and develop hypotheses regarding relationships between constructs, providing a less restrictive modeling framework. Such flexibility is especially valuable when examining the relationship between DFL, FSE and SME

performance, as highlighted by Hair et al. (2017, 2019) and Ringle et al. (2015). Additionally, PLS-SEM does not require the data to follow a normal distribution, which simplifies the analysis by removing concerns about stringent normality assumptions. This feature ensures a more robust examination of the constructs (Ali et al., 2016).

For this research, the Hierarchical Component Model (HCM) was employed to simplify the structural model, thereby enhancing parsimony and interpretability (Hair et al., 2018). Specifically, a reflective-formative HCM was applied to the DFL construct, enabling the study to assess the impact of its five key dimensions: basic knowledge and skills, awareness, practical know-how, decision-making, and self-protection on SME performance. These dimensions serve as lower-order constructs (LOCs) within the higher-order construct (HOC) of DFL. One of the primary advantages of using PLS-SEM within this HCM framework is its capacity to accommodate both reflective and formative measurement models simultaneously, providing a nuanced representation of multidimensional constructs (Becker et al., 2012). The application of the HCM approach ensures a more parsimonious and theoretically coherent structural model, facilitating a clearer interpretation of how LOCs contribute to the HOC and, consequently, affect SME performance.

To address measurement challenges associated with higher-order constructs in PLS-SEM, a two-stage disjoint approach was employed. In this setup, LOCs were modeled reflectively, while the HOC was modeled formatively. The two-stage approach effectively combines these distinct measurement models without distorting the structural relationships. In the first stage, LOCs such as basic knowledge and skills, awareness, practical know-how, decision-making, and self-protection were modeled reflectively, and their measurement properties such as convergent validity (assessed via factor loadings, composite reliability, and AVE) and discriminant validity (using the Heterotrait–Monotrait ratio, HTMT) were evaluated. The latent scores for the LOCs were then exported.

In the second stage, the HOC (DFL) was modeled as a formative construct, with the latent scores of the LOCs used as indicators to assess its impact on FSE and SME Performance (Hair et al., 2021). Multicollinearity was assessed using Variance Inflation Factor (VIF) values, ensuring that all values were below the threshold of 3.3. The reflective and formative models were evaluated separately to ensure robust and reliable results.

The second step of the PLS-SEM analysis involved a detailed examination of the associations within the structural model, putting the study hypotheses to the test at specified significance levels (Chin, 2009). Model estimation was performed using metrics such as R^2, Q^2. In the context of PLS-SEM, these metrics are essential for evaluating model fit, as they assess the model's explanatory power (R^2) and predictive relevance (Q^2) for the relationships between the variables under investigation (Hair et al., 2019).

4. Finding

4.1 Measurement Model Analysis

In employing PLS-SEM, reliability is a necessary condition for validity. According to Hair et al. (2017), indicator reliability should be assessed to ensure how well each indicator reflects its associated construct. Factor loadings are commonly used for this purpose, with values of 0.7 or higher being ideal. However, for social science studies, factor loadings between 0.6 to 0.7 are considered acceptable (Hair et al., 2017). They also further state that if an indicator’s factor loading is below 0.5, it may be removed to improve model fit.

Various methods were applied to assess the validity and reliability of the measurement model, covering internal consistency reliability, convergent validity, and discriminant validity (Hair et al., 2019). Convergent validity was determined through the Average Variance Extracted (AVE) values, following Henseler et al. (2015), with a recommended threshold of 0.50. Table 1: All AVE values exceeded the established threshold, indicating satisfactory convergent validity.

To evaluate internal consistency reliability, Cronbach's Alpha (CA) and Composite Reliability (CR) were employed. In this study, CA values for each case exceeded the threshold of 0.7 (CA>0.7) for each construct (Table 1), indicating acceptable internal consistency. Similarly, CR values above 0.70, as proposed by Hair et al. (2019), were considered satisfactory. The composite reliabilities of the different measures demonstrated that they met the prescribed threshold.

Table 1: Measurement Model Analysis

Latent Variable	Item	Outer loading	VIF	CA	CR	AVE
Digital finance Knowledge and Skills (DFK)	DFK1	0.622	1.16	0.784	0.862	0.614
	DFK2	0.834	1.869			
	DFK3	0.853	2.194			
	DFK4	0.804	2.014			
Self-Protection (SP)	SP1	0.882	1.852	0.752	0.856	0.669
	SP2	0.899	2.159			
	SP3	0.648	1.317			
Practical know-how (PK)	PK1	0.844	1.623	0.71	0.821	0.537
	PK2	0.643	1.203			
	PK3	0.775	1.484			
	PK4	0.648	1.384			
Decision Making (DM)	DM1	0.842	1.255	0.713	0.833	0.63
	DM2	0.674	1.627			
	DM3	0.811	1.521			
Awareness (AW)	AW1	0.795	1.491	0.7	0.829	0.617
	AW2	0.742	1.463			
	AW3	0.818	1.249			
Financial Self-Efficacy (FSE)	FSE1	0.654	1.395	0.804	0.866	0.565
	FSE2	0.811	2.144			
	FSE3	0.823	2.089			
	FSE4	0.77	1.835			
	FSE5	0.686	1.441			
Performance (PER)	PER1	0.827	2.306	0.842	0.888	0.616
	PER2	0.801	2.5			
	PER3	0.827	2.782			
	PER4	0.794	1.763			
	PER5	0.662	1.375			

Source: Author's construct from SmartPLS 4

The Heterotrait-Monotrait Ratio (HTMT) assesses discriminant validity in PLS-SEM. The HTMT is regarded as a robust method for assessing discriminant validity in PLS-SEM (Hair et al., 2017). HTMT is calculated by taking the ratio of the average correlations between items across different constructs to the average correlations of items within the same construct (Hair et al., 2019). High HTMT values suggest potential issues with discriminant validity. When constructs in the path model are conceptually distinct, a lower threshold value of .90 is recommended (Henseler et al., 2015). In this study, the HTMT values, as shown in Table 2, fall below this threshold, indicating satisfactory discriminant validity and suggesting that the constructs are sufficiently distinct from one another.

Table 2: Discriminant validity (Heterotrait-monotrait ratio (HTMT) Matrix)

	AW	DFK	DM	FSE	SP	PER	PK
AW							
DFK	0.365						
DM	0.197	0.194					
FSE	0.316	0.244	0.137				
SP	0.218	0.836	0.171	0.352			
PER	0.163	0.387	0.195	0.635	0.549		
PK	0.36	0.592	0.161	0.316	0.595	0.549	

Note: AW-Awareness, DFK-Digital Finance knowledge and skills, DM-Decision Making, SP-Self-Protection, FSE-Financial Self-Efficacy, PER-Performance

Source: SmartPLS 4

4.2 Assessment of structural model

The structural model assessment examines the relationship between the latent constructs and evaluates the predictive value of the conceptual model *(Hair et al., 2019)*. Bootstrapping was performed to examine the Structural Model which confirmed the relationship between NC and SME Performance with ER as a mediator. To detect the presence of collinearity within the model, a collinearity test was performed. The results of the variance inflation factor (VIF) scores ranged from 1.16 to 2.782 (table 1). VIF values below the threshold of 3.3 do not indicate a significant issue (Hair et al., 2019). The coefficient of determination (R^2) was applied to measure the proportion of variance in the dependent variable explained by independent variables, reflecting the model's explanatory power. Predictive relevance (Q^2) assessed the model's predictive accuracy, and the path coefficient were examined to determine the strength and significance of the relationship between constructs *(Hair et al., 2017)*.

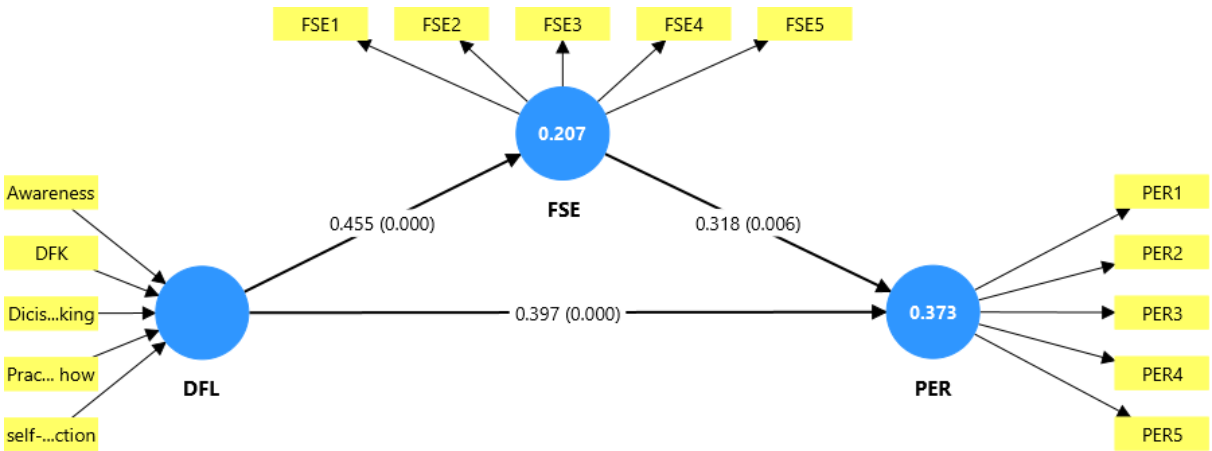

Figure 2: Structure Model Assessment

Source: SmartPLS4

Table 3: Constructed model

	R-square	Q^2predict
PER	0.373	0.184
FSE	0.207	0.221

Source: SmartPLS 4

Chin (1998) suggests that R^2 values of 0.67, 0.33, and 0.19 correspond to substantial, moderate, and weak explanatory power, respectively. The findings indicate that the exogenous constructs in this study collectively explain 37.3% (Table 2) of the variance in the endogenous construct, SMEs' performance. This suggests that the model exhibits a moderate explanatory capability in line with Chin's (1998) criteria. Financial Self-Efficacy (FSE) R^2 is 0.207, indicating that 20.7% of the variance in FSE is explained by its predictors. Although lower, this R^2 still provides meaningful insights, suggesting a weak to moderate explanatory strength.

A Q^2 value greater than zero indicates the model's predictive relevance (Henseler et al., 2009). The Q^2 values obtained in this study, 0.308 for PER and 0.226 for FSE, are both greater than zero, confirming the model's predictive relevance. This means the model not only explains a moderate portion of the variance but also can predict future outcomes with acceptable accuracy (Chin, 2010).

4.3 Hypothesis Testing

Table 3: Hypothesis Testing

Hypothesis	Path	Path coefficient (β)	T statistics	P values	Result
Direct effect					
H1	DFL -> PER	0.455	5.104	0.000	Support
H2	FSE -> PER	0.318	2.754	0.006	Support
H3	DFL -> FSE	0.397	3.889	0.000	Support
Mediation effect					
H4	DFL -> FSE -> PER	0.145	2.381	0.017	Support

Note: DFL=Digital finance literacy; FSE= Financial self-efficacy; PER=SMEs' performance

Hypotheses 1-4 were tested using path analysis to assess the significance of the relationships at a 5% significance level. As shown in Table 3, the findings support all four hypotheses (H1, H2, H3, and H4).

H1: (DFL-> PER) is positive and statistically significant ($\beta = 0.455$, $t = 5.104$, $p < 0.001$), suggesting that SMEs with a higher level of DFL tend to exhibit better performance, likely due to their more effective use of digital finance services in their business operation. H2 (FSE -> PER) suggesting that financial self-efficacy has a significant positive effect on SME performance ($\beta = 0.318$, $t = 2.754$, $p = 0.006$). the finding indicates that entrepreneurs who are confident in their ability to manage financial task are more capable of managing business finances, which positively influences performance outcomes. H3: (DFL-> FSE) The results show a significant relationship between DFL and FSE ($\beta = 0.397$, $t = 3.889$, $p < 0.001$). This finding suggests that DFL not only directly contributes to the performance of SMEs but also enhances entrepreneurs' financial confidence, which is crucial for applying digital knowledge in practice. Finally, H4: (DFL -> FSE -> PER) the mediation effect is also supported. The indirect path from DFL to PER through FSE is significant ($\beta = 0.145$, $t = 2.381$, $p = 0.017$). This finding confirms that FSE partially mediates the relationship between DFL and SME performance. It suggests that while DFL directly enhances SME performance, it also does so indirectly by strengthening entrepreneurs' confidence in their financial capabilities.

5. Discussion and Conclusion

This study examined the impact of digital finance literacy on the performance of SMEs in Laos, which focuses on the mediating role of financial self-efficacy. The findings confirm that DFL significantly contributes to SME performance. Entrepreneurs equipped with strong digital financial literacy are better able to leverage financial technologies to streamline operations, enhance strategic decision-making, and access financial services more effectively. These results are consistent with previous studies (Kulathunga et al., 2020; Tuffour et al., 2022; Ratnawati & Soelton, 2022; Kuma et al., 2023), which demonstrated that DFL enables SME owners to understand and utilize digital financial products to drive business success.

The study also highlights the critical role of FSE as a psychological enabler of effective financial management within SMEs. Entrepreneurs with greater confidence in their financial capabilities are more likely to engage in proactive financial behaviors, such as risk assessment, financial planning, and strategic investment decisions (Lone & Bhat, 2022). This finding aligns with prior literature (Farrell et al., 2016; Mindra and Moya, 2017; Nguyen & Shafi, 2021; Dare et al., 2022), which emphasized the positive association between FSE, sound financial behavior, and business performance.

Furthermore, the results reveal that DFL significantly enhances entrepreneurs' financial self-efficacy. This relationship suggests that as entrepreneurs acquire greater knowledge and experience with digital financial tools, their belief in their ability to manage financial responsibilities also increases. This finding is consistent with previous studies by Lone & Bhat (2022) and Herawati et al. (2020), who noted that the acquisition of financial knowledge and digital skills is fundamental to the development of financial self-efficacy.

Finally, the study also confirms that FSE partially mediates the relationship between DFL and SME performance. This mediation effect suggests that while DFL provides entrepreneurs with the knowledge and skills needed to navigate digital financial environments, FSE empowers them to apply these capabilities effectively in business decision-making and eventually in business outcomes. Consistent with the findings of Mindra and Moya (2017) and Noor et al. (2020)

5.1. Practical Implications

The findings offer several important implications for practice. First, policymakers should prioritize the development of national programs that combine digital finance training with efforts to build financial self-efficacy among entrepreneurs. Simply providing technical skills is insufficient without enhancing entrepreneurs' confidence in applying them.

Second, financial institutions and fintech companies should design user-friendly digital financial platforms and complement them with financial education initiatives aimed at SMEs. Third, SME support organizations and training institutions should integrate financial psychological components such as confidence-building and self-efficacy exercises into digital finance literacy programs to ensure that knowledge is effectively translated into business action.

5.2. Limitations and Future Study Directions

While this study provides valuable insights into the role of Digital Financial Literacy and Financial Self-Efficacy in enhancing SME performance, it is not free of limitations. First, the study employs a cross-sectional design, which restricts the ability to infer causal relationships between DFL, FSE, and performance outcomes. Longitudinal studies are recommended to capture how digital financial competencies and self-efficacy evolve and influence business sustainability. Second, the model focused primarily on internal psychological (FSE) and knowledge-based factors (DFL), excluding other influential variables such as access to digital infrastructure, regulatory support, or entrepreneurial orientation. Future research could extend the model to include environmental or institutional variables to better understand the ecosystem shaping SME performance.

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Lending Channel of Monetary Policy: Does Market Power Matter? Evidence from South Asia

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Abstract
This paper examines the impact of market power in the banking industry on the monetary policy transmission mechanism in emerging South Asian economies. The analysis focuses on the effect of market power on the bank lending channel, which stresses the impact of monetary policy on the supply of bank loans. Undoubtedly, banks play a vital role in the lending channel of monetary transmission. In a monetary policy contraction, banks may curtail the supply of loans if they are not able to restore their lost loanable funds. Such a reduction in loan supply increases the cost of credit for loan-dependent economic agents unless these borrowers resort to obtaining capital from alternative sources. However, this depends on the degree of capital market development in the country or the accessibility of foreign direct investments. In their absence, a monetary contraction decreases the employment and output levels of the economy. Since the global financial crisis in 2008, researchers have shown interest in re-examining how monetary policy transmission can be made more effective through the generation of new bank credits. The empirical analysis uses a unique bank-level annual panel dataset for 125 commercial banks in Bangladesh, India, Nepal, Pakistan, and Sri Lanka over the period 2015–2022. Using several structural measures of market power in the banking industry, the results provide evidence that a higher concentration in the banking industry tends to weaken monetary policy transmission through the bank lending channel. These findings are robust to a broad range of sensitivity checks, including alternative measures of monetary policy and different specifications. The analysis is extended to examine the way in which bank-specific characteristics alter the relationship between bank concentration and the strength of the lending channel. The results suggest that the weakening effect is more substantial for small, less-liquid, poorly-capitalised and less-profitable banks. These results are consistent with the existing literature showing that financially constrained banks are less insulated from monetary contractions, as they do not have easy access to alternative sources of funds.

Keywords: Market Power, Lending Channel, Monetary Transmission

1. Introduction

The banking industries of South Asian economies have exhibited significant changes over the last few decades. While the speed and extent of these reforms have varied from country to country, financial liberalisation fosters competition among financial institutions. Financial market openness has attracted new investments through privately owned banks and has encouraged many foreign banks to set up branches in South Asian countries. These financial developments have resulted in a sharp increase in competition among banks while reducing the market share (market concentration) of the state-owned banks. On the other hand, the global financial crisis in 2008 caused the financial regulators of most countries to encourage small financial institutions to consolidate

with each other, as a part of the restructuring process that aimed to increase the soundness of the banking sector and thus stabilise the financial system. Similarly to the contradictory views on competition-fragility and competition-stability, the literature presents opposing findings on the impacts of market power and competition on monetary policy transmission in any economy.[1] The global financial crisis reignited the interest of policymakers and academics in bank competition and the role of the state in developing competition policies (World Bank 2020b). This confirms the necessity of establishing the correct laws and policies that determine adequate bank competition in the financial market, to ensure social welfare.

The bank lending channel of monetary transmission operates via the supply side of the credit market, rather than the traditional demand-side of monetary transmission, namely the interest rate channel (Olivero et al. 2011b, p. 1035). Changes in banking market power, and in particular concentration/competition in the banking market, are expected to impact the transmission of monetary policy, primarily through the lending channel. The market power no doubt alters the supply of loans in the market directly. However, it may also impact the loan supply indirectly via the monetary transmission mechanism. Some studies have already examined the relationship between the bank market concentration/competition and the lending channel. However, the existing literature does not provide conclusive evidence in the context of developed and some developing countries.

With the exception of a few studies of the effects of bank competition on bank efficiency, revenue diversification and pricing, no empirical studies on market power or market concentration in the South Asian banking sector seem to be available. Apart from this gap in the existing literature, there are several reasons for this essay. First, this is one of the few cross-country studies to focus on the banking industry and its impact on monetary policy in the emerging market economies of South Asia. Banks play an essential role in these countries' financial systems, as most economic agents depend on bank lending as a primary source of finance. This is due mainly to the underdeveloped capital market and the lack of availability of active secondary markets. Second, the majority of the previous studies on monetary policy transmission channels have relied on aggregate macro-level data, which raises the concern of the identification problem.[2] This paper uses bank-level data to examine the effects of bank concentration on supply-side monetary transmission from the lending channel, as opposed to the demand-side interest rate channel of monetary policy transmission in South Asian economies. Moreover, the use of bank-level data allows the systematic differences in the effects of bank concentration across different balance sheet strengths and corporate attributes to be examined. Third, in the aftermath of the global financial crisis, bank regulators encouraged mergers and acquisitions among financial institutions as a prudential policy in order to maintain financial stability. As has been documented in the literature, a higher concentration/lower competition in the banking industry may have either a positive or a negative impact on monetary policy transmission. Hence, the findings of this essay can be used to assess the use of bank market concentration as a stability measure, relative to its impact on the effectiveness of monetary policy.

For these reasons, this paper aims to revisit the lending channel of monetary policy transmission in South Asian economies and to examine the effects of bank concentration on monetary policy. The study uses bank-level panel data from five South Asian economies, namely Bangladesh, India, Nepal, Pakistan, and Sri Lanka, over the period 2011–2018. Specifically, this paper addresses two key questions: (i) Does the bank lending channel of monetary policy transmission exist in these economies? and (ii) Does banking concentration have an impact on the bank lending channel of monetary policy transmission?

The study employs five non-structural measures for inferring the level of bank concentration: three HHIs, defined as the market share of the banking sector in terms of total assets (HHI-TA), total loans (HHI-L) and the deposit base (HHI-D), and the three-firm and five-firm concentration ratios (CR3 and CR5 respectively). Using the fixed effects (FE) model, the analysis provides new evidence on the presence of the bank lending channel of

[1] Under the competition-stability view, Berger et al. (2009) argued that large banks, resulting in a highly concentrated banking market, can be more diversified, take smaller risks and earn more profit. Having a smaller number of large banks in the industry, and thus regulators, enables efficient resource allocation for monitoring the stability of the banking system. In contrast, under the competition-fragility view, if these large banks believe that they are too big to fail, they are likely to undertake more risk. Such big banks also expect cover-up or assurances from policymakers. This threatens the stability, as a result of the moral hazard problem of too-big-to-fail (Acharya et al. 2012; Boyd & De Nicolo 2005).

[2] The identification problem will be discussed in detail in the literature review.

monetary policy transmission. The results suggest that monetary policy tightening induces banks in South Asian economies to reduce their loan supply. Furthermore, they suggest that a higher concentration in the banking industry serves as a buffer in the transmission of monetary policy shocks to bank lending, meaning that monetary policy transmission becomes weaker and less effective. Moreover, the weakened effect is more evident for smaller, less-liquid, poorly-capitalised and less-profitable banks. This is consistent with the existing literature on the bank lending channel, which shows that banks which are more financially constrained find it difficult to substitute loanable funds in a monetary contraction. These findings are broadly robust across alternative measures of monetary policy and the different estimated methods. From a policy standpoint, our findings call for a close oversight of banking concentration and the development of measures that can offset the negative effect of banking sector concentration on the effectiveness of the monetary policy transmission mechanism.

The rest of this paper is organised as follows. Part 2 of this paper provides a brief literature analysis of the bank lending channel and the theory as to the way in which market power impacts monetary transmission. Part 3 discusses the empirical strategy and describes the data. Part 4 begins by estimating the baseline model and then proceeds to estimate an alternative model for ensuring the robustness of the baseline results, and part 5 provides the conclusions and policy implications of this paper.

2. Literature Review

Following the traditional IS-LM model, a decrease in the money supply has an immediate impact on the money market, increasing the equilibrium interest rate in the money market. It then impacts the real decisions of firms and households through a reduction in investments. In line with this process, a decrease in deposits on the liability side of a bank's balance sheet is set off by a proportionate reduction in loan disbursements and bond investments on the assets side of the balance sheet. This is called the 'money view' of monetary policy (Taylor 1995). Monetary policy changes assets' prices and returns, and thus influences the bond price, interest rates and exchange rates. Under this view, money plays a unique role, but banks have no active involvement except in the issuing of deposits, as bonds and loans are considered as perfect substitutes (Lensink & Sterken 2002).

In contrast, the 'credit view' considers credit and bonds as imperfect substitutes. In this case, some banks will prefer to build a bond portfolio and slow down their loan disbursements following a change in monetary policy.[3] Hence, banks play an active role in monetary transmission as providers of credit to the economy (Bernanke & Gertler 1995; Cecchetti 1995). The existing literature on the credit view has two sub-channels of such transmission: the bank lending channel and the balance sheet channel. Since the influential works of Bernanke & Gertler (1995) and (Kashyap & Stein 1995), several studies have confirmed the existence of the lending channel of transmission. Those studies explain how monetary policy changes affect bank balance sheets through the variation in the supply of loans (See Altunbaş et al. 2002; Brissimis & Delis 2009; Kashyap & Stein 2000; Kishan & Opiela 2000). In general, the underlying assumption with bank lending is that monetary tightening drains banks' reserves and deposits, and this reduction in loanable funds causes banks to shrink their available loan portfolios. Similarly, an expansionary monetary policy replenishes banks' reserves and deposits and leads to a spike in their loanable funds.

However, if banks can replace the reduction in loanable funds using an alternative source of funds (e.g. the issuance of new equity) in the case of monetary tightening, the lending channel will break down (See Fungáčová et al. 2014). As most of the recent literature points out, this is not a reasonable assumption due to various industry-specific features of the banking business. Banks' responses to monetary policy changes depend on their balance sheet characteristics (Kashyap & Stein 2000). (Kishan & Opiela 2000) suggested that the size of a bank's assets is associated significantly with the bank's reaction to the monetary policy shocks. They argued that monetary tightening has a stronger impact on small banks due to their lower ability to access alternative sources

[3] Bhaumik et al. (2011) argued that banks in developing countries are likely to downsize their loan portfolios more aggressively than their bond portfolios in monetary contractions, as bonds are assumed to be less risky assets (as the sovereign government is the primary issuer of bonds).

of funding. Peek & Rosengren (1995) found that bank leverage, represented by the capital to assets ratio, is an essential factor for determining the sensitivity of bank loans to monetary policy initiatives. Similarly, the literature indicates that well-capitalised and highly-liquid banks are more resistant to monetary contractions, as they have access to unsecured funding in the market in order to protect their loanable funding (Juurikkala et al. 2011; Kishan & Opiela 2006). Hence, as was discussed earlier, banks will be reluctant to expand their lending if they find it costly or difficult to raise capital, even if there is a higher demand for loans in the market.

Recently, the modelling of banks' reactions to monetary policy impulses has been modified slightly by Disyatat (2011) through the external finance premium hypothesis. The tightening of monetary policy leads to a deterioration in asset quality and banks' leverage, which increases the external finance premium. Changes in this risk perception of a bank's balance sheet increase the cost of funding due to a higher external finance premium. In turn, banks pass this premium on to customers by increasing the lending rate (Cantero-Saiz et al. 2014). From an external finance premium perspective, the mechanism of the bank lending channel is that a contractionary monetary policy reduces a bank's loanable funds through a fall in deposits and/or an increased external finance premium, thus limiting the loan supply to borrowers.

While there has been ample research on the lending channel, the majority of the studies have focused on developed countries, and the results on the existence and effectiveness of the lending channel have been inconclusive. In general, the results suggest that small banks with poor capitalisation and weak liquidity positions are more likely to have their loan supply affected adversely by monetary policy contractions, as they find it difficult to obtain alternative sources of finance. Hence, banks with weak balance sheets opt to downsize their lending portfolios. Unlike developed economies, research results on developing countries provide more conclusive evidence on the existence of the lending channel (See Freedman & Click 2006; Sanfilippo-Azofra et al. 2018). This is because banks are the primary financial intermediary in developing economies, and deposits are their primary source of funding for the provision of credit facilities. Hence, monetary tightening has a negative impact on the loan supply (See De Mello & Pisu 2010; Hou & Wang 2013). These studies further suggest that, while the lending channel is present in developing economies, its intensity in developed economies varies.

3. Empirical Strategy

3.1. Data

This study uses annual bank-level data for five selected South Asian economies: Bangladesh, India, Nepal, Pakistan, and Sri Lanka. The panel data encompass the unconsolidated balance sheets and income statements of 125 commercial banks, including 906 bank-year observations.[4] The sample period is from 2015 to 2022, covering the systemic important commercial banks of selected countries. The data are obtained from several sources, with unconsolidated bank-level financial statements being extracted from the Orbis database, provided by Bureau van Dijk.[5]

The sample includes only domestic-commercial banks, to ensure the comparability of the data. All other financial institutions, such as specialised banks, investment banks and finance companies who engage in similar types of business, are excluded, as the regulatory provisions and reporting requirements applied to these institutions may differ from those of commercial banks. Foreign-owned commercial banks are excluded due to the lack of availability of unconsolidated financial statements. In cases where corporate mergers or acquisitions took place during the sample period, the acquiree/target bank has been eliminated from the sample, and the acquirer bank is treated separately by considering unconsolidated data in the sample. Similarly, banks with short

[4] The use of bank-level data allows a better understanding of the supply-side credit channels of monetary policy transmission vs. the supply-side interest rate channel (See Olivero et al. 2011a).
[5] Orbis presents financial statement data in a standardised format for all countries. All data are stated in millions of US dollars. In the literature, the quality of the data provided by Bureau van Dijk has been assessed as good overall.

periods of financial statements and banks with outliers are also eliminated from the sample.[6] The country-specific macroeconomic data are extracted from the financial statistics published by the International Monetary Fund (IMF) and the world development indicators published by the World Bank. This section presents the descriptive statistics and correlations among the main variables used in the study, a summary of which is provided in Table A1 in the appendix.

3.2. Variables in the Model

This study employs five alternative measures of the concentration ratio: three HHIs, defined as the market share of the banking sector in terms of total assets (HHI-TA), total loans (HHI-L) and the deposit base (HHI-D); and the three-firm (CR3) and five-firm (CR5) concentration ratios. As was noted earlier, the market share of large banks, measured by the CR3 and CR5 of these five economies, has decreased over the period under investigation.

Changes in bank lending activities are represented by the annual percentage change in the bank's gross loan portfolio. This is the dependent variable that is used most commonly in the literature for studying the lending channel of monetary transmission. The size of the domestic commercial banking market varies across the selected economies. Hence, this study avoids the size effect of loans in larger markets by using the growth of loans instead of the volume of loans, as was suggested by Olivero et al. (2011b). Following the monetary policy literature, I measure changes in the monetary policy stance by changes in the short-term interest rate; i.e., a monetary policy easing (tightening) is reflected in a drop (hike) in the short-term interest rate (See Bernanke & Blinder 1988). I mainly use changes in the money market rate (MMR) to represent the monetary changes in this study.

Most of the early empirical studies on the bank lending channel have since been challenged, as they relied on aggregate data. The issue with using aggregate data for the empirical estimates is that it creates an 'identification problem', namely a difficulty in identifying the exact reason(s) for the reduction in the loan supply. In other words, using aggregate data to study changes in loans cannot separate the demand-side and supply-side effects of monetary policy transmission. Kashyap & Stein (1995) were the first to use disaggregate data to address the identification problem. Since then, many researchers have pointed out that the decline in bank loans following a monetary policy tightening is tied closely to individual bank characteristics, such as liquidity position and capital strength (Gambacorta 2005; Kashyap & Stein 2000). The other side of this argument is that all banks face identical loan demands, which suggests that the demand for loans does not depend on bank characteristics (Fungáčová et al. 2014). For example, following the introduction of an expansionary monetary policy, the loan demand decreases by the same amount for both small and big banks (see Bernanke & Blinder 1988). While recent empirical studies using loan-level data to study the effect of monetary transmission have relaxed this assumption (Jiménez et al. 2012), our study retains this assumption because loan-level data are not available in the South Asian context. Furthermore, most South Asian countries still rely on the bank-based financial system; customers do not have an alternative to bank loans as a source of finance.

The bank-level data used in this analysis allow me to control for the degree and type of financial strength or constraints of heterogeneous banks (Ashcraft 2006). Bank size, capitalisation, and liquidity are vital bank-specific characteristics that are associated with information asymmetries (Kashyap & Stein 2000). Hence, I include several bank balance sheet variables, to control for the effects of bank balance sheet conditions on changes in credit growth and supply that are unrelated to the monetary policy changes. I measure the individual bank size by the logarithm of total assets, as bigger banks could easily handle adverse monetary shocks by issuing financial instruments. The liquidity position of each bank is computed as its ratio of liquid assets (cash, deposits with other banks and short-term securities) to total assets, and its degree of capitalisation is computed as the equity to total assets ratio. These three prominent bank characteristics influence the accessibility of and the

[6] The data outliers are eliminated following the criteria used in similar studies, for instance Olivero et al. (2011b).

premium on external finance. Banks with better capital and highly liquid assets tend to pay lower risk premiums for their debt, and can still create loans against unexpected deposit shocks caused by monetary policy changes.

I also include GDP growth and financial sector development, to control for macroeconomic changes and the availability of alternative sources of finance, respectively. These two factors may affect the demand for bank credit from the banking customers in the selected economies. Controlling for demand-side effects helps to distinguish the supply-side effects of the lending channel. Furthermore, no significant financial or monetary sector reforms occurred during the sample period. Table A2 in the appendix presents the definitions and the data sources in more detail.

3.3. Models and Estimation Techniques

I uncover the effect of the banking market concentration on the lending channel of monetary policy transmission by following the empirical approach introduced by Kashyap & Stein (2000). This approach has been used subsequently to analyse the lending channel in both developed and emerging market economies (Bhaumik et al. 2011; Gambacorta 2003; Khan et al. 2016). The specification of the model is

$$\Delta L_{i,c,t} = \alpha + \rho\Delta L_{i,c,t-1} + \beta\Delta MP_{c,t} + \gamma X_{i,c,t-1} + \emptyset Z_{c,t-1} + \mu_i + \sigma_t + \epsilon_{i,c,t}\,, \qquad (1)$$

where the subscripts *i*, *c* and *t* denote the individual bank, the country in which the bank operates and the time, respectively. The outcome variable $\Delta L_{i,c,t}$ represents the growth rate of bank loans for bank *i*, in country *c*, at time *t*. $\Delta L_{i,c,t-1}$ is the lagged value of the outcome variable. $\Delta MP_{c,t}$ is a measure of the change in monetary policy. $X_{i,c,t-1}$ is the vector of control variables for bank-specific characteristics, including size, capitalisation, deposit growth, profitability, liquidity, risk of problem loans, and capital adequacy. $Z_{c,t-1}$ represents country-specific macroeconomic characteristics, including GDP growth and financial sector development. μ_i is the bank fixed effects, σ_t is the year fixed effects and $\epsilon_{i,c,t}$ is the error term.

I model the effect of a bank's market structure on the lending channel of monetary transmission by extending Eq. (3.1) to include the market concentration term and the interaction term of the bank concentration with the monetary policy measures, where the extended model is given by

$$\Delta L_{i,c,t} = \alpha + \rho\Delta L_{i,c,t-1} + \delta MC_{c,t} + \beta\Delta MP_{c,t} + \theta\left(\Delta MP_{c,t} * MC_{c,t}\right) + \gamma X_{i,c,t-1} + \emptyset Z_{c,t-1} + \mu_i + \sigma_t + \epsilon_{i,c,t}\,. \qquad (2)$$

Here, $MC_{c,t}$ measures the bank market concentration for each country-year. The interaction term $(MP * MC)_{c,t}$ captures the marginal impact of the banking sector market concentration on monetary policy transmission through the bank lending channel. The remaining variables are the same as in Eq. (3.1). Guided by prior studies on the bank lending channel, all control variables are lagged by one year to avoid an endogeneity bias (See Kashyap & Stein 2000; Kishan & Opiela 2000).

The coefficient on the bank concentration (δ) captures the effect of the market concentration on the loan growth. Similarly, the coefficient on monetary policy β estimates the response of the loan growth of bank *i* to monetary policy impulses. As per the literature, it is expected that an increase in the monetary policy rate will lead to a reduction in bank lending. Hence, the β coefficient, which represents the effect of monetary policy on the lending growth, should be negative. As was discussed in the literature review section, banking sector concentration can either weaken or strengthen monetary policy transmission via its impact on bank lending. Therefore, the coefficient of the interaction term (θ), which shows the marginal effect of market structure on the banking lending channel, can be either negative or positive. A positive (negative) coefficient indicates that the sensitivity of bank lending to monetary policy is smaller (larger) when the concentration in the banking industry is high. This suggests that the market structure weakens (strengthens) monetary policy transmission via the bank lending channel.

The empirical method used in this paper is based on previous studies of bank lending channels. The majority of those studies follow the empirical framework developed by Kashyap & Stein (2000), which examines whether

individual banks react differently to monetary policy changes (for instance, Bhaumik et al. 2011; Fungáčová et al. 2014; Hou & Wang 2013; Olivero et al. 2011b). I use the fixed effects estimator as my main estimation method, then confirm the robustness of the empirical results using an alternative estimation method. Specifically, I re-estimate the model using a System Generalised Method of Moments (GMM) method. GMM is a popular method of dynamic panel estimation in the banking and finance literature because it ensures more efficient and consistent results. I then split the data into different subsamples based on different bank-specific characteristics in order to examine the relationship between bank concentration and monetary policy transmission across heterogeneous banks.

4. Empirical Results

The regression results for Eq. (2), estimated using the fixed effects model, are reported in Table 1. The dependent variable is the growth rate of loans in all specifications. I use five different measures of market concentration to capture the effects of the market structure on monetary policy transmission. Panel A presents the results of Eq. (2) without the interaction term, while panel B includes the interaction term.

As expected, I find the coefficient of monetary policy to be negative and significant in all specifications. The negative coefficient suggests that an expansionary (contractionary) monetary policy, characterised by a downward (upward) adjustment to the interbank money market interest rate, has a positive (negative) effect on the credit supply in all economies. Hence, monetary policy contractions induce banks to cut down their credit supply and suggest the existence of a bank lending channel in South Asian economies. This result is consistent with prior empirical evidence on the lending channel of monetary policy in South Asian countries, such as Bhaumik et al. (2011) and Bhatt & Kishor (2013) for India, Afrin (2017) for Bangladesh, and Perera et al. (2014) for South Asian economies in general.

The coefficients on the market concentration measures are significantly negative except in model 9, which suggests that the supply of loans grows at a slower rate in more concentrated markets. Furthermore, the results in Panel B of Table 1 show that the coefficient on the interaction term between bank concentration and monetary policy is positive and statistically significant except for CR3 and CR5. This result indicates that banks with higher concentration/market power are less sensitive to monetary policy changes. Thus, an increased concentration/increased market power weakens the transmission of monetary policy through the bank lending channel. This may be due to higher market power enhancing the accessibility of the interbank money market and/or an alternative source of funds.

On the other hand, it is more difficult and costly for banks with low market power to access liquidity and funds. Such banks are more vulnerable to monetary policy shocks and have limited ability to hedge their lending activities against monetary policy shocks. Higher competition in the banking sector ensures that changes in monetary policy influence the cost and availability of funds. Hence, an increase in bank competition may facilitate a more direct transmission of monetary policy to the supply of bank loans. These results are consistent with the results of Olivero et al. (2011b) for the Asian and Latin American contexts.

