Operational Efficiency and Business Diversification for the Financial Sustainability of 3 Kg LPG Stations: Mediating Cash Flow Resilience

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ABSTRACT
This study investigates the effects of operational efficiency and business diversification on financial sustainability, with cash flow resilience as a mediating variable among 3 kg subsidized LPG stations in Bangkalan Regency. Using a quantitative explanatory design, data were collected through questionnaires from station owners/managers and analyzed using SEM-PLS. Results show that operational efficiency and business diversification positively affect cash flow resilience and financial sustainability. Cash flow resilience also significantly improves financial sustainability and partially mediates the relationships between both predictors and financial sustainability. The findings indicate that financial sustainability in regulated, low-margin micro-enterprises depends on efficiency improvements, diversified income sources, and disciplined cash flow management.

ABSTRAK
Penelitian ini bertujuan menganalisis pengaruh efisiensi operasional dan diversifikasi usaha terhadap keberlanjutan finansial dengan ketahanan arus kas sebagai variabel mediasi pada pangkalan LPG subsidi 3 kg di Kabupaten Bangkalan. Penelitian menggunakan pendekatan kuantitatif eksplanatori dengan pengumpulan data melalui kuesioner kepada pemilik atau pengelola pangkalan LPG, serta dianalisis menggunakan SEM-PLS. Hasil penelitian menunjukkan bahwa efisiensi operasional dan diversifikasi usaha berpengaruh positif terhadap ketahanan arus kas dan keberlanjutan finansial. Ketahanan arus kas juga berpengaruh signifikan terhadap keberlanjutan finansial dan memediasi sebagian hubungan antara kedua variabel independen dan keberlanjutan finansial. Temuan ini menegaskan bahwa keberlanjutan finansial usaha mikro bermargin rendah dipengaruhi oleh efisiensi, diversifikasi pendapatan, dan pengelolaan arus kas yang disiplin.

INTRODUCTION

Financial sustainability is an important prerequisite for long-term business continuity, including for micro-enterprises that play a strategic role in meeting community needs. Financial sustainability is understood as the ability of a business entity to maintain financial stability, meet financial obligations, and maintain sustainable operations amid economic uncertainty and operational pressures (Thomas & Mantri, 2022; Schwab, 2020). The inability to maintain financial sustainability has the potential to cause liquidity problems, reduce competitiveness, and increase the risk of business failure.

The literature confirms that financial sustainability is influenced by internal factors, particularly operational efficiency, business diversification, and cash flow resilience (Rodríguez Bolívar et al., 2016). Operational efficiency reflects a business's ability to manage resources optimally and control costs, thereby strengthening long-term financial stability (Essuman et al., 2020). Business diversification plays a role in reducing dependence on a single source of income and increasing income stability, especially when there are market dynamics and external risks (Saliba, 2024). Cash flow resilience is a fundamental factor because stable cash flow supports daily operational financing and maintains liquidity, and is often positioned as a mediating variable that strengthens the relationship between efficiency and diversification towards financial sustainability (Almeida, 2021; Satriani et al., 2024).

In the Indonesian context, this issue is particularly relevant in the subsidized energy distribution sector, especially 3 kg subsidized LPG stations, which operate under strict regulation, low profit margins, and fluctuating supply and demand. In this study, the term '3 kg subsidized LPG stations' refers to official micro-level distribution units (locally known as 'pangkalan LPG') responsible for distributing subsidized LPG to end consumers, and the term 'stations' is used consistently throughout this article to refer to these units. Such operating conditions increase the vulnerability of these micro-enterprises to capital constraints and operational pressures, thereby highlighting the importance of internal strategies to maintain financial sustainability. Consequently, adaptive strategies through operational efficiency and business diversification become essential, although their effectiveness remains dependent on adequate cash flow management (Essuman et al., 2020; Githaiga, 2022). Bangkalan Regency represents a relevant research setting, with 686 active LPG stations, most of which are managed by micro and small businesses facing similar financial and operational challenges. Therefore, examining the influence of operational efficiency and business diversification on financial sustainability, with cash flow resilience as a mediating variable, is relevant both academically and practically.

Operational efficiency reflects an organization's ability to utilize resources optimally to reduce costs, minimize waste, and increase productivity without compromising service/product quality (Puspaningtyas et al., 2024). In the context of MSMEs, operational efficiency becomes increasingly crucial due to limited capital, human resources, and managerial capacity; the application of accounting management and cost control contributes to both efficiency and long-term profitability (Puspaningtyas et al., 2024). Beyond cost aspects, efficiency can also be enhanced through digitalization, which drives transaction cost reduction, accelerates information flow, and improves marketing and distribution processes (Mendrofa et al., 2025; Anwari et al., 2024). Work system improvement approaches such as total quality management (TQM) are also associated with increased efficiency through process quality improvement and reduction of operational errors (Rahmas et al., 2024; Masoudi & Shahin, 2025). Empirically, operational efficiency is seen as contributing to financial sustainability because process improvements and cost control strengthen a business's ability to maintain long-term financial stability (Song et al., 2020). In sectors affected by distribution and supply chains, efficiency is also related to strengthening cash flow through cost management, accelerating cash cycles, and increasing operational resilience (Roshan, 2024; Ige-gbadeyan, 2025, Wilson, 2025). In this study, operational efficiency is measured using indicators such as the ratio of operating costs to revenue (Herman, 2023) as well as the dimensions of people efficiency, assets utilization efficiency, process efficiency, and technology efficiency (Wilson, 2025).

Business diversification is a strategy of expanding the variety of products/services or expanding market coverage to create more than one source of income, thereby reducing the risk of dependence on a single line of business (Ansoff, 1948). This strategy is considered relevant to microenterprises because more diverse income tends to stabilize cash flow and increase business resilience to fluctuations in demand and external pressures. The document also explains that diversification can take horizontal, vertical, or conglomerate forms, and its success greatly depends on its suitability to internal resource capacities so as not to trigger uncontrolled costs (Lee et al., 2016). In the context of 3 kg subsidized LPG stations, diversification is positioned as an adaptive strategy to expand sources of income, which can ultimately strengthen cash flow resilience and support financial sustainability. Empirical findings cited in the document also show that income diversification/differentiation is positively correlated with financial stability and cash flow resilience in various business contexts (Githaiga, 2022; Saliba, 2024).

Cash flow resilience is defined as the ability of a business entity to maintain liquidity and cash flow stability when facing external pressures, such as fluctuations in demand and supply constraints (Essuman et al., 2020). Stable cash flow is the foundation of operations because it enables businesses to finance daily activities, meet obligations, and maintain flexibility in financial decision-making (Almeida, 2021). In the research model in the document, cash flow resilience is positioned as a variable influenced by internal strategies (operational efficiency and business diversification) as well as a mechanism that strengthens the impact of these two strategies on financial sustainability (Satriani et al., 2024).