Table 1: FE Estimates with and Without the Interaction Term

	Panel A: without the interaction term					Panel B: with the interaction term				
	1	2	3	4	5	6	7	8	9	10
	HHI-TA	HHI-L	HHI-D	CR3	CR5	HHI-TA	HHI-L	HHI-D	CR3	CR5
Lag Loan Growth	0.003	0.002	0.003	0.007	0.003	0.002	0.002	0.002	0.007	0.003
	(0.008)	(0.008)	(0.008)	(0.009)	(0.011)	(0.008)	(0.008)	(0.008)	(0.009)	(0.011)
MP	-0.024***	-0.022***	-0.023***	-0.023***	-0.018***	-0.027***	-0.025***	-0.026***	-0.024***	-0.020***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)
Market Concentration	-4.737**	-3.778**	-4.311**	-0.764	-0.445**	-4.556**	-3.602**	-4.141**	-0.492	-0.424**

	*	*	*			*	*	*		
	(0.892)	(0.662)	(0.808)	(0.490)	(0.193)	(0.845)	(0.646)	(0.770)	(0.535)	(0.195)
MP*M Concentration	-	-	-	-	-	0.134**	0.150** *	0.142** *	0.022	0.015
						(0.054)	(0.055)	(0.052)	(0.014)	(0.009)
Size	-0.078	-0.082	-0.078	-0.051	-0.042	-0.124	-0.130	-0.128	-0.072	-0.071
	(0.102)	(0.098)	(0.100)	(0.109)	(0.097)	(0.100)	(0.096)	(0.098)	(0.110)	(0.101)
Capitalisation	0.902*	0.909*	0.905*	0.861*	0.899*	0.924*	0.930*	0.930*	0.860	0.912*
	(0.489)	(0.480)	(0.484)	(0.518)	(0.494)	(0.495)	(0.486)	(0.490)	(0.521)	(0.499)
Liquidity	0.714** *	0.704** *	0.698** *	0.742** *	0.731** *	0.713** *	0.703** *	0.697** *	0.744** *	0.734** *
	(0.171)	(0.174)	(0.174)	(0.184)	(0.168)	(0.171)	(0.173)	(0.174)	(0.185)	(0.168)
Profitability	0.014	0.012	0.014	0.015	0.010	0.017	0.016	0.018	0.018	0.012
	(0.017)	(0.016)	(0.017)	(0.017)	(0.015)	(0.017)	(0.017)	(0.017)	(0.018)	(0.015)
Deposit Growth	-0.164	-0.153	-0.161	-0.147	-0.148	-0.155	-0.144	-0.151	-0.144	-0.142
	(0.101)	(0.097)	(0.099)	(0.108)	(0.098)	(0.101)	(0.097)	(0.098)	(0.109)	(0.099)
Problem Loans	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP Growth	-0.006*	-0.006*	-0.006*	-0.004	-0.005	-0.006*	-0.006*	-0.006*	-0.004	-0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Financial Developments	-0.000	0.000	-0.000	0.001	0.001	-0.000	0.000	-0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	645	645	645	645	645	645	645	645	645	645
R-squared	0.608	0.608	0.608	0.608	0.608	0.633	0.629	0.629	0.611	0.625

Note: This table reports panel estimates with bank and time fixed effects. The dependent variable is the loan growth rate, and the monetary policy variable is the change in the money market rate. All control variables are lagged one period. Standard errors clustered by bank ID and year are in brackets. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Using the results reported in Table 1, I next compute the overall impact of a one per cent change in monetary policy on bank lending at different levels of market concentration. Table 2 reports the changes in bank lending, obtained by $\beta + \theta * level\ of\ concentration$. Columns 1, 3, 5, 7 and 9 in the table show the level of concentration at different percentiles, while columns 2, 4, 6, 8 and 10 report the percentage changes in bank lending in response to a one per cent change in monetary policy for different concentration measures. The table shows the role of the market structure at different intensities for alternative concentration measures. These results show that an increase in the interest rate has a negative impact on lending, but that a higher concentration in the banking sector reduces the marginal effects of monetary policy.

Table 2: Percentage Change in Bank Lending Following a One Per Cent Increase in Monetary Policy

Market structure value category	HHI-TA	Change in lending %	HHI-L	Change in lending %	HHI-D	Change in lending %	CR3	Change in lending %	CR5	Change in lending %
	1	2	3	4	5	6	7	8	9	10
Mean value	0.0791	-0.0164	0.0761	-0.0136	0.0801	-0.0146	0.3505	-0.0163	0.4573	-0.0131
10th percentile	0.0479	-0.0206	0.0409	-0.0189	0.0475	-0.0193	0.2801	-0.0178	0.3414	-0.0149
25th percentile	0.0497	-0.0203	0.0456	-0.0182	0.0483	-0.0191	0.2880	-0.0177	0.3595	-0.0146
50th percentile	0.0514	-0.0201	0.0514	-0.0173	0.0514	-0.0187	0.2948	-0.0175	0.3989	-0.0140
75th percentile	0.1059	-0.0128	0.0954	-0.0107	0.1095	-0.0104	0.3986	-0.0152	0.5481	-0.0118

Note: Values are calculated as $\beta + \theta * level\ of\ concentration$, using the results obtained in Table 1.

When an economy has a concentration at the 10th percentile of the HHI-TA, a one per cent increase in the MMR induces a 0.0206% reduction in the supply of loans, while for HHI-TA at the 50th percentile, the reduction in the supply of loans decreases to 0.0201%. Similarly, for concentration measured at the 75th percentile, the decrease

in the loan supply in response to a one per cent monetary policy shock drops to only 0.0128%. Similar analyses are also conducted for all other measures of the market concentration, but the results are consistent across alternative concentration measures and therefore are not reported here for the sake of brevity. These results show that an increase in monetary policy (tightening) always has a negative impact on bank lending, and decreases the supply of loans. However, the real effect of monetary policy diminishes as the banking sector grows more concentrated. A higher concentration ratio also decreases the loan growth, a result similar to that found in the empirical analysis conducted by Khan et al. (2016) for the ASEAN economies.

In summary, the regression results show that a higher concentration in the banking industry serves as a buffer in the transmission of monetary policy shocks to bank lending; thus, the transmission of monetary policy becomes weaker and less effective as the banking industry grows more concentrated.

4.1. Robustness Tests

Robustness With Time-Varying Fixed Effects: The first robustness check involves the addition of time-varying fixed effects to the model. Accordingly, I incorporate a country-year interaction term into the model in addition to the bank and time fixed effects. As Table 3 shows, the coefficient on monetary policy is negative and statistically significant. However, it is much higher in magnitude than the corresponding value in the baseline model. Under this specification, the coefficient on market concentration is positive and significant, suggesting that a higher market power enables banks to increase their loans. The interaction term between the monetary policy indicator and the market structure is still negative and significant, although with a different magnitude. Similarly to the earlier findings, the effect of monetary policy transmission is dampened with a higher rate of bank concentration. Overall, these results seem to be consistent with those in Table 1 using a panel FE without controlling for the time-varying heterogeneity.

Table **Error! No text of specified style in document.**: Robustness Check: Model With Time-Varying Fixed Effects

	1 HHI-TA	2 HHI-L	3 HHI-D	4 CR3	5 CR5
Lag Loan Growth	-0.003	-0.003	-0.003	-0.003	-0.003
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
MP	-1.315***	-0.895***	-0.880***	-1.403***	-1.672***
	(0.362)	(0.278)	(0.276)	(0.472)	(0.506)
Market Concentration	14.805***	10.173***	8.605***	-1.271	0.211
	(4.026)	(2.782)	(2.400)	(1.159)	(1.444)
MP*M. Concentration	2.829***	2.606***	1.913***	0.424***	0.413***
	(0.648)	(0.595)	(0.434)	(0.131)	(0.143)
Size	-0.066	-0.066	-0.066	-0.066	-0.066
	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)
Capitalisation	0.640	0.640	0.640	0.640	0.640
	(0.522)	(0.522)	(0.522)	(0.522)	(0.522)
Liquidity	0.757***	0.757***	0.757***	0.757***	0.757***
	(0.132)	(0.132)	(0.132)	(0.132)	(0.132)
Profitability	0.028	0.028	0.028	0.028	0.028
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Deposit Growth	-0.238**	-0.238**	-0.238**	-0.238**	-0.238**
	(0.118)	(0.118)	(0.118)	(0.118)	(0.118)
Problem Loans	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP Growth	0.093***	0.064***	0.047***	-0.030*	-0.017
	(0.027)	(0.020)	(0.017)	(0.015)	(0.019)
Financial Developments	0.002	0.003	0.004	0.010***	0.008**

	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Bank FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Country year interaction	Yes	Yes	Yes	Yes	Yes
Observations	647	647	647	647	647
R-squared	0.378	0.378	0.378	0.378	0.378

Note: This table reports panel estimates with bank and time fixed effects. The dependent variable is the loan growth rate, and the monetary policy variable is the change in the money market rate. All control variables are lagged one period. Standard errors clustered by bank ID and year are in brackets. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

4.2. Robustness: Alternative Measures of Monetary Policy

I test the robustness of the estimated results further by using an alternative measure of the short-term interest rate. The literature uses several different interest rates to measure monetary policy changes. I use the three-month Treasury bill rate (TBR) as a replacement for the money market rate, which is used in the baseline model as the indicator of monetary policy, and Table 4 displays the results. The three-month TBR is a standard proxy for monetary policy in the literature on the bank lending channel.

The results are similar to those obtained from the baseline model. First, the coefficient on monetary policy is significantly negative for all concentration measures. The growth in loan supply decreases in response to a monetary tightening, as it leads to increases in both of these interest rates. Hence, the existence of the lending channel of monetary policy transmission in these economies is still supported. Second, the interaction term is positive in all models and significant in all except the HHI-TA and CR3 models.

Table 4: Robustness Check Using Alternative Monetary Policy Measure (Treasury Bill Rate)

	Fixed Effects (FE) Estimates				
	1	2	3	4	5
	HHI-TA	HHI-L	HHI-D	CR3	CR5
Lag Loan Growth	0.003	0.002	0.003	0.007	0.002
	(0.007)	(0.007)	(0.007)	(0.008)	(0.010)
MP	-0.021***	-0.023***	-0.024***	-0.027**	-0.032***
	(0.007)	(0.007)	(0.007)	(0.011)	(0.010)
Market Concentration	-4.986***	-4.803***	-4.925***	-0.565	-0.776***
	(1.068)	(0.983)	(1.045)	(0.447)	(0.221)
MP*M Concentration	0.110	0.171**	0.146*	0.045	0.049**
	(0.082)	(0.078)	(0.080)	(0.034)	(0.021)
Size	-0.072	-0.082	-0.075	-0.031	-0.047
	(0.113)	(0.111)	(0.112)	(0.119)	(0.107)
Capitalisation	1.049**	1.033**	1.032**	0.970*	1.011**
	(0.497)	(0.492)	(0.494)	(0.521)	(0.501)
Liquidity	0.783***	0.784***	0.775***	0.796***	0.804***
	(0.179)	(0.180)	(0.181)	(0.193)	(0.172)
Profitability	0.010	0.009	0.011	0.013	0.007
	(0.017)	(0.017)	(0.017)	(0.018)	(0.015)
Deposit Growth	-0.131	-0.127	-0.132	-0.127	-0.130
	(0.105)	(0.103)	(0.104)	(0.111)	(0.104)
Problem Loans	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP Growth	0.010***	0.010***	0.010***	-0.006	-0.006
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Financial Developments	-0.000	0.000	-0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Bank FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	645	645	645	645	645
R-squared	0.624	0.623	0.622	0.603	0.622

Note: This table reports panel estimates with bank and time fixed effects. The dependent variable is the loan growth rate, and the monetary policy variable is the change in the short-term Treasury bill rate. All control variables are lagged one period. Standard errors clustered by bank ID and year are in brackets. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

4.3. Robustness: Alternative Estimation Methods

To further validate these findings, I use an alternative estimation method to check the robustness of the empirical results obtained above. In the bank lending literature, some scholars prefer to estimate the dynamic model in Eq. (2) using the system GMM introduced by Arellano & Bond (1991). Accordingly, I re-estimate the model specified in Eq. (2) using the system GMM with robust standard errors. Our main findings stay intact.

The results of the FE model show that the lagged value of the loan growth is not significant. This may be due to the fact that annual rather than quarterly data are employed for the analysis. However, only annual data are available in the South Asian banking context. Furthermore, scholars criticise the economic rationale for using lagged loan growth in the model, as the current lending growth does not influence next year's lending growth directly. They argue that the lagged value of the loan growth is relevant at monthly and/or quarterly data intervals (See Fungáčová et al. 2016; Fungáčová et al. 2014).[7]

The system GMM estimates have a lower bias and higher efficiency for small samples. Further, endogeneity problems may arise from certain bank variables (like size, liquidity, and capital). Hence, the system GMM is intended to check the consistency of the results obtained using the baseline model on the issue of endogeneity. In the system GMM, the first equation is the first- difference equation, and the second equation is the level equation. When estimating the system GMM, the monetary policy indicator and the macroeconomic variables are considered to be exogenous, while the bank characteristics are endogenous. The instruments used are the first and second lags of the dependent variable and the first lag of all explanatory variables. I validate the model by conducting the autocorrelation and Sargan/Hansen tests in order to explore the issues of serial correlation and the validity of instruments, respectively.

Table 5: Robustness Check: Model Re-estimated Using the System Generalised Method of Moments (GMM) Method

	System generalised method of moments (GMM) estimates				
	1	2	3	4	5
	HHI-TA	HHI-L	HHI-D	CR3	CR5
Lag Loan Growth	0.223	0.181	0.244	-0.189	-0.120
	(0.203)	(0.191)	(0.213)	(0.123)	(0.080)
MP	-0.068***	-0.068***	-0.070***	-0.170*	-0.164**
	(0.024)	(0.022)	(0.025)	(0.097)	(0.066)
Market Concentration	-8.658***	-9.433***	-7.718***	-4.836**	-2.815***
	(2.717)	(2.648)	(2.800)	(2.350)	(0.966)
MP*M Concentration	0.651**	0.727**	0.636*	0.437	0.367**
	(0.327)	(0.293)	(0.329)	(0.293)	(0.156)
Size	-1.154	-0.892	-1.307*	-0.977	-1.177
	(0.734)	(0.660)	(0.781)	(0.801)	(0.717)
Capitalisation	-4.664	-3.938	-5.118*	-2.359	-1.409
	(2.834)	(2.502)	(2.940)	(3.147)	(2.413)

[7] I tried estimating Eq. (3.2) without the lagged dependent variable in a standard fixed effects panel regression framework and obtained results similar to those with the lagged dependent variable.

Liquidity	2.042**	2.156**	1.831*	1.826	1.587*
	(0.947)	(0.861)	(1.005)	(1.373)	(0.868)
Profitability	0.020	0.002	0.029	0.045	0.033
	(0.049)	(0.044)	(0.054)	(0.061)	(0.048)
Deposit Growth	0.691	0.461	0.809	0.684	0.920
	(0.709)	(0.648)	(0.751)	(0.727)	(0.666)
Problem Loans	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GDP Growth	0.006	0.004	0.009	0.007	-0.000
	(0.010)	(0.009)	(0.010)	(0.015)	(0.010)
Financial Developments	0.002	0.002	0.002*	0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Year dummies	Yes	Yes	Yes	Yes	Yes
Observations	647	647	647	647	647
AR (2) *p*-value	0.654	0.701	0.649	0.838	0.472
Number of instruments	26	26	26	26	26
Sargan/Hensen *p*-value	0.313	0.333	0.227	0.653	0.415

Note: This table reports the GMM estimate. The dependent variable is the loan growth rate, and the monetary policy variable is the difference in the money market rate. All control variables are lagged one period. Robust standard errors are in brackets. *, **, *** denote significance at 10%, 5% and 1% respectively.

The results of the system GMM method are presented in Table 5. Our regressions pass the Arellano-Bond test for second-order serial correlation and the Sagan test for the overidentification of restrictions. Consistent with the FE model, it finds that the lagged value of loan growth is not significant. These results are also broadly consistent with those from the baseline model.

Overall, this study has obtained several robust findings thus far. First, the negative and statistically significant coefficient on monetary policy confirms the existence of the bank lending channel, emphasising the fact that monetary policy tightening induces banks in the South Asian economies to reduce their loan supply effectively. Second, the negative and significant coefficients on the concentration measures suggest that the loan supply grows at a lower rate in more concentrated markets. Finally, the positive and significant coefficient on the monetary policy and concentration interaction term suggests that an increased concentration weakens the monetary policy transmission and decreases the loan supply.

4.4. The Heterogeneity Effects

It is agreed widely that banks with different degrees of financial constraints respond differently to monetary policy shocks (Kashyap & Stein 1995; Kashyap & Stein 2000). Therefore, I examine whether the buffering effect of bank concentration that was revealed in the benchmark model holds equally for banks with different balance sheet characteristics. I try to uncover the bank characteristics, including capital level, liquidity, profitability, and size, that create this buffering effect against monetary shocks. Further, I investigate the role of corporate attributes, such as the ownership structure and the status of the public listing, in the lending channel of monetary policy transmission.

I divided the sample into various subsamples based on different bank characteristics or corporate attributes. The subsample analyses are performed using approaches similar to those in prior studies (See Hou & Wang 2013; Olivero et al. 2011a), splitting the sample for each bank-specific characteristic based on banks' median values by country in each year. Banks with equity assets ratios above (below) the median are contained in the subsample of high- (low-)capitalisation banks. Banks with liquidity assets above (below) the median value are in the high- (low-)liquidity subsample. Banks with ROA above (below) the median level are in the high- (low-)profitability subsample. Similarly, banks with total assets above (below) the median value are categorised as large (small) banks.

The estimated results for different bank categories using the HHI-TA are reported in Table 6. The results of Tables 3 to 5 show negative and significant coefficients on the monetary policy indicator, which confirms the existence of the bank lending channel after controlling for all bank characteristics and corporate attributes, with the exception of the non-listed banks. The results show that the reduction in loan growth is higher for the less-capitalised, less-liquid, and smaller banks. This finding is consistent with the literature showing that banks with large asset bases, which are mostly well-capitalised and highly liquid, are more resilient to monetary policy shocks (Kashyap & Stein 2000). This insulation is due mainly to their easy access to alternative sources of funds and existing capital buffers against monetary policy contractions. Hence, banks that are poorly capitalised, less liquid and with lower asset bases may have to reduce their lending capacity under contractionary monetary policy. These banks are affected the most by monetary policy shocks, as their reservable deposits are drained in monetary tightening. This is consistent with the results of Khan et al. (2016), and Amidu & Wolfe (2013).

In addition to bank characteristics, this study also examines the roles of the different corporate attributes. Since foreign banks are excluded, the sample is divided into state-owned and private banks. In the South Asian context, state-owned banks are generally large-scale government-owned banks that operate nationwide. In these economies, it is typical for state-owned enterprises' accounts to be maintained at state banks, and state banks generally hold a significant portion of the banking sector assets. However, state-owned banks still maintain an arm's-length banking relationship with the government and work toward the same profit maximisation objective as other private banks. Accordingly, the assumption of 'profit focus' that forms the basis of analyses of bank behaviour in the banking literature is equally applicable to state-owned banks in the South Asian context. Few studies have examined how banks' lending behaviour varies according to a bank's ownership structure. Bhaumik et al. (2011) conducted a study on the influence of ownership on banks' reactions to India's monetary policy, among public, private and foreign banks. Their results suggested that the credit disbursal of all three types of banks are affected adversely by monetary policy tightening. However, the credit contraction was largest for foreign banks, followed by private banks. The public banks were affected the least by monetary policy shocks. They suggested that this may have been due to the higher cost of obtaining and processing information for foreign banks, resulting in information asymmetry.

As Table 6 shows, both state-and privately-owned banks have negative and significant coefficients on the monetary policy indicator, suggesting that both types of banks are affected adversely by the monetary contraction. However, the magnitudes suggest that state-owned banks have stronger responses to monetary policy shocks than private banks. The interaction term between the monetary policy indicator and the concentration ratio is significantly positive for both state-owned and privately-owned banks. Nevertheless, the size of the interaction term suggests that an increased concentration in state-owned banks makes monetary policy transmission weaker than for privately-owned banks. The results suggest that the higher market power of the state-owned banks creates a buffering effect and reduces the effectiveness of the bank lending channel.

Table 6: Lending Channel of Monetary Policy Transmission Across Heterogeneous Bank Types

	HHI-TA using Fixed Effects (FE) Estimates									
	1	2	3	4	5	6	7	8	9	10
	Capitalisation		Liquidity		Profitability		Size		Ownership	
	High	Low	High	Low	High	Low	Large	Small	Sate	Private
Lag Loan Growth	0.001	-0.017	-0.001	-0.012	-0.008	0.005	-0.017	0.001	-0.103	0.001
	(0.011)	(0.085)	(0.019)	(0.012)	(0.011)	(0.022)	(0.085)	(0.011)	(0.089)	(0.011)
MP	-0.028***	-0.129***	-0.018***	-0.073***	-0.024**	-0.026***	-0.028***	-0.129***	-0.035***	-0.029***
	(0.005)	(0.036)	(0.005)	(0.014)	(0.011)	(0.006)	(0.005)	(0.036)	(0.008)	(0.005)
Market Concentration	-4.971***	-57.411***	4.227***	-1.687	-4.917***	-4.083	-4.971***	-57.411***	-2.416	-4.111***
	(1.172)	(26.913)	(1.331)	(1.558)	(1.403)	(4.228)	(1.172)	(26.913)	(1.789)	(0.970)

MP*M. Concentration	0.206***	2.616**	0.227***	0.137	0.161**	0.071	0.206***	2.616**	0.312**	0.138**
	(0.056)	(1.137)	(0.049)	(0.155)	(0.071)	(0.091)	(0.056)	(1.137)	(0.122)	(0.061)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	425	220	323	322	228	417	220	425	157	488
R-squared	0.625	0.675	0.753	0.579	0.489	0.773	0.675	0.625	0.578	0.608

Note: This table reports panel estimates with bank and time fixed effects. The dependent variable is the loan growth rate, and the monetary policy variable is the difference in the money market rate. All control variables are lagged one period. Robust standard errors are in brackets. *, **, *** denote significance at 10%, 5% and 1% respectively.

5. Conclusion

Even though there have been studies on the bank lending channel of monetary transmission, the literature on the impact of the market structure on this transmission is limited in both scope and context. This is due mainly to the lack of agreement among scholars on the measurement of market competition and the presence of conflicting evidence on the effect of banking market structure on monetary transmission. The present research examines the impact of market concentration on banks' loan supply in South Asian banking systems. This analysis contributes to the literature by deepening the understanding of the bank lending channel in South Asia, as emerging market economies that have not been studied extensively. Hence, this study uses bank-level balance sheet and income statement data to investigate the potential impact of the market concentration on bank lending using structural measures of the market structure in South Asian economies from 2011 to 2018.

The results gathered from the analysis allow me to draw several conclusions about the bank lending channel of monetary policy in South Asian economies. The evidence confirms the existence of the bank lending channel in these economies. The structural measures of market structure show that an increased bank concentration tends to hamper the bank lending channel of monetary policy. Moreover, by examining the heterogeneous effect using different bank characteristics and corporate features, I find that banks that are large, well-capitalised, and have good liquidity positions are better insulated against monetary tightening and are affected the least. This may be due to the fact that such banks have superior access to alternative sources of funds, and hence have a capital buffer to cater to the supply of bank loans against contractionary monetary policy shocks. These results support the hypothesis that banks which are poorly-capitalised and with low liquidity cannot resist the impact of monetary contractions and therefore curtail their supply of loans.

These research questions are especially appropriate in South Asian economies, as they have undeveloped financial systems which depend heavily on banks. Accordingly, the banking sector plays a critical role in promoting developmental priorities and corporate efficiency in these emerging economies. Hence, from a policy point of view, these results indicate a pressing need for a close monitoring of developments in the banking industry that may affect the competitiveness of the banking market, such as privatization policies, the removal of entry barriers, allowing foreign banks to enter the market, etc. Hence, this study provides insights for banking regulators which are calling for policy measures in order to tackle the adverse effects of banking sector concentration on effective monetary policy transmission.

One of the significant limitations of this study is the fact that it does not use non-structural measures as proxies for bank competition, as such information is not available. Hence, this study could be extended to use the Lerner Index or the Boone indicator for South Asian economies and then re-examine the effect of non-structural competition measures on the lending channel of monetary policy.

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Appendix:

Table A1: Descriptive Statistics

	Mean	Median	SD	Minimum	Maximum
Loan growth	0.185	0.110	0.779	-0.298	5.638
MP (change in the MMR)	0.042	-0.027	0.421	-0.875	2.364
HHI-total assets	0.079	0.051	0.043	0.045	0.274
HHI-loans	0.076	0.051	0.044	0.039	0.271
HHI-deposits	0.080	0.051	0.045	0.047	0.274
CR3	35.049	29.478	12.190	18.179	95.250
CR5	45.726	39.894	15.082	24.169	98.510
Size	15.171	14.981	1.699	11.248	19.046
Capitalisation	0.090	0.081	0.114	-0.973	0.988
Liquidity	0.129	0.104	0.097	0.001	0.846
Profitability	0.895	0.940	1.550	-13.930	12.600
Deposit growth	14.945	14.765	1.724	10.341	18.698
Problem loans	4.985	3.240	5.459	-2.890	44.670
GDP growth	0.179	0.031	1.437	-0.823	12.430
Financial developments	43.945	31.804	22.087	15.248	91.002

Table A2: Variable Definition

Variable	Definition	Source
Dependent Variable		
Loan growth	Annual percentage change in gross loans	Calculated based on Orbis data
Independent Variables		
Monetary Policy Indicator	Annual percentage in short term interest rate (money market rate/ 3-months Treasury bill rate)	World Development Indicators/Central banks and Statistical authorities
Market concentration indicators		
HHI- total assets	Sum of squared market shares market share of the banking sector in terms of total assets	Calculated based on Orbis data
HHI-loans	Sum of squared market shares market share of the banking sector in terms of total loans	Calculated based on Orbis data
HHI-deposits	Sum of squared market shares market share of the banking sector in terms of the deposit base	Calculated based on Orbis data
CR3	Share of assets held by the largest 3 banks of each country	Calculated based on Orbis data

CR5	Share of assets held by the largest 5 banks of each country	Calculated based on Orbis data
Control Variables		
Size	Natural logarithm of the bank's total assets in dollars.	Calculated based on Orbis data
Capitalisation	Equity to total assets ratio	Calculated based on Orbis data
Liquidity	Liquid assets to total assets ratio	Orbis data
Profitability	Return of average assets ratio	Orbis data
Deposit Growth	Annual percentage change in deposit	Calculated based on Orbis data
Problem Loans	Gross non-performing ratio	Orbis data
GDP growth	Annual percentage change in real GDP	World Development Indicators
Financial Developments	Market capitalisation as a percentage of GDP	World Development Indicators

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Optimizing Higher Education Archives Through Integrated Participatory Commitment and Archival Competence to Enhance Performance Accountability

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Abstract
Optimal archival management in higher education plays a role in supporting institutional performance accountability. Effective performance accountability in archival management requires both active involvement from all stakeholders and enhanced archival competency. This study aims to examine the influence of an integrated participatory commitment model and archival competency on improving the performance accountability of archival institutions in higher education. A quantitative survey approach was employed, with data collected through questionnaires distributed to 248 respondents, archivists and administrative staff from various higher education institutions. Data analysis was conducted using multiple regression to assess the of integrated participatory commitment and archival competency on performance accountability. Instrument validity and reliability tests were performed to ensure consistent measurement. The results indicate that both integrated participatory commitment and archival competency have a significant positive effect on performance accountability. Active participation from all institutional elements, combined with sufficient archival competency, contributes to a more effective, and accountable archival system.

Keywords: Archives, Participatory Commitment, Archival Competence, Performance Accountability

1. Introduction

To achieve good governance, the principles of good governance must be firmly applied and consistently implemented across all levels of society and government. According to the World Bank, there are five essential requirements for achieving good governance: efficiency in public sector management, the establishment of public accountability, the availability of a robust legal infrastructure, a reliable information system that ensures public access to policy-related information, and transparency in the formulation and execution of various policies. The successful implementation of these principles requires active participation and support from a government administration system that is both transparent and accountable.

Accountability can be measured based on: (1) the decision-making process being documented in writing, accessible to citizens/staff, and adhering to applicable administrative standards; (2) the accuracy and completeness of information related to methods for achieving a program's objectives; (3) the clarity of the goals to be achieved;

(4) the feasibility and consistency of operational targets; and (5) the management information system and monitoring of results (Shafritz & Russel, 1997).

Achieving the goals of archival management is critical for advancing governance toward good governance. These goals must be addressed accurately, promptly, and efficiently, in alignment withestablished objectives. Archival activities should emphasize high-quality, timely execution, proper systems, effective working methods, appropriate tools, and be supported by capable leadership, competent personnel, and sufficient facilities and infrastructure. Efficient and effective archival management greatly facilitates the tracing and retrieval of data or information, which serves as a valuable resource for informed decision-making by leaders. Ultimately, effective archival management contributes directly to the achievement of efficient and effective office administration.

Effective archival management is fundamental pillar in supporting the accountability of higher education institutions. Universities, as centers for education and research, generate a wide range of documents and information that possess administrative, legal, and historical value (Ding et al., 2023; Manzano et al., 2024). Consequently, archival practices in universities extend beyond mere document management; they constitute a foundational mechanism to ensure transparency and institutional accountability. Professionally managed archives can enhance good governance, improve operational efficiency, and minimize the risk of losing critical information (Loscher & Kaiser, 2022; Marshall et al., 2024). Despite the centrality of archives, many universities still encounter significant challenges in archival organization. These challenges include limited active involvement from institutional leaders and staff, low awareness of the importance of archive management, and inadequate archival competencies among archivists and administrative personnel (Crockett, 1993). Such deficiencies result in inefficiencies in storing and managing archives; and reduce the accountability of institutional performance in administrative operations and public transparency.

Organizational commitment plays a critical role in addressing these challenges. It refers to the condition in which an employee identifies with a particular organization and its goals and intends to maintain membership within it. Commitment is understood as the willingness of a social actor to devote energy and loyalty to social systems or relationships perceived as self-expressive (Mowday et al., 1982). Specifically, commitment is manifested in three dimensions: identification (belief in the organization's values), involvement (the willingness to exert effort for the organization's bestinterests), and loyalty (the desire to remain a member), as expressed by employees toward their organization (Mowday et al., 1982:50). This study further emphasizes the integration of participatorycommitment in the workplace as a strengthening variable (Meyer, Allen& Smith, 1993; 2022).

The resilience of an organization depends not only on its productivity but also on its alignment with the surrounding environment. Even highly productive organizations that generate goods or services with limited market value may fail to sustain themselves. Therefore, resilience factors—such accurate market assessment, sound decision-making regarding when and how to seize opportunities, and effective change management to adapt to evolving business conditions—are crucial for organizational survival and long-term success.

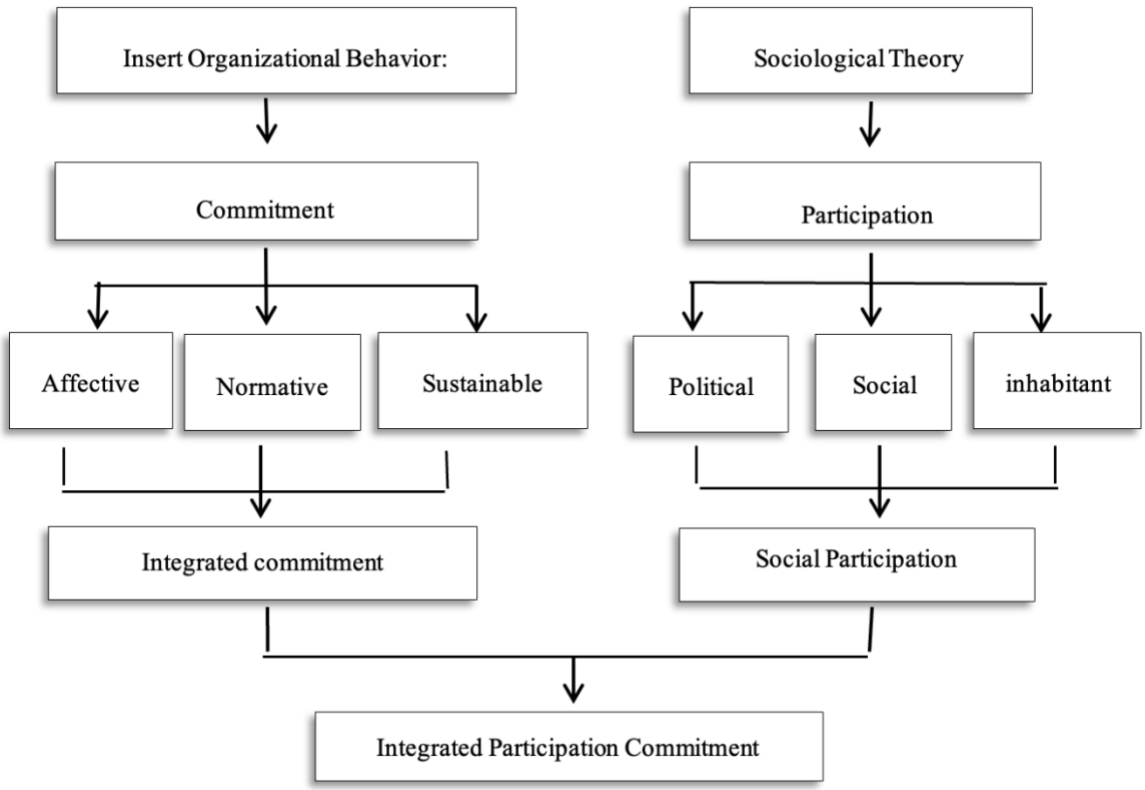

Figure 1: Theoretical Framework of Integrated Participatory Commitment
Source: Processed by the Author (2023)

Based on its level of effectiveness, participation can be categorized as effective or ineffective. Effective participation occurs when participatory activities achieve all intended objectives, whereas ineffective participation arises when few or none of the objectives are met. Participation can also be classified by the participants involved: local community members (residents, leaders), government officials, and external parties. By purpose and, it can be grouped into participation in regional development, social planning, or social activities. The model of community organization practice is closely linked to community development and seeks to actively involve communities in development initiatives. Its aims include stimulating participation (a process goal) and mobilizing social energy to facilitate self-help. the community in social planning helps align programs with actual needs and enhances program effectiveness (Khairuddin (1992; Bahua, 2018).

Participation is synonymous with involvement or engagement, encompassing a process of mutual learning, understanding, analyzing, planning, and taking action among community members. The mobilization of participation relies on mutual understanding, which is fostered through communication and interaction. Citizen participation has shifted the concept of participation from mere concern for aid recipients or marginalized groups active involvement in policy formulation and decision-making on issues that significantly impact community life. Unlike general social participation, citizen participation emphasizes public policy-making by citizens rather than using policy platforms solely for learning purposes.

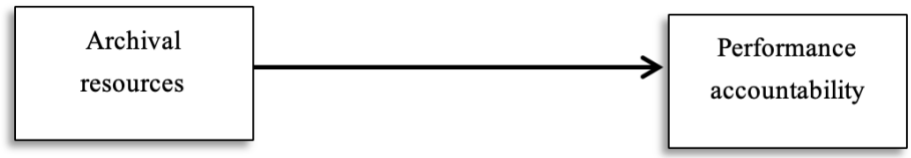

Figure 2. Proposition Model 1
Source: Developed by the author for this research

Higher education institutions are organizations operating in the education sector, where daily and historical activities inherently generate records, both dynamic and static. As institutions serving the academic community and various stakeholders, effective records management must ensure high-quality services to all users. Therefore, the presence of an archival unit within universities, functioning as a record management body, is essential. This requirement aligns with Article 27, Paragraph (1) of Law Number 43 of 2009 concerning Archiving, which mandates public universities to establish a university archive. This demonstrates that higher education institutions are entrusted with the reliable management of records to provide optimal services to all users.

The accountability of archival performance is influenced not only by archival resources but also by integrated participatory commitment. Participatory commitment indirectly affects performance accountability. Proposition Model 2 is presented in Figure 3 below.

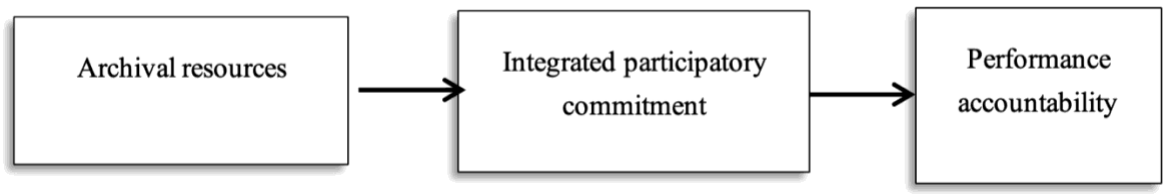

Figure 3: Proposition Model 2
Source: Developed by the author for this research

Competence refers to the authority to make decisions or manage specific tasks. In this context, competence pertains to the authority to manage archives. An officer is an individual assigned specific responsibilities; in this case, the officer is tasked with managing archives, which includes recording, controlling, distributing, storing, maintaining, supervising, transferring, and destroying records (KBBI, 2016).

According to Law Number 43 2009, archiving encompasses all matters related to archives. This includes all activities within government and private organizations associated with archival management. From this definition, it can be concluded that the competence of archiving officers is a fundamental requirement for anyone authorized in the field of archiving to carry out the duties and responsibilities of managing archives effectively.

The primary tasks of the archival unit include receiving documents, recording documents, distributing documents according to organizational needs, storing, organizing, and retrieving archives according to a systematic method, providing services to parties requiring archives, maintaining archives, and planning or implementing the reduction or disposal of archives (Sedarmayanti, 2003:19).

Addressing these challenges requires a comprehensive solution, one of which isthe implementation of an integrated participatory commitment model (Chrysanthopoulos et al., 2023; Clavaud, 2015). This model emphasizes the active involvement of all stakeholders including leadership, archivists, administrative staff, and archive usersin collaboratively optimizing archival management. By fostering shared commitment, all members of the higher education institution can support one another in achieving effective and accountable archive management (Caswell & Mallick, 2014; Iacovino, 2015; Pang & Kai Khiun, 2014).

In addition to participatory commitment, archival competence is a critical element in enhancing the quality of archive management. Archival competence encompasses the knowledge, skills, and attitudes required to manage

archives professionally (Cheng et al., 2023; Kroon & Alves, 2023). Higher education institutions must ensure that archivists and administrative staff possess adequate skills to manage documents and information systematically, securely, and in an accessible manner Competency improvement can be achieved through continuous training, certification, and the adoption of relevant information technology.

This study emphasizes the development of an integrated participatory commitment model and the enhancement of archival competence as strategies to optimize archiving in higher education institutions. The model aims to foster synergy mong stakeholders involved in archival management while promoting practices that are professional, efficient, and aligned with established archival standards. By doing so, higher education institutions can strengthen the accountability of their performance to the public and supervisory authorities.