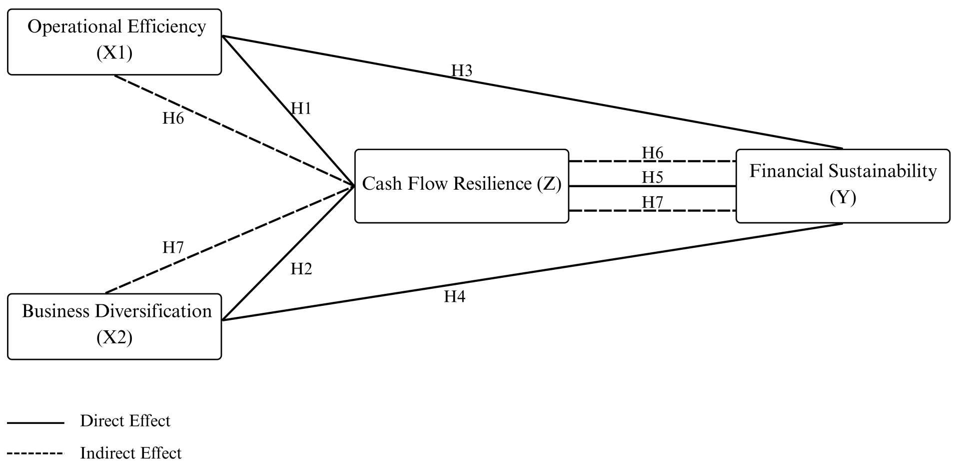
Financial sustainability refers to a business's ability to maintain long-term financial stability so that it remains able to finance operations, meet obligations, and survive economic uncertainty and operational disruptions (Thomas & Mantri, 2022; Schwab, 2020). This concept emphasizes the balance between cost efficiency, diversity of income sources, and robust cash flow management as prerequisites for business sustainability. In the document, financial sustainability is confirmed to be influenced by internal factors such as operational efficiency and business diversification, with cash flow resilience as an important pathway that strengthens the relationship between internal strategy and long-term financial stability (Rodríguez Bolívar et al., 2016; Satriani et al., 2024).

Operational efficiency is expected to strengthen cash flow resilience through cost control and productivity improvement, which have an impact on liquidity, as well as directly improving financial sustainability through improved long-term financial performance. Furthermore, business diversification is expected to strengthen cash flow resilience by creating multiple income streams that stabilize revenue, while promoting financial sustainability through revenue risk spreading. Cash flow resilience is positioned as a determinant of financial sustainability and also as a mediating variable, because stable cash flow makes efficiency and diversification strategies more effective in generating financial sustainability (Satriani et al., 2024; Almeida, 2021). Based on this description, the research hypotheses are formulated as follows:

H1: Operational efficiency has a positive and significant effect on cash flow resilience.
H2: Business diversification has a positive and significant effect on cash flow resilience.
H3: Operational efficiency has a positive and significant effect on financial sustainability.
H4: Business diversification has a positive and significant effect on financial sustainability.
H5: Cash flow resilience has a positive and significant effect on financial sustainability.
H6: Operational efficiency has a positive and significant effect on financial sustainability through cash flow resilience as a mediating variable.
H7: Business diversification has a positive and significant effect on financial sustainability through cash flow resilience as a mediating variable.

Based on the relationships between variables that have been described, the research model used in this study is shown in the following figure.

Picture 1. Conceptual Framework



Source: *Research Data Proceseed*

RESEARCH METHOD

This study uses an explanatory quantitative approach, which is a study that aims to explain the position of the variables studied and the causal relationships between variables. Thus, the study not only describes the conditions of operational efficiency, business diversification, cash flow resilience, and financial sustainability at 3 kg subsidized LPG stations, but also tests the direct and indirect (mediating) effects according to the research hypothesis. Data analysis was conducted using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach because the model involved latent constructs, multivariate causal relationships, and mediation testing.

Research object is the target or focus of the research, which can be an individual, group, institution, or specific phenomenon (Sugiyono, 2023). In this study, the research object is the 3 kg subsidized LPG station in Bangkalan Regency as the field analysis unit. The research respondents were determined to be the owners or managers of LPG stations who understand the operational, financial, and business strategy conditions, so that the information provided is considered relevant and can represent the conditions of the business units being studied.

The data used in this study is quantitative data obtained as primary data through the distribution of questionnaires to respondents. All main variables, namely operational efficiency (X1), business diversification (X2), cash flow resilience (Z), and financial sustainability (Y), were measured using statements in the questionnaire with a 1–5 Likert scale, ranging from 1 for “strongly disagree” to 5 for “strongly agree.” Because the instrument used is a Likert scale, the measurement data is categorized as ordinal data at the item level. However, in SEM-PLS processing, the respondents' answer scores are represented in the form of discrete numbers 1–5 so that they can be analyzed as numerical inputs to construct latent constructs and test causal relationships between variables.