Optimizing archiving through a participatory approach and improving archival competency is particularly crucial in addressing the challenges posed by the digital era. As higher education undergoes digital transformation, the management of archives must adapt to digital platforms to enhance accessibility, security, and long-term sustainability of information. Successful digital transformation, however, depends on a strong collective commitment from all parties and sufficient competency in handling electronic archives.

Previous research on archive management in higher education has largely focused on information technology, digital archiving, and the implementation of modern archival management systems (Nakayama et al., 2024; Paul et al., 2023; Reshma et al., 2023). Nevertheless, there remains a significant gap in studies that investigate the combined role of participatory commitment and archival competence as primary factors in enhancing institutional performance accountability. Most prior studies emphasize technical aspects, often neglecting the active involvement of all stakeholders, including leaders, administrative staff, and archivists. This underscores a clear need to explore how collective commitment and professional competence can jointly improve the quality and effectiveness of archival management.

This study seeks to address the existing research gap by developing an Integrated Participatory Commitment model that integrates two critical components: shared commitment among stakeholders and archival competency. This approach is distinctive because it emphasizes cross stakeholder collaboration in archival management within higher education, an area that has not been extensively explored. Furthermore, the study's focus extends beyond technical aspects of archive managementto enhancing the capabilities of archivists and administrative staff, enabling them to perform their duties more efficiently and accountably. Such improvements are anticipated to strengthen the overall institutional performance.

The study, aims to identify the key factors that influence the successful implementation of the Integrated Participatory Commitment model and archival competency in higher education institutions. The findings are expected to make a meaningful contribution to the development of archival policies within universities and offer strategic recommendations to optimize archival management practices. Accordingly, the main objective of this research is to analyze how the Integrated Participatory Commitment model and archival competency affect the accountability of archival performance in higher education. Ultimately, this study provides a deeper understanding of the importance of active stakeholder involvement and enhanced archival competence in achieving an effective and accountable archival management system.

2. Method

This study employs a quantitative approach aimed at analyzing the influence of Integrated Participatory Commitment and Archival Competence on Performance Accountability in archival management within higher education institutions. The research design is a quantitative survey, in which data is collected through a structured questionnaire developed based on relevant theoretical frameworks. Given that the study seeks to test relationships between variables, the quantitative approach is appropriate for generating objective, statistically measurable results.

The population of this study comprises archivists and administrative staff at several universities in Indonesiawho are directly involved in managing archives. A purposive sampling technique was employed to select participants based on specific criteria, namely individuals who actively participate in archival management. The final sample included 248 respondents, considered sufficient to provide a representative overview of the impact of participatory commitment and archival competence on performance accountability in higher education.

The data collected through the questionnaire were analyzed using multiple regression analysis with SmartPLS. This technique was employed to examine the effect of the independent variables Integrated Participatory Commitment and Archival Competence—on the dependent variable Performance Accountability Prior to conducting the regression analysis , assumption tests including normality, heteroscedasticity, and multicollinearity were performed to ensure that the regression model met the required statistical criteria. This analysis aims to determine whether the independent variables have a significant effect on Performance Accountability, either partially or simultaneously, within higher education archival management.

The hypotheses proposed in this study are: (1) Integrated Participatory Commitment has a positive and significant effect on Performance Accountability, and (2) Archival Competence has a positive and significant effect on Performance Accountability. The findings of this study are expected to offer a deeper understanding of the critical roles of participatory commitment and competency in archival management, as well as provide strategic recommendations for universities to optimize their archival systems and enhance institutional performance accountability.

3. Results

This study demonstrates that the Integrated Participatory Commitment Model effectively enhances performance accountability in managing archives within higher education institutions. The analysis shows that active involvement of all stakeholders, from leadership to operational staff, significantly influences the efficiency and effectiveness of archival management. Such participation not only raises awareness of the importance of accountable archiving but also motivates stakeholders to adhere more consistently to established procedures. This is reflected in improved compliance with institutional archival regulations and policies.

	Akuntabilitas Kiner	Komitmen Partisip	Kompetensi
AK_1	0.919		
AK_2	0.932		
AK_3	0.938		
AK_4	0.830		
AK_5	0.945		
AK_6	0.925		
K1			0.883
K2			0.870
K3			0.938
K4			0.910
K5			0.941
K6			0.865
K7			0.767
K8			0.791
KP_1		0.820	
KP_2		0.882	
KP_3		0.726	
KP_4		0.750	
KP_5		0.917	
KP_6		0.930	

Table 1: Convergent Validity

Convergent validity assesses whether multiple measurements intended to capture the same concept produce highly correlated results. As shown in Table 1, all statement items have a loading factor greater than 0.70. A loading

factor above 0.70 indicates that the items are convergently valid. In the context of this study on the Integrated Participatory Commitment Model, convergent validity suggests that the questionnaire items or other measurement instruments consistently capture the same dimensions of participatory commitment, archival management, or performance accountability. This indicates that the constructs measured accurately represent the intended theoretical concepts, and there is no substantial discrepancy among items that should be related.

The subsequent stage involves testing validity using the Average Variance Extracted (AVE. The results obtained are summarized in Table 2.

Table 2. Average Variance Extracted (AVE)

Variable	Average Variance Extracted (AVE)
Participatory Commitment	0.708
Competence	0.762
Performance Accountability	0.838

Table 2. Average Variance Extracted (AVE)

Based on the results presented in the previous table, all variables exhibit an Average Variance Extracted (AVE) value greater than 0.5, indicating that Participatory Commitment, Competence, and Performance Accountability are valid. Since the item validity test demonstrates that all items are valid, the overall variable validity test further confirms that all variables meet the required criteria with AVE values exceeding 0.5. Therefore, all variables are suitable for hypothesis testing using inferential statistical methods.

Hypothesis testing was conducted using inferential statistics, including the assessment of discriminant validity via Cross-Loading. The Cross-Loading value reflects the correlation between each construct and its associated indicators, as well as the correlation with indicators from other constructs. A measurement model is considered to have good discriminant validity if the correlation between a construct and its indicators is higher than the correlation between the construct and indicators from other constructs.

Table 3: Discriminant Validity Cross Loading

	Performance Accountability	Participatory Commitment	Competence
AK_1	0,919	0,841	0,913
AK_2	0,932	0,767	0,801
AK_3	0,938	0,840	0,838
AK_4	0,830	0,720	0,749
AK_5	0,945	0,815	0,832
AK_6	0,925	0,755	0,856
K1	0,861	0,740	0,883
K2	0,747	0,768	0,870
K3	0,864	0,852	0,938
K4	0,818	0,809	0,910
K5	0,879	0,830	0,941
K6	0,839	0,702	0,865
K7	0,651	0,807	0,767
K8	0,649	0,831	0,791
KP_1	0,613	0,820	0,753
KP_2	0,724	0,882	0,743
KP_3	0,582	0,726	0,624
KP_4	0,493	0,750	0,548
KP_5	0,904	0,917	0,877

KP_6	0,902	0,930	0,914

The results obtained are presented in Table 3: Discriminant Validity Cross Loading. The Cross-Loading analysis shows that the correlation coefficients between each construct and its own indicators are greater than the correlations with indicators from other constructs. This confirms that all constructs or latent variables possess high discriminant validity, as indicated by the dominance of each construct's indicator block over other indicator blocks.

In this study, the reliability of the constructs was assessed using Composite Reliability and Cronbach's Alpha. The results of these calculations are presented in Table 4.

Table 4: Composite Reliability dan Cronbach's Alpha

Variable	Cronbach's Alpha	Composite Reliability
Participatory Commitment	0.917	0,935
Competence	0.955	0,962
Performance Accountability	0.961	0,969

The Composite Reliability results indicate that all constructs have values greater than 0.7, confirming that each construct is reliable. Similarly, the Cronbach's Alpha values for all constructs exceed 0.7, further demonstrating the reliability of the measurement instruments.

Bootstrapping analysis conducted using SmartPLS produced coefficient values for each hypothesized relationship. The highest values were observed in the path from Participatory Commitment to Performance Accountability, with a coefficient of 0.229, and from Competence to Performance Accountability, with a coefficient of 0.704. The complete results of the path: coefficients, including Mean, Standard Deviation (STDEV), T-Statistics, and P-Values, are summarized in Table 5.

Table 5: Mean, STDEV, T-Statistics, dan P-Values

Table 5: Mean, STDEV, T-Statistics, dan P-Values

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Participatory Commitment -> Performance Accountability	0,229	0,240	0,083	2,757	**0,006**
Competence -> Performance Accountability	0,704	0,696	0,082	8,614	**0,000**

The coefficient of determination (R-squared) was calculated to assess the extent to which the independentvariables influence the dependent variable. The results are presented in Table 6.

Table 6: Coefficient of Determination (R)

	R Square	R Square Adjusted
Performance Accountability	0,839	0,838

As shown in Table 6, the R-squared value is 0.839. This indicates that 83.9% of the variation in Performance Accountability can be explained by the independent variables, namely Participatory Commitment and Archival Competence. The remaining 16.1% is influenced by other factors not included in this study.

3.2 Structural Model Test (Hypothesis)

The Inner Model Test (Structural Model) is used to evaluate the research hypotheses, including path coefficients, parameter coefficients, and t-statistics. Hypothesis acceptance or rejection is determined by assessing the significance of the relationships between constructs, using t-statistics and p-values. In this study, statistics greater than 1.65, a p-value of 0.05 (5%), and a positive beta coefficient were used as the criteria for significance. Table 7 presents the results of hypothesis testing, while Figure 2 illustrates the research model.

Based on the table above, here is a discussion of the hypotheses tested:

a. The first hypothesis examines the direct effect of Participatory Commitment on Performance Accountability. The results show a path coefficient of 0.229, a t-statistic of 2.757 (>1.65), and a p-value of 0.006 (<0.05). Therefore, Ho1 rejected, and Ha1 is accepted, indicating a significant direct effect of participatory commitment on performance accountability.
b. The second hypothesis tests the direct effect of Archivist Competence on Performance Accountability. The results show a path coefficient of 0.708, a t-statistic of 8.614 (>1.65), and a p-value of 0.000 (<0.05). Therefore, Ho2 is rejected, and Ha2 is accepted indicating a significant direct effect of archivist competence on performance accountability.

4. Discussion

The competence of archivists or record managers has a positive and significant effect on performance accountability. High competence in archiving is reflected in extensive knowledge of archiving, a solid understanding of archival science, practical archiving skills executed efficiently, strong work values such as discipline and diligence, and a responsive attitude toward archival tasks. These qualities significantly enhance archival performance accountability. The impact on accountability is manifested in precise decision-making during archival tasks, timely and accurate completion of archival activities, meticulous archival information management, clarity of objectives in archival work, feasibility and consistency in completing tasks, and effective monitoring aligned with archival performance targets. In this study, the influence of competence on accountability is measured at 77.3%.

This finding aligns with Damalita (2009), who emphasizes that universities should establish archival management units, recruit competent archival personnel, promptly inventory high-value records, institutional historical archives, scientific works, and research archives, and implement leadership policies that support archival activities. Similarly, Bukhori & Laksmi (2019) found that the overall competence of archivists encompassing knowledge, skills, and attitudes accounts for 56.4% of performance at ANRI.

Moreover, Faturohmah & Mayesti (2021) argue that the archivist profession is still not widely recognized in Indonesian society, creating a need for ongoing development of archivists' competencies and acquisition of new skills to keep pace with advancements in knowledge, information, and communication technology. Handayani & Sari (2018) further state that fulfilling human resource needs in archiving requires careful planning and selection of individuals who are genuinely competent in their field, rather than relying on personnel considered as a last resort.

Integrated participatory commitment has a significant effect on the accountability of archival performance. This indicates that the stronger an archivist or record manager's integrated participatory commitment, the greater the impact on their archival performance accountability. Integrated participatory commitment consists of affective commitment (actively engaging in work and feeling a sense of belonging to the institution or unit), normative commitment (a sense of moral obligation and responsibility to advance the institution), continuance commitment (reluctance to leave the institution and experiencing a sense of loss if departing), and participatory commitment (actively contributing to work and assisting in completing tasks).

Indicators of integrated participatory commitment show that archivists and record managers generally fall into the "excellent" category. This is evident in their work attitudes and performance: they are highly active in carrying

out duties, demonstrate strong organizational identification, fulfill their responsibilities diligently, feel a sense of loss at the prospect of leaving the institution, and complete archival tasks thoroughly and efficiently.

The influence of integrated participatory commitment on archival performance accountability manifests in multiple ways: precise decision-making in archival tasks, timely and accurate completion of work, detailed and systematic management of archival information, clear objectives in performing archival duties, feasibility and consistency in task execution, and effective monitoring of results aligned with archival performance targets. In this study, the effect of integrated participatory commitment on archival performance accountability is measured at 78.5%.

Aboramadan and Dahleez (2020) state that transformational and transactional leadership positively influence affective commitment and organizational citizenship behavior, with work engagement serving as a significant positive mediator in these relationships. In the context of archiving in higher education institutions. Commitment functions as an intervening variable that affects performance accountability. In this study, the form of commitment examined is integrated participatory commitment, which goes beyond mere individual commitment. This aligns with Adams (2011, who emphasizes that participation alone is insufficient; staff involvement must be supported and reinforced by institutional structures and leadership to be truly effective.

The implementation of the Integrated Participatory Commitment Model in higher education archival institutions has demonstrated significant improvements inperformance accountability. The model highlights the importance of active participation from all stakeholders, including management and administrative staff, at every stage of the archival process. Such inclusive participation not only strengthens individual engagement in maintaining the archival system but also fosters a sense of ownership and responsibility for the system as a whole (Desai et al., 2024; Roeschley, 2023). This is evident in heightened awareness of orderly and accountable archiving practices, as well as increased compliance with institutional archival procedures.

Further analysis indicates that integrating information technology within this model is critical for modernizing archival processes. Digital tools enable more efficient, accurate, and traceable managementof archives. For instance, digital archival systems allow faster and more secure data access compared to traditional methods (Cushing, 2018; DeLyser, 2014). Moreover, these technological systems enhance transparency in archival reporting, facilitating both internal and external audits while improving data security to protect archives from potential loss or damage.

Furthermore, the implementation of standardized archiving procedures is sa critical component of the Integrated Participatory Commitment Model. Standardized procedures provide clear and uniform guidelines for all parties involved, thereby minimizing errors and inconsistencies in archive management. When standards are consistently applied, archival institutions can ensure that each stage of the archival process aligns with established rules, which ultimately enhances the reliability of archives as accurate and dependable sources of information. Standardization also facilitates auditing and evaluation, which are essential elements of institutional performance accountability (Chrysanthopoulos et al., 2023; Li et al., 2018).

The model incorporates ongoing evaluation as a control mechanism, ensuring that archival processes continue to meet predetermined goals and standards. Periodic evaluations allow institutions to identify and resolve problems or weaknesses in the archival system before they scalate (Bressey, 2014). Continuous feedback from these evaluations enables necessary adjustments that improve the quality, efficiency, and effectiveness of archival work. Moreover, evaluations ensure that the archiving system remains relevant and adaptive to evolving needs and technological advancements.

The Integrated Participatory Commitment Model also positively influences organizational culture within archival institutions. Greater participation in archival activities fosters a collaborative culture among stakeholders (Matusiak, 2022; Opgenhaffen, 2022). This culture is characterized by open communication, enhanced cooperation, and shared responsibility in maintaining archival quality. Such a collaborative environment not only

improves operational efficiency but also nurtures a more positive and productive workplace, where individuals feel valued and recognized for their contributions to archival operations.

The implementation of the Integrated Participatory Commitment Model in higher education archival institutions has successfully enhanced performance accountabilityin archival management. By integrating stakeholder participation, information technology, standardized procedures, and continuous evaluation, this model fosters a more efficient, secure, and accountable archival system (Khandelwal et al., 2022). The findings of this study contribute significantly to the development of archival systems in universities and can serve as a reference for other institutions seeking to improve performance accountability through optimized archiving practices.

This model also underscores the importance of capacity and skills development among stakeholders. The study found that improved performance accountability was influenced by training and development programs designed to enhance understanding of archival management and the effective use of emerging technologies (Cameron, 2014). Through continuous professional development, archival staff and other stakeholders gain greater competence and confidence in executing their responsibilities. This enhanced competence is crucial for maintaining high-quality standards in archive management and ensuring that processes are executed smoothly, efficiently, and effectively.

Moreover, the Integrated Participatory Commitment Model has the potential to be adapted beyond the university context. Government agencies, non-profit organizations, and private companies can adopt this approach to strengthen their archival performance. The model's flexibility allows it to be tailored to the specific needs and contexts of different organizations, making it a versatile framework for enhancing archival accountability (Abdul Aziz et al., 2024). Therefore, this model not only benefits higher education institutions but also offers broader advantages for various organizations that prioritize transparency, efficiency, and accountability in their archival practices.

5. Conclusion

The Integrated Participatory Commitment Model in organizing archives within higher education archival institutions emphasizes collaboration among all institutional elements, including lecturers, administrative staff, and students, to ensure proper management and maintenance of archives. This commitment is demonstrated through the active participation of each work unitc in the processes of recording, storing, and distributing documents in an orderly and structured manner. The model fosters shared awareness that archives are not merely collections of documents but serve as crucial sources of information that support institutional accountability. Consequently, its implementation provides a strong foundation for transparent and accountable administrative governance.

Moreover, the model incorporates digital archival technology to facilitate efficient document management and access. Digital systems accelerate administrative processes, reduce the risk of loss or damage to archives, and enable effective monitoring and evaluation of institutional performance. In higher education, participatory digital archival systems enhance efficiency across academic and non-academic operations, including student data management, lecture administration, and scientific research and publications. This integration ensures that all institutional stakeholders actively contribute to maintaining high-quality archives.

Through the application of integrated participatory commitment, university archival institutions can significantly strengthen performance accountability. The involvement of all institutional elements in archival processes enhances transparency and reinforces internal and external trust in institutional management. Additionally, the model encourages continuous improvement through regular evaluation and enhancement of staff competencies in archive management. Ultimately, this approach is essential for universities to establish a sustainable archival system that supports the achievement of their strategic goals.

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Evaluating Sustainable Urban Tourism in Corfu Island, Greece: An Indicator-Based Approach Using the DPSIR Framework Greece

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Abstract
In Greece the mass tourism has rapidly expanded since the 1970s, significantly affecting cities and island destinations, with Overtourism emerging as a critical challenge. This paper examines the urban areas of Corfu Island, Greece, a location heavily influenced by seasonal tourism. It applies sustainable tourism indicators to evaluate tourism's sociocultural, economic, and environmental impacts. Using the DPSIR (Drivers, Pressures, State, Impact, and Response) model and a set of 38 indicators, the study highlights the intensity of tourism development in Corfu compared to national averages. Results show that Corfu exhibits exceptionally high tourist arrivals per capita, accommodation capacity, and overnight stays per area, indicating significant saturation during peak seasons. Economically, the island benefits from longer average stays and higher tourist expenditure, though it faces challenges related to seasonality in employment and hotel occupancy. Environmental data point to elevated energy and water consumption levels, raising sustainability concerns, especially amid climate change and aging infrastructure. Despite these pressures, the study finds that Corfu does not yet fully exhibit Overtourism across the island, although local hotspots—such as cruise ship ports and historic urban centers—are at risk. The analysis underscores the importance of continuous monitoring through tailored indicators and the urgent need for sustainable tourism planning to mitigate long-term impacts and ensure a balanced coexistence between residents and tourism activities.

Keywords: Corfu, Greece, Sustainable Tourism, Tourism Indicators, Overtourism

1. Introduction

The rapid and massive tourism development following World War II has resulted in negative impacts on the environment, society, and economy in many tourist destinations. Since the 1970s, the relationship between tourism development and environmental protection has been a research focus. In search of alternatives to mass tourism, the term "Soft Tourism" was introduced in German-speaking countries in 1980. By the late 1980s and into the 1990s, discussions about "Sustainable Tourism" began to replace the concept of Soft Tourism (Baumgartner, 2008). The UN World Commission on Environment and Development adopted the idea of

sustainability in the Brundtland Report in 1987, defining "sustainable development" as development that meets present needs without compromising the ability of future generations to meet their own needs (UN WCED, 1987). Butler (1999) noted that “the greatest research need is to develop measures of sustainability and apply these to existing and new forms of tourism development to help determine what affects sustainability and how it can be achieved.” Monitoring tourism development through sustainable tourism indicators is a useful tool in this context. The World Tourism Organization has developed a list of sustainability indicators to measure tourism development effects, but their implementation at the city level remains limited. In cities, many studies focus on the impact of tourist flows on monuments and cultural sites, examining sustainability issues. Urban tourism, the fastest-growing form of tourism, is characterized by travel to places with high population density, shorter stays, and a substantial number of business and MICE (Meetings, Incentives, Conferencing, and Exhibitions) visitors (Earth Changers, 2021). Cities like Venice and Dubrovnik illustrate Overtourism phenomena, which negatively affect residents and visitors and burdens city infrastructure and the environment. The concept of sustainable urban tourism is relatively new (Razali & Ismail, 2014). Prior to the introduction of the World Tourism Organization’s indicators for sustainable development, urban tourism largely overlooked sustainability issues. Most research on sustainable tourism has focused on rural or community-based tourism (Barke & Newton, 1995). In Greece, many regions are popular tourist destinations, with many small islands attracting significant tourist flows. Corfu, one of these islands, will be examined in this paper to assess the impact of tourism on sociocultural, economic, and environmental levels by calculating sustainable tourism indicators tailored to its characteristics.

2. Methods

The objective of sustainable tourism development is to implement all areas of sustainable development (ecology, economy, social and cultural issues) in tourism. Tourism policies that focus solely on environmental aspects cannot be considered fully sustainable. According to Müller (1994), sustainability in tourism can be depicted as a pentagon pyramid, where the top represents future generations' rights, while the base includes functioning environment, resource protection, intact culture, subjective well-being of locals and employees, guest satisfaction, and economic well-being. The study of tourism's impact on these sectors has led to the creation of indicators and indexes applied in various geographical areas. For instance, the Sustainable Tourism Index by the Economist Intelligence Unit assesses countries' commitments to sustainable tourism practices (The Economist Intelligence Unit Limited, 2017) and explores growth, environmental sustainability, socio-cultural sustainability, economic sustainability, and policy and regulatory environments.

Indicators are essential tools for measuring, analyzing, and comparing data on tourist destinations and evaluating sustainability issues. The World Tourism Organization published a guide in 1995 that has influenced recent indicators, updated in 2004 as a guidebook on indicators of sustainable development for tourism destinations (WTO, 2004). The optimal number of indicators for assessing tourism sustainability is unclear; however, the World Tourism Organization guide suggests 12 to 24 indicators (WTO, 2004). These indicators must be relevant, feasible, credible, clear, and comparable (Cernat & Gourdon, 2012).

In 2013, the European Commission launched ETIS, a management tool for monitoring and measuring sustainable tourism performance using a common approach based on 27 core indicators and 40 optional indicators across four categories: destination management, social and cultural impacts, economic value, and environmental impact (EC, 2016). The DPSIR model (Drivers, Pressures, State, Impact, and Response) from the European Environment Agency is based on the concept of causality, linking human activities to environmental pressures and changes in quality and quantity of natural resources. Society responds through appropriate policies to alleviate these pressures.

Various sets of indicators have been developed in tourism research. Indicators of sustainable tourism development can include public participation, water and energy consumption, waste management, accessibility, investments, ecotourism promotion, economic vitality, employment, security, satisfaction, and traffic (Torres-Delgado & Palomeque, 2014). Conflicts between tourist flows and cultural heritage necessitate understanding these dynamics and identifying their impacts (Garcia-Hernandez et al., 2017; ICOMOS, 2011). Methodologies

such as Heritage Impact Assessment (HIA) have been developed to minimize adverse impacts on cultural sites (Seyedashrafi et al., 2017). Lozano-Oyola et al (2012) presented indicators for evaluating sustainable tourism in cultural destinations across social, economic, and environmental fields.

Tanguay et al. (2012) explored 16 case studies, highlighting common indicators such as water and energy consumption, tourist volume, accommodation occupancy rates, tourist satisfaction levels, and local employment in tourism. Implementing sustainable tourism practices is challenging, requiring adaptability to various tourism types, seasons, and destination characteristics. A common set of indicators is necessary for comparability between tourist areas, such as water consumption in tourism regions, which can account for significant national water use (Gössling et al., 2012; Essex et al., 2004).

3. Results

3.1 Geography, Characteristics, and Tourism in Corfu Island

Corfu (Kerkyra in Greek) is Greece's westernmost island, situated in the Ionian Sea, near the mainland, covering an area of 585,3 km². The island belongs to the Region of Ionian Islands, which includes large islands, such as Kefalonia 786,6 km², Zakynthos 405,6 km², Lefkada 325 km² and Ithaca 96,3 km² but also some smaller islands. The area of the coast of Corfu is 217 km, forming many coves and capes. Its territory is predominantly mountainous, especially in the north, with the highest peaks being Pantokratoras (914 m) and Stravoskiadis (849 m). Corfu comprises three municipalities: North Corfu (with Acharavi as the capital and 17.187 inhabitants), Central Corfu (with Corfu Town as the capital and 68.608 inhabitants), and South Corfu (with Lefkimi as the capital and 15.681 inhabitants). The total population is approximately 100.259, excluding 1.217 inhabitants on smaller islands nearby. Corfu is one of Greece's most densely populated islands, with 173 inhabitants per km² (the national average is 81).

3.2 The History

Settlers from Eretria founded Corfu's first documented colony around 775-750 BC. Then followed the Roman Period, the Byzantine period and the Venetian period that lasted four centuries (1385 -1796). After the defeat of the Venetians and with the "Treaty of Campoformium", the Ionian Islands came under the sovereignty of the French. In 1815, the Treaty of Paris was signed, and the Ionian Islands were recognized as free under English protection. With the Treaty signed by the Great Powers in 1863 in London, the English protection in the Ionians was over and in May 1864, Corfu was finally united with Greece Corfu-kerkyra.eu. History of Corfu Island.

3.3 Main Attractions

Some notable attractions include the Achilleion museum, the palace of Princess Sissy (Empress Elizabeth of Austria), who built it between 1889 and 1891 to honor the Greek hero of the Iliad Achilles and became her favored holiday retreat. After her death, the palace was bought in 1907 by Kaiser of Germany Wilhelm II. The Palace of St. Michael and St. George, also called the Royal Palace, is located on the opposite side of Spianada to the Liston. It was built from 1814-1824 during the first days of British occupation. The old town, which we can see today, dates back to the 13th century and is the largest "living" medieval monument in Greece.

The church of Saint Spyridonas, the Old Castle that was originally constructed during the Byzantine era on an artificial island and later, in the 16th century, was rebuilt by the Venetians. The New Castle was built on the coast in the late 16th century in order to protect the city from possible Turkish invasion. Today, only part of the fortress is accessible to visitors. The Rue Liston is a miniature copy of the Rue de Rivoli in Paris. The lower floors of the houses here represent a continuous open arcade in the background of which there are cafes and expensive shops and many smaller cultural and historical attractions offering a wide variety of choices to the visitors (Garrison, n.d.). The primary attraction for tourists in Corfu is in any case the sea, the beaches, and the sun. Based on reports on TripAdvisor, the most famous beaches are those of Palaiokastritsa, Canal D' Amour,

Sidari beach, Sant George Beach, and others. It should be noted that nine beaches of Corfu have been awarded with a blue flag.

3.4 Tourism Infrastructure and Facilities

The island of Corfu is classified as the mature tourist area of Greece, and offers significant hotel infrastructure and attracts substantial tourist demand from abroad. 413 hotels are established on the island, offering a total capacity of 50.333 beds. About 58,4% of the capacity is classified in the category of 4 and 5 stars, about 19,7% in the middle class of 3-star category and 22% in the lower class of 2 and 1-star categories (Hellenic Chamber of Hotels, 2025). The growth of tourism in the post-covid period was rapid, showing an increase in bed capacity of 39,8% in just 5 years (2019-24).

Table 1: Hotels in Corfu by category in 2019 and 2024

Corfu	**5 stars**	**4 stars**	**3 stars**	**2 stars**	**1 star**	**In total**
Hotels (2019)	25	56	102	177	51	411
Hotels (2024)	38	62	108	157	48	413
Rooms (2019)	5.459	6.460	6.107	5.800	1.037	24.863
Rooms (2024)	7.593	6.948	5.091	4.861	1.004	25.497
Beds (2019)	11.181	12.513	11.852	10.954	2.001	48.501
Beds (2024)	15.639	13.763	9.906	9.142	1.909	50.333
% of beds 2019	*23,1%*	*25,8%*	*24,4%*	*22,6%*	*4,1%*	*100,0%*
% of beds 2024	*31,1%*	*27,3%*	*19,7%*	*18,2%*	*3,8%*	*100,0%*

In addition to hotels there are many supplementary accommodations, such as Airbnb, rooms for rent (classified in four key categories, furnished apartments and Villas. In 2019, the capacity of the rooms for rent was 21.636 beds, while 793 tourist furnished houses and villas were in operation, offering a capacity of 6.106 beds (INSETE, 2021a). In recent years, Airbnb-type accommodations have been growing rapidly, which in Corfu, according to AirDNA data, amounted to 12.200 listings. The total accommodation capacity in 2019 amounted to 76.243, including all accommodation facilities in Corfu and in 2024 are estimated to 90.275.

Table 2: Supplementary accommodations in Corfu by category in 2019

Corfu	**4 keys**	**3 keys**	**2 keys**	**1 key**	**In total**
Establishments	71	276	636	642	1.625
Rooms	494	1.476	3.363	2.900	8.233
Bed capacity	1.333	4.058	8.709	7.536	21.636
% Of beds	*6,2%*	*18,8%*	*40,3%*	*34,8%*	*100,0%*

The main means for the arrival of foreign tourists in Corfu, is the airport of Corfu located 3km from the city center. Since December 2015, Corfu Airport has been managed by Fraport Greece. In 2019, the works for the renovations and modernization of the existing facilities were completed.

The new port of Corfu is built west of the old one and serves passenger ships and cruise ships, as well as cargo ships that moor on the island, while the old port is used by sailboats and yachts. In addition, Corfu has two organized marinas in Gouvia (1.068 berths) and Corfu (98 berths), as well as 5 anchorages of tourist boats. Since 1973 it has been a golf court that occupies an area of 668 acres and is 18 holes (Par 72) and the visitors can watch also cricket matches.

3.5 Tourist Demand

The international airport is the main gate for the international visitors every year, especially the summer period. The international air arrivals at Corfu airport in 2024 amounted to 1.971 million passengers. It is notable that

only in the last ten years (2014-2024) the international arrivals to the island have increased by 83,5% and the domestic flights by 72,09%.

Table 3: Arrivals and Visitors in Corfu in the period 2014 - 2024

Arrivals	**2014**	**2019**	**2024**
By international flights	1.074.289	1.457.420	1.971.766
By domestic flights	115.701	166.553	200.108
Port domestic	812.718	885.249	881.054
Port international	69.371	175.928	295.872
Cruises ships	395	420	507
Cruises passengers	672.368	767.673	815.667
Museum's visitors	49.835	66.836	148.161
Archeological site visitors	208.971	206.772	357.158
Overnight stays in hotel	4.198.092	6.691.790	8.051.000(*)
Hotel Occupancy	54.1%	61.0%	70,7% (*)

(*) estimations based on Bank of Greece (2025b)

Sources: Bank of Greece; Hellenic Statistical Authority; INSETE; Corfu Port Authority; Fraport Greece

The main international passengers arrive from Britain (37,1%), Germany (17,4%), Poland (6,7%), Italy (9,3%) and France (5,4%). About 21,3% of the arrivals are recorded in July, 22,1% in August, 16,7% in June, 17,1% in September, 9,6% in Mai and 9,2% in October (Fraport – Greece, 2025). The main tourist season extends these 6 months, when 96% of air arrivals take place and highlighting the seasonal nature of tourism on the island. The same tourist seasonality is observed in the arrivals of domestic flights. The domestic arrivals by air, in 2024 were 200.108 of which 97.322 (48,6%) are tourists, excluding arrivals outside the peak tourist season (Fraport – Greece, 2024).

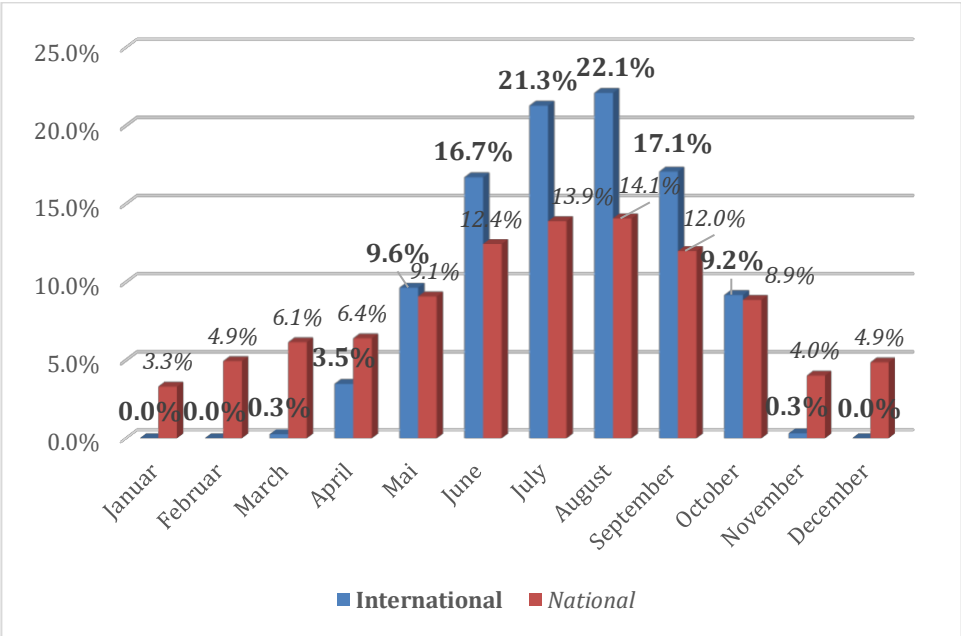

Figure 1: Arrivals at the Airport of Corfu in 2024 by month

Source: Fraport Traffic Report by Country Jan-Dec 2024

Except the airport, other gateways to the islands are the ports with ships and ferry connections to mainland Greece, Albania and Italy. The domestic passenger ferry arrivals on the island in 2024 amounted 881.054. Of the

881.054 arrivals, based on the monthly distribution of arrivals, it is estimated that at least 45% are related to tourist arrivals, i.e. 396.474.
Significant growth is observed in the post-covid era in ferry arrivals from Albania, while arrivals from Italy are stable. In 2024 arrivals by ferry lines were 257.716 and arrivals from Italy were 38.156, increasing the total number of international arrivals to Corfu ports from abroad to 295.872. In addition, 815.667 passengers arrived by cruise ships. It is worth noting that the port of Corfu was a homeporting for 54 cruise ships and 196.057 passengers.

Based on these data the arrivals by air and sea (without counting the out of season passengers) in Corfu in 2024 amounted to 3.577 million travelers.

The tourist season in Corfu (as in the whole of Greece) starts at the Catholic Easter (in mid-April) and ends at the end of October with a tendency to expand in early November. Figure 1 shows the monthly distribution of arrivals, and that the tourist season lasts approx. 190 days. This duration of the tourist season will also be used for the calculation of tourism indicators in the next chapter. According to a study by the Research Institute for Tourism (2024) of the Hellenic Chamber of Hotels, the average duration of operation of seasonal hotels in Greece is 5,7 months, while in 4-star hotels the average duration of operation is 6,0 months and in 5-star hotels it is 6,3 months.

In 2019, the year before COVID, about 6691790 Hotel overnight stays were recorded in Corfu, while the total number of overnight stays in Hotels in Greece was 109.206.980. The total overnight stays (in all kinds of accommodation) in Greece are estimated at 232.464 million (INSETE, 2022) and in the Region of the Ionian Islands at 23.744 million, of which 12.346 million (i.e. 52%) in Corfu (Hellenic Chamber of Hotels, 2019; INSETE, 2021a). In 2024, the Bank of Greece (2025b) estimates the number of overnight stays in Greece at 231.037.634 and in the Region of the Ionian Islands at 24.680.800. Corfu is the most touristically developed island with the most transport connections abroad and it is estimated that at least 12.834 million overnight stays are made in 2024.

The Ionian Islands of Kerkyra, Kefallonia, Lefkada and Zakynthos seem to be in the middle of their evolution and located at the development (C-Consolidation) phase according to the TALC (Tourism Area Life Cycle) model by Butler (Butler, 2006). Kerkyra is more saturated in terms of overnight stays in comparison to the arriving tourists, thus indicating a preference for long-term vacation (Amoiradis, 2021). According to the results of survey the interregional distribution of the growth coefficient for the number of the stayings per tourist's capita $r(t)$, but also the growth coefficient for the total number of overnight stayings $r_s(t)$ indicates, that Corfu and generally the Region of Ionian Islands belongs to the most touristically developed areas in Greece. In addition, they add that the Ionian Islands are more capable of receiving larger number of tourists, implying a direction where the tourism development should invest to (Polyzos et all, 2013).

4. Discussion

4.1 Sustainable Urban Indicators for Corfu Island

4,1,1 Methodology
As presented above, there are many methodological approaches and a very large number of indicators to demonstrate the impact of tourism in a tourism destination at ecological or socioeconomic level. In the case of Corfu, the applied methodology was based on the DPSIR model (Drivers, Pressures, State, Impact and Response model of intervention) of the European Environment Agency and considered some indicators at sustainability level for tourism in cultural destinations by Lozano-Oyola et al (2012), which are on the Table 4 marked with (*).
Making the required modifications the following table has been drawn up of 38 indicators, 13 of which concern the Sociocultural dimension, 13 the Economic dimension and 12 the Environmental dimension.

Table 4: Sustainable tourism indicators using DPSIR model for the island of Corfu

	1.Sociocultural Dimension (13)	**2. Economic Dimension (13)**	**3. Environmental Dimension (12)**
A. Cause of Pressure (8)	A1.1 Tourist population A1.2 The origin of tourists A.1.3 Means of transportations	A2.1 Seasonality A2.2 Travel organization	A3.1 Energy consumption A3.2 Water Consumption A3.3 Volume of waste
B. Pressure Indicators (4)	B1.1 Image of the region (Brand name)	B2.1 Accommodation capacity B2.2 Overnights	B3.1 Potential human pressure on natural and urban spaces
C. State Indicators (10)	C1.1 Resident population C1.2 Tourism attractions (Museums, Archeological sites etc.). C1.3. Tourism Festivals and Events	C2.1 Transport access C2.2 Basic infrastructure and services C2.3 Tourist businesses C2.4 Local Properties	C3.1 Distribution of land uses C3.2 Distribution of Urban spaces use *C3.3 Intensity of use (*)*
D. Impact Indicators (8)	D1.1 Degree of satisfaction of tourist D1.2 Degree of satisfaction of residents *D1.3 Sociocultural influence on local population (*)* *D1.4 Social carrying capacity of the site (*)*	D2.1 Tourist expenditure D2.2 Employment in tourism D2.3 Prices of tourist services	D3.1 Tourist anthropisation factor (The transformation of the environment for tourism)
E. Response Indicators (8)	E1.1 Accessibility to tourist services *E1.2 Cultural heritage conservation (*)*	E2.1 Public investment in tourism *E2.2 - Cultural investments (*)*	E3.1 Waste management E3.2 Environmentally certified enterprises and premises E3.3 Integration of environmental criteria into tourism planning E3.4 Participation of local stakeholders in tourism planning

4.1.2 Sustainable Tourism indexes for Corfu Island

Sustainable tourism indicators are a very useful measurement tool, especially for comparison purposes. Comparisons can be timeless for a tourist destination, so they show over time the increase or decrease in tourism indicators and consequently the pressure that the region is under. The indicators can also make comparisons between different tourist destinations. A key parameter in the indicators is the size of the local population, but also the size of the area of the tourist destination. Consequently, if the population or the area is too small, the calculated indicators will be too large. So, it is sensible to make measurements for larger regions. For this reason, one of the largest islands of Greece, Corfu, with a population of 100 thousand inhabitants and an area of 585 km2, was selected for this study. Also, comparisons between tourist areas should be similar in terms of surface size or population. For example, an island of 1000 inhabitants cannot be compared with an island of 100 thousand inhabitants, because the indicators will not be comparable.

Based on the above indicators and the available data for Corfu are calculated some significant Tourism indexes showing the Growth and pressure caused by tourism. For comparison purposes, the corresponding data for the Tourism in Greece were also calculated. The resulting Tourism indexes demonstrate the size of the tourism development on the island of Corfu.

Table 5: Resulted Tourism indexes for Corfu Island compared to the average indexes in Greece.

Socio-cultural Tourism Indexes	**Corfu**	**Greece**
The Average duration of stay (in days)	7.2	5.9
The Tourist Arrivals Index (Arrivals / Population),	35.7	3.8
Defert Index (Beds / Population in %),	90.0%	17.8%
The Tourist intensity Index (Total overnight stays / Population)	123.5	21.6
The Tourism Saturation Index (Total overnight stays/Season in days/Population in %). Shows the overnight stays of tourists (per day) in relation to the population	65.0%	11.4%
The Tourism Arrival Saturation Index (Tourist arrivals /Season in days / Population in %) shows the Daily arrivals to the population	18.8%	2.0%
The Tourist Penetration Index (Overnight stays / Area in Km2)	21168	1750
The Accommodation Penetration Index (Available bed capacity / Area in Km2)	154.3	14.4
Museum's visitors / population in %	147.8%	62,3%
Archaeological sites visitors / population in %	356%	131%
General Satisfaction Index of hotel guests (GRI) – 2023 (Region)*	84.3%	86.6%
Economic tourism Indexes	**Corfu**	**Greece**
Seasonal Hotel Occupancy rate, (Overnight stays /Available capacity X operating days) X100)	72.2%	63.8%
Annual Hotel Occupancy rate, (Overnight stays / Available capacity) X100	37.8%	33.2%
The average per capita expenditure (excluding cruises)	577,8	523,2
Average expenditure per overnight stay (in €)	80,4	89,7
The Employment Index (Employees in tourism / Total employment (in the region)	28.1%	9.4%
The average nights spent per Employee (in the Region)	1159	576
The Seasonality of operation and employment in days	approx. 190	150-220
Environmental Indexes	**Corfu**	**Greece**
Energy consumption in hotels / m2*a	333.2 kWh/(m2*a)	273 kWh/(m2*a
Water Consumption for tourist	4.69 hm3	88.34 hm3
Water Consumption per overnight stay or per bed	0.38m3	0.38m3

5. Conclusion

A limitation of the present research was the difficulty of finding or even the lack of focused data on local level in certain fields, especially on the environmental dimension. It should also be considered that the Island of Corfu is one of the largest islands in Greece, but also one of the most densely populated. This fact affects the dimensions of the indexes which are related to the population, but also to the area of the island. However, based on the indexes presented in Table 5, the Tourism in Corfu is developed on a large scale, since most of the indicators are multiples of the Average of Greece and confirm the results of Polyzos (2013) that Corfu is one of the most touristically developed areas in Greece.

Concerning the Socio-economic indicators, the Arrivals / Population index in Corfu is 37,5, while the average in Greece is 3,8, indicating that tourist arrivals exceed the island's population by a factor of 37,5. The total number of overnights stays in relation to the Population in Corfu is 123,5 which means that for every resident there are 123,5 nights, while the corresponding index for the average of Greece is 21,6. Based on the Tourism Saturation Index, the number of tourists overnight stays during the tourist season accounts for 65% of the population. The overnight stays in Corfu per Km2 are about 21.168 and the average in Greece is 1.750, this means that every square kilometer of the island corresponds to more than 21 thousand overnight stays. The average duration of

stay is 7,2 days and longer than the average stay in Greece (5,9). This is to be expected, due to the fact Corfu is mainly a holiday destination.
The visitor rates of museums and archaeological sites are also higher than the average in Greece. The only Index in Corfu that is below the average of Greece is the General Satisfaction Index of hotel guests (GRI by ReviewPro, INSETE, 2020).

In terms of Economic indicators, the average expenditure per tourist in 2024 in Greece was 523€, while in the Region of the Ionian Islands it was higher at 577,8€, due to the longer average duration of stay. On the contrary, the Average expenditure per overnight stay was 80,4€ and lower than the Greek average of 89,7€. The occupancy rate of hotels during the summer season is 72,2%, also higher than the Greek average (Research Institute for Tourism, 2025).

According to the labor force surveys of the Hellenic Statistical Authority (2024 and 2025) in the Hospitality sector, (Hotels, Accommodation, Food and Beverage) an average of 400.975 employees worked in 2024, representing 9,4% of the Greek workforce, with a variation from 8,3% to 10,4% depending on the quarter of the year. In the Ionian Islands region, the number of employees in the Hospitality sector in 2024 was 21294 and represented 28,1% of the workforce. In fact, according to a Research Tourism Institute survey (2023), there is a shortage of staff in hotels by 21,5% in the Ionian Region. However, seasonality in employment, as well as in the operation of hotels, is a weakness of tourism on the island, which is recorded in the occupancy index of hotels.
Each employee in the region of the Ionian Islands corresponds to 1.159 overnight stays. This index is double the Greek average of 576.

Regarding the Environmental Indicators, the main problem lies in water consumption, which in relation to climate change may become more pronounced in the coming years. According to statements of the 2 mayors of Corfu, the problem of water sufficiency is intense because during the summer season the demand increases, while another important problem is the leaks due to the old water pipes (Pagkrati M. ERT News, 2021). Related studies regarding the water consumption in hotels in Greece showed a wide range of results between 0.240 m3 per guest night and 0.517m3 (Menegaki, Agiomirgianakis, 2018). Taking the average (0.380 m3), the water consumption in Corfu from tourism is estimated at 4,69 million m3.

For most hotels in Europe energy use falls in the range 200-400 kWh/m2/yr. (Hotel Energy Solutions, 2011). In Greece the energy use in the hotels is (approximately) 273 kWh/m2/yr (Santamouris et al, 1996), while in climate zone B, where Corfu belongs, studies have shown consumption of 333,18 kWh/m2/yr. (Kokkinis, 2011), that's 22% above average.

Finally, it should be noted that Corfu is a large island where tourism is concentrated locally and in places where many visitors are crowded, such as the arrival of cruise visitors in the center of Corfu Town. Therefore, we will agree "Overtourism impacts are not city-wide" (Koens Ko, 2018), as well that Overtourism are not island-wide, but becomes more intense in places of tourist interest. In general, we cannot claim that Corfu today presents phenomena of Overtourism, but if the great growth rates of tourism continue, it is very likely that this will be the case in the near future.

Concluding indicators can be a very useful tool to support the destinations stakeholders to take focused action in tourism planning for a sustainable tourism development, but the existence of reliable data is a basic requirement for the reliability of the indicators. On the other site, the availability of data is also a basic requirement for the Configuration of the indicators.

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Transformative Capabilities: Does it play a Role in the Nexus Between Late Movers' Strategies and Performance of Microfinance Banks in Kenya?

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Abstract
Microfinance banks have been critical players in enhancing financial deepening hence fostering socioeconomic development. Despite anchoring socioeconomic transformation and fostering societal wellbeing of households in Kenya, financial performance and sustainability of microfinance have been a concern to players in the industry. The study investigated the mediating effect of transformative capabilities in the nexus between late-mover strategies and the performance of Microfinance Banks. The anchoring theory was dynamic capability theory supported by the balanced scorecard model and theory of change. Positivism research philosophy was employed while integrating descriptive and explanatory research designs. The study population was 13 microfinance banks within Nairobi City County with a target population of 389-unit managers. The sample size was 197-unit managers. To select the sample size, both simple random sampling and stratified sampling were employed. Primary data was employed collected using semi-structured questionnaire. In ascertaining the reliability of the questionnaire, Cronbach's Alpha coefficient was adopted where a value of 0.7 and over indicated the tool is consistent. Validity was ascertained by using content, construct and face validity. Baron and Kenny techniques were employed to investigate mediating role of transformative capabilities on the association between late mover strategies and performance of microfinance banks. It was found out that transformative capabilities mediate the relationship between late movers' strategies and the performance of microfinance banks. The study recommends that mangers in charge of training should regularly organize in-service training, workshops, and seminars in collaboration with industry experts and regulatory bodies to strengthen employee competencies that are key in fostering performance.

Keywords: Late Mover Strategies, Performance of Microfinance Banks and Transformative Capabilities

1. Introduction

Success of any business is largely determined by organizational performance, which entails its ability to attain core objectives that include financial and non-financial goals through prudent use of resources in income

generating activities (Fatihudin, 2018). In essence, organizational performance can be considered as efficiency and effectiveness of attaining in meeting client desires which not only gives it a clear orientation, but also a sense of optimizing financial growth (Agarwal & Sinha, 2010). Performance in the context of an organization can either be client or the firm's perspective (Elena-Iuliana & Maria, 2016). The client perspective focuses on the return rates of customers based on the principal invested by the firm (Taouab & Issor, 2019). On the other hand, organizational performance from a firm's perspective entails financial indicators representing the financial health state of a firm (Ouma & Kilika, 2018). Nonetheless, the definition of organizational performance lacks universality in terms of dimensions, indicators, and measures; as such, use differs from scholars, thereby, firm performance is premised on multidimensional factors.

Notably, firm performance may be driven by technological leapfrogging strategy, pricing strategy, benchmarking strategy, and competitive diffusion strategy (Geroski, 2005 Neuvonen, 2019; Yayboke, 2020; Lankford, 2022). However, Ciplet *et al.* (2018) and Schroeder (2019) noted that late-mover strategies are not entirely sufficient ingredients to spur organization performance but transformative capabilities like unique skills, core competencies, knowledge creation and development and technical skills play important roles in aligning the firm's late mover strategies (Larson, 2021). In addition, the impact of late mover strategies on firm performance tends to differ across organizations operating in different business segments.

Markides and Geroski (2005) considers late mover strategy as strategies taken by late entrants in the process of pursuing new business ideas, concepts and innovations. In yet another stance, Besharat *et al.* (2016) observe that mover strategy as a situation within an organization during which innovation and imitation occur in the process of immense competition. However, Koch (2014) views late-mover strategy as the returns an entrant firm enjoys because there is no first mover's strategy. On his part, Klepper and Sleeper (2005) view it as a process by which firms take advantage of the positive externalities of first-movers and their innovations. Considering the lack of consensus among scholars on whether late movers reap the benefits associated with a new business concept or not, this study sought to uncover this research gap by interrogating an organization's internal factors particularly its transformative capabilities.

The transformative capabilities of an organization and its goals are important factors (Le & Le, 2021; Boateng & Li, 2022). The differentiation of the organization's capabilities includes a dedicated focus on the organization's true sense of existence and core principles while doing the same by continuously evolving and changing the way this is achieved in response to the seemingly dynamic business environment (Boso et al., 2018). Despite the significance of transformative capabilities in the operational performance of organizations, empirical research has not determined how transformative capabilities mediate the linkage between late mover strategy and the performance of MFBs.

The transformative capabilities provide a guide for acquiring specific abilities, and leadership that can be effectively utilized to support a successful transformation in an organization. The fluidity of this idea should be highlighted showing that the evolving transformative capability allows the organization to compete in an ongoing stiff business environment. Nevertheless, the connection of transformative potential to the organizations' performance is still an object of disagreement among scholars. Shroeder (2019) claims that organizational transformative capability has a direct implication on organizational performance. However, Widodo (2015) points out that the effects of transforming capabilities on organization's performance differ across firms. This assertion is supported by the view that the capabilities enhancing transformational capacity can influence organizational performance. The mediating effect transformational capability has been discussed in literature for instance Le and Le (2021) mentioned an intervening role of transformative capability in the association between transformational capabilities and organization performance. Similarly, Boateng and Li (2022) demonstrated the mediating role of transformative capability in the nexus between technological advancement and organization performance.

The declining performance of some Microfinance Banks (MFBs) in Kenya has drawn the attention of investors, MFB management, regulators and policymakers. A significant of MFBs are experiencing low financial growth, as reflected by negative Return on Equity (ROE) and Return on Assets (ROA) (CBK, 2022). The negative ROA has been attributed to a challenging business environment, marked by intense competition from other financial service

providers, particularly commercial banks (Maluki, 2021). Additionally, the instability in MFBs' financial health is linked to their failure to implement business strategies and innovations that align with the evolving needs of the financial market. Ouma and Kilika, (2018) observed that MFBs have generally not been proactive in pursuing innovation strategies, often adopting a passive, wait and see approach toward a new business concept and technological advancements. According to Ouma, Kinyua, and Muchemi (2022), MFB performance is closely tied to innovation, which is crucial for sustained success, business creativity, and competitiveness in the financial sector. According to Ouma, Kinyua, and Muchemi (2022), MFB performance is closely tied to innovation, which is crucial for sustained success, business creativity, and competitiveness in the financial sector.

2. Statement of the Problem

Microfinance Banks (MFBs) in Kenya play a vital role in advancing financial inclusion and supporting socio-economic development. Despite their importance, many MFBs have experienced fluctuating financial performance, marked by losses and stagnating customer deposits. For example, MFBs posted a loss of 2.2 billion in 2020, up from Kes. 0.71 billion in 2019 (CBK, 2020). Although customer deposits have shown intermittent growth, sustainability remains a concern due to deteriorating financial health, stiff competition from commercial banks and SACCOs, and an inability to keep pace with market dynamics. The sector also, faces lack of strategic direction, especially in innovation adoption, with most MFBs taking a reactive wait and see approach rather than proactively embracing new business models (Ouma & Kilika, 2018). Despite supportive policy framework like Kenya's Vision 2030 and AU agenda 2063 promoting financial inclusion, MFBs continue to struggle with maintaining competiveness and achieving long term viability.

There is also inconclusive debate among scholars and industry practitioners on whether late movers reap the benefits of an innovation or business idea indicating the existence of an empirical gap. A study by Lee, and Zhou (2012) targeted how late mover strategies affect performance and it was established that late mover performance remains inconclusive. Investigation by Jiang, *et al.* (2017) examined first movers' strategies and firm performance and found out that late movers have been stifled in the market as a result first mover early entry into market hence diversification was considered as the only viable remedy. Considering the lack of consensus among scholars on whether early movers or late movers reap the benefits associated with a new business concept, it is postulated that either early movers or late movers can strive to be competitive. However, this was dependent on how the organizations integrate other internal. Of particular concern is the internal factor is the organizational transformative capabilities that are related to the organization's kind of leadership and aspirations (Le & Le, 2021; Boateng & Li, 2022). However, this is yet to be determined via empirical literature in the context of MFBs.

Investigation by Mutie (2018) found out a positive correlation system development and performance in government projects but presented a contextual gap since government structures have different regulation with MFBs. Ombati and Muturi (2018) research adopted descriptive design and this is not the most appropriate hence occasioned methodological gap. Investigation by Ouma and Kilika (2018) revealed that most MFBs are late movers but failed to outline how late movers' strategies in Kenya resulting conceptual gap. Further, Ouma, muchemi and Kinyua (2022) innovation aspect of late movers influenced performance but failed to highlight other three aspects considered critical by literature and this resulted in conceptual gap. Based on the mentioned gaps, the study sought to establish the significance of late mover strategies in enhancing financial performance of MFBs in Kenya with transformative capabilities as mediator variable.

3. Literature Review

3.1 Dynamic Capability Theory

Teece et al. (1997) introduced the Dynamic Capability Theory as an advancement of the Resource-Based View (RBV) developed by Barney (1991). While the RBV emphasizes the identification and deployment of valuable, rare, inimitable and non-substitutable resources, it has been criticized for overlooking the necessity of reconfiguring these resources in response to environmental changes. The Dynamic Capability Theory addresses this gap by emphasizing the need for organization to continuously reconfigure, integrate and redeploy resources

to align with evolving business environment and strategic objectives (Teece, 2014). This theory highlights the that sustainable competitive advantage arises not just from possessing strategic resources, but also from firm's ability to adapt and utilize these resources effectively in dynamic context (Helfat, 2009; Wang et al., 2015). Through dynamic capabilities, firms are better positioned to respond to uncertainty, innovate, and enhance overall performance.

Despite its strengths, the Dynamic Capability Theory faces criticism for conceptual overlap and definitional inconsistencies when distinguishing dynamic capabilities from other forms of organizational capabilities (Salvato, 2003; Zahra et al., 2006; Schreyogg & Kliesch-Eberl, 2007). Zahra and George (2002) argue that while dynamic capabilities focus on aligning strategies with customer and competitor demand, they may not fully represent a firm's strength in resource endowment. Nonetheless, the theory remains valuable for this study at it provides a framework for understanding how organization can leverage internal human capabilities such as skills, expertise and strategic leadership alongside financial and technological resources to meet core objectives. By aligning these resources with business strategies, firms can improve adaptability, competitiveness and financial performance in turbulent market environment.

3.2 Balance Score Card Model

The Balanced Scorecard (BSC) model, introduced by Kaplan and Norton in 1992, transforms an organization's strategy, vision, and mission into specific performance objectives, measures, targets, and initiatives, thereby demystifying the process of continuous performance and improvement. The theory is structured around four models that include financial customer, internal processes, and learning and growth underpinned by a cause-and-effect logic. The strength of the BSC lies in its flexibility and broad applicability across diverse organizational contexts, allowing managers to coordinate resources effectively for market growth and overall prosperity (Butt, 2021). In Today's dynamic business environment, traditional financial metrics alone are insufficient due to the increasing complexity and volume of financial data (Akbarzadeh, 2012). Organizations need to assess both financial and non-financial factors to gain a comprehensive understanding of their performance in relation to strategic goals (Wieczorek, 2008). As such, the BSC serves not only as a tool for measuring performance but also as strategic management framework that guides thinking, decision-making, and implementation (Szczupak & Stajniak, 2022). The balanced scorecard predicts the accuracy of the strategy of the organization through various performance indicators based on four prepositions that comprise customers, finance, employee learning and growth, and internal processes. For MFBs in Kenya, the BSC is particularly relevant as it helps align financial, customer, innovation, and internal process strategies with organizational objectives. It serves as a roadmap for enhancing performance by linking strategy to operations and guiding implementation. As a result, MFBs can benchmark their progress against market players like commercial banks and SACCOs, driving competiveness and improve financial performance.

3.3 Theory of Change

The theory of change was developed by Weiss (1995). The theory of change was created by evaluating planning methods like logic frameworks and is often used in intervention planning. Compared to other methods, the theory of change is seen to be more effective in the causal modeling of interventions (Rogers, 2014). This theory is focused on understanding the critical conditions or requirements to be met to achieve a certain long-term endeavor (Mayne, 2023). As indicated by Kail and Lumley (2012), the theory of change documents the process and requirements needed by an organization to make a certain intervention occur. The theory is useful in outlining how an organization can make a change (Riesman *et al*., 2004). In addition, it outlines evidence-based interventions and key assumptions to be considered in the pursuit of change.

Thus, the theory of change ought to carry the vision of all the organization participants. This was important for the unified implementation of the idea or concept in the organization. Through the theory of change, the participants can pinpoint key necessary changes that should drive the vision of the organization. After the deployment of the theory of change, the organization can pursue its core endeavors of achieving the organization's goals. Thus, the theory of change is relevant in this study in the deployment of late-mover strategies to various changes in how

organizations operate. They define the approach that MFBs should take to implement new technologies and processes aimed at enhancing their performance.

3.4 Empirical Literature Review

According to Schroeder (2019), transformative capability has a direct impact on firm performance. A similar assertion is made by Widodo (2015) who establishes a direct impact of transformative capability on firm performance. However, some scholars establish that transformative capability has a mediating effect on organizational performance. According to Homaid (2016), transformative capability mediated the linkage between total quality management and the performance of microfinance banks. In another instance, Le and Le (2021) argue transformative capability mediates the association between transformational leadership and firm performance while Boateng and Li (2022) indicate that transformative capability mediates the nexus between technology innovation deployment and firm performance.

Based on the scholars, there lacks an agreement among studies pertaining the effect of transformative capability on organizational performance. Other scholars provide a direct impact of transformative capability on organizational performance (Widodo, 2015; Schroeder, 2019) while others indirectly with transformative capability having a mediating effect on organizational performance (Qamari, *et al.,* 2020). Le and Le (2021) indicated that transformative capability mediates the link between transformational leadership and the organizational performance of manufacturing Vietnamese firms. In another study, Rono *et al*. (2020) indicate that transformative capability mediates the linkage between dynamic capabilities and the competitive advantage of manufacturing firms. However, Para-González, *et al.* (2018) established that transformative capability does not mediate the nexus between strategic innovation and organizational performance of Spanish industrial firms. This phenomenon may be attributed to operational contextual differences where firms operate.

Para-González *et al.* (2018) explored the mediating role of transformational capabilities and firm performance. This study focused on 200 manufacturing firms in Spain. Partial Least Squares were employed in testing the relationship. It was noted that transformational capabilities mediate the link between innovation and firm performance. This study sought to determine if transformational capabilities mediate the link between late mover strategy and performance of microfinance banks in Kenya.

Focusing on agricultural organizations in West Azerbaijan Province, Iran, Rezaei and Amin Fanak, (2019) determined the mediating effect of transformative capabilities on the nexus between entrepreneurial orientation and performance of organizations. Semi structured questionnaire was used to collect. Structural equation modelling (SEM) was adopted to test hypotheses. It was noted transformational capabilities mediate the nexus between entrepreneurial orientation and performance of the agricultural organizations. However, it is clear that in the microfinance sector, no amount of meditation has been witnessed regarding transformational capabilities.
Al-Husban, *et al*. (2021) determined the digital leadership and organization performance under the mediating role of transformational capabilities. A total of 130 industrial firms in Jordan formed the target population. Structural Equation Modelling (SEM) was used in analyzing data. The research found that transformational capabilities mediate the nexus between digital leadership and performance of industrial firms.

Homaid (2016) applied cross-sectional surveys to determine the mediating effect of transformative capabilities between market orientation, total quality management, and performance of microfinance in Yemen. Dynamic Capability Theory, Complementarity Theory and Resource-Based View guided the study. Data were collected by use of a questionnaire. Supporting the theoretical base of the study, transformative capabilities meditate the relationship between total quality management, market orientation, and microfinance performances.

Rehman *et al*. (2019) explored the mediating effect of transformative capabilities on the relationship between control system design and firm performance in Pakistan. Textile companies participated in the research whereby a questionnaire was employed in collecting data. Smart Partial Least Square (PLS) was employed in testing the relationship among the research variables. It was established that transformative capabilities moderate the

influence of management control system design (culture, trust, data, technology, and organization effectiveness) and organization performance.

Boateng and Cai (2022) investigated the mediating effect of transformative capabilities on the nexus between technology innovation and firm performance of manufacturing firms in Ghana. Data was gathered from 325 managers across a diverse number of manufacturing companies. Using Hayes process module in SPSS version 25 was employed to establish the direct and indirect relationships between the study variables. Transformative capabilities were found to have a partial mediation in the relationship between financial resource and firm performance, as well as top management support and performance.

Noor, *et al*. (2021) investigated the mediating effect of transformative capabilities in the nexus between knowledge management, competitive intelligence and business strategy formulation. Data was collected from 331 managers of Multimedia Super Corridor enterprise. It was established that transformative capabilities mediate the relationship between knowledge management, competitive intelligence and business strategy formulation. This current study explored the effect of transformational capabilities as mediating factor on the nexus between late mover strategy and performance of the MFBs in Kenya.

Markides and Geroski (2005) considers mover strategy as strategies taken by late entrants in the process of pursuing new business ideas, concepts and innovations. In yet another stance, Besharat *et al.* (2016) observe that mover strategy as a situation within an organization during which innovation and imitation occur in the process of immense competition. However, Koch (2014) views late-mover strategy as the returns an entrant firm enjoys because there is no first mover's strategy. On his part, Klepper and Sleeper (2005) view it as a process by which firms take advantage of the positive externalities of first-movers and their innovations. Considering the lack of consensus among scholars on whether late movers reap the benefits associated with a new business concept or not, this study sought to uncover this research gap by interrogating an organization's internal factors particularly its transformative capabilities.

The transformative abilities of an organization, of its institutional leadership, and the goals of that institution are important factors (Le & Le, 2021; Boateng & Li, 2022). The differentiation of the organization's capabilities includes a dedicated focus on the organization's true sense of existence and core principles while doing the same by continuously evolving and changing the way this is achieved in response to the seemingly dynamic business environment (Boso et al., 2018). Despite the significance of transformative capabilities and regulatory environment in the operational performance of organizations, empirical research has not determined how transformative capabilities mediate the linkage between late mover strategy and the performance of MFBs.

3.5 Conceptual Framework

In Figure 1, late mover strategies as the predictor variables and organization performance as the dependent variable. Transformative capabilities are operationalized as an intervening variable.

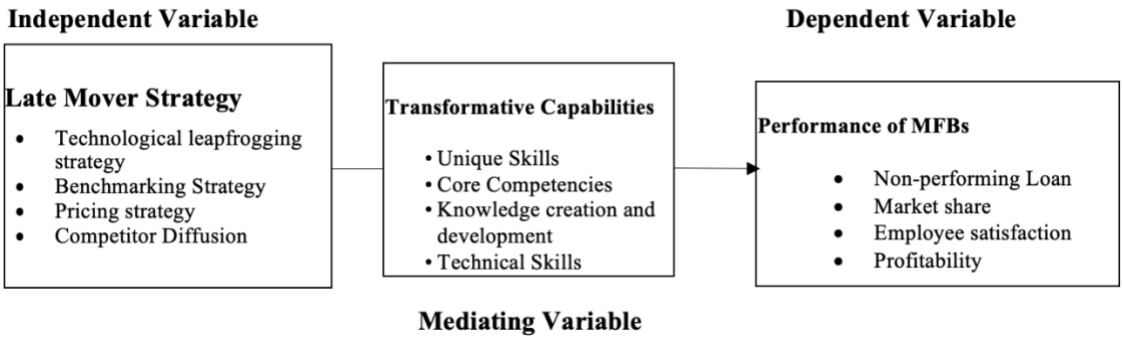

Figure 1: Conceptual Framework

3.5 Research Hypothesis

Ho: Transformative capabilities have no significant mediating effect on the relationship between late movers' strategies and the performance of Microfinance Banks in Nairobi City County.
H1: Transformative capabilities have significant mediating effect on the relationship between late movers' strategies and the performance of Microfinance Banks in Nairobi City County.

4. Research Methodology

The positivism research philosophy supports the use of quantitative data to model the existence and nature of relationships between variables in a study (Rehman & Alharthi, 2016). It aligns with structured methodological approaches, such as explanatory research design, systematic sampling procedures, and use of standardized instruments. Positivism is grounded in a deductive approach, emphasizing empirical investigation, hypothesis testing, and scientific rigor (Corry et al., 2019). This philosophy was appropriate for the current study, which was anchored on a theoretical framework and aimed to test a series of hypotheses to answer research objectives. Positivism facilitated the identification of cause-and-effect relationships among study variables and supported drawing empirical inferences from the collected data. Specifically, it was well-suited to establish how late mover strategies influence the performance of Microfinance Banks (MFBs) in Nairobi City County, Kenya, using a quantitative approach.

The explanatory research design was adopted to address the research questions of "how" and "why" certain relationships exist between variables (Baskerville & Pries-Heje, 2010; Blatter & Haverland, 2012). This design enabled the study to describe findings while simultaneously explaining the relationships, including the direction and strength of associations among variables. It was particularly suitable for examining the impact of late mover strategies on the performance of MFBs, under the mediating role of transformative capabilities and moderating effect of the regulatory environment.

The target population consisted of all thirteen (13) MFBs licensed and regulated by the Central Bank of Kenya (CBK) and located in Nairobi City County. These MFBs served as the units of analysis, while the units of observation were the departmental heads or unit managers in key functional areas: Information Technology, Finance, Human Resource Development, Research and Development, Legal, Strategy and Innovation, Marketing, Operations, and Sales. Each unit is overseen by a manager reporting directly to the Chief Executive Officer of the MFB.

To determine the sample size, a stratified random sampling technique was employed, allowing for equal representation across different departments. This approach was combined with simple random sampling within each stratum to ensure unbiased selection. The Yamane formula (Yamane, 1967), which assumes a normal distribution, was used to calculate the sample size at a 95% confidence level and 5% margin of error (0.05). The formula used is:

The Yamane formula is suitable for a homogenous population sharing similar characteristics. As such, for parametric tests like multiple linear regression to be adopted, using the Yamane formula to calculate the sample size is justified. According to Chaokromthong and Sintao (2021), the Yamane formula is suitable for a homogenous population. In this study, the level of precision of 0.05 at a 95% confidence interval was employed. From the target population of 389 respondents, the sample size was calculated as;

$$n = \frac{389}{1 + 389(0.05)^2} = 197$$

In consequence, the sampling proportion adopted in the calculation of samples across the sampling frame is provided as;

$$k = \frac{n}{N} = \frac{197}{389} = 0.506$$

Thus, the sampling proportion was adopted to compute the number of participants to be included from each of the microfinance banks categorized as large, medium, and small MFBs.

Table 1: Sample Size Distribution

Category of MFB	Stratum Size	Number of Participants	Sampling proportion	Sample Size	% proportion to the sample population
Large	4	183	0.506	93	47
Medium	7	172	0.506	87	44.25
Small	2	34	0.506	17	8.74
Total	13	389		197	100

The study employed a stratified random sampling technique to select unit managers and their assistants from 13 regulated MFBs, with proportionate stratified sampling ensuring equitable representation across different functional units and bank sizes. A sampling proportion of 0.506 was applied, resulting in a sample of 93 respondents from large-sized, 87 from medium sized, and 17 from small-sized MFBs, totaling 197 respondents. These participants were drawn from departments such as Information Technology, Finance, Human Resource Development, Research and Development, Legal, Strategy and Innovation, Marketing, Sales, and Operations, units are critical in implementing late-mover strategies, transformative capabilities, and regulatory practices. Data collection utilized a drop and pick later method using semi-structured questionnaires, allowing respondents ample time to complete them. Participation was voluntary, and follow-ups were conducted to boost response rate. After collection, the data underwent cleaning and entry for analysis.

To enhance quality of the data collection instrument, pilot testing was conducted on 19 respondents (10% of the sample), who were excluded from the main study. This pilot phase helped assess content validity, which was verified through expert reviews and supervisor feedback, consistent with Kothari (2004). Reliability of the questionnaire was evaluated using Cronbach's alpha (α), a statistical measure of internal consistency. An alpha value of 0**.7** and above was accepted as reliable, following Cronbach (1951) and Field (2013), though values above 0.6 were also considered acceptable based on Taherdoost (2016). The tool's high reliability ensured consistency and credibility in measuring responses across different MFB functional units.

Table 2: Reliability Test

Variables	**Items**	**Cronbach Alpha**	**Remark**
Technological leapfrogging strategy	12	.707	Reliable
Benchmarking strategy	12	.865	Reliable
Pricing strategy	13	.679	Reliable
Competitive diffusion strategy	9	.843	Reliable
Regulatory framework	11	.705	Reliable
Transformative capabilities	10	.865	Reliable
Performance of Microfinance Banks	5	.719	Reliable

The study's instrument demonstrated a strong reliability, with most Cronbach's alpha values exceeding 0.7, indicating high internal consistency and making the results acceptable as supported by Cronbach (1951), Field, (2013), and Taherdoost (2016). The researcher properly introduced the study's purpose to respondents, emphasized the voluntary nature of participation, and ensured anonymity, privacy and confidentiality of the data. All the sources were duly acknowledged, and the collected information was solely for academic purposes, without any intent to promote or discredit participating organizations.

In checking the meditating effect of transformative capabilities on the linkage between late-mover strategies and the performance of regulated microfinance banks, the four-step technique advanced by Baron and Kenny (1986) was employed. The technique by Baron and Kenny is most suitable for predicting the linear or nonlinear effect of

the mediator in comparison to the product-coefficient technique advanced by Fiedler and Sivo (2015). The following steps were followed while testing for mediating effect.

Step 1: Simple linear regression where the explanatory variable predicts the outcome variable.
$Y = \beta_0 + \beta_1 X + \varepsilon$……1
Step 2: Simple linear regression with explanatory variable predicting the mediator variable
$M = \beta_0 + \beta_1 X + \varepsilon$……2
Step 3: Simple linear regression where the mediator variable predicting the outcome variable
$Y = \beta_0 + \beta_2 M + \varepsilon$……3
Step 4: Multiple linear regression where the explanatory variable and mediator variable predict the outcome variable
$Y = \beta_0 + \beta_1 X + \beta_2 M + \varepsilon$……4

Where:
Y depicts the performance of regulated microfinance banks in Kenya
β_0 denotes the constant value of the model
β_1 and β_2 are the beta coefficients of the explanatory (composite of late mover strategy) and mediator variables respectively.
X is the composite value denoting the late mover strategy
M is the mediator variable, transformative capabilities in the context of this study.
The error term is depicted by ε

Testing the mediating effect of a variable encompasses establishing if the explanatory variable (X) significantly influences the outcome variable (Y), in this study the performance of regulated MFBs in the presence of the mediator variable (transformative capabilities). The purpose of steps 1-3 when checking the link between the study's constructs is to ascertain if the conditions are met, proceeding to the fourth step. The influence of the late mover strategies on the performance of MFBs in the presence of transformative capabilities as the mediator was evaluated if the effect is partial or full mediation in stage four. The assertion was made as guided by the postulations of Baron and Kenny (1986) and Wood *et al.* (2008) when testing the mediating effect of a variable. Thus, transformative capabilities were employed to test its mediating role on the linkage between late mover strategies and the performance of MFBs and whether there exists a partial, full, or no mediating effect.

5. Descriptive Results

5.1 Response Rate

The questionnaires were administered to a total of 197 MFB unit managers and assistants in the 7 of MFBs. Amongst the 197 selected participants, the study managed to collect 164 questionnaires for analysis. The responses and non-response rates were 83.25% and 16.75% respectively. The proportion of response rate exceed 50% that is viewed acceptable by Sileyew (2019). The return rate was thus sufficient to make inference about this survey population. As indicated by Fincham (2008), a response rate of 60 per cent and above is sufficient while according to Sataloff and Vontela (2021), response rate of 70 per cent and above is very good.

5.2 Descriptive Statistics for Transformative Capabilities

Transformative capabilities were operationalized as activities that depict the ability to use and reconfigure human and financial resources for the benefit of the organization. Table 3 tabulates the means, standard deviations and CVs for transformative capabilities.

Table 3: Descriptive Statistics for Transformative Capabilities

Transformative Capabilities	N	Mean	Std. Dev	CV

The microfinance bank has employed a pool of personnel with unique skills that meet the operational needs of the MFB	164	1.75	0.59	0.34
The expertise of the microfinance bank personnel has facilitated the creation of innovative products and services	164	2.13	0.47	0.22
The work experience of the workers in the microfinance bank has enabled the driving of the institution's innovation activities	164	3.54	1.31	0.37
The core competencies of the personnel are aligned with the day-to-day operations of the microfinance bank	164	1.40	0.48	0.35
The competencies possessed by the microfinance bank work personnel have helped the institution to remain competitive over time	164	1.51	0.26	0.17
The creation of necessary competencies in this microfinance bank is informed by the needs of the market	164	1.66	0.33	0.20
There are periodic in-service trainings conducted by the microfinance management to enhance the pool of knowledge and skills	164	3.75	1.28	0.34
The periodic workshops and seminars organized by microfinance in conjunction with industry experts have enabled the institution to drive its innovative products and services	164	2.03	1.00	0.49
Knowledge created is shared across similar departments and functional units in the institution	164	4.01	1.31	0.33
The technological concepts being pursued by the institution have facilitated the creation of new innovative products and services	164	3.72	1.34	0.36
Our microfinance bank has shown commitment to embracing the latest technology	164	2.01	0.78	0.39
The MFB staff are capable of converting information and concepts into novel products, procedures, and systems.	164	1.76	0.42	0.24
Aggregate Scores	**164**	**2.44**	**0.80**	**0.32**

Calculating Overall Variability= CV*100%

The descriptive statistics on transformation capacity indicate that the mean scores ranged from 3.82 to 4.16, suggesting that respondents generally agreed with the presence and importance of transformation capacity practices in the institutions studied. These values hover around 4.00 on the rating scale, showing consistent agreement across different aspects of transformation capacity. The corresponding standard deviations ranged from 0.55 to 1.04, reflecting low dispersion and confirming that responses were closely aligned with their respective means. This suggests that the respondents perceived transformation capacity as essential and actively embedded in organizational practices.

Furthermore, the overall mean score was 4.01, with a standard deviation of 0.79, reinforcing the consistency in the responses across the measured items. The coefficient of variation ranged between 14% (for presence of information meetings) and 27% (for use of IT systems in knowledge dissemination), further demonstrating limited variability among responses. These results indicate that transformation capacity is widely practiced and deemed vital for organizational success, and that the sample mean is a reliable estimator of the broader population's view.

5.3 Descriptive Statistics for the Performance of Microfinance Banks

The performance of microfinance banks was operationalized as outcomes that include non-performing Loans, market share, employee satisfaction, and profitability. The means, standard deviations and CVs for the performance of microfinance banks are tabulated in Table 4.