The population in this study was all 3 kg subsidized LPG stations in Bangkalan Regency, which numbered 686 active stations. Given that the population is spread across several subdistricts, the sampling technique used is stratified random sampling. According to (Sugiyono, 2023), stratified random sampling is a sampling technique carried out by dividing the population into certain strata (levels), then samples are taken randomly from each stratum proportionally. The strata in this study were determined based on the subdistricts where the stations operated. The number of samples from each subdistrict was determined proportionally to the size of the station population in that subdistrict, so that each subdistrict had a representative chance of being represented.

In this study, the sample size was determined using the Slovin formula with a margin of error of 10% of the total population of 686 3 kg subsidized LPG stations in Bangkalan Regency, based on the formula:

$$n = N / (1 + Ne2)$$

Description:
n = sample size
N = population size
e = margin of error
With N = 686 and e = 0.1 or 10%, then:

$$n = 686 / (1 + 686(0,1)2) = 686/7,68 = 87,28$$

This value was then rounded up to 88 respondents. This approach is in line with current sample size determination principles as outlined in "Sample Size Determination: Principles and Applications for Health Research." Using the Slovin formula with a 10% margin of error, the minimum required sample size was 88 respondents. However, during data collection, a total of 165 valid questionnaires were obtained from owners or managers of 3 kg subsidized LPG stations. All valid responses were included in the analysis to increase statistical power and robustness of the results.

The data collection techniques in this study were conducted through questionnaires and documentation. The questionnaire was used to collect primary data in a structured manner from owners or managers of 3 kg subsidized LPG stations who have knowledge of the business's operational and financial conditions. The questionnaire instrument was developed based on indicators of operational efficiency, business diversification, cash flow resilience, and financial sustainability and was measured using a 1–5 Likert scale to allow for quantitative analysis. In addition, documentation was used as supporting data in the form of relevant notes, documents, or archives to enrich the context and strengthen the interpretation of the research findings (Sugiyono, 2023).

The analysis was conducted using Structural Equation Modeling–Partial Least Squares (SEM-PLS), which is appropriate for examining complex causal relationships involving latent constructs and mediation effects (Hair et al., 2022). PLS-SEM analysis was carried out in two main stages, namely the evaluation of the measurement model (outer model) and the evaluation of the structural model (inner model). This technique was used to examine the structural relationships between latent variables and to assess the strength and significance of the hypothesized paths in the research model, in accordance with the two-stage approach in PLS-SEM.

RESULTS AND DISCUSSION

Respondent characteristics

The research data was obtained from questionnaires distributed to 165 respondents at 3kg LPG stations. The characteristics of the respondents studied in this research included sub-district and age of business. The following is a classification of each respondent:

Table 1. Respondent Characteristics

Subdistrict	Number of Respondents	Percentage
Arosbaya	10	6,06%
Bangkalan	15	9,09%

Blega	11	6,67%
Burneh	10	6,06%
Galis	12	7,27%
Geger	6	3,64%
Kamal	9	5,45%
Klampis	9	5,45%
Kokop	4	2,42%
Konang	5	3,03%
Kwanyar	10	6,06%
Labang	11	6,67%
Modung	10	6,06%
Sepulu	7	4,24%
Socah	10	6,06%
Tanah Merah	9	5,45%
Tanjung Bumi	9	5,45%
Tragah	8	4,85%
Total	**165**	**100%**
Business Age	**Number of Respondents**	**Percentage**
< 1 year	0	0%
1-4 year	14	8,48%
5-9 year	119	72,12%
>10 year	32	19,39%
Total	**165**	**100%**

A total of 165 valid questionnaires were obtained from owners or managers of 3 kg subsidized LPG stations and were included in the analysis. All responses met the completeness and consistency criteria required for SEM-PLS analysis, allowing the data to be processed without further elimination. The use of all valid responses increased the statistical power of the analysis and provided a more comprehensive representation of the operational and financial conditions of the studied stations.