Table 4: Descriptive Statistics for Performance of Microfinance Banks

Performance of MFBs	N	Mean	Std. Dev	CV
Workers in this microfinance are satisfied with the way the institution is operated	164	2.63	0.47	0.18
The employees in this organization are satisfied with the sales growth being recorded in the institution	164	2.63	0.51	0.19
Employees in this organization are satisfied with the working conditions of this organization	164	2.68	0.7	0.26
Employees of this organization are satisfied with how the organization is managed	164	2.63	0.49	0.19
Employees of this microfinance are satisfied with how they are compensated	164	2.57	0.7	0.27
Firm's Market Share Growth 2019	164	1.51	0.32	0.21
Firm's Market Share Growth 2020	164	1.49	0.29	0.19
Firm's Market Share Growth 2021	164	1.50	0.3	0.20
Firm's Market Share Growth 2022	164	1.50	0.4	0.27
Firm's net profit margin growth 2019	164	2.07	0.6	0.29
Firm's Net Profit Margin Growth 2020	164	2.14	0.45	0.21
Firm's Net Profit Margin Growth 2021	164	2.07	0.37	0.18
Firm's Net Profit Margin Growth 2022	164	2.12	0.34	0.16
Firm's Nonperforming Loan 2019	164	2.59	0.56	0.22
Firm's Nonperforming Loan 2020	164	2.65	0.42	0.16
Firm's Nonperforming Loan 2021	164	2.63	0.48	0.18
Firm's Nonperforming Loan 2022	164	2.63	0.51	0.19
Aggregate Scores		**2.24**	**0.47**	**0.21**

Calculating Overall Variability= CV*100%

The results in Table 4 show that the **sample mean responses** for various aspects of microfinance bank performance ranged narrowly between 1.49 for market share growth in 2020 and 2.68 for employee satisfaction with working conditions. This narrow spread indicates general agreement among participants that while internal satisfaction among employees was moderate, external performance indicators such as market share and profit margins were relatively low. The low scores for market share and net profit growth (means approximating 2.00) suggest that these performance outcomes were less prominent among the observed microfinance banks.

The standard deviations for all performance indicators were low, ranging from 0.29 to 0.70, with the highest coefficient of variation being 29 percent, indicating that the responses were consistently clustered around their respective means. The overall sample mean for microfinance bank performance was 2.24, with a corresponding standard deviation of 0.47, and an aggregate variability of 21 percent. This confirms that the observed sample mean is a reliable estimator of the overall population performance, reflecting relatively low but consistent performance levels across the microfinance institutions studied.

6. Inferential Statistics

In this study linear regression was used as an approach for modelling the relationship between the set of research variables chosen. The research hypotheses drawn from the independent and dependent variables were modelled on the basis of simple linear regression analysis. As a result, exploitation capacity was regressed on organizational performance. The output of this regression analysis is displayed in Table 5

$$Harmonic\ Mean = \sum_{i=1}^{n} W_i \div \sum_{i=1}^{n} (W_i \div X_i) \dots\dots\dots\dots\dots\dots\dots\dots 5$$

Where:
Xi is the ith dimension of late movers' strategies
wi is the weight associated with ith dimension of late movers' strategies

Using the composite index, the causal step technique advanced by Baron and Kenny (1986) was employed to perform mediation tests whereby four regression test were step by step estimated, whereby the significance level of each of the variable in the model was examined at each level.

Step 1: Regressing late movers' strategies and performance of MFBs

Table 5: Regression of Late Movers' Strategies and Performance of Microfinance Banks

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.585[a]	.342	.338	.46899

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.513	1	18.513	84.169	.000[b]
	Residual	35.633	162	.220		
	Total	54.146	163			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.718	.222		7.744	.000
	Late movers' strategies	.552	.060	.585	9.174	.000

a. Dependent Variable: Performance of MFBs

b. Predictors: (Constant), Late Movers' Strategies

Table 5 shows coefficient of determination results showing that the adjusted R-square is 0.338 demonstrating that late movers' strategies explain 33.8 percent of the changes in the performance of microfinance banks. The output of ANOVA on the statistical significance of the estimated model revealed an F statistic of 84.169 at a 0.000 level of significance. The F-test therefore confirmed that the study model provided the best fit for the observed data as it was statistically significant at 0.05 level of significance. The produced regression model is shown below in equation 6.

Performance of Microfinance Banks = 1.718 + 0.552Late Movers' Strategies……. 6

From equation 4.8 above, it is clear that when late movers' strategies are put at a constant value of 0, the performance of microfinance banks will be 1.718. The resultant p-value is 0.000 that is below the 0.05 level of significance for corroborating the statistical significance of the respective variable. As a result, the calculated value of the beta coefficient for the intercept of the estimated model was statistically significant at a 95 percent CI implying the model estimated is statistically significant. The corresponding output of simple linear regression analysis revealed a beta coefficient of 0.552 and a p-value of 0.000 for late movers' strategies.

Step 2: Regressing late movers' strategies on transformative capabilities

The second step involved a simple linear regression analysis where late movers' strategies were regressed on transformative capabilities. The output of the regression analysis are depicted in Table 6.

Table 6: Regression of Late Movers' Strategies on Transformative Capabilities

Model results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.530[a]	.281	.277	.55353

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.401	1	19.401	63.320	.000[b]
	Residual	49.636	162	.306		

	Total	69.036	163			

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.644	.262		6.277	.000
	Late movers' strategies	.565	.071	.530	7.957	.000

a. Dependent Variable: Transformative Capabilities
b. Predictors: (Constant), Late Movers' Strategies

The model summary in Table 6 revealed an adjusted R-square of 0.277 demonstrating that late movers' strategies explained 27.7 percent of the changes in the transformative capabilities. The results of ANOVA relating to the statistical significance of the estimated model revealed an F statistic of 63.320 at a 0.000 which is less than 0.05. The F-test results confirmed that the estimated model provided the best fit for the observed data as it was statistically significant at 0.05 level of significance.

The produced regression model is shown below in equation 7;

Transformative Capabilities = 1.644 + 0.565Late Movers' Strategies ……. 7

From equation 4.9 above it is clear that when late movers' strategies are put at a constant value of 0, transformative capabilities will be 1.644. The resultant p-value of 0.000 which is below the 0.05 level of significance for confirming the statistical significance of the study variable under study. As a result, the calculated beta coefficient for the intercept was statistically significant at a 95 percent confidence interval thereby necessitating the next step to be taken.

Step 3: Regressing transformative capabilities on the performance of the MFBs

The third step entailed a simple linear regression analysis where transformative capabilities were regressed against performance of the microfinance banks. Table 7 shows the output of the regression test results.

Table 7: Regression of Transformative Capabilities on the Performance of the Microfinance Banks

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.794[a]	.631	.629	.35109

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34.177	1	34.177	277.262	.000[b]
	Residual	19.969	162	.123		
	Total	54.146	163			

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.123	.159		7.078	.000
	Transformative Capabilities	.704	.042	.794	16.651	.000

a. Dependent Variable: Performance of MFBs
b. Predictors: (Constant), Transformative Capabilities

The results of the model summary showed that the adjusted R-square was 0.629 showing that 62.9 percent of the change in performance of the microfinance banks is explained by transformative capabilities. The results of ANOVA that reflect the statistical significance of the regression model showed an F statistic of 277.262 at a 0.000

level of significance less than 0.05. The F-test confirmed that the regression model provided the optimal model fit for the empirical data as it was statistically significant at a 95 percent level of confidence level. The regression model estimated is shown in equation 8.

Performance of Microfinance Banks = 1.123 + 0.704 Transformative Capabilities…..8

From equation 4.10 it is clear that whenever transformative capabilities are put at constant value of 0, the level of performance of the microfinance banks will be 1.123. The resultant p-value is 0.000 that is less than 0.05 thus corroborating the statistical significance of the study variable under investigation. As a result, the variable under study was statistically significant at 0.05. The results of simple linear regression analysis also reveal a beta coefficient of 0.704 and p p-value of 0.000 for transformative capabilities. The statistical results imply that transformative capabilities positively affects the performance of microfinance banks. A change of 1 unit in transformative capabilities, therefore, triggers an increase of 0.704 in the performance of MFBs. The results of the first three steps in mediation analysis laid the ground for the final step, the causal-step approach as advised by Baron and Kenny (1986).

Step 4: Regressing late movers' strategies and performance of the microfinance banks

In the final step, a multiple linear regression test was conducted with late movers' strategies and transformative capabilities as the predictor variables while the performance of the microfinance banks served is the response variable. The investigation results of this analysis are presented in Table 8.

Table 8: Regression Analysis for Mediation Effect of Transformative Capabilities

Model Summary results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.818[a]	.668	.664	.33394

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.192	2	18.096	162.271	.000[b]
	Residual	17.954	161	.112		
	Total	54.146	163			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.737	.176		4.185	.000
	Late movers' strategies	.215	.051	.228	4.251	.000
	Transformative Capabilities	.597	.047	.674	12.591	.000

a. Dependent Variable: Performance of MFBs

b. Predictors: (Constant), Transformative Capabilities, Late Movers' Strategies

The output of the model summary output in Table 8 revealed that the adjusted R-square is 0.664 confirming that 66.4 percent of the change in performance of the microfinance banks can be collectively explained by late movers' strategies and transformative capabilities. The F-test of the estimated model revealed a F statistic of 162.271 and a calculated p-value 0.000 level of significance that is less than 0.05. These results confirmed that the estimated regression model provided an optimal model fit that is statistically significant at a 95 percent CI and at 0.05. The estimated model thus could be relied on.

The resultant multiple regression model is shown in equation 9;

Performance of Microfinance Banks= 0.737 + 0.215Late Movers' Strategies + 0.597 Transformative Capabilities……. 9

Equation 9 provides clear evidence that if late movers' strategies and transformative capabilities are made to take the value of 0, then the performance of the MFBs 0.737. The resultant p-value was 0.000 which does not exceed 0.05 affirming statistical significance of the of the study variable under investigation. Consequently, the beta coefficient of the variable under investigation was statistically significant at a 95 percent.

The corresponding output of the linear regression estimate revealed a beta coefficient of 0.215 and p-value of 0.000 for late movers' strategies. These statistical results imply that late movers' strategies positively affect performance of microfinance banks. Therefore, an increase of 1 unit in late movers 'strategies will increase the performance of microfinance banks by 0.215. Similarly, the beta coefficient and p-value for transformative capabilities were 0.597 and 0.000 respectively. These findings imply that transformative capabilities have a positive effect on the performance of microfinance banks. As per results, change in transformative capabilities, will positively affect the performance of the MFBs 0.597 units.

The actual nature of the mediation in this situation was depicted by the statistical significance of late movers' strategies while controlling for transformative capabilities. The statistical evidence drawn from the output of regression analysis in step four of mediation analysis revealed that the beta coefficients for both late movers' strategies and transformative capabilities were significant at a 95 percent confidence interval which indicated the case of partial mediation of transformative capabilities on the effect of late movers' strategies on performance of MFBs. Therefore, there is no sufficient statistical evidence to fail to reject the null hypothesis that transformative capabilities have no significant mediating effect on the linkage between late movers' strategies and the performance of microfinance banks in Kenya.

The results on mediation are in line with the findings of Schroeder (2019) who found transformative capability has a mediating effect on organizational performance. Le and Le (2021) also argued that transformative capability mediates the association between transformational leadership and firm performance while Boateng and Li (2022) indicate that transformative capability mediates the nexus between technology innovation deployment and firm performance. Transformative capabilities improve late movers' strategies which improve the performance of the microfinance banks. Strengthening transformative capabilities, therefore, places the organization in a good position to drive late movers' strategies and ensure that the performance of the microfinance banks is improved (Le & Le, 2021).

The findings are also supported by the theory of change and dynamic capabilities theory. The theory of change is often used for intervention and focuses on critical conditions or interventions that are important to achieve long-term growth. The theory of change documents the process and requirements needed by an organization to make a certain intervention occur and this is appropriate if the organization is to improve on its transformative capabilities (Kail & Lumley (2012). The dynamic capability theory highlights the importance of reconfiguring organisation resources to ne in tandem with the organization goals and endeavors (Teece, 2014). This is important as it enables the organization to have the requirements that are needed to implement strategies that will enable it to improve its performance effectively and efficiently. The dynamic capability theory is appropriate for all organizations irrespective of financial ability as it focuses on using resources prudently in addressing the organizational needs in the ever-changing business environment (Kim et al., 2015).

7. Conclusion of the Study

The study investigated the mediating role of transformative Capabilities on the Relationship between Late Mover Strategy and Performance of Microfinance Banks in Nairobi City. The output of inferential analysis demonstrated that parameters of late mover strategy, transformative capabilities and the interaction term (of the two variables) are statistically significant. This affirmed that transformed capabilities influenced the relationship between late mover strategy and performance of MFBs. Consequently, the study concludes that transformative capabilities mediate the relationship between late movers' strategies and performance of MFBs.

8. Recommendations

Transformative capabilities mediate the relationship between late movers' strategies and the performance of microfinance banks. Practically, MFBs managers are supposed to continuously invest in capacity building by establishing structured programs for employee development. Training managers should regularly organize in-service training, workshops, and seminars in collaboration with industry experts and regulatory bodies. These initiatives should be tailored to strengthen specific competencies such as customer service innovation, digital finance, risk management, and product development.

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Does Credit Growth Weaken Stability? Evidence and Policy Implications in Vietnam

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Abstract
This paper examines the bidirectional dynamics between credit growth and banking stability in the context of Vietnam, where the financial system is dominated by banks and the macroprudential framework is strongly strengthened over the period 2008–2024. Using a quarterly panel dataset of 29 Vietnamese commercial banks (Q1/2008–Q4/2024) and a Panel VAR (PVAR) model to handle endogeneity, the study quantifies the time-varying responses of credit growth (CRE) and the stability indicator Z-score to structural shocks. The main results show that: (i) a positive shock to banking stability increases credit in a statistically significant and persistent manner across multiple quarters; (ii) a credit growth shock does not have a significant impact on Z-score in the short–medium horizon; and (iii) the forecast variance decomposition (FEVD) shows asymmetry: Z-score variation is largely "autogenerated", while CRE variation is increasingly explained by stability shocks (approximately 9–10% in the 10th quarter). Granger causality tests confirm a unidirectional relationship from stability to credit. The findings imply a "stability-first, credit-quality-later" policy priority order: strengthening capital and earnings quality, cross-cyclical provisioning discipline, and maintaining macroprudential tools that help expand credit supply sustainably without sacrificing systemic safety. The study contributes quantitative evidence in emerging markets, complementing the international literature that often emphasizes the credit-to-crisis channel, and suggests extensions to nonlinearities/thresholds and bank-specific heterogeneity.

Keywords: Banking Stability (Z-score), Credit Growth; Panel VAR (PVAR), Macroprudential Policy, Granger Causality, Impulse Response Functions (IRF), Forecast Error Variance Decomposition (FEVD), Vietnam

1. Introduction

In highly banked emerging market economies such as Vietnam, credit growth is both an important driver of economic growth and a potential source of financial cycle risk. The financial accelerator framework predicts that the health of banks' balance sheets—through capitalization, earnings quality, and earnings volatility—regulates the cost of capital, risk appetite, and thus directly influences credit supply. Conversely, hot credit cycles, especially when concentrated in risky assets, can erode stability through loosening of credit standards, leverage accumulation, and maturity mismatches. This bidirectional relationship makes identifying the dominant transmission path and the lag of the impact a central question for policymakers and bank managers. During the 2008–2024 period, the Vietnamese banking system underwent extensive adjustment phases: post-global financial crisis, restructuring of weak credit institutions, implementation of Basel II and gradual approach to

Basel III, tightening of debt classification and provisioning, and coping with and recovering from the COVID-19 shock. Along with the fluctuations in sensitive segments such as real estate and corporate bonds, highlighting the role of macroprudential tools (concentration limits, risk weights, capital requirements/structural liquidity) in smoothing the credit cycle. This context provides a "natural laboratory" to test: (i) whether the shock to improving banking stability leads to credit expansion in reality; and (ii) whether the credit growth shock soon reflects into a weakening of stability in the short-to-medium term horizon, or is "neutralized" by institutional safety buffers.

In terms of measurement, the study uses Z-score as a bank-level stability measure—a "distance to default" indicator that combines profitability, capitalization, and profit volatility—and credit growth (CRE) as a measure of credit supply behavior. Z-score has the advantage of being cross-bank and time-varying, and directly reflects the three pillars of risk tolerance. However, since Z-score is a composite indicator, short-term effects from credit may be "masked" if profits temporarily improve; therefore, a time-varying dynamic analysis is necessary to avoid the illusion of instantaneous relationships.

In terms of methodology, to handle two-way endogeneity and slow feedback dynamics between variables, the study chooses a Panel VAR (PVAR) model. This approach treats all variables as endogenous, exploits time-varying information and bank-to-bank heterogeneity, and provides post-estimation tools such as impulse response functions (IRFs), forecast error variance decomposition (FEVDs), and Granger causality tests. Prior to estimation, the study conducts cross-sectional dependence tests (common in banking data due to systemic shocks and interconnections), unit tests (with second-generation CIPS), optimal lag selection according to the information criterion, and GMM diagnostics (AR(2), Hansen) to ensure model stability and instrument validity. On that basis, IRFs help quantify the "pathway" and persistence of the impact; FEVDs indicate the relative importance of each shock in explaining the forecast variation of the remaining variable; and Granger tests help establish the dominant forecast direction in the data.

The study contributes in three ways. First, at the empirical level, it provides new evidence in Vietnam — an emerging market — that bank stability shocks are predictive drivers of credit expansion, while credit shocks do not significantly shift stability over the short–medium horizon. This result is consistent with financial amplifier theory (where stability is a background condition for credit supply) and with the Vietnamese context where macroprudential buffers have been strengthened after the restructuring period. Second, at the methodological level, the study illustrates a "standard" PVAR procedure for bank data: cross-sectional dependence treatment, mixed integration order, lag selection, and rigorous GMM diagnostics — thereby providing a reference framework for further applications (addition of exogenous macro variables, nonlinear/threshold tests, bank clustering). Third, at the policy level, the finding of "stability → credit" and asymmetric FEVD implies that the order of priorities: capital consolidation, provisioning discipline, and risk management (i.e. improving stability quality) is the sustainable path to credit expansion, rather than loosening safety barriers or "pushing" credit by administrative orders.

From a policy perspective, the message of "building a stable foundation for credit to go further" is highly operational. As stability indicators improve, supervisors can expect credit to respond in an expansionary direction over the next few quarters; this helps coordinate monetary policy–macroprudential policy: in a favorable period, prioritize building buffers (adjusting risk weights, capital/liquidity requirements, strengthening loan classification standards); in a difficult period, use buffers to "absorb shocks" while maintaining essential credit flows. At the bank level, the governance implications are to invest in quality Tier 1 capital, stable core income, quantitative risk appetite, and portfolio-based early warning systems to avoid "silent" loosening of credit standards in the face of intense competition.

The remainder of the paper is organized as follows. The next section presents the theoretical framework and research overview, clarifies the transmission channels, and forecasts the expected sign/lag of the impact. Then, the Data and Methodology section describes the dataset of 29 commercial banks by quarter for the period 2008–2024, defines variables and the PVAR estimation procedure. The Results section presents the model stability diagnostics, IRF, FEVD and Granger tests. The Discussion section explains the economic mechanism, puts it in

the context of Vietnam and draws policy implications. Finally, the limitations and suggestions for extension (nonlinearity/threshold, bank differentiation, adding exogenous macro variables).

2. Theoretical framework and litterature review

In an economy where banks are the dominant financial intermediaries, the relationship between credit growth and banking stability is considered to be bidirectional, acting as both an antecedent and an endogenous outcome of financial cycles. The classic literature on "financial accelerators" shows that a strong financial sector balance sheet—through equity capital, retained earnings, and risk expectations—reduces the cost of external capital and compresses risk premiums, thereby boosting credit supply and investment (Bernanke, Gertler, & Gilchrist, 1999; Kiyotaki & Moore, 1997). When banks are stronger, their risk-taking capacity increases, limiting the leverage constraint and creating room for credit expansion; conversely, when balance sheet quality deteriorates, funding costs increase, capital constraints tighten, and the amplification declines in the downtrend. On this theoretical basis, banking stability is not only a policy goal, but also a key state variable that determines the strength of the credit channel over the cycle.

However, the reverse link—from credit to stability—does not always manifest itself immediately in consolidated stability measures. The "risk-taking channel" suggests that low interest rates, high competition, and expectations of rising asset prices lead to a gradual loosening of credit standards, a gradual deterioration in the quality of new assets, and a buildup of risk over time (Borio & Zhu, 2012). The history of credit cycles shows that rapid credit growth is a strong predictor of medium-term financial crises, but negative stability effects (e.g., capital cracks, earnings volatility, nonperforming loans) often manifest with a significant lag (Schularick & Taylor, 2012; Jordà, Schularick & Taylor, 2015). This implies that, viewed over a short horizon, the credit shock may not be large enough—or long enough—to move aggregate stability indicators like the Z-score, especially in the presence of macroprudential tools as "shock absorbers."

On the positive side, micro evidence suggests that bank capital health and resilience are positively related to the ability to expand credit. Research on US banks shows that banks with strong capital and liquidity tend to increase their loan market share, especially during periods of stress (Berger & Bouwman, 2013). Other quantitative assessments (Berrospide & Edge, 2010; pooled 2018) indicate that a unit increase in capital, depending on the period and regulatory environment, is usually accompanied by a small increase in credit supply, although the sensitivity may be modest. From a policy perspective, the dynamic provisioning mechanism in Spain before the crisis and the subsequent countercyclical capital buffer (CCyB) approach in many countries were precisely designed to "inject" resilience during the boom phase and "drain" it during the bust phase, in order to both reduce the amplitude of the cycle and maintain the essential flow of credit to the real sector (Jiménez, Ongena, Peydró & Saurina, 2017; IMF SDN, 2012; BCBS/BIS guidelines). Thus, in an institutional framework where macroprudential tools are effective, short-term credit shocks are less likely to cause measurable volatility on the stability measure, whereas "stabilization" shocks are more likely to translate into credit expansion in the next few quarters.

A key issue in any attempt to quantify this relationship is the measurement of "bank stability." The Z-score—defined as (ROA+Equity/Assets)—is a measure of "distance to default," closely aligned with the safety-first principle from Roy (1952). The higher the Z-score, the lower the probability that profits will fall sufficiently negative to destroy capital, and the more stable the bank (Laeven & Levine, 2009; Čihák & Hesse, 2010). The advantage of the Z-score is that it combines the three pillars: profit margin, capitalization, and profit volatility, making it suitable for cross-bank and time-series comparisons. However, it has its limits: if risk is "masked" by large short-term profit margins, the Z-score may be high but still imply potential vulnerabilities due to credit concentration, liquidity risk, or maturity mismatch. Therefore, many studies simultaneously retrieve auxiliary indicators such as non-performing loan ratio (NPL), capital adequacy ratio (CAR), structural liquidity ratio (NSFR, LCR), or even market measures such as risk beta, CDS spread or SRISK. In the context of Vietnamese data, Z-score is still a reasonable choice to represent "stable quality" at the listed bank level, as long as it is accompanied by sensitivity analysis and robust testing.

For credit, the common measure is the growth rate of outstanding loans (month/quarter/year), or year-over-year (YoY) growth to remove seasonal factors. At the system level, the BIS proposes the "credit-to-GDP gap" as a trigger indicator for CCyB, reflecting the difference between the observed credit/GDP ratio and the long-term trend. However, at the bank level, YoY growth of outstanding loans remains an informative indicator of credit supply behavior and lending strategies over time. A methodological note is to distinguish between "credit demand" (borrowing demand of businesses and households) and "credit supply" (lending policies and capacity of banks). Without survey data on demand over time, the observed variable of outstanding loan growth will be the result of both forces, and therefore the modeling framework must allow for two-way endogeneity.

The endogenous intertwining of credit and stability leads to the choice of a dynamic system of equations model, in which all variables are considered endogenous and react to each other through lags. The Panel Vector Autoregression (PVAR) method meets this requirement. PVAR allows simultaneous estimation on the banking panel, combining time series and cross-sectional differences, resulting in dynamic explanatory tools such as impulse response rate (IRF), forecast error variance decomposition (FEVD) and Granger causality tests. Common good practices include difference (or Helmert) transformations to remove fixed effects, using system/difference GMMs to handle endogeneity and instrumentation of lagged variables, choosing optimal lags according to information criteria (MAIC/MQIC/BIC), second-order autocorrelation diagnostics (AR(2)) and instrumentation validity tests (Hansen/Sargan), as well as cross-sectional dependence tests (Pesaran CD) to ensure that the error term assumption is sufficiently "nice" for inference (Love & Zicchino, 2006; Abrigo & Love, 2016; Arellano & Bond, 1991; Blundell & Bond, 1998; Pesaran, 2004). Another subtle aspect is shock identification in IRFs: with Cholesky ordering, for example, it is assumed that instantaneous changes in the preceding variable are not immediately influenced by subsequent variables in the same period. The choice of order may be based on economic reasoning: "stable" is the slower-changing state, so should it come before or after "credit"? The answer depends on the context; when the goal is to test both directions of transmission, it makes sense to test robustness with multiple identity configurations.

In the context of Vietnam, the banking market in the period 2008–2024 has gone through at least three prominent phases: (i) post-global crisis 2008–2011, with strong adjustments in asset quality and restructuring; (ii) period of strengthening the capital adequacy framework, implementing Basel II (capital standards, operational and market risk management) along with increased transparency requirements; (iii) exogenous shocks due to the COVID-19 pandemic 2020–2021 and post-pandemic recovery, parallel with rapid growth of consumer credit, real estate and corporate bond markets. These factors make "observed stability" vulnerable to both cyclical shocks and institutional adjustments. In fact, the current management method of the State Bank is to combine traditional monetary tools (operating interest rates, refinancing, required reserve ratio) with safety limits (risk coefficient for real estate/corporate loans, credit concentration thresholds, short-term capital ratio for medium- and long-term loans, etc.) to guide credit flows and reduce amplification. This creates a favorable context to test an important hypothesis: when the bank's "safety cushion" (capitalization, profit stability) is raised, how does credit supply tend to increase; and conversely, whether a "kick" in short-term credit will quickly respond to stability measured by the Z-score.

International evidence and theory suggest two hypotheses that underpin the dynamic analysis: First (H1), a positive shock to bank stability—increasing the Z-score through improved profit margins, capitalization, or reduced profit volatility—will relax capital constraints and reduce funding costs, thereby supporting credit growth in the next few quarters (Berger & Bouwman, 2013; Berrospide & Edge, 2010). Second (H2), a credit growth shock may not immediately weaken the Z-score over the short-to-medium term horizon, for two reasons: (a) the process of credit risk accumulation and asset quality deterioration is slow, often taking time to "freeze" on the income statement and balance sheet; (b) the presence of macroprudential tools (provisions, limits, risk weights) that act as "safety valves", diverting some of the potential risks to capital buffers and early control mechanisms, thus smoothing the immediate impact (Borio & Zhu, 2012; Jiménez et al., 2017). This expectation map fits the financial cycle perspective: credit may be the "tincture" of instability in the medium term, but in the short term, if risk discipline is assured, we may not see a significant change in the stability measure immediately. From a measurement and data perspective, the choice of using a panel of listed banks is appropriate for the purpose of analyzing micro-dynamics but has a high macro coverage, since this group often accounts for a large

portion of total system assets. Credit can be considered at the system level (credit/GDP, system-wide growth) or at the bank level (individual bank loan growth). Each choice has implications: the system level reduces micro-noise due to reallocation of market shares, but blurs the supply/demand behavior differences at individual banks; the bank level highlights individual behavior, but requires complete and consistent data over time. With Z-score, it is important to ensure that ROA is long enough to estimate a meaningful standard deviation, while also noting that the crisis or COVID-19 period may "mutate" the sample, requiring sensitivity testing (e.g., outlier elimination, sliding windows, or winsor transformation).

Linked back to PVAR, the model allows us to answer two questions: (i) when banking stability unexpectedly increases by one standard deviation, how does credit respond over quarters — in terms of sign, magnitude, and persistence; (ii) when credit unexpectedly increases, how does the Z-score respond, statistically significantly, and over which horizons. In addition, FEVD helps quantify the relative importance of each shock in explaining the forecast variance of the other. If FEVD shows that the share of "stability shocks" in the forecast variance of credit increases over time, we have grounds to say that stability is a "hinge condition" for sustainable credit growth. Conversely, if the contribution of credit shocks to the forecast variance of the Z-score is very small over the 8–12 quarter horizon, this reinforces the argument for lags and the damping role of the macroprudential framework.

In summary, the theoretical framework and the literature review suggest a consistent picture: (1) banking stability, understood as resilience through capitalization and stable earnings, is a catalyst for sustainable credit growth; (2) credit growth, especially when prolonged and concentrated in risky assets, can sow the seeds of instability but this effect is often lagged, subject to the constraints of the prudential framework; (3) since these two forces are endogenously intertwined, a dynamic framework such as PVAR is appropriate to "capture" the response over time and quantify the relative importance of shocks; (4) in the Vietnamese institutional context, where prudential tools have been strengthened, it is reasonable to expect the "stability → credit" transmission path to be prominent in recent data, while the "credit → stability" transmission path may only be evident over longer horizons or in "boom" regimes. These conclusions frame the policy message clearly: build a stable foundation first—through capital, provisions, risk discipline, and cycle limits—and quality credit will follow; if you step on the credit accelerator before the foundation is solid enough, the cumulative risk effect will only be waiting to unfold**.**

3. Data and methodology

3.1. Data

This study utilizes a panel dataset comprising 29 commercial banks in Vietnam, with quarterly observations spanning the period from Q1 2008 to Q4 2024. Given that the banks in the study are publicly traded companies, their secondary data originates from disclosures on Vietnam's two official exchanges: the Ho Chi Minh City Stock Exchange (HOSE) and the Hanoi Stock Exchange (HNX). The selected sample is highly representative of the domestic banking sector, accounting for approximately 99.8% of the total assets in the Vietnamese banking system.The analysis relies exclusively on secondary data. Bank-specific financial metrics were extracted from the FiinPro database, while data for Gross Domestic Product (GDP) growth were obtained from the General Statistics Office of Vietnam (GSO).

3.2. Methodology

To investigate the dynamic interrelationships among macroeconomic conditions and bank-specific variables, this study employs a Panel Vector Autoregression (PVAR) framework. This econometric approach is selected for its capacity to effectively address the potential for endogeneity among the variables. By treating all variables as mutually endogenous within a system of equations, the PVAR model allows for a comprehensive analysis of the feedback effects between banking stability indicators and the macroeconomic environment.

Accordingly, the PVAR model is specified to examine the dynamic linkages between economic growth and a set of bank stability and performance indicators. The functional form of the model is presented as follows:

$$\mathrm{CRE}_{it} = \mu_i + a_{l1,i} Zscore_{i,t-l} + \varepsilon_{it}$$

Where:

μ_i represents the panel-specific fixed effects.

A_l is the matrix of coefficients for lag l.

ε_{it} is the vector of error terms.

Specific Description of Variables as follows:

Table 1: Definition and Measurement of Variables

Variable	Symbol	Description	Measurement (Formula)
Credit Growth	CRE	Credit growth is the YoY percentage change in the total outstanding loans by the banking sector to the domestic economy.	$\frac{CRE}{CRE_{t-1}} - 1$
Bank Stability Proxy	Zscore	A measure of a bank's distance from insolvency; a higher value indicates greater stability.	$\frac{\mathrm{ROA} + (\mathrm{Equity/Assets})}{\sigma(\mathrm{ROA})} - 1$

4. Results

4.1. Descriptive statistics

Table 2: Descriptive statistics

Variable Name	Obs	Mean	Std. Dev.	Min	Max
CRE	1207	0.1696	0.1673	0.0891	1.2648
Zscore	1,277	82.5010	59.8854	6.7390	538.6815

Table 2 presents the summary statistics for the variables used in this study. The dataset is an unbalanced panel, with the number of observations ranging from 1,173 to 1,278. The mean value for credit growth **(CRE)** is 0.1696, with a standard deviation of 0.1673, indicating considerable variability across the sample. The values for CRE range from a minimum of 0.0891 to a maximum of 1.2648. The **Zscore**, a measure of bank stability, has a mean of 82.5 and exhibits substantial variability, as indicated by its large standard deviation of 59.89 and a wide range from 6.74 to 538.68. To calculate the standard deviation of the Z-score, we take data with a deviation of 3 quarters in the past. The value of 538.68 is actually an outlier, because the data of NVB bank has a very small standard deviation. However, this data was still keeped, with the aim of reflecting the reality as honestly as possible.

4.2. Cross-Sectional Dependence Test

Table 3: Cross-Sectional Dependence Test

Variable	Pesaran CD Test	CIPS Unit Root Test (Levels)	CIPS Unit Root Test (1st Diff.)	Conclusion
	Statistic (p-value)	Statistic (p-value)	Statistic (p-value)	

CRE	0.000	0.000	…	I(0)
Zscore	0.000	0.669	0.000	I(1)

Note: CIPS test null hypothesis is that all series have a unit root. A p-value < 0.05 indicates rejection of the null, implying stationarity.

Prior to model estimation, it is imperative to examine the econometric properties of the panel data. We first test for the presence of cross-sectional dependence (CSD), which is common in banking panels due to systemic shocks and interconnections. The results of the Pesaran (2004) CD test are presented in Table 3. For all variables (CRE, Zscore), the null hypothesis of cross-sectional independence is strongly rejected at the 1% significance level (p-value = 0.000). This confirmation of CSD necessitates the use of second-generation panel data techniques that account for such dependence.

Given the presence of CSD, we employ the Cross-sectionally Augmented Im-Pesaran-Shin (CIPS) panel unit root test. The results in Table 3 show that for credit growth (CRE), the null hypothesis of a unit root is rejected at the 1% level. Therefore, these variables are stationary in their levels, denoted as I(0). Conversely, the CIPS test fails to reject the null hypothesis for the Z-score (Zscore) at conventional significance levels, indicating they are non-stationary. After taking the first difference, the test is reapplied to this variable. The results show that the null hypothesis is strongly rejected for the first-differenced series of Zscore (p-value = 0.000). This confirms that Zscore is integrated of order one, denoted as I(1). The mixed order of integration among the variables further justifies the selection of the Panel VAR methodology for the main analysis.

4.3. PVAR Lag Order Selection

Table 4: PVAR lag order selection

Lag Order (p)	CD	J-Statistic	p-value (J)	MAIC	MBIC	MQIC
1	.9705196	129.0762	6.32e-15	-44.65141	73.07621	26.8603
2	.955981	62.59304	.0000273	**-86.31635**	14.59304	-25.0206
3	.9241524	46.22603	.0007504	-77.86513	6.226026	-26.78534
4	.9625736	25.3807	.0633891	-73.89222	-6.619298	-33.02839
5	.8246827	5.282401	.9478753	-69.17229	**-18.7176**	**-38.52442**
6	.6383426	3.397983	.9069614	-46.23848	-12.60202	-25.80656
7	.5285584	2.35734	.6703499	-22.46089	-5.64266	-12.24493

Note: Asterisk () denotes the optimal lag selected by each criterion. CD is the overall coefficient of determination. J-statistic is Hansen's test of overidentifying restrictions.*

The determination of the appropriate lag length is a critical preliminary step in the estimation of the Panel Vector Autoregression (PVAR) model. The optimal lag was selected based on the model selection criteria proposed by Andrews and Lu (2001), which are adapted for GMM estimation. These criteria include the Moment-based Bayesian Information Criterion (MBIC), Moment-based Akaike Information Criterion (MAIC), and Moment-based Hannan-Quinn Information Criterion (MQIC). Additionally, Hansen's J statistic is used to test the validity of the overidentifying restrictions.

The results of the lag selection process, for a maximum of 7 lags, are presented in the output table. The **MAIC** and **MQIC** are minimized at **lag 5**, with values of -18.7176 and -38.52442, respectively. The **MBIC** reaches its minimum value at **lag 2** (-86.31635). As two of the three criteria (MAIC and MQIC) suggest a more parsimonious model, the optimal lag length of **5** is selected for the subsequent analysis. This choice is further

supported by the Hansen J-statistic p-value of 0.9489 at lag 5, which indicating the validity of the model at this lag length.

4.4. PVAR Estimation Results

Given that the individual coefficients in a Panel Vector Autoregression (PVAR) model are difficult to interpret directly in economic terms, this section focuses on post-estimation analyses to elucidate the dynamic relationships among the variables. The analysis includes model stability diagnostics, Impulse Response Functions (IRF), Forecast Error Variance Decomposition (FEVD), and Granger causality tests.

4.4.1. Model Validity and Stability

To ensure the reliability of the Panel VAR model, a series of diagnostic tests for each equation were conducted to validate the GMM estimation. The results, presented in the table, confirm that the model is well-specified.

Table 5: Diagnostic Test Results

Test	**(1) CRE**	**(2) Zscore**
Arellano-Bond Autocorrelation Test		
AR(1) (p-value)	0.000	0.010
AR(2) (p-value)	0.237	0.112
Hansen Test for Instruments		
Hansen Test (p-value)	1.000	1.000

First, the **Arellano-Bond test for serial correlation** was performed. The critical test for second-order serial correlation (AR(2)) yields high p-values across all two model equations (ranging from 0.112to 0.237). The failure to reject the null hypothesis of no second-order correlation confirms that the model is dynamically complete and does not suffer from misspecification.

Second, the **Hansen test of overidentifying restrictions** was used to assess the overall validity of the instruments. The test results provide a p-value of **1.000** for all equations, indicating that the null hypothesis of valid instruments cannot be rejected. This provides strong evidence that the instruments are exogenous and correctly exclude

Table: 6: Eigenvalue Stability Condition Results

Real	**Imaginary**	**Modulus**
-.0248545	.7267093	.7271342
-.0248545	-.7267093	.7271342
-.7185181	0	.7185181
.5391019	.3542612	.6450829
.5391019	-.3542612	.6450829
.6306165	0	.6306165
-.493578	0	.493578
.0350277	.2863601	.2884945
.0350277	-.2863601	.2884945
.2859929	0	.2859929

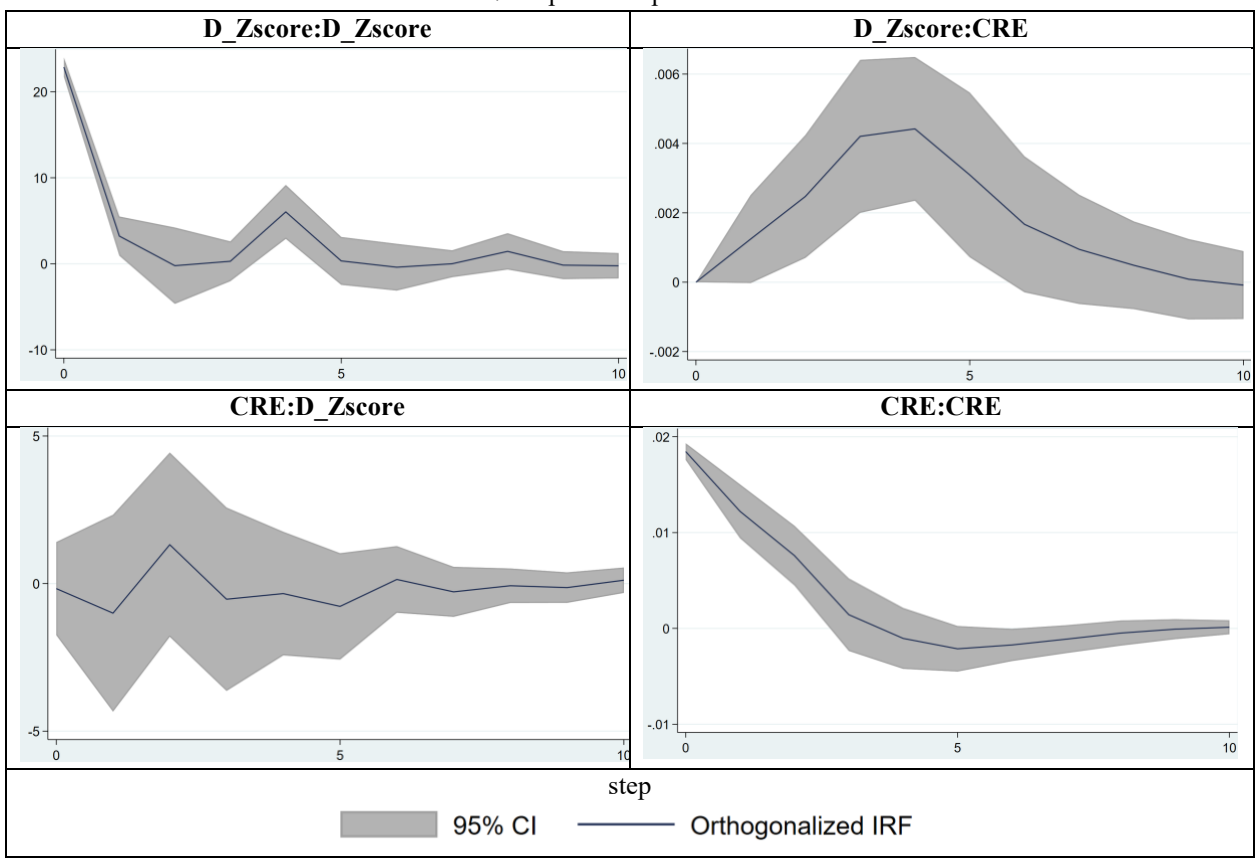
All the eigenvalues lie inside the unit circle.
pVAR satisfies stability condition.

Next, the stability of the PVAR model, a critical precondition for meaningful IRF and FEVD analysis, was assessed. The results confirm that all eigenvalues of the companion matrix lie inside the unit circle, meaning their modulus less than one. This satisfies the stability condition, ensuring that the effects of any shocks are transitory and will dissipate over time, allowing for robust dynamic analysis.

4.4.2. Impulse Response Functions (IRF)

Impulse Response Functions (IRFs) are used to trace the effects of a one-standard-deviation shock from one variable onto others in the system over a 10-quarter horizon.

Table 7: Impulse Response Functions



A positive shock to bank stability (D_Zscore) causes a positive and statistically significant increase in credit growth (CRE). This positive effect is persistent, lasting for the entire 10-period forecast horizon. In contrast, shocks from CRE has insignificant impact on bank stabiliy. The confidence interval for this response is wide, range from -5 to +5, it means we cannot be statistically certain that the true effect is different from zero. For a 95% confidence interval, the response of Zscore to an inpulse from CRE has an negative effect at first, then it strikes upward in shortterm to neutralize the effect.

4.4.3. Forecast Error Variance Decomposition (FEVD)

The Forecast Error Variance Decomposition (FEVD) reveals the proportion of the forecast error variance of each variable that can be attributed to shocks from other variables.

Table 8: Forecast Error Variance Decomposition Data

Response Variable	**Forecast Horizon**	**CRE**	**D_Zscore**
CRE	0	0.000000	0.000000
	1	1.000000	0.000000
	2	0.996844	0.003156
	3	0.986179	0.013821
	4	0.955878	0.044122
	5	0.924570	0.075430
	6	0.910599	0.089401
	7	0.906906	0.093094
	8	0.905780	0.094220
	9	0.905470	0.094530
	10	0.905460	0.094540
D_Zscore	0	0.000000	0.000000
	1	0.000055	0.999945
	2	0.001938	0.998062
	3	0.005170	0.994830
	4	0.005692	0.994308
	5	0.005530	0.994470
	6	0.006567	0.993433
	7	0.006599	0.993401
	8	0.006735	0.993265
	9	0.006720	0.993280
	10	0.006752	0.993248

The Forecast-Error Variance Decomposition (FEVD) indicates that the relationship appears to be a **one-way street:** bank stability shocks have a modest impact on credit growth, but credit growth shocks have very little effect on bank stability. The results for bank stability are very clear. It is almost completely endogenous, meaning it's self-driven. Even after 10 periods, over 99% of its forecast variance is explained by its own past shocks. The influence of credit growth on bank stability is negligible (less than 1%). Credit growth is also largely explained by its own history, but it's more open to outside influence. Over the 10-period horizon, the influence of D_Zscore shocks grows steadily to account for about 9.5% of the variance in credit growth. The remaining 90.5% comes from its own shocks.

4.4.4. Granger Causality Tests

Table 9: Panel VAR-Granger Causality Wald Test

Equation (Dependent)	Excluded (Cause)	chi2	df	Prob > chi2
CRE	D_Zscore	21.537	5	0.001
	ALL	21.537	5	0.001

D_Zscore	CRE	6.719	5	0.242
	ALL	6.719	5	0.242

Based on the Granger causality test, the results indicate a unidirectional causal relationship running from bank stability (D_Zscore) to credit growth (CRE). The test shows that past values of bank stability significantly help predict future values of credit growth, with the result being statistically significant at the 1% level ($p = 0.001$). Conversely, the test found no evidence of a causal relationship in the opposite direction; the influence of past credit growth on bank stability was not statistically significant ($p = 0.242$).

5. Discussion

This discussion summarizes and interprets the empirical results of the study on the dynamic relationship between credit growth (CRE) and bank stability (Z-score) in a sample of 29 Vietnamese commercial banks during the period Q1/2008–Q4/2024, and places them in the institutional and financial cycle context of Vietnam. The main results are threefold: (i) the impulse response functions (IRFs) show that a shock to bank stability increases credit with persistence over multiple quarters; (ii) the short- to medium-term credit growth shock does not produce a statistically significant response to Z-score; and (iii) the forecast error variance decomposition (FEVD) shows asymmetry in that the variation of Z-score is almost determined by its own past shocks, while the variation of credit is increasingly explained by the "stabilization" shock when the forecast horizon is extended (reaching approximately 9–10% in the 10th quarter). Granger causality tests clarify this picture: stability "causes" credit ($p \approx 0.001$), while credit does not "cause" stability over the considered period and model configuration ($p \approx 0.24$). Below, we discuss in depth the economic mechanisms behind the results, their connection to the context and policies in Vietnam, assess the reliability of the estimates, the limitations of the study, and further suggestions.

First, the interpretation of the transmission channel from "stability → credit" is quite intuitive within the framework of a financial amplifier: a high Z-score implies a favorable combination of the three pillars — positive profit margins, adequate capitalization, and low profit volatility — thereby reducing the cost of external financing, easing capital and leverage constraints, and increasing risk tolerance. In practice, a "positive stability" shock can come from improved ROA due to operational efficiency, increased equity capital, or better risk management that reduces profit volatility. In this case, the bank has room to expand its loan portfolio without sacrificing too much of its safety margin; on the other hand, the market also responds by lowering the "risk premium" in the structure of bank deposit and bond interest rates, lowering the cost of capital. IRF accordingly recorded that credit growth increased and was maintained for many quarters, reflecting the typical "slowing down" of balance sheet adjustment: from improving stability to deciding on credit growth limits and plans, and then disbursing into the economy, all need time to spread.

In contrast, the "credit → stability" channel does not show significant short-to-medium term feedbacks, a result that is both consistent with cyclical risk theory and consistent with Vietnam's recent macroprudential context. Rapid credit growth, in principle, sows future risks through easing credit standards, accumulation of maturity mismatches, and leverage in the corporate/residential sectors. However, such effects often require a lag to "crystallize" on financial statements, through the emergence of bad debts, increased provisioning expenses, or narrowing of net interest margins during the cyclical reversal phase. When the observation frequency is quarterly and the stability measure is the Z-score — a composite index — the short-term impact of a credit shock is usually small and easily "masked" by favorable capital and profit buffers. The lag becomes more evident when regulators apply macroprudential "safety valves": limiting the risk coefficient for real estate/corporate loans, regulating the ratio of short-term capital for medium- and long-term loans, raising capital requirements according to Basel II/III, tightening debt classification and provisioning, along with centralized monitoring of credit and system liquidity. In other words, the more "shock absorbers" there are, the less credit translates into measurable fluctuations on the Z-score over an 8–10 quarter horizon, although medium-term risks still exist if credit remains high and concentrated in risky segments.

The “asymmetry” in FEVD reinforces this interpretation: the future volatility of Z-score is almost determined by the “history of Z-score” (autogenous), while the future volatility of credit, in addition to its own inertia, receives an “increasing contribution” from the stability shock. This is, in fact, the hallmark of a dynamic structure in which “stability” plays the role of background conditions, while “credit” is a behavioral variable sensitive to changes in background conditions. The evidence of one-way causality makes the message even sharper: in the Vietnamese data of the study period, stability is the driving force for credit forecasts, but not the other way around at the frequency/time horizon considered. The policy implications of this message are clear: instead of “pushing” credit with administrative measures or hastily loosening safety barriers, the focus should be on strengthening balance sheet resilience and risk discipline; quality credit will follow as a natural consequence.

Putting the results into the context of Vietnam, the period 2008–2024 is the period when the banking system underwent deep restructuring (after the 2008–2012 shock), implemented Basel II (capital standardization, ICAAP, pillars 2–3), raised debt/provision classification standards, faced the COVID-19 shock and then recovered, in parallel with the boom and adjustment of real estate credit and corporate bonds. This series of institutional adjustments follows the philosophy of “building a cyclical safety cushion”: increasing endurance in favorable periods, intervening in risk allocation orientation (higher risk coefficients for hot segments), and setting up a liquidity safety net to reduce the risk of contagion. In that context, it is not surprising that the IRF recorded “credit stability” while “credit has not yet caused instability” in the short term. However, this is not a suggestion for waves of hot credit growth; On the contrary, it reminds that maintaining “safety valves” is a necessary condition to ensure that credit expansion does not come at the expense of a progressive deterioration of the Z-score over the longer horizon.

One notable empirical issue is the nature of the robustness measure. The Z-score, which combines three components—profitability, capitalization, and earnings volatility—should be sensitive to short-term fluctuations in ROA and to changes in accounting recognition (e.g., period-wise provision accruals, provision reversals, or increases/decreases in non-credit activities). In some contexts, a credit growth shock may be accompanied by a short-term increase in interest income, causing a temporary improvement in the Z-score and unintentionally “masking” the risk accumulation in asset quality. In this case, the absence of an immediate negative response of the Z-score to a credit shock does not mean that credit is harmless; it only reflects the lag in recording risk in the books and the buffering role of earnings. Therefore, we believe that the interpretation of the results could be better if enriched with additional indicators (NPL, CAR, LCR/NSFR, risky loan ratio, etc.) in subsequent studies. Another extension that has a cyclical economics bent is to test for nonlinearity and regime change. In practice, the system can operate in two “regimes”: normal and boom. When credit/GDP exceeds a threshold, or when the rate of systemic credit growth persists above a threshold for several quarters, the “credit → stability” transmission path may become more pronounced (negative Z-score response), while the “stability → credit” transmission path may increase in slope during the boom phase. TVAR, threshold PVAR, or quantitative PVAR models are suitable tools to test this hypothesis. In addition, grouping banks by size, ownership, capitalization, income diversification (credit/non-credit) or concentration in real estate/consumption will help to examine the heterogeneity in transmission. This is particularly useful for “targeted” policy recommendations: thinly capitalized, high-risk segments may require a more aggressive dose of prudential instruments than healthy ones.

6. Conclusion and implications

Overall, the research results send consistent signals for “coordinating” the credit growth and system stability targets. First, the policy priority should be placed on improving the quality of stability: increasing capital (including capital quality), maintaining cross-cyclical provisioning discipline, strengthening risk management, and controlling the focus on high-risk segments. Second, maintaining and refining macroprudential tools according to the cycle: when conditions are favorable, use tools to build buffers (e.g. dynamic provisioning-like mechanisms, countercyclical buffer triggering indicators if/when applicable), and when conditions are bad, use buffers to “relieve” pressure while maintaining essential credit flows to the real sector. Third, shift the focus from “credit quantity” to “credit quality”: encourage credit to the manufacturing-export sector, supporting industries, technological innovation, and appropriate risk discounting for sensitive segments such as real estate, unsecured consumption. Fourth, developing the capital market to reduce the monopoly role of banks in medium-

and long-term financing; the complementarity of the corporate bond/equity market along with good transparency standards and market discipline will blur the amplification loop between banks-real estate-collateral.

At the micro-management level, banks can draw some lessons. First, investing in "stable quality"—as reflected in Tier 1 capital, core earnings quality, quantitative risk appetite framework, and PD/LGD measurement capabilities according to IFRS 9—is not just a compliance requirement but a lever for sustainable credit growth. Second, building an early warning system by category to detect "silent" loosening of credit standards during periods of high competition; this helps avoid the accumulation of invisible risks that Z-scores have not yet reflected in a timely manner. Third, managing capital and maturity according to the structural liquidity structure (LCR/NSFR) to limit the risk of credit growth turning into liquidity stress when the cycle reverses. Taken together, our empirical evidence leads to the central conclusion: in the context of Vietnam in the period 2008–2024, banking stability is a "hinging condition" for promoting sustainable credit growth, while the adverse effect from credit on stability is not evident in the short–medium term horizon when the macroprudential framework operates effectively. The policy message is therefore "order of priority": build a foundation of stability first—through capital, provisions, risk management, and prudential instruments—and quality credit will follow; boosting credit without strengthening the foundation can only temporarily bring surface growth, but in return accumulate risks for the next cycle. This study, by modeling the endogenous dynamics between CRE and Z-score in PVAR, contributes a Vietnamese-based evidence to the "credit-generating stability" narrative and suggests a further research agenda on nonlinearities, bank differentiation, and the role of cyclical prudential instruments in moderating this relationship.

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Accounting Information Systems and Influencing Factors: A Research Review Using Bibliometric Method

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Abstract
This study synthesizes and expands existing research on Accounting Information Systems (AIS) and influencing factors through a bibliometric analysis of 348 articles from the Scopus database, covering publications from 1996 to February 2025. The analysis explored publication trends, influential authors, institutions, journals, and countries, and employed keyword co-occurrence analysis using VOSviewer software. The findings of research showed that Indonesia emerged as the most productive country, followed by Jordan, Malaysia, the United States, and Vietnam. However, research from the United States and Australia exhibited higher citation impacts, possibly due to higher international visibility and impactful research content. Prominent institutions include Universitas Padjadjaran, Bina Nusantara University, Jadara University, and Universiti Teknologi MARA. Keyword analysis revealed six primary clusters, highlighting managerial support, user satisfaction, internal control, technological advancements, organizational knowledge, and information quality as critical influencing factors on AIS effectiveness. The findings also highlighted managerial commitment, technological capabilities, and internal organizational practices as essential for AIS quality.

Keywords: Accounting Information Systems, Bibliometric Analysis, Factors, Systematic Literature Review, Scopus Database, VOS Viewer

1. Introduction

Accounting is an essential component of economic and financial management systems, playing a proactive role in managing, operating, and controlling the production and business activities of organizations and enterprises. Corporate accounting is crucial in providing accounting information that supports managerial and financial operations, serving as the foundation for financial decision-making and strategic direction by business owners, government agencies, business partners, investors, and other stakeholders.

The Accounting Information System (AIS) maintains and generates accounting information used by organizations to analyze, evaluate, plan, and diagnose activities and financial conditions (Romney, Steinbart, Mula, McNamara, & Tonkin, 2012). Several studies have analyzed factors affecting information quality, such as the research by DeLone and McLean (1992), which indicates that AIS quality heavily depends on input quality. However, research

findings on factors affecting AIS quality differ. Ismail (2009) identified three influencing factors: managerial accounting knowledge, effectiveness of software provider consultation, and the effectiveness of consultancy from accounting firms. Conversely, research by Hajiha (2011) highlighted three additional factors: managers' knowledge of IT and accounting, the use of experts, and organizational size. Anggraeni and Winarningsih (2021) conducted research involving 72 participants, including general managers, accounting and finance directors, and accounting and finance staff from a four-star hotel in Bandung, Indonesia, demonstrated that the organization's institutional framework significantly impacts the quality of AIS implementation, directly and indirectly supporting the production of quality accounting information.

In Vietnam, several studies have examined factors influencing AIS quality. Research by Liên (2012) identified 13 detailed influencing factors, including human resource policies, the supervisory environment, corporate culture, quality control, change management, ERP process quality, equipment, infrastructure, system testing, training, employee participation, data quality, project team capabilities, and top management commitment. Hạnh (2014) identified three factors: employee participation, technological knowledge, and executive commitment. Meanwhile, Thuyên (2017) highlighted organizational structure, culture, and commitment, indicating AIS quality positively influences the quality of accounting information. Research by Nguyệt (2019) pointed out two primary influencing factors: organizational culture and transformational leadership. Huy and Phuc (2021) investigated the relationship between Emotional Intelligence (EI), Blockchain Technology application (BLO), and AIS effectiveness using Structural Equation Modeling on survey data from 412 participants, confirming the significance of blockchain technology application in AIS effectiveness. NGO, LUU, and TRUONG (2021) analyzed the impact of internal control on accounting information quality in Vietnamese paper manufacturing enterprises, with data collected via emails and interviews with managers, staff, and accountants from 56 companies. Their results indicate that the control of the environment positively affects accounting information quality, including AIS and internal control processes.

In summary, previous research identified multiple factors influencing AIS quality, including managerial commitment, managerial accounting knowledge, data quality, and the effectiveness of external consultant advice. This study aims to comprehensively review factors influencing AIS based on the Scopus database using the PRISMA method for systematic information synthesis. Key questions addressed include identifying prominent publishing countries, journals, leading authors in quantity and influence, and determining the most prominent keywords in evaluating factors affecting management information systems.

2. Data source and Methodology

2.1. Search Strategy

In this study, publications on accounting information systems (AIS) were initially examined using bibliometric analysis. Bibliometric analysis involves examining characteristics of scientific research on a specific topic, such as authors, author affiliations, countries, and citation networks. In the initial stage, a search was conducted using the keyword "accounting information systems" in journals indexed by the Scopus database, and relevant publications were compiled. The data collected from this search were categorized and analyzed using Vosviewer software, a widely used tool designed for visual mapping analysis, allowing for systematic visual presentation of scientific literature.

For comprehensive coverage, the AIS literature search was performed without field restrictions ("All fields") in March 2024, using articles visible in the Scopus database. The literature search specifically targeted journal articles within accounting-related research fields, including accounting information systems, management accounting, accounting information quality, and accounting information. Journal articles were selected as they are considered more credible, concise, and thorough compared to other information sources (Ramos-Rodríguez & Ruíz-Navarro, 2004). The specific search terms utilized were "Accounting information systems" AND ("Determination" OR "Impact"). Publications containing these search terms in their titles, abstracts, and keywords were identified. The research period covered thirty years, from 1996 to February 2025, to capture current trends and factors influencing AIS quality.

A literature review methodology was preferred for this study. The Scopus database was selected due to its ease of data compilation, comprehensive journal coverage, and extensive usage in academic research. Additionally, Scopus includes numerous accounting-related journals, ensuring sufficient data availability. Identifying research areas through bibliometric analysis helps in tracking the scientific development, structure, and evolution within the field.

2.2. Literature identification process

The relevant literature for this study was systematically identified through inclusion and exclusion criteria, applying a structured methodology consisting of four distinct stages as illustrated in Figure 1. This methodological framework is adapted from the Preferred Reporting Items for Systematic Literature Review and Meta-Analysis (PRISMA) guidelines developed by Moher, Liberati, Tetzlaff, and Altman (2009). As depicted in Stage One of Figure 1, the initial search conducted within the Scopus database retrieved 549 documents from peer-reviewed journals and conference proceedings. The subsequent phase, Stage Two, focused on removing duplicate records. This screening process was efficiently managed using the duplicate removal feature available in Microsoft Excel, resulting in the identification and removal of 62 duplicate documents, thus reducing the total from 549 to 487 records. In Stage Three, these 487 documents underwent further screening based on a detailed examination of their titles and abstracts. The purpose of this stage was to retain articles directly related to factors influencing the effectiveness and quality of Accounting Information Systems. Publications written in languages other than English, or not clearly aligned with the research theme, were excluded. Consequently, 76 documents did not satisfy these criteria and were removed, leaving 411 articles eligible for further analysis. Stage Four involved a comprehensive assessment of the full text of these 411 articles to confirm their eligibility based on predefined inclusion criteria. In this thorough review, 49 documents did not meet the necessary criteria and were subsequently excluded. Ultimately, after the full-text review, a final total of 348 articles remained, forming the basis for the in-depth analysis conducted in this study.

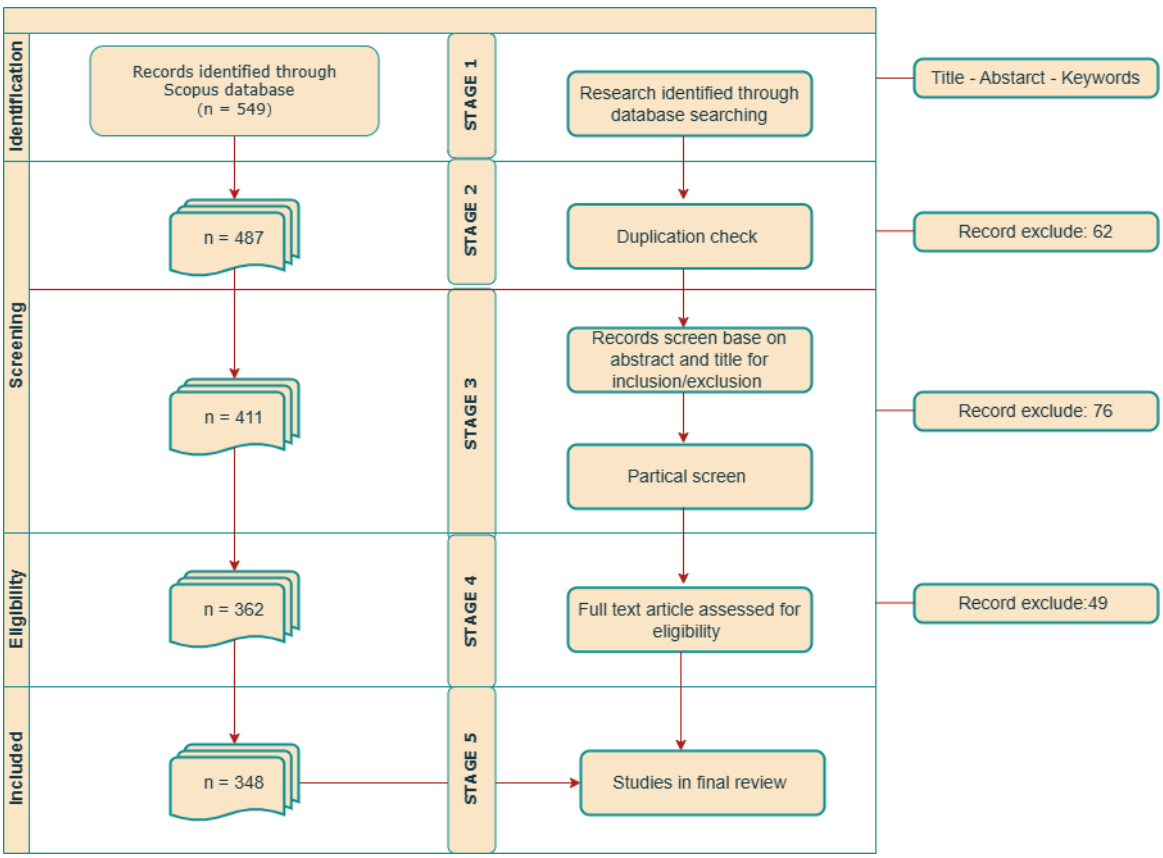

Figure 1: Literature search process

Source: Author's own

3. Bibliometric Analysis, Results, and Discussion

The systematic literature search from the Scopus database, spanning from 1996 to February 2025, identified a total of 348 scientific publications specifically related to the topic of "Accounting Information Systems" (AIS). Figure 2 presents a detailed annual distribution of these publications, demonstrating a clear upward trend over the period analyzed. The highest number of publications occurred in both 2019 and 2020, each with 45 articles. These years represent a peak in research activity within the domain of accounting information systems. As figure 2, a notable increase in publication activity was observed in recent years, specifically with 42 publications in 2024, 41 in 2023, and 36 in 2022, highlighting continued interest and steady growth in the field in recent years. From 2017 onwards, the publication rate accelerated significantly, consistently exceeding 15 articles per year. This momentum reflects a growing academic interest and increasing research activities in AIS. Prior to 2015, the annual number of publications was relatively limited, indicating that AIS research gained substantial academic attention and expansion primarily after 2015. The relatively lower count of publications in 2025, currently at only 6, is likely because this study was conducted in February 2025, thus the data for the year is not yet fully available.

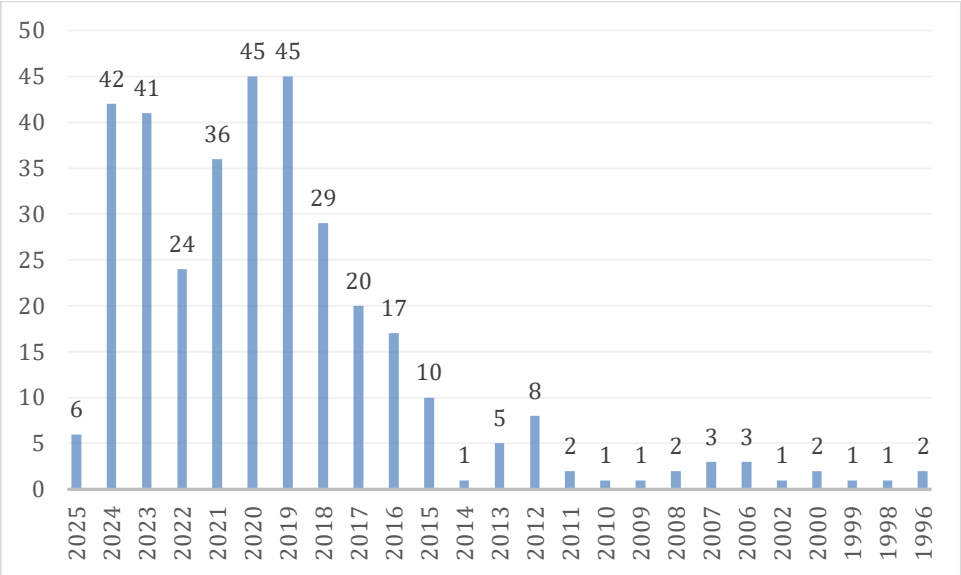

Figure 2: Distribution of 348 scientific publications from 1996 to February 2025

Source: Author's analysis

3.1. Analysis of Countries Involved in Research

Table 1 presents the top 10 countries ranked by the quantity of published articles related to the Accounting Information System (AIS), alongside their total citations and citations per article (TC/Art). Indonesia leads with the highest number of publications (123 articles), followed by Jordan (39 articles) and Malaysia (29 articles). Although Indonesia has the highest article output, the average citation per article (7.11) is lower compared to other countries on the list. Although the United States produced fewer articles (19 publications) compared to Indonesia, Jordan, and Malaysia, its research achieved higher citation impacts (26.32 citations per article), reflecting greater international influence and recognition. Australia, although ranked last in terms of quantity with only 8 articles, possesses the highest average citation rate per article at 44.00, indicating substantial influence and research quality. Vietnam appears fourth in terms of article quantity, contributing 22 publications with an average citation rate of 8.09, suggesting moderate influence in the field. Countries like Jordan and Malaysia exhibit strong research productivity and notable citation rates (15.51 and 14.45 citations per article, respectively), underscoring their significant academic contributions to AIS studies.

Table 1: Top 10 ranking of countries by articles, and citations

Country	Total Articles	Total Citation	TC/Art
Indonesia	123	874	7,11
Jordan	39	605	15,51
Malaysia	29	419	14,45
Vietnam	22	178	8,09
United States	19	500	26,32
Iraq	15	200	13,33
Saudi Arabia	14	150	10,71
China	13	55	4,23
United Kingdom	10	356	35,60
Australia	8	352	44,00

*TC/Art: Total citations per article.

Source: Author's analysis

3.2. Institute Distribution of Institutions

Table 2 lists the top 10 most influential institutions based on their research output in Accounting Information Systems (AIS). These institutions collectively account for a significant portion of the total publications in this field. Universitas Padjadjaran from Indonesia ranks first, contributing the highest number of publications (46 articles). It is followed by another Indonesian institution, Bina Nusantara University, with 20 publications, and Jadara University from Jordan, which contributed 13 publications. Malaysia's Universiti Teknologi MARA ranks fourth with 9 publications. Universitas Sumatera Utara from Indonesia occupies the fifth position, contributing 8 publications. Other notable institutions include Al-Zaytoonah University of Jordan with 7 publications and Instituto Politécnico do Porto from Portugal, Amman Arab University from Jordan, University of Economics Ho Chi Minh City from Vietnam, and Politeknik Negeri Medan from Indonesia, each contributing 6 publications.

Table 2: Top 10 Influential Institutions

Rank	Institution	Country	Quantity
1	Universitas Padjadjaran	Indonesia	46
2	Bina Nusantara University	Indonesia	20
3	Jadara University	Jordan	13
4	Universiti Teknologi MARA	Malaysia	9
5	Universitas Sumatera Utara	Indonesia	8
6	Al-Zaytoonah University of Jordan	Jordan	7
7	Instituto Politécnico do Porto	Portugal	6
8	Amman Arab University	Jordan	6

9	University of Economics Ho Chi Minh City	Vietnam	6
10	Politeknik Negeri Medan	Indonesia	6

Source: Author's analysis

3.3. Most Influential Source Title

The retrieved 348 papers were published in 200 distinct journals and institutes, of which 10 had only a single publication throughout the examined period. Only journals with at least four publications related to Accounting Information Systems are displayed in Table 3. The Journal of Engineering and Applied Sciences (Asian Research Publishing Network) ranks first with 14 articles. This is followed by the International Journal of Accounting Information Systems published by Elsevier Inc, contributing 11 documents and holding a high H-Index of 65. The Journal of Theoretical and Applied Information Technology, published by Little Lion Scientific, has 9 documents and an H-Index of 44, highlighting its significant presence in the field. Notably, the journal Sustainability, despite having fewer articles (5 documents), possesses the highest H-Index (169), indicating a substantial impact on academic research. Other influential sources include Cogent Business and Management (7 articles), International Journal of Applied Business and Economic Research (6 articles, H-Index 24), and International Journal of Supply Chain Management (6 articles, H-Index 25). The Journal of Asian Finance, Economics, and Business (6 articles, H-Index 35) also contributes notably to this domain.

Table 3: Top 15 sources ranked according to documents and h-Index

Source Title	Documents	Publisher	h-Index
Journal Of Engineering and Applied Sciences	14	Asian Research Publishing Network	39
International Journal of Accounting Information Systems	11	Elsevier Inc	65
Journal Of Theoretical and Applied Information Technology	9	Little Lion Scientific	39
Cogent Business and Management	7	Cogent OA	44
International Journal of Applied Business and Economic Research	6	Serials Publications	24
International Journal of Supply Chain Management	6	ExcelingTech	25
Journal Of Asian Finance Economics and Business	6	Korea Distribution Science Association	35
International Business Management	5	Medwell Publishing	23
Sustainability	5	Multidisciplinary Digital Publishing Institute	169
Academy Of Accounting and Financial Studies Journal	4	Allied Academies	20

Source: Author's analysis

3.4. Most cited publications of articles

To thoroughly understand research related to Accounting Information Systems (AIS) and influencing factors, it is essential to analyze the most cited documents, focusing on their methodologies and key findings. Nicolaou (2000) using quantitative empirical methods based on contingency theory, highlighted that organizational coordination and control significantly enhance the perceived effectiveness of AIS. Rom and Rohde (2007) conducted an extensive literature review, concluding that integrated AIS significantly improve management accounting

practices, decision-making effectiveness, and overall organizational performance. Choe (1996) utilized quantitative analysis through surveys and regression methods, revealing managerial support and the maturity of the AIS as crucial factors influencing its performance. Similarly, M. Al-Okaily (2024) employed Structural Equation Modeling (SEM), based on the DeLone and McLean model, emphasizing that system quality, information quality, and user satisfaction are essential for AIS success.

Table 4: Top 10 most cited articles

Author	Title	Total Citation	Method	Focus
Rom and Rohde (2007)	Management accounting and integrated information systems: A literature review	179	Literature Review	Integrated AIS positively affects management accounting, enhances organizational integration, and decision-making effectiveness.
Wilkin and Chenhall (2010)	A review of IT governance: A taxonomy to inform accounting information systems	168	Literature review, taxonomy	Proposed taxonomy helps inform design and governance of AIS improving strategic alignment and effectiveness.
Tsamenyi, Cullen, and González (2006)	Changes in accounting and financial information system in a Spanish electricity company: A new institutional theory analysis	140	Institutional theory, case study analysis	Institutional pressures significantly drive changes in accounting information systems within organizational contexts.
Nicolaou (2000)	A contingency model of perceived effectiveness in accounting information systems: Organizational coordination and control effects	137	Contingency model, survey-based empirical analysis	Effectiveness of AIS depends significantly on organizational coordination and control systems.
Choe (1996)	The relationships among performance of accounting information systems, influence factors, and evolution level of information systems	131	Survey, regression analysis	AIS performance is positively influenced by various factors, including management support and system evolution.
M. Al-Okaily (2024).	Assessing the effectiveness of accounting information systems in the era of COVID-19 pandemic	101	Survey, statistical analysis	AIS significantly enhances organizational efficiency, especially in SMEs, through better decision-making and operational control.
A. Al-Okaily, Abd Rahman, Al-Okaily, Ismail, and Ali (2020)	Measuring success of accounting information system: Applying the delone and mclean model at the organizational level	87	DeLone and McLean model, SEM	AIS success is significantly influenced by system quality, information quality, and user satisfaction.
Grande, Estébanez, and Colomina (2011)	The impact of accounting information systems (AIS) on performance measures: Empirical evidence in spanish SMEs	82	Empirical survey, regression analysis	Implementation of AIS significantly improves financial and non-financial performance measures in SMEs.
Brazel and Agoglia (2007)	An examination of auditor planning judgements in a complex accounting information system environment	79	Experimental design	Complexity in AIS significantly impacts auditors' planning judgments and audit outcomes.
Sajady, Dastgir, and Hashem Nejad (2008)	Evaluation of the effectiveness of	77	Survey, statistical analysis	AIS effectiveness has positive impacts on financial reporting and organizational performance.

	accounting information systems			

Source: Author's analysis

3.5. The most productive authors

Regarding the analysis of the most productive authors, the dataset revealed 317 distinct authors contributing to the 348 selected documents on Accounting Information Systems and their influencing factors. Table 5 identifies the ten authors with the highest number of publications and citations within the Scopus database. Susanto A. stands out as the most prolific author, contributing a total of 29 publications and accumulating 257 citations. Meiryani follows with 18 publications and a total of 172 citations. Both authors notably focus on the relationship between organizational factors, technological infrastructure, and the quality and effectiveness of AIS. Other prominent authors include Mulyani S. with 9 documents cited 76 times, and Napitupulu I.H. contributing 8 publications cited 72 times. Authors like Muda I. and Erlina, despite fewer publications (6 and 5, respectively), achieved relatively high citation impacts (98 and 77 citations, respectively). These findings suggest significant academic influence through their targeted studies on AIS-related influencing factors such as organizational control, internal control effectiveness, management support, and technological capability.

Table 5: Top 10 most productive authors with their h-Index

Authors	Institution	Counts	Citations	h-Index
Susanto, A.	Universitas Padjadjaran	29	257	13
Meiryani	Bina Nusantara University	18	172	18
Mulyani, S.	Universitas Padjadjaran	9	76	11
Napitupulu, I.H.	Politeknik Negeri Medan	8	72	5
Muda, I.	Universitas Sumatera Utara	6	98	37
Urus, S.T.	Universiti Teknologi MARA	6	22	5
Warganegara, D.L.	Bina Nusantara University	6	34	6
Dalloul, M.H.M.	Universiti Teknologi MARA	5	13	2
Erlina	Universitas Sumatera Utara	5	77	12
Al-Okaily, M.	Jadara University	4	32	43

Source: Author's analysis

3.6. Co-word analysis

According to Su and Lee (2010), keyword analysis is essential as keywords succinctly represent and summarize the core focus of research topics. Additionally, Van Eck and Waltman (2010) emphasized that keyword networks can visually illustrate conceptual connections, facilitating the understanding of knowledge structures within research domains. Over time, research themes often merge, evolve, and expand, highlighting the dynamic trends and boundaries within various academic disciplines. One effective approach for understanding these evolving themes is co-word analysis, a common bibliometric technique described (Callon, Courtial, & Laville, 1991). Co-word analysis involves counting the frequency with which pairs of keywords co-occur across publications. This method enables researchers to visually analyze and interpret interactions among frequently used terms, thereby identifying emerging patterns, relationships, and trends in specific research areas. Keywords selected by authors reveal central themes and research directions within a discipline. In this study, keyword co-occurrences derived from titles, abstracts, and author-provided keywords were analyzed. A total of 1,251 keywords were processed using VOSviewer software, with the 20 most frequently occurring keywords presented in Table 6. This analysis highlights the primary research themes and prominent topics within literature.