Measurement of Variables

Prior to the final measurement model assessment, an initial outer loading evaluation (Stage 1) was conducted to examine the adequacy of all indicators included in the questionnaire. This initial assessment involved all originally proposed measurement items for each construct, namely operational efficiency, business diversification, cash flow resilience, and financial sustainability. Indicators with outer loading values below the recommended threshold of 0.70 were considered for removal in order to improve convergent validity and internal consistency reliability. Following this procedure, several indicators that did not meet the minimum loading criteria were eliminated. The measurement model was then re-estimated, and only indicators with acceptable outer loading values were retained in the final model, as presented in Table 2.

Table 2. Outer Loading (Stage 1)

Variables	Items	Loading Factor	Remaks
Operational Efficiency (X1)	X1.1	0.776	Valid
	X1.2	0.137	Unvalid
	X1.3	0.800	Valid
	X1.4	0.289	Unvalid
	X1.5	0.721	Valid
	X1.6	0.733	Valid
	X1.7	0.229	Unvalid
	X1.8	0.737	Valid
	X1.9	0.750	Valid

Variables	Items	Loading Factor	Remaks
	X1.10	0.728	Valid
Business Diversification (X2)	X2.1	0.832	Valid
	X2.2	0.779	Valid
	X2.3	0.794	Valid
	X2.4	0.799	Valid
	X2.5	0.803	Valid
	X2.6	0.081	Unvalid
	X2.7	0.781	Valid
	X2.8	0.779	Valid
	X2.9	0.784	Valid
	X2.10	0.832	Valid
	X2.11	0.069	Unvalid
Financial Sustainability (Y)	Y.1	0.778	Valid
	Y.2	0.726	Valid
	Y.3	0.775	Valid
	Y.4	0.101	Unvalid
	Y.5	0.118	Unvalid
	Y.6	0.769	Valid
	Y.7	0.108	Unvalid
	Y.8	0.740	Valid
	Y.9	0.764	Valid
	Y.10	0.777	Valid
	Y.11	0.207	Unvalid
	Y.12	0.785	Valid
Cash Flow Resilience (Z)	Z.1	0.790	Valid
	Z.2	0.770	Valid
	Z.3	0.805	Valid
	Z.4	0.058	Unvalid
	Z.5	0.127	Unvalid
	Z.6	0.813	Valid
	Z.7	0.772	Valid
	Z.8	0.212	Unvalid
	Z.9	0.764	Valid
	Z.10	0.759	Valid
	Z.11	0.845	Valid
	Z.12	0.773	Valid

The results of the initial outer loading assessment indicate that several indicators did not meet the recommended minimum threshold of 0.70, suggesting insufficient convergent validity at the initial measurement stage. Following established PLS-SEM guidelines, indicators with low outer loading values were considered for removal to improve the reliability and validity of the measurement model (Hair et al., 2022; Henseler et al., 2015). Accordingly, these indicators were eliminated, and the measurement model was subsequently re-estimated to obtain a more robust and parsimonious model. The results of this re-estimation, representing the final measurement model, are presented in the subsequent analysis.

Table 3. Outer Loading and Outer VIF (Stage 2)

Variables	Items	Loading Factor	Outer VIF	Remaks
Operational Efficiency (X1)	X1.1	0.774	1.889	Valid
	X1.3	0.798	2.042	Valid
	X1.5	0.736	1.736	Valid
	X1.6	0.743	1.702	Valid