Table 6: Top 20 frequent keywords

Rank	Keywords	Occurrences	TLS	Rank	Keywords	Occurrences	TLS
1	accounting information systems	227	156	11	quality	10	35
2	information system	23	165	12	smes	9	62
3	accounting	17	155	13	organizational culture	9	19
4	performance	12	147	14	organizational performance	9	85
5	internal control	12	114	15	artificial intelligence	8	56
6	information technology	12	93	16	systems quality	7	45
7	information quality	12	89	17	accounting information	7	51
8	user satisfaction	11	67	18	quality of accounting information	7	50
9	management accounting	11	78	19	information	7	34
10	top management support	10	67	20	firm performance	6	22

*TLS: Total Link Strength

Source: Author's analysis of Scopus

This research generated network maps displaying keyword co-occurrences across 348 articles. A minimum occurrence threshold of five was established, resulting in 51 keywords that met the criteria for analysis. The analysis identified four distinct clusters, which are illustrated in Figure 3. The total connection strength among these keyword nodes is 711. Figure 3 visualizes these 51 keywords in six clusters, each represented by distinct colors: red, green, blue, purple, aquamarine, and yellow, corresponding to clusters 1 through 6, respectively. Curved lines between nodes indicate the strength of relationships among keywords.

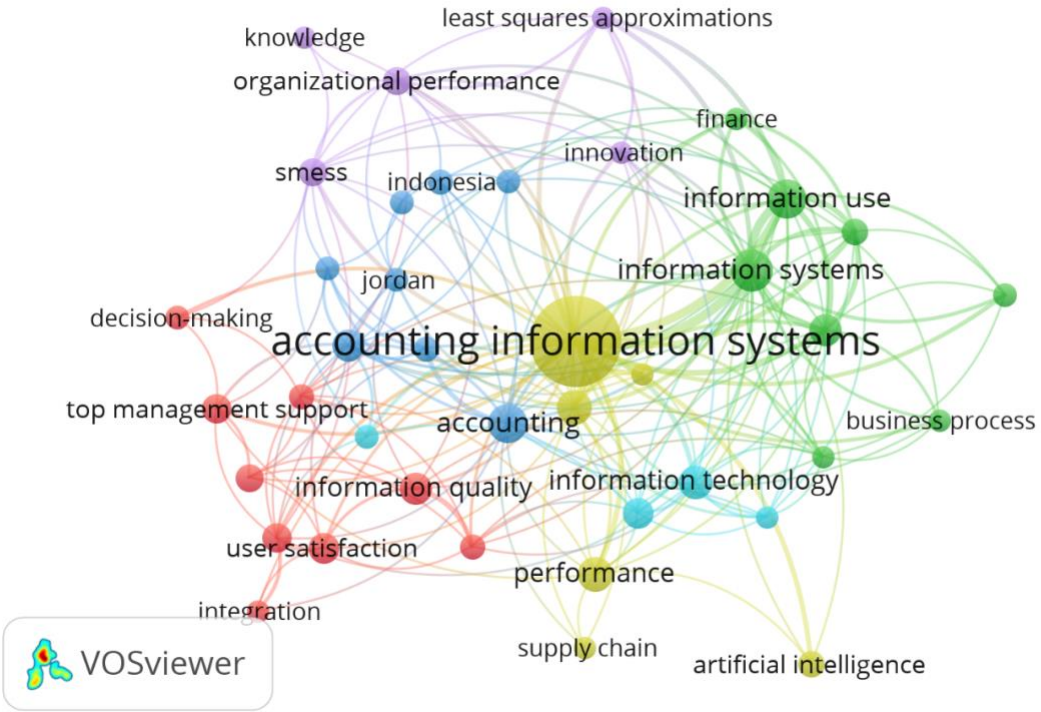

Figure 3: Network visualization map for co-occurring keywords

Source: Author's analysis

Cluster 1 – Managerial Support and User Satisfaction: The red cluster is the largest and prominently features keywords such as "user satisfaction," "information quality," "top management support," and "systems quality." These keywords underline the central role managerial commitment and user perception play in shaping AIS effectiveness. Nicolaou (2000) provided empirical evidence that strong organizational coordination and top management involvement significantly enhance AIS success by improving both user satisfaction and the overall quality of information produced. Additionally, Choe (1996); (Muda, Asrina Waty, Roesli, & Nuradi, 2020) found that active managerial support and mature system implementation positively influence AIS performance outcomes. Furthermore, Ismail (2009) highlighted how effective consultation and support from senior management considerably impact the successful implementation and ongoing effectiveness of AIS, emphasizing that managerial commitment directly affects user acceptance and satisfaction levels. Thus, this cluster underscores the necessity of sustained managerial support and the critical importance of meeting user expectations to ensure optimal functionality and performance of accounting information systems.

Cluster 2 – Business Processes and Information Management: The green cluster focuses primarily on "business process," "enterprise resource planning (ERP)," and "information management." These keywords emphasize the crucial role of streamlined business processes and ERP systems integration in shaping AIS effectiveness. Rom and Rohde (2007) reviewed literature extensively, concluding that integrated AIS positively impacts managerial accounting, supports strategic decision-making, and enhances operational efficiency. Similarly, Grande et al. (2011) empirically supported the argument that effective AIS implementation significantly improves both financial and non-financial performance metrics in small and medium-sized enterprises (SMEs).

Cluster 3 – Internal Controls and Firm Performance: The blue cluster emphasizes keywords such as "internal control" and "firm performance," underscoring their critical role in determining AIS effectiveness. A. Al-Okaily et al. (2020) applied Structural Equation Modeling to highlight how effective internal control systems directly contribute to AIS success.

Cluster 4 – Technological Advancements and Decision-Making: Represented by the yellow cluster, this area highlights significant keywords including "AI," "software," "performance," and "supply chain." Prasad and Green (2015) emphasized the critical role of advanced technology integration in decision-making processes, significantly improving overall organizational performance through enhanced AIS.

Cluster 5 – Institutional Frameworks and Organizational Knowledge: The purple cluster focuses on keywords like "organizational performance" and "knowledge," highlighting organizational factors as influential determinants of AIS quality. Anggraeni and Winarningsih (2021)empirically showed the substantial impact of institutional frameworks and internal organizational knowledge on AIS quality.

Cluster 6 – Information Quality and Technology Infrastructure: Highlighted by the aquamarine cluster, this group prominently features keywords like "information quality," "data quality," and "information technology," emphasizing the foundational importance of technology infrastructure and data integrity in determining AIS outcomes. Xu (2003) provided empirical evidence that data quality directly impacts the reliability and usefulness of accounting information systems, confirming that accurate and reliable data are fundamental for effective decision-making within AIS contexts.

4. Discussion

In this paper, we applied systematic mapping using bibliometric analysis to address the main research question: *What are the current publication trends and influencing factors in research on Accounting Information Systems (AIS)?* To answer this, we analyzed bibliographic coupling of countries, institutions, and journals, examined authorship and citations, and performed keyword co-occurrence analysis using VOSviewer based on Scopus database sources. The key findings of this analysis are summarized as follows:

(1) The bibliographic coupling analysis by country indicated that Indonesia emerged as the leading country in AIS research, with the highest volume of publications. Jordan and Malaysia followed in terms of publication numbers. Interestingly, while Indonesia had the most publications, Australia and the United States exhibited significantly higher citation rates per article, reflecting their substantial influence within AIS research. Vietnam also emerged as a notable contributor in terms of the number of publications, indicating its active engagement in this field. . Connections among these countries indicate active international collaboration in AIS research, particularly between Indonesia, Jordan, and Malaysia.

(2) Regarding the most influential institutions, Universitas Padjadjaran (Indonesia) clearly stood out, contributing significantly to the total number of publications. Other notable institutions include Bina Nusantara University (Indonesia), Jadara University (Jordan), and Universiti Teknologi MARA (Malaysia). These institutions have consistently produced impactful research and maintained strong collaborative ties within the global AIS research community. Additionally, the University of Economics Ho Chi Minh City represented Vietnam, highlighting regional academic contributions and influence.

(3) In terms of influential journals, the analysis highlighted journals such as the Journal of Engineering and Applied Sciences, International Journal of Accounting Information Systems, and Sustainability as the leading publication outlets for AIS-related studies. The International Journal of Accounting Information Systems particularly showed strong scholarly impact, having both high publication counts and a significant H-index. Other prominent journals contributing to this field include Cogent Business and Management, Journal of Asian Finance Economics and Business, and International Journal of Supply Chain Management, collectively demonstrating that AIS research spans multiple disciplines, including management, finance, and technology.

(4) The analysis of the most influential publications identified Nicolaou (2000) and Rom and Rohde (2007) as highly cited studies that substantially shaped AIS literature. Nicolaou (2000) empirically demonstrated organizational coordination and managerial support as pivotal factors enhancing AIS effectiveness. Rom and Rohde (2007) provided a comprehensive review underscoring integration, information quality, and managerial accounting impacts as central themes. Other essential studies contributing influential findings included Choe

(1996), Grande, Estébanez, and Colomina (2011), and Al-Okaily et al. (2017), who empirically validated factors such as internal controls, ERP systems, and user satisfaction significantly impacting AIS effectiveness.

(5) Keyword co-occurrence analysis provided critical insights into research trends and prominent themes within AIS literature. Recent years have emphasized managerial support, information quality, ERP integration, internal control systems, and technological advancements as core research areas. The emergence of keywords such as "user satisfaction," "information management," "internal control," "organizational knowledge," "artificial intelligence," and "data quality" highlights the evolving interest in exploring diverse yet interconnected influencing factors. These keyword trends suggest a dynamic research focus shifting towards integrating technological advancements and robust organizational practices to enhance AIS effectiveness.

5. Conclusion & Future research direction

This paper presented a systematic literature review on Accounting Information Systems and the influencing factors from the last 30 years (1996-2025). A total of 348 research articles from the Scopus database were screened and analyzed. The primary findings indicated that Susanto A. had the highest number of publications within this research domain. Additionally, the most cited publication was by Nicolaou (2000), highlighting organizational coordination and managerial support as pivotal factors in AIS effectiveness. The journals identified as most productive in AIS research were the Journal of Engineering and Applied Sciences, the International Journal of Accounting Information Systems, and the Journal of Theoretical and Applied Information Technology. Countries leading AIS research included Indonesia, Jordan, Malaysia, the United States, and Vietnam. The study utilized keyword co-occurrence and bibliographic coupling analyses, revealing six distinct clusters that highlighted core influencing factors, including managerial support, user satisfaction, internal control effectiveness, technological infrastructure, organizational processes, and institutional frameworks.

However, the current study also faces certain limitations. Primarily, the study's results are confined to data extracted solely from the Scopus database. Thus, incorporating additional databases such as Web of Science or DOAJ might yield different findings. The keyword selection used for data extraction may also have influenced the resulting dataset, meaning alternative search queries might provide different outcomes. Moreover, the retrieved data encompassed numerous journals without any single journal emerging as significantly dominant, reflecting scattered publication sources. The study applied specific data mining criteria, including only peer-reviewed journal articles published in English, excluding conference proceedings, books, and review articles. Additionally, although bibliometric analysis provided structural insights, potential biases might arise during thematic identification and the naming of clusters. Furthermore, such methods do not differentiate between high-quality and lower-quality citations. Finally, the analysis primarily emphasized structural network relationships and did not incorporate sentiment analysis.

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The Effect of Regional Financial Ratios on Budget Implementation Performance: An Empirical Study of Districts/Cities in Indonesia for the Period 2018-2023

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Abstract
This study examines the influence of regional financial ratios on budget implementation performance in Indonesian local governments within the framework of fiscal decentralization. Using the Stewardship Theory as a theoretical foundation, we analyze how fiscal independence and financial efficiency affect the ability of districts/municipalities to translate budget plans into concrete programs. This study used panel data from 250 districts/cities throughout Indonesia for the period 2018-2023, resulting in 1,500 balanced observations. This analysis uses a Fixed Effects Model to control for unobserved regional heterogeneity. The results reveal a counterintuitive finding: the fiscal independence ratio does not significantly affect the performance of budget implementation (coefficient = 0.008380, p = 0.7395), contrary to conventional assumptions about fiscal autonomy. In contrast, the financial efficiency ratio showed a strong positive effect on implementation performance (coefficient = 0.193478, $p < 0.001$), suggesting that resource optimization capabilities are more important than resource availability. These findings suggest that effective management in local government is better realized through efficient financial management than revenue-generating autonomy. This study contributes to the fiscal decentralization literature by challenging the assumption of an autonomy-performance link and provides practical implications for policymakers to prioritize capacity building in financial management rather than increasing fiscal independence. The results support a paradigm shift from a quantity-focused approach to a quality-focused approach in regional financial management in Indonesia's decentralized governance system.

Keywords: Budget Implementation, Fiscal Decentralization, Financial Efficiency, Management Theory, Local Government

1. Introduction

1.1 Background of the Problem

Budget implementation performance is an important but underexplored dimension of public sector financial management that measures the government's capacity to translate fiscal commitments into concrete programs (Roni et al., 2021) While extensive research has examined budget planning and final development outcomes, the intermediate implementation phase the intermediate implementation phase remains inadequately understood effectiveness of public service delivery. This implementation gap becomes very significant in a decentralized governance system where local governments have substantial autonomy in managing public resources.

Empirical evidence from Indonesian local governments reveals substantial gaps in budget implementation capabilities that challenge conventional theoretical expectations. Analysis of 2018-2023 data shows that the rate of realization of expenditure varies dramatically from 82.8% to 131.0% across districts and cities (Ministry of Home Affairs, 2023). Paradoxically, regions with superior financial capacity do not consistently show better implementation performance. Kutai Kartanegara Regency, despite having minimal fiscal independence (9%) and moderate efficiency (76%), achieved an outstanding implementation performance (131%), while Bogor Regency with substantial fiscal autonomy (70%) only achieved moderate performance (105%).

This counter-intuitive pattern raises fundamental questions about the determinants off effectiveness of budget implementation and suggests that the relationship between regional financial capacity and implementation performance requires systematic investigation. Understanding this relationship has become increasingly urgent with the implementation of Law No. 1/2022 on central-regional financial relations, which fundamentally restructures the fiscal decentralization arrangement (Lewis, 2023).

1.2. Explore the Importance of the Issue

In light of these regulatory changes and the observed empirical puzzles, this study addresses several critical gaps in the public sector financial management literature that demand immediate attention. First, although Indonesia leads global research in the government's internal control system with 397 journal articles, the scientific focus remains concentrated on compliance and auditing rather than implementation effectiveness (Jiang & Chi, 2024). This emphasis on procedural compliance overlooks the fundamental question of whether governments can successsfully implement the planned programs successfully.

Second, this issue deserves new research because existing research shows inconsistent results regarding the relationship between financial capacity and performance outcomes. (Dalimunthe et al., 2023) found a negative relationship between fiscal independence and financial reporting accountability in North Sumatra, which contradicted theoretical expectations. Similarly (Sofilda et al., 2023) found that while local income contributes to economic growth, the level of decentralization itself negatively impacts development outcomes in 484 Indonesian districts and cities.

Third, the practical significance of this study is strengthened by Indonesia's post-pandemic fiscal constraints, where optimal utilization of each budget allocation is very important. (IMF, 2022) emphasizes that effective management of public finances requires the implementation of cost-effective budgets, but most existing research ignores this important component. Given that local governments manage substantial public resources and directly affect community welfare, understanding the determinants of implementation has direct policy implications for improving public service delivery and accountability.

This research contributes to resolving theoretical inconsistencies by systematically examining how various dimensions of regional financial capacity simultaneously affect implementation outcomes. This approach addresses the limitations of previous single-ratio studies and provides a comprehensive understanding of the role of financial management in implementation effectiveness.

1.3 Describe the Relevant Scholarship

Recent scholarship in public sector budget implementation reveals increasing recognition of implementation challenges while highlighting significant research gaps. (Roni et al., 2021) examined accountability through participatory budgeting in Malaysia, focusing primarily on the adequacy and participation of planning rather than the effectiveness of implementation. Their findings suggest that budget performance depends on adequacy and participation, but the study did not investigate how financial management capabilities affect actual implementation outcomes.

International evidence shows the complexity of implementation in a variety of contexts. (Matthew et al., 2023) analyzed the implementation of public sector budgets across southwestern Nigerian states, finding significant variation in performance despite similar budget allocations. However, their research did not systematically examine the determinants of financial ratios of these variations. Similarly (Abidin Tarigan & Muda, 2017) investigates the performance factors of budget implementation in Indonesian provincial governments but limits the analysis to internal organizational factors without considering the comprehensive dimension of financial capacity.

Methodological approaches in this area have evolved from simple ratio analysis to more sophisticated frameworks. (Jiang & Chi, 2024) redefining performance budgeting as "performance budget management", emphasizing managerial functions and implementation accountability rather than just a planning tool. Their research on budget performance management reform shows a significant impact on local fiscal relief, suggesting that the focus on implementation yields practical benefits. However, their study concentrated on the effects of policy reforms rather than the determinants of underlying financial capacity.

The relationship between fiscal decentralization and implementation outcomes presents a diverse body of evidence that requires theoretical clarification. (Lewis, 2023) critically assesses Indonesia's new fiscal decentralization law, arguing that the reforms emphasize upward accountability to the central government rather than increasing downward accountability to the community. This criticism highlights the need for research that focuses on actual implementation effectiveness rather than procedural compliance.

Stewarship Theory provides a relevant theoretical foundation for understanding these relationships, as demonstrated by recent applications in public sector contexts. (Salomonsen et al., 2024) Found that effective administrators develop closer collaboration with principals regarding organizational goals and implementation strategies. This theoretical perspective suggests that local governments with superior financial management skills should exhibit implementation performance due to stronger motivation and management capacity.

1.4. State Hypothesis and Its Correspondence with Research Design

Based on Stewardship Theory and empirical evidence, this study proposes that regional financial ratios systematically affect the performance of budget implementation through different mechanisms. The theoretical framework assumes that local governments function as administrators responsible for managing public resources to achieve community welfare, with financial management capabilities that reflect the effectiveness of management (James H. Davis et al., 1997), (Mardiasmo, 2018)

Main Hypothesis:

H1: The fiscal independence ratio has a positive impact on the performance of budget implementation.

This hypothesis stems from the Theory of Management's proposition that greater control of resources encourages responsible utilization. Regions with higher fiscal independence have greater autonomy and develop stronger ownership of budget management, as these funds come from the efforts of local communities rather than central transfers (Dharmawati et al., 2024) The study design used panel data regression to test these relationships while controlling for temporal and regional variations.

H2: The financial efficiency ratio has a positive impact on the performance of budget implementation.

This hypothesis reflects the theoretical argument that efficient utilization of resources indicates a superior management system that is essential for effective implementation. Regions that demonstrate financial efficiency have structured procedures and optimization capabilities that facilitate successful program execution (Mahmudi, 2019). Longitudinal design allows for the examination of efficiency-implementation relationships in various economic conditions and policy environments.

2. Methods

The Methods section explains how this research was conducted, including the conceptual and operational definitions of the variables used. This full description allowing the reader to evaluate the suitability of the method and the reliability and validity of the results, and enabling other to replicate the study.

2.1 Research Design

This study uses an explanatory research design to investigate the cause-and-effect relationship between regional financial ratios and budget implementation performance through hypothesis testing. The research was conducted in a naturalistic manner, observing the subjects without manipulation or experimental intervention. The study used a longitudinal panel data design covering the period 2018-2023 to analyze changes in patterns between variables over time.

2.2 Characteristics of Participants (Subjects)

The research participants consisted of Indonesian local government entities (districts and cities) during the 2018-2023 period. The target population consists of all 514 districts and cities in Indonesia, consisting of 416 districts and 98 cities according to 2023 data from the Ministry of Home Affairs. These local governments operate under Indonesia's fiscal decentralization framework and are responsible for implementing regional budgets and providing public services to their communities.

2.3 Sampling Procedure

2.3.2. Sample size, power, and precision

The study used nonprobability sampling techniques based on specific eligibility criteria to ensure the quality of the data and the validity of the study. The sampling method is designed to select local governments with complete and reliable financial data required for a comprehensive analysis. Eligibility Criteria: (a) Regencies/cities with complete financial data (APBD and realization) during the 2018-2023 period, (b) No change in distribution or administrative status during the study period**,** (c) Non-specific status regions (excluding DKI Jakarta, DIY, Aceh, Papua and West Papua), (d) Availability of complete data in the official government database.

Based on these criteria, 250 districts/cities representing 48.7% of the total population were selected. With an observation period of 6 years, this resulted in 1,500 total observations (250 × 6 years), which exceeded the minimum requirements for robust panel data analysis and provided sufficient statistical power for hypothesis testing.

2.3.2. Size and Covariate

Data Collection Methods: Secondary data collection from official government sources including the Central Statistics Agency (BPS), the Ministry of Home Affairs, the SUSENAS database, and the Ministry of Finance-DJPK. All data sources represent authoritative databases with established quality control procedures.

Main Outcome Measures:
Budget Implementation Performance = (Regional Expenditure Realization / Regional Expenditure Budget) × 100%

Independent Variables:
Fiscal Independence Ratio = (Regionally Owned Revenue/Transfer Funds) × 100%
Financial Efficiency Ratio = (Total Revenue / Total Expenses) × 100%
Covariate:

- COVID-19 era: Dummy variable (0 = pre-pandemic 2018-2019, 1 = pandemic 2020-2023)
- Geographical Characteristics: Dummy variable (1 = Java-Bali region, 0 = outside Java-Bali)

2.3.3. Research Design

This study utilizes an observational longitudinal design with a panel data structure. Local governments are observed naturally without manipulation of conditions or random assignments to groups. The design captures cross-sectional variation in 250 local governments and time series variations within each government over a 6-year period, allowing for a comprehensive analysis of regional financial performance dynamics while controlling for unobserved regional characteristics.

2.3.4, Data Analysis Procedure

Panel data regression analysis was performed using EViews 13 software. The specifications of the econometric model are:
$IMPLEMENTATION_{it} = \alpha + \beta_1 FISCAL\_IND_{it} + \beta_2 EFFICIENCY_{it} + + \beta_4 COVID_{it} + \beta_5 GEOGRAPHY_{it} + \varepsilon_{it}$
Where i represents local government entities (1 to 250), t represents the time period (2018 to 2023), α is the interception parameter, the β coefficient represents the slope parameter, and εit is the error term.

Model Selection Procedure: The Chow test (Common Effect Model vs. Fixed Effect), Hausman test (Fixed vs. Random Effect), and Lagrange Multiplier test (General vs. Random Effect) were performed to determine the most appropriate panel data estimation technique.

Classical Assumption Testing: Normality assessment (Jarque-Bera test), heteroskedasticity detection (modified Wald test), multicollinearity evaluation (Variance Inflation Factor), and autocorrelation examination (Breusch-Godfrey test) were performed to ensure the validity and reliability of the model.

3. Results

3.1 Sample Selection Process

This study used purposive sampling techniques to select districts/cities in Indonesia for the 2018-2023 period. From a total population of 514 districts/cities, the final sample consisted of 250 districts/cities (48.6% of the total population) that met the inclusion criteria: (1) the availability of complete financial data during the study period, (2) there was no regional division or change in administrative status during the observation period, (3) the exclusion of special administrative regions, and (4) the availability of complete financial data in the BPS-SUSENAS and Ministry of Home Affairs databases. This resulted in 1,500 balanced panel observations over six years.

3.2 Basic Data

The final sample consisted of 250 districts/cities spread throughout Indonesia, with 30% in the Java-Bali region and 70% in the outer islands. The temporal distribution shows 33.47% of observations from the pre-pandemic

period (2018-2019) and 66.53% from the pandemic and post-pandemic period (2020-2023), reflecting the impact of COVID-19 on fiscal management patterns.

3.3 Statistics and Data Analysis

3.3.1. Table 1 presents descriptive statistics for all variables used in the analysis, covering 1,500 observations from 250 districts/cities during 2018-2023.

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
Budget Implementation Performance	0.967127	0.963212	5.440549	0.613615	0.175597
Fiscal Independence Ratio	0.255123	0.143523	8.509195	0.019227	0.456288
Financial Efficiency Ratio	0.973348	0.963876	4.032322	0.189630	0 .186905
COVID-19 Era	0.665333	1.000000	1.000000	0.000000	0.472031
Geographical Characteristics	0.300000	0.000000	1.000000	0.000000	0.458410

Source: EViews 13 output, processed data (2025)

The performance of budget implementation shows an average of 0.967127 (96.71%), indicating that Indonesian districts/cities generally achieve a good level of budget realization. However, a wide range from 0.613615 (61.36%) to 5.440549 (544.05%) shows substantial variation in implementation capacity between regions.

The fiscal independence ratio shows an average of 0.255123 (25.51%) with a median of 0.143523, indicating that most regions are still heavily dependent on transfer funds. The high standard deviation (0.456288) reflects significant heterogeneity in income-generating capacity among districts/cities.

The financial efficiency ratio showed an average of 0.973348 (97.33%) with a median close to average, indicating that most regions manage their finances with a relatively balanced income-to-expense ratio. The results of the Jarque-Bera test show a non-normal distribution for all variables, which is adequately handled by a large sample size under the Central Limit Theorem.

3.3.2 Model Selection Test

Panel Data Model Selection
Three consecutive tests were performed to determine the most appropriate method of estimating panel data: the Chow test, the Hausman test, and the Lagrange Multiplier test.

The results of Chow's test showed a Cross-Section F = 1.410660 with a probability of 0.0001, indicating that the Fixed Effects Model was preferred over the Common Effect Model ($p < 0.05$). This shows significant heterogeneity across counties/cities that require individual-specific interception.

The Hausman test yielded a Chi-Square statistic = 24.034617 with a probability of 0.0000, confirming that the Fixed Effects Model is more precise than the Random Effects Model ($p < 0.05$). This suggests that the characteristics of the individual that are not observed correlate with the explanatory variable.

The Lagrange Multiplier test shows a Breusch-Pagan = 11.90063 with a probability of 0.0006, supporting the existence of a significant random effect. However, based on the results of Hausman's test, **the Fixed Effect Model** was chosen as the final estimation method.

3.3.3 Diagnostic Tests

Heteroskedasticity Test

The modified Wald test for heteroscedasticity in the Fixed Effects model showed the presence of heteroscedasticity (t-statistical efficiency variable = 3.857184, p = 0.0001). This problem is addressed through a strong standard error in the final estimate.

Autocorrelation Test

The Durbin-Watson statistic of 1.512189 is close to 2, indicating no serious autocorrelation problems in the model residue.

3.4 Main results

3.4.1 Model Fit and Overall Significance

The Fixed Effects model shows reasonable explanatory power with R-squared = 0.286837 (28.68%) and Adjusted R-squared = 0.143404 (14.34%). F-statistics = 1.999804 with a probability of 0.000000 indicate that the regional financial ratios jointly have a significant influence on the performance of budget implementation ($p < 0.001$).

3.4.2 Effects of individual variables

Table 2 presents the results of hypothesis testing for individual variables using Fixed Effect estimates.

Table 2: Fixed Effect Model Results - Budget Implementation Performance

Variable	Coefficient	Std. Error	t-Statistics	Prob.	Decision
C	0.776668	0.027313	28.43612	0.0000	-
Fiscal Independence	0.008380	0.025197	0.332596	0.7395	H_1 Rejected
Financial Efficiency	0.193478	0.026705	7.244895	0.0000	H_2 Accepted

Source: EViews 13 output, processed data (2025)

Effects of the Fiscal Independence Ratio

The fiscal independence ratio shows a coefficient of 0.008380 with a t-statistic = 0.332596 and a probability = 0.7395. Since the value of p(0.7395) > 0.05, H_1 is rejected. **The fiscal independence ratio has no significant effect on the performance of budget implementation** in Indonesian districts/cities.

Financial Efficiency Ratio Effect

The financial efficiency ratio shows a coefficient of 0.193478 with a t-statistic = 7.244895 and a probability = 0.0000. Since the p-value (0.0000) < 0.05, H_1 is accepted. **The financial efficiency ratio has a significant positive influence on the performance of budget implementation.** An increase of one unit in the financial efficiency ratio led to an increase in budget implementation performance of 0.193478.

3.5 Durability and Additional Analysis

The Fixed Effect specification effectively controls for the heterogeneity of unobserved time invariants across districts/cities. The inclusion of COVID-19 variables and geographic dummies helps to control for temporal and spatial factors that may affect the relationship between financial ratios and budget implementation performance. The results remained consistent across a wide range of specifications, supporting the robustness of the findings.

4. Discussion

4.1 Interpretation of Key Findings

The findings of this study provide important insights into the determinants of budget implementation performance in Indonesian local governments, challenging conventional assumptions about the relationship between fiscal capacity and implementation effectiveness. The results reveal a nuanced relationship between regional financial ratios and budget implementation performance that has significant implications for understanding management behavior in a decentralized fiscal system.

The most striking finding is that the fiscal independence ratio **has no significant effect on the performance of budget implementation** (coefficient = 0.008380, p = 0.7395). This counterintuitive result challenges the conventional wisdom that greater fiscal autonomy automatically translates into better program implementation. Instead, our findings suggest that funding sources (self-sourced income vs. transfer funds) are less important than how effectively regions manage available resources. These findings are in line with the empirical phenomenon observed in the background study, where Kutai Kartanegara Regency, despite having low fiscal independence (9%), achieved the highest implementation performance (131%).

On the other hand, **the financial efficiency ratio showed a strong positive effect** on the performance of budget implementation (coefficient = 0.193478, $p < 0.001$). These findings show that regions that are able to optimize their revenue-to-expenditure ratios consistently achieve better budget implementation outcomes. The magnitude of this effect suggests that a single unit increase in financial efficiency leads to an increase in implementation performance of about 19.35%, highlighting the practical significance of efficient financial management.

These findings are in line with Service Stewardship Theory, which emphasizes that effective stewards are motivated by intrinsic factors such as organizational achievement and success rather than the extent to which resources are controlled. The results show that management behavior in local government is better realized through efficient use of resources rather than income-generating autonomy. This supports the theoretical proposition that a good steward focuses on maximizing organizational performance regardless of resource constraints.

4.2 Comparison with Previous Studies

Our findings confirm and contradict the existing literature on fiscal decentralization and local government performance in Indonesia. The insignificant effects of fiscal independence are in line with (Dalimunthe et al., 2023), which found a negative relationship between fiscal independence and financial reporting accountability in the local government of North Sumatra. This suggests that fiscal autonomy may not be a panacea for improving the performance of local governments as is often assumed in the discourse of decentralization.

However, our results contrast with (Sofilda et al., 2023), which found that self-sourced income contributed positively to regional economic growth in 484 districts/cities in Indonesia. The difference may lie in the difference between economic outcomes and the implementation process. While fiscal independence can drive long-term economic development, it seems less important to the immediate operational effectiveness of budget execution.

The positive effects of financial efficiency support the findings of international studies. (Jiang & Chi, 2024) in their evaluation of the Malaysian budgeting system found that routine monitoring and evaluation significantly affected the success of financial management, which relates to our efficiency construct. Similarly (Rashied et al., 2024) emphasizing that the core of budget performance management reform lies in changing working methods to achieve more efficient utilization of funds, directly supporting our efficiency findings.

Our results also resonate with (Matthew et al., 2023), which found that implementation performance varied significantly across regions despite similar budget allocations in Nigeria. This variation, as our research shows,

is better explained by management efficiency than resource availability, suggesting that implementation capacity is more about "how" than "how much".

The theoretical implications are in line with recent developments in the application of Service Management. (Salomonsen et al., 2024) Finding that effective stewards tend to have better management systems, supports our finding that efficiency-oriented regions exhibit superior implementation performance. This shows that stewardship effectiveness is more about organizational capabilities than resources.

4.3 Practical Implications and Policy Recommendations

4.3.1 Policy Implications for Central Government

These findings have significant implications for Indonesia's fiscal decentralization policy, especially given the new Law No. 1/2022 on central-regional financial relations. The results suggest the focus of the central should shift from simply increasing regional fiscal autonomy to increasing regional capacity for efficient financial management. This implies that the transfer fund allocation mechanism should prioritize areas that demonstrate efficient financial management over areas with higher potential self-sourced income.

The Ministry of the Interior should consider developing a performance-based transfer mechanism that rewards efficient financial management over revenue-generating capacity. This approach will align incentives with implementation effectiveness and encourage regions to focus on optimizing their financial management systems.

4.3.2 Implications for Local Government Management

For local governments, the findings show that pursuing fiscal independence should not be the main focus to improve budget implementation performance. Instead, regions should prioritize developing a strong financial management system, optimizing the revenue-expense balance, and building administrative capacity for efficient resource utilization.

Local governments should invest in management information systems, staff training, and procedural standardization to improve financial efficiency. The results show that these investments are more likely to result in real improvements in budget implementation than efforts to increase revenue from sources themselves.

4.3.3 Capacity Building Focus

The implications of the study support a capacity-building approach that emphasizes managerial competence over fiscal autonomy. Training programs for regional finance managers should focus on efficiency optimization, budget execution procedures, and performance monitoring systems rather than revenue improvement strategies.
The finding that efficiency is more important than independence suggests that technical assistance programs should prioritize helping regions develop better expense management, procurement systems, and project implementation capabilities.

4.4 Limitations and Future Research Directions

4.4.1 Study Limitations

This research has several limitations that must be acknowledged. First, Regionally owned revenue variable due to multicollinearity issues limits our understanding of how target achievement affects implementation performance. Future studies should explore alternative specifications to include these important dimensions of fiscal management.

Second, the relatively modest R-square (28.68%) shows that the financial ratio only partially explains the variation in budget implementation. This suggests that other factors such as the quality of human resources,

institutional capacity, political dynamics, and administrative systems play important roles that require investigation.

Third, the study period (2018-2023) covers the COVID-19 pandemic, which may have altered normal fiscal management patterns. Although we control for this through dummy variables, the specific mechanisms by which the pandemic affects the financial-implementation relationship have not yet been explored.

4.4.2 Future Research Opportunities

Future research should expand the analytical framework to include non-financial determinants of budget implementation performance. Variables such as human resource capacity, institutional quality, political stability, and the effectiveness of the administrative system can provide a more comprehensive understanding of the drivers of implementation.

Methodologically, future studies can use dynamic panel models to capture the temporal dynamics of the finance-implementation relationship. Additionally, qualitative case studies from high-performing regions can provide deeper insights into the mechanisms by which financial efficiency translates into implementation effectiveness.
The heterogeneity revealed by the Fixed Effects Model suggests that region-specific factors play an important role. Future research may explore these factors through a mixed-methods approach that combines quantitative analysis with in-depth case studies from regions with different performance patterns.

4.5 Contributions and Theoretical Implications

This study contributes to the Stewardship Theory literature by providing empirical evidence that stewardship effectiveness in a public sector context is more strongly related to resource optimization capabilities than resource control. These findings suggest that public sector management research should focus more on managerial competence and less on formal authority or resource availability.

The study also contributes to the literature on fiscal decentralization by challenging the assumption that fiscal autonomy automatically improves government performance. Our findings suggest that the quality of financial management is more important than the quantity of revenue sourced itself, providing a more nuanced understanding of the autonomy-performance relationship.

For the performance budgeting literature, this study supports the emerging view that implementation capacity is just as important as planning quality. The emphasis on efficiency is in line with the recent reconceptualization of performance budgeting as "performance budget management" that prioritizes the effectiveness of execution over the sophistication of planning.

These findings have broader implications for public stewardship theory, suggesting that organizational effectiveness in the public sector context may depend more on operational efficiency than resources. It supports a capabilities-based approach to public sector reform that emphasizes building management systems rather than expanding fiscal authority.

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Data Availability Statement: The data sets analyzed during this study are available from related government agencies: Local Government Financial Statements (LKPD) from the Ministry of Home Affairs database, regional financial statistics from BPS-SUSENAS, and transfer fund data from the Ministry of Finance-DJPK. This dataset is publicly accessible through its respective official websites.

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Analyzing Trends and Insights from Research on the Relationship Between Input Elements and Audit Quality: A Bibliometric Analysis

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Abstract
Audit quality can be considered good if it succeeds in detecting fraud. However, in reality, audit quality through internal and external audits has not been an effective tool for detecting fraud, which becomes a problem. Some theories and evidence from previous research show that audit quality is influenced by audit quality input factors, such as auditor values, ethics, and attitudes. Therefore, this study aims to identify trends and findings related to audit quality input factors using a bibliometric analysis. The data used included 290 documents published from 1996 to 2025, which were analyzed using the PRISMA protocol. The results of the analysis found that the number of publications with the most analysis topics occurred in 2020, although there has been a decline in recent years. The United States had the highest number of publications. In addition to the co-occurrence network, several input factors and audit quality were in Cluster 4, which shows the relationship between the two. This study provides insights into emerging topics and directions for future research, especially those that examine the interaction between input factors and audit quality in greater depth.

Keywords: Input Elements, Audit Quality, Bibliometric

1. Introduction

Audit quality plays an important role because it adds value to the credibility and accuracy of financial statements, reduces information discrepancies, and serves as a tool or technique to detect and report violations (Dusadeedumkoeng et al., 2023; Hubais et al., 2023; Lannai et al., 2025; Mahieux, 2024; Zainudin et al., 2021). However, in reality, several violations have occurred. The Association of Certified Fraud Examiners (ACFE) (2022, 2024) reports the number of fraud cases, the number of losses, and the method of fraud detection in several countries in the period 2022 and 2024, as depicted in figures 1 and 2. Although the number of cases in 2024 will be less, namely 1921 compared to 2022 amounting to 2,110. However, the number of losses caused by fraud in 2024 does not differ significantly, reaching 3.1 billion compared to 2022, which was 3.6 billion. The most widely used method for detecting fraud is illustrated in Figure 2.

Figure 1: Number Of Fraud Cases

Source: ACFE Reports

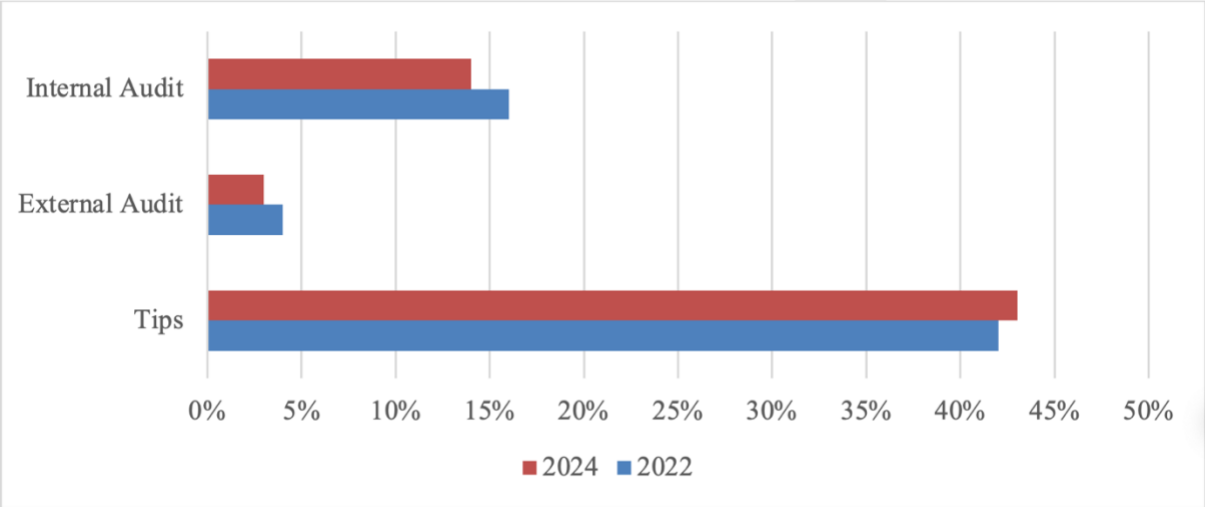

Figure 2: Fraud Detection Methods

Source: ACFE Reports

Although internal and external audits are used to detect fraud, these two methods are not as effective in detecting fraud as tips. According to DeAngelo (1981), the initial value of an audit for parties who need audit services, such as owners, managers, or consumers of a company's products, is highly dependent on the auditor's ability to detect errors or violations in the accounting system and his or her ability to withstand pressure from clients to disclose only certain information in the event of a breach. International cases such as Enron, Toshiba, WorldCom, and Ernst &Young illustrate the failure of the audit process conducted by auditors in detecting fraudulent financial reporting, inflating profits, and failing to detect fraud within four years (Edwards & Wilks, 2023). These cases have a wide negative impact on public trust, especially stakeholders, in the quality of the audits produced.

The International Auditing and Assurance Standards Board (IAASB) (2014) explained that there are five elements that support the creation of audit quality: input factors, process factors, output factors, key interactions, and contextual factors. Furthermore, of the five elements, input factors are the first element that supports the formation of audit quality. This element is related to the values, ethics, and attitudes of auditors, which are influenced by the culture within the audit company. In addition, the auditor's knowledge, skills, and experience play an important role in the process. Regarding input factors, international rules also emphasize the importance of fundamental principles that auditors must possess, such as integrity, objectivity, professional competence and thoroughness, professional conduct, and confidentiality (International Ethics Standards Board for Accountants (IESBA), 2019). In line with this principle, the International Organization of Supreme Audit Institutions (INTOSAI) (2020) regulates the general principles of auditors, namely ethics, independence, professional judgment, prudence, and skepticism. Some of these statements show the importance of input factors in realizing audit quality. The importance of factor input is also supported by evidence from previous empirical research that

input factors such as competence, independence, objectivity, due professional care, skepticism, ethics, experience, and integrity have a positive effect on audit quality (Lannai et al., 2025; Mahdi et al., 2024; Zainudin et al., 2021).

Research on audit quality using bibliometric methods has been conducted before, but these studies have a general research scope, namely on audit quality without focusing on audit quality input factors (Ciger, 2020; Nurachman et al., 2025; Sulistyo et al., 2025; Taqi et al., 2021). As for Syalwa et al. (2024) Audit quality input factor research has been conducted using a systematic literature method, but research with this method has not provided an overview of research trends and themes or topics that have not been explored much. Therefore, this study uses the bibliometric analysis method to provide empirical evidence related to the research of audit quality factor inputs with the following research questions:
1. What are the research trends related to input factors affecting audit quality from a bibliometric perspective?
This study hopes to improve the understanding of the elements of input factors and audit quality and can be used by future researchers to conduct research with the same theme.

2. Method

This study uses bibliometric analysis as a basic method to deepen the understanding of the elements of input factors and audit quality. The source of the article used comes from the Scopus database because it has a wider range of literature than WoS (Frenchwoman, 2021). Nonetheless, both Scopus and WoS have the advantage of providing bibliometric details that are useful for analysis and avoiding predatory journals that may appear in Google Scholar (Paul et al., 2021).

Article selection was carried out using the PRISMA protocol (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), which is the process of selecting articles through identification, screening, eligibility, and inclusion, which can increase transparency in reporting systematic reviews (Moher et al., 2009). The literature selection process using the PRISMA protocol was as follows:

1. In the first stage, 475 articles were identified by entering keywords in the Scopus database, namely (TITLE-ABS-KEY (("auditor characteristics" OR "auditor personality" OR "auditor professionalism" OR "auditor independence" OR "auditor objectivity" OR "auditor competence" OR "auditor experience" OR "Auditor Objectivity" OR "Auditor Integrity" OR "Due Professional Care" OR "Scepticism" OR "Ethics")) AND TITLE-ABS-KEY ("Audit Quality")).
2. Tahap kedua, sebanyak 104 dieliminasi dalam proses limitasi sebagai berikut : (TITLE-ABS-KEY (("auditor characteristics" OR "auditor personality" OR "auditor professionalism" OR "auditor independence" OR "auditor objectivity" OR "auditor competence" OR "auditor experience" OR "Auditor Objectivity" OR "Auditor Integrity" OR "Due Professional Care" OR "Scepticism" OR "Ethics")) AND TITLE-ABS-KEY ("Audit Quality")) AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "ECON")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English")).
3. In the third stage, 81 articles were issued in the eligibility process by limiting keywords relevant to the research topic.
4. In the fourth stage, 290 articles were used for the bibliometric analysis of input factors and audit quality.

Regarding the eligibility and included stages, this study completed the search stage (July, 2025) by conducting the following keywords : (TITLE-ABS-KEY (("auditor characteristics" OR "auditor personality" OR "auditor professionalism" OR "auditor independence" OR "auditor objectivity" OR "auditor competence" OR "auditor experience" OR "Auditor Objectivity" OR "Auditor Integrity" OR "Due Professional Care" OR "Scepticism" OR "Ethics")) AND TITLE-ABS-KEY ("Audit Quality")) AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "ECON")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "Audit Quality") OR LIMIT-TO (EXACTKEYWORD , "Auditor Independence") OR LIMIT-TO (EXACTKEYWORD , "Independence")

OR LIMIT-TO (EXACTKEYWORD , "Ethics") OR LIMIT-TO (EXACTKEYWORD , "Competence") OR LIMIT-TO (EXACTKEYWORD , "Auditor Competence") OR LIMIT-TO (EXACTKEYWORD , "Perceived Audit Quality") OR LIMIT-TO (EXACTKEYWORD , "Professional Skepticism") OR LIMIT-TO (EXACTKEYWORD , "Quality") OR LIMIT-TO (EXACTKEYWORD , "Auditor Characteristics") OR LIMIT-TO (EXACTKEYWORD , "Auditor Experience") OR LIMIT-TO (EXACTKEYWORD , "Professional Ethics") OR LIMIT-TO (EXACTKEYWORD , "Professional Scepticism") OR LIMIT-TO (EXACTKEYWORD , "Professionalism") OR LIMIT-TO (EXACTKEYWORD , "Internal Audit Quality") OR LIMIT-TO (EXACTKEYWORD , "Independence In Appearance") OR LIMIT-TO (EXACTKEYWORD , "Objectivity") OR LIMIT-TO (EXACTKEYWORD , "Integrity") OR LIMIT-TO (EXACTKEYWORD , "Experience") OR LIMIT-TO (EXACTKEYWORD , "Due Professional Care") OR LIMIT-TO (EXACTKEYWORD , "Experience Gap") OR LIMIT-TO (EXACTKEYWORD , "Auditor's Independence") OR LIMIT-TO (EXACTKEYWORD , "Auditors' Independence") OR LIMIT-TO (EXACTKEYWORD , "Auditor Professional Skepticism") OR LIMIT-TO (EXACTKEYWORD , "Auditor Personality") OR LIMIT-TO (EXACTKEYWORD , "Auditor Objectivity") OR LIMIT-TO (EXACTKEYWORD , "Auditor Ethics") OR LIMIT-TO (EXACTKEYWORD , "Auditor Conservatism") OR LIMIT-TO (EXACTKEYWORD , "Auditor") OR LIMIT-TO (EXACTKEYWORD , "Auditors") OR LIMIT-TO (EXACTKEYWORD , "Motivation") OR LIMIT-TO (EXACTKEYWORD , "Individual Auditors") OR LIMIT-TO (EXACTKEYWORD , "Conservatism") OR LIMIT-TO (EXACTKEYWORD , "Auditor Industry Specialization") OR LIMIT-TO (EXACTKEYWORD , "Internal Audit") OR LIMIT-TO (EXACTKEYWORD , "Knowledge Spillover") OR LIMIT-TO (EXACTKEYWORD , "External Audit") OR LIMIT-TO (EXACTKEYWORD , "Audit Independence")).

The stages of bibliometric analysis in this study were based on the research of Setiawan et al. (2023) Namely, through the stages of data collection, data preprocessing, data analysis, and visualization and interpretation of results. This method makes it possible to identify research patterns, collaboration between authors, and the development of topics that are the focus of academic research. The analysis tools used were R Studio, Vosviewer, and Scopus analysis to support this research stage.

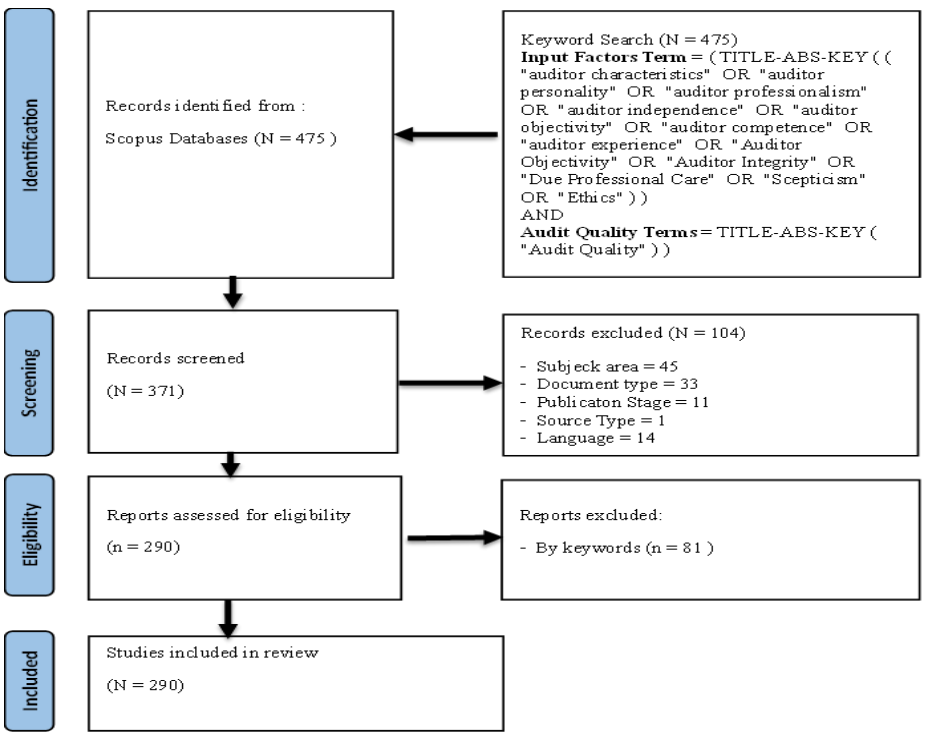

Figure 3: PRISMA Protocol

Source: Data Processing, 2025

3. Results and Disscusion

Table 1 presents the main results of the analysis using Biblioshiny, providing in-depth information about the data used in the study. The time period analyzed covers the years 1996 to 2025, with a total of 132 sources, including journals, books, and others. During this period, 290 documents were issued, with an annual growth rate of 9.25%. The average age of the analyzed documents was 7.23 years, and each document obtained an average of 27.74 citations per year. In addition, the number of references used in the document was 14,925.

In terms of document content, no additional keywords (Keywords Plus) were found, but there were 740 keywords used by the author (Author's Keywords). The number of authors involved in the document was 679, with 39 writing the document alone. Documents written by one author recorded a number of 41, while the average number of authors per document was 2.69. International collaboration was detected in 20.34% of the total documents analyzed. All recorded documents were articles.

Table 1: Key Document Information

Description	Result
MAIN INFORMATION ABOUT DATA	
Timespan	1996:2025
Sources (Journals, Books, etc)	132
Documents	290
Annual Growth Rate %	9.25
Document Average Age	7.23
Average citations per doc	27.74
References	14925
DOCUMENT CONTENTS	
Keywords Plus (ID)	0
Author's Keywords (DE)	740
AUTHORS	
Authors	679
Authors of single-authored docs	39
AUTHORS COLLABORATION	
Single-authored docs	41
Co-Authors for Doc	2.69
International co-authorships %	20.34
DOCUMENT TYPES	
article	290

Source: Biblioshiny Data Processing, 2025

3.1 Distribution Across Global Regions and organizations

Figure 4 presents the trend of article production from 1996 to 2025, which shows significant fluctuations in the number of articles published. At the beginning of the period, between 1996 and 2006, article production tended to be low, with several years without publication. Although there was a small increase in 2007, the overall period showed stagnation, which could be influenced by various factors, such as limited research facilities. The first peak of the increase occurred from 2007 to 2015, with the number of articles continuing to grow, reflecting a change in the intensity of research and efforts to increase the number of scientific publications.

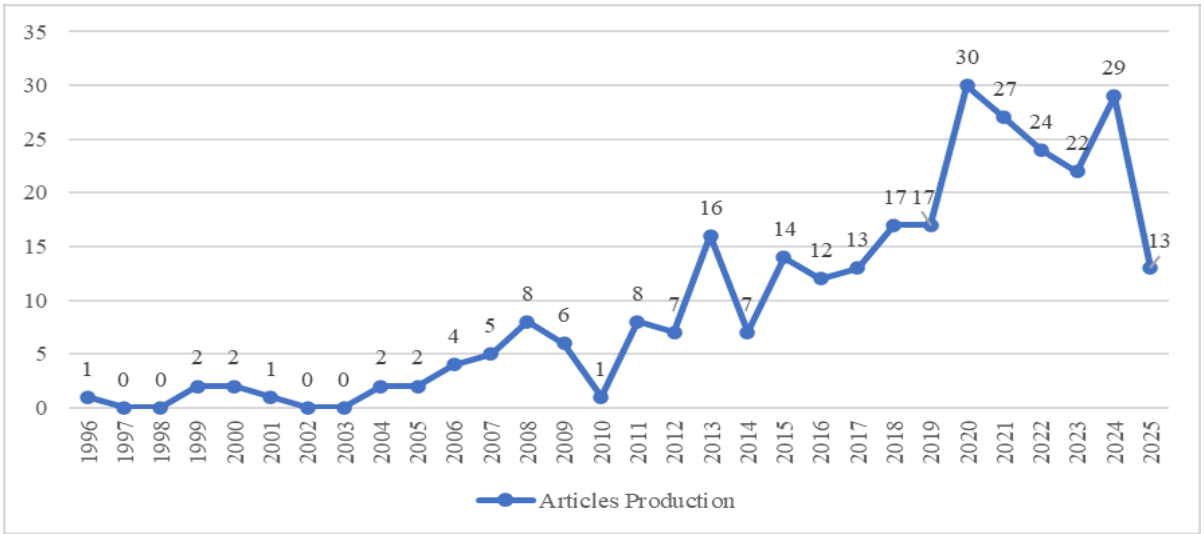

Figure 4: Articles Production

Source: Biblioshiny Data Processing, 2025

Entering the period 2016 to 2020, there was a significant surge in the number of articles produced, reaching the highest number in 2020 with 30 articles. This increase indicates greater support for the research and development of scientific publications. However, after the peak, there was a sharp decline in 2024 and 2025, with the number decreasing to 13 articles. This decline is likely due to a change in the focus of research, which is now more concentrated in other areas. Overall, this picture reflects the interesting dynamics in the world of scientific research on audit quality input factors over the past three decades.

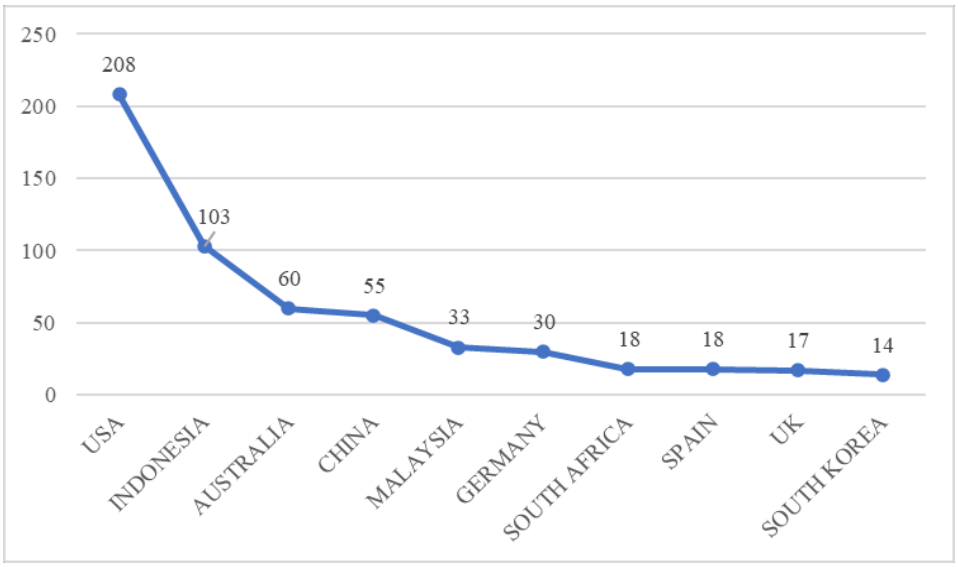

Figure 5: Contributing Countries

Source: Biblioshiny Data Processing, 2025

Figures 5 and 6 describe the global distribution of scientific contributions and research production, showing significant differences between large and smaller countries in terms of scientific production. Countries such as the United States and Indonesia dominated, with a huge contribution of publications related to the audit quality input element, reaching 208 and 103 publications, respectively, which was reflected in the dark blue color on the map, indicating a high level of scientific production. Countries such as Australia, China, and Malaysia also made substantial contributions, with 60 and 55 publications, respectively. However, after the top four countries, there was a sharp decline in the number of publications, as seen in countries such as Germany, South Africa, and Spain, which recorded between 30 and 18 publications. Countries with smaller contributions, such as the United Kingdom and South Korea, had even lower numbers, with approximately 14 publications each. Overall, these

data highlight the dominance of several countries in scientific contributions to audit quality input elements globally.

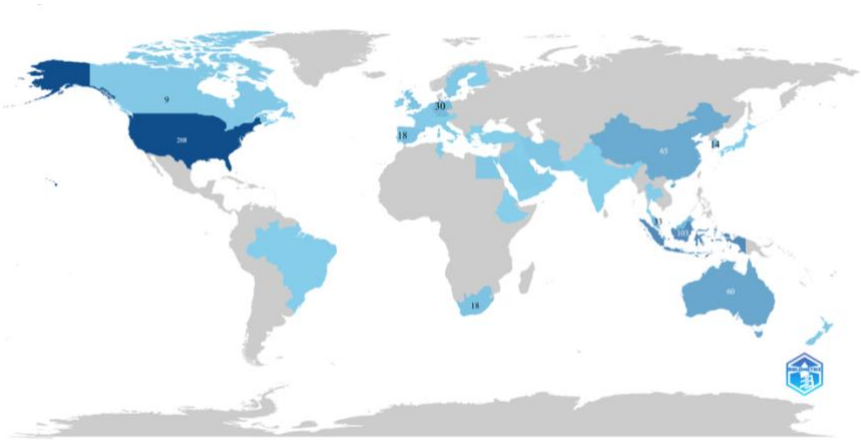

Figure: 6 Global Distribution of Publication Density

Source: Biblioshiny Data Processing, 2025

Regarding the number of publications by organization, Technische Universität Darmstadt (Germany), UNSW Sydney (Australia), and the University of Wisconsin-Milwaukee (United States) have contributed to the research on input factors and audit quality over the past three decades, producing 9,9, and 8 articles, respectively, as shown in Table 2. Table 2 also shows that in the United States and Australia, there are organizations, namely universities, that have a high interest in research related to input factors and audit quality. In addition, Table 2 shows that universities are centers of study related to input factors and audit quality.

Table 2: Top 10 Organizations That Contribute to Audit Quality Input Factor Research

Organization	Region	Number of Publications
Technical University of Darmstadt	Germany	9
UNSW Sydney	Australia	9
University of Wisconsin-Milwaukee	United States	8
MARA University of Technology	Malaysia	6
UNSW Business School	Australia	6
University of the Witwatersrand, Johannesburg	South Africa	5
University of South Florida, Tampa	United States	4
University of Antwerp	Belgium	4
Florida Atlantic University	United States	4
Kennesaw State University	United States	4

Source: Biblioshiny Data Processing, 2025

As shown in Table 3, four organizations (research funding programs) originated in China, with a total of 16 publications, followed by the United States with nine publications from three funding sponsoring institutions. The National Natural Science Foundation of China sponsored nine documents, or 7% of the 90 funding institutions that researched the input, factors, and quality of audits.

Table 3: Top 10 Organizations (Funding Sponsors) That Contribute to Audit Input Factor and Quality Research

Funding Sponsor	Region	Numbers
National Natural Science Foundation of China	China	9
American Accounting Association	United States	4
Ministry of Education of the People's Republic of China	China	3
University of Wisconsin-Madison	United States	3
China Postdoctoral Science Foundation	China	2
Deakin University	Australia	2
Erasmus University Rotterdam	Netherlands	2
Florida Atlantic University	United States	2
Fundamental Research Funds for the Central Universities	China	2
Korea Advanced Institute of Science and Technology	South Korea	2

Source: Scopus Analysis, 2025

Figure 7 shows the countries with the highest number of citations. The United States had the highest number of citations (2,110), followed by Australia (283) and Germany (174). This shows that articles from these countries are the main sources of research on input factors and audit quality. According to Setiawan et al. (2023), authors whose articles are often used as references by other researchers are those who have published many works on a particular topic and generally have a deeper understanding of the field of research. In this case, the fields in question are the input factors and audit quality.

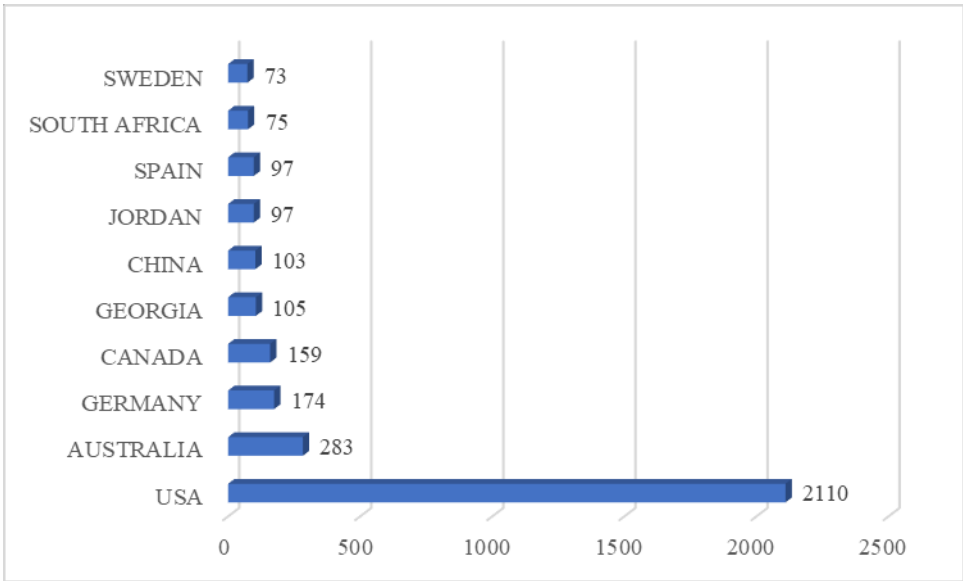

Figure: 7 Most Cited Countries

Source: Biblioshiny Data Processing, 2025

3.2 Journal Analysis

Figure 8 shows the top 10 journals with the highest number of publications on audit input factors and quality between 1996 and 2025. The Managerial Auditing Journal leads the list of publications with 21, followed by Auditing and the International Journal of Auditing, which each have 17 publications.

Figure 8: Top 10 Most Relevant Source

Source: Biblioshiny Data Processing, 2025

In addition, accounting and other business journals contributed to less than 10 publications. On the other hand, the local impact journal represented in Table 4 shows that the articles published in the Auditing journal have a wide quality and impact, as well as new findings about input factors and audit quality that are often used as references by other researchers. The Managerial Auditing Journal, Accounting Review, and International Journal of Auditing each have an h-index of 11 and 8. H- This index shows that articles published in these journals have a wide impact, and new findings on input factors and audit quality are often used as references by other researchers.

Table 4: Top 10 Local Impact Journals

Source	h_index
Auditing	12
Managerial Auditing Journal	11
Accounting Review	8
International Journal Of Auditing	8
Journal Of Accounting Research	6
Journal Of Accounting And Public Policy	5
Journal Of Business Ethics	5
Contemporary Accounting Research	4
Academy Of Accounting And Financial Studies Journal	3
Accounting, Organizations And Society	3

Source: Biblioshiny Data Processing, 2025

3.3 Author's Analysis

Table 5 shows the leading authors on input factors and audit quality. Quick Reiner led the way in the most publications (N = 8) but did not lead in the most citations (N = 116), the second position was occupied by Michael Harber and Warren Maroun with 5 publications each. In terms of citations, Ferdinand A. Gul had the highest number (N = 610). Furthermore, the article on the most influential input factors and audit quality written by Ferdinand A. Gul was published in 2013 and has been cited 475 times. This study discusses the influence of individual auditors on audit results by analyzing approximately 800 auditors. The findings show that the quality of audits produced by auditors varies, and this variation has economic and statistical effects. Furthermore, it was

also found that audit quality can be influenced by who conducts the audit regardless of the size of the firm, in addition to auditor characteristics such as education, experience at Big N, position within audit firms, and political affiliation explain the variation in audit quality (Gul et al., 2013). Although in the total citations Ferdinand A. Gul has the highest number of citations, in terms of citations from the aspect of link strength, this author has 0 link strength, this may be because Ferdinand A. Gul's publications have not established a significant or strong enough relationship or connection to influence the literature on the topic of internal factors and audit quality.

Table 5: Most Relevant Author

Authors	Articles	TC	h_index
Quick, Reiner	8	116	5
Harber, Michael	5	48	4
Maroun, Warren	5	74	4
Abbott, Lawrence J.	4	364	4
Yellow, Ferdinand A.	4	610	4
Higgs, Julia L.	4	109	4
Hossain, Sarwar	4	63	4
Brown, Veena L.	3	46	2
Daugherty, Brian E.	3	301	3
Krauß, Patrick	3	60	3

Source: Biblioshiny Data Processing, 2025

Figure 9 shows that this bibliometric network is formed from elements in the form of nodes and connections between nodes that are connected through lines (Van Eck & Waltman, 2014). Further, it can be seen that Reiner Quick has a strong number of citations from collaborations with lead authors in the areas of input factors and audit quality.

Figure 9: Author Citation Network

Source: Vosviewer Data Processing, 2025

3.4 Keyword Analysis

Figure 10, illustrating Figure 11, illustrates a co-occurrence network consisting of nodes (dots) and edges (connecting lines) that connect keywords. The thicker the connecting line between the nodes, the more often the keywords appear together. Each color indicates a thematic cluster, where the nodes and connecting lines within the cluster can be used to illustrate how the theme (cluster) includes the topics (nodes) and the relationships between the topics (nodes) present in the theme (cluster) (Donthu et al., 2021). As expected, audit quality and auditor independence, which are elements of factor input, have the largest node size, which is a major topic in this study. Some nodes may not appear because their occurrence frequencies are too small. In this case, there are four clusters, each represented by a different color, each cluster has several keywords and the same theme (cluster 1 = red; cluster 2 = blue; cluster 3 = green; and cluster 4 = purple). A keyword can be related to other keywords that belong to different clusters. Cluster 1 contains the same number of nodes as cluster 3. In contrast, clusters 2 and 4 have larger nodes, such as ethics and auditor independence (which is part of factor input), that represent the underlying themes in this review.

Figure 10: Co-Occurance Network
Source: Biblioshiny Data Processing, 2025

Donthu et al. (2021) explain that several network metrics are used to describe the structure and influence within a network, such as degree of centrality, centrality of betweenness, centrality of eigenvector, centrality of closeness, and PageRank. The centrality of betweenness measures the ability of a node to connect a group of unconnected nodes, whereas the centrality of closeness indicates how quickly a node can disseminate information through its proximity to other nodes in the network. PageRank, which was originally used to prioritize web pages, is also used to assess the prestige of a publication by looking at its influence on publications that are more cited, even if the publication itself is not cited as much. In addition, PageRank can be applied to group and identify important themes in a research domain.

Table 6: Co-Occurance Network

Node	Cluster	Betweenness	Closeness	PageRank
Independence	1	47,53	0,011	0,023
Competence	1	0	0,007	0,01
Auditor	1	0	0,01	0,007
Auditing	2	40,015	0,011	0,039
Auditors	2	63,275	0,011	0,029
Ethics	2	0,733	0,011	0,019

Quality	2	0	0,008	0,008
Australia	2	0,637	0,009	0,012
Jordan	2	0	0,007	0,005
Sweden	2	0	0,01	0,01
Perceived Audit Quality	3	10,226	0,009	0,014
Audit Firm Rotation	3	36,915	0,01	0,012
Germany	3	0	0,007	0,009
Audit Quality	4	906,885	0,019	0,27
Auditor Independence	4	149,714	0,014	0,138
Audit Fees	4	6,271	0,011	0,039
Discretionary Accruals	4	0,592	0,011	0,029
Non-Audit Services	4	0,148	0,011	0,028
Earnings Management	4	0,038	0,011	0,023
Corporate Governance	4	0	0,01	0,01
Auditor Competence	4	0,306	0,01	0,015
Internal Audit	4	0,216	0,01	0,012
Auditor Rotation	4	0	0,011	0,017
Auditor Tenure	4	0	0,01	0,012
Financial Reporting Quality	4	0	0,01	0,01
Mandatory Audit Firm Rotation	4	0	0,011	0,015
Non-Audit Fees	4	0	0,01	0,013
Professional Skepticism	4	0	0,01	0,007
Auditor Characteristics	4	0	0,01	0,008
Going Concern	4	0	0,01	0,011
Knowledge Spillover	4	0	0,01	0,013
Audit Committees	4	0	0,01	0,007
Audit Failure	4	0	0,01	0,007
Auditor Experience	4	0	0,01	0,007
Client Importance	4	0	0,01	0,012
External Audit	4	0	0,01	0,008
Nonaudit Services	4	1,14	0,01	0,011
Regulation	4	0	0,01	0,006
Audit	4	0	0,01	0,006
Audit Fee	4	0	0,01	0,008
Audit Tenure	4	0	0,01	0,006
Auditor Change	4	0	0,01	0,008
Earnings Quality	4	0	0,01	0,009
Non-Audit Service Fees	4	0,36	0,01	0,012
Performance	4	0	0,01	0,006
Professional Ethics	4	0	0,01	0,005
Professional Scepticism	4	0	0,01	0,005
Sarbanes-Oxley	4	0	0,01	0,007
Vietnam	4	0	0,01	0,006

Source: Biblioshiny Data Processing, 2025

Based on Table 6, audit quality and auditor independence are the most influential factors. These two topics had the highest scores for betweenness, closeness, and pagerank metrics, indicating their important role in connecting information and significantly influencing the network. In contrast, nodes such as professional ethics and professional skepticism showed low centrality on all metrics. This indicates that the influence and

connectivity of the two nodes in the network are low. As additional information in terms of centrality, there are keywords that have lower values than professional ethics and professional skepticism, such as Jordan, Germany, and Vietnam. However, this refers to a place where research is conducted that has no connection to the research topic, as well as professional ethics and professional skepticism. Meanwhile, the quality of the audit has a high betweenness and pagerank, demonstrating the significance and importance of this topic.

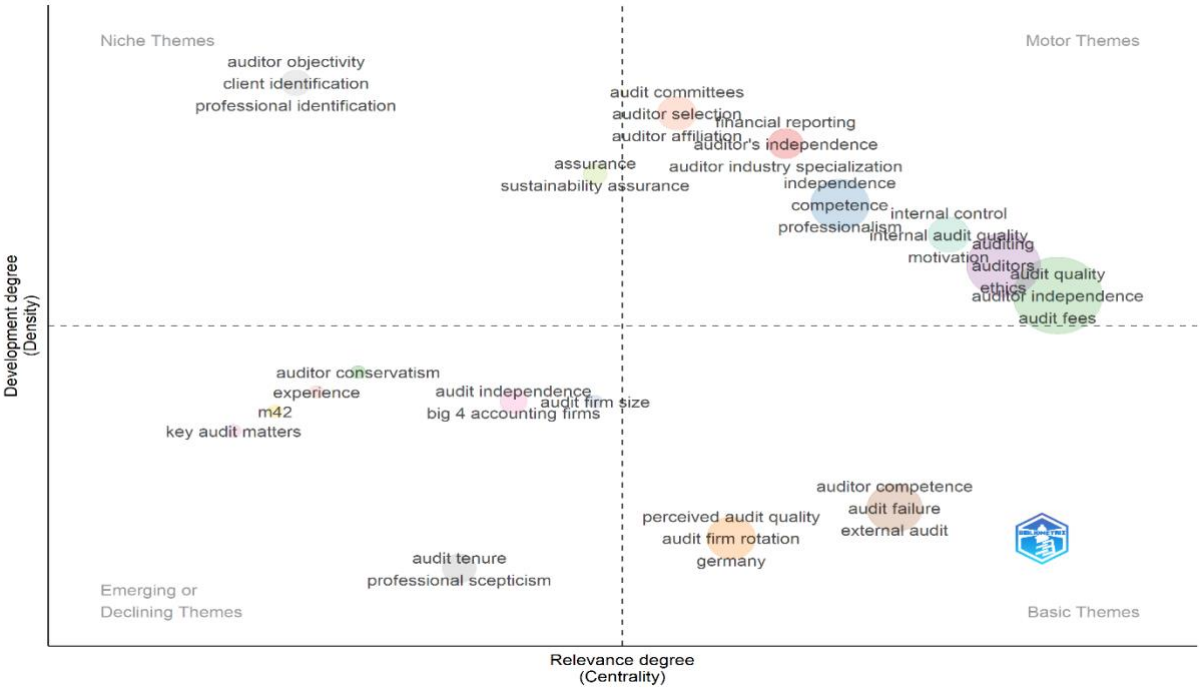

Figure 11: Thematic Map Based on Keywords

Source: Biblioshiny Data Processing, 2025

Figure 11 shows a graph maps various audit-related themes based on two dimensions: Development Degree and Relevance Degree. Themes in the upper left quadrant, such as "auditor objectivity" and "client identification," indicate more niche or specific themes with a low level of development. On the top right side, there are themes with a high level of relevance and good development, such as "audit committees," "auditor independence," and "audit quality," which show the main topics that are very relevant in the world of auditing and are constantly evolving.

In the lower left quadrant, we find themes that are developing more slowly and have lower relevance, such as "auditor conservatism" and "key audit matters." These themes may appear in certain contexts but do not receive widespread attention. Meanwhile, in the lower right quadrant, themes such as "auditor competence" and "audit failure" reflect themes that are quite relevant and have developed well, but are not as popular as the themes in the upper right quadrant. Overall, this graph illustrates how the various themes within the audit field are placed based on how far they have evolved and how important or relevant they are in the context of audits.

Figure 12 describes the development of the main topics in audit quality research from year to year, divided into three periods: 1996-2016, 2017-2021, and 2022-2025. In the first period, the main focus was on audit costs, audit quality, auditor tenure and non-audit services. For example, research shows that cutting audit costs in the first year of auditor involvement does not necessarily negatively impact audit quality, although there is a difference in audit costs between the first year and subsequent years. These cost cuts are often considered auditors' natural response to competitive market conditions, which do not necessarily threaten auditor independence (Krauß et al., 2014). In addition, economic factors, such as the financial attachment between the auditor and the client, influence the auditor's behavior more than the amount of fees received. Research also reveals that although audit costs are higher, audit quality can be lower, indicating that economic attachment dominates auditors' behavior more than their concern for their reputation (Hoitash et al. 2007).

Figure 12: Thematic Evolution Based on Keywords

Source: Biblioshiny Data Processing, 2025

For example, an auditor's tenure is a study that tests the influence of auditor tenure on audit quality, which is measured by the auditor's tendency to provide a going-concern opinion. The auditor's tenure was measured based on the duration of the auditor-client relationship, and the results of this study showed that the longer the auditor's tenure, the less inclined the auditor was to give a going-concern opinion (Junaidi et al., 2012). In the second period, attention shifted to audit firm rotation, auditor characteristics, auditor competencies, and new themes such as corporate governance, profit management, and auditor independence. An example of research in period 2 is audit firms; some studies in this period found that the implementation of audit firm rotation does not significantly improve auditor independence or audit quality (Aschauer & Quick, 2018; Quick & Schmidt, 2018).

In the latter period, research focused more on discretionary accruals, the quality of financial reporting, and professional skepticism, with a strong emphasis on auditor competence and auditor independence. An example of a study on discretionary accruals found that the absolute value of discretionary accruals decreased as the proportion of audit costs to the total audit costs received by audit partners from all their clients increased, suggesting that the higher the audit costs, the lower the tendency to conduct discretionary accruals. In contrast, negative abnormal audit costs are negatively correlated with the absolute value of discretionary accruals, which means that when audit costs are lower than they should be (negative abnormal audit costs), companies tend to have more discretionary accruals (Hossain et al., 2023; Hossain & Wang, 2023). Overall, the lines in Figure 11 connecting these themes show the interconnectedness between the various issues, reflecting the more complex developments in audit research over time.

4. Conclusion

The conclusion of this study shows that input factors such as auditor independence, auditor experience, auditor competence, auditor characteristics, auditor experience, professional ethics, and professional skepticism have a close relationship with audit quality, as shown by the same cluster category in the co-occurrence network analysis. This can provide insight to improve or control audit quality based on an understanding of the factors that play a role. in it. Furthermore, regarding publications, although there has been an increasing trend in publications related to audit quality since 2016, this study also found a sharp decline in 2024 and 2025, which reflects a change in focus in research that is more concentrated on other aspects of audit quality. The dominance of publications comes from countries such as the United States and Australia, while the contribution of other countries remains limited. In addition, the thematic evolution by keyword found that one author had multiple

publications on the same topic, indicating that some authors have a research focus on a particular field. This study suggests that future studies should further explore the interaction between input factors in audit practices, especially in the context of fraud detection. Further research is expected to explore the role of these factors in under-reported areas in the literature to enrich the understanding of audit quality globally.

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