Variables	Items	Loading Factor	Outer VIF	Remaks
	X1.8	0.734	1.762	Valid
	X1.9	0.751	1.795	Valid
	X1.10	0.739	1.749	Valid
Business Diversification (X2)	X2.1	0.829	2.692	Valid
	X2.2	0.780	2.476	Valid
	X2.3	0.794	2.293	Valid
	X2.4	0.798	2.437	Valid
	X2.5	0.802	2.340	Valid
	X2.7	0.783	2.222	Valid
	X2.8	0.781	2.260	Valid
	X2.9	0.786	2.260	Valid
	X2.10	0.829	2.807	Valid
Financial Sustainability (Y)	Y1	0.776	2.138	Valid
	Y2	0.728	1.897	Valid
	Y3	0.776	2.122	Valid
	Y6	0.766	1.977	Valid
	Y.8	0.747	1.904	Valid
	Y.9	0.763	1.938	Valid
	Y.10	0.779	2.170	Valid
	Y.12	0.790	2.150	Valid
Cash Flow Resilience (Z)	Z.1	0.792	2.380	Valid
	Z.2	0.770	2.323	Valid
	Z.3	0.805	2.443	Valid
	Z.6	0.814	2.668	Valid
	Z.7	0.772	2.097	Valid
	Z.9	0.765	2.161	Valid
	Z.10	0.759	2.038	Valid
	Z.11	0.847	2.883	Valid
	Z.12	0.771	2.198	Valid

Interpretation of Table 3 (Outer Loading and Outer VIF) shows that all indicators in the Operational Efficiency (X1), Business Diversification (X2), Financial Sustainability (Y), and Cash Flow Resilience (Z) constructs have met the measurement quality criteria because the outer loading values of all items are above 0.70, thus convergent validity is fulfilled and all indicators are valid. At the same time, the results of the collinearity test through outer VIF show that the VIF values of all indicators are in the range of approximately 1.70–2.88, with the highest value at Z11 = 2.883, so that all are still below the general VIF limit of ≤ 5 and even meet the more ideal limit of VIF ≤ 3; these findings indicate that there are no multicollinearity problems at the indicator level and the measurement model is feasible to proceed to the structural model evaluation stage (Hair et al., 2022).

Measurement Model Evaluation

Measurement model in this study adopts a reflective specification, where indicators are assumed to reflect the underlying latent constructs, namely operational efficiency (X1), business diversification (X2), cash flow resilience (Z), and financial sustainability (Y). Evaluation of a reflective measurement model follows the reliability and validity criteria recommended in SEM-PLS, including assessment of indicator reliability through outer loadings (preferably ≥ 0.708, with 0.40–0.70 considered for retention depending on its impact on AVE and composite reliability), internal consistency reliability through Composite Reliability (≥ 0.70) and Cronbach's Alpha (≥ 0.70), and convergent validity through Average Variance Extracted (AVE

≥ 0.50) (Hair et al., 2022). Discriminant validity is subsequently confirmed using criteria such as Fornell–Larcker and/or HTMT to ensure that each construct is empirically distinct from the others (Hair et al., 2022).

Table 4. Cronbach Alpha, Composite Reability, AVE

Variables	Cronbach's Alpha	Composite Reability	Average Variance Extrancted (AVE)
Operational Efficiency (X1)	0.873	0.902	0.568
Business Diversification (X2)	0.929	0.941	0.637
Financial Sustainability (Y)	0.899	0.919	0.587
Cash Flow Resilience (Z)	0.928	0.937	0.622

The test results in Table 4 show that all constructs in the model have met the criteria for reliability and convergent validity. Cronbach's Alpha values for each variable are above the threshold of 0.70, ranging from 0.873 to 0.929, which indicates good internal consistency of the indicators. In addition, the Composite Reliability values for all constructs also exceed the minimum threshold of 0.70 and range from 0.902 to 0.941, confirming the adequacy of construct reliability. Meanwhile, the Average Variance Extracted (AVE) value for all variables is greater than 0.50, ranging from 0.568 to 0.637, indicating that each construct is able to explain more than half of the variance of its indicators. With these criteria met, it can be concluded that the measurement instruments in this study are reliable and valid, making the measurement model suitable for use in the next stage of structural analysis.

Discriminant Validity Evaluation

Discriminant validity testing aims to ensure that each construct in the model truly represents a different concept, so that the indicators in each construct do not "overlap" in measuring other constructs and the accuracy of the measurement can be accounted for (Hair et al., 2022). The evaluation of discriminant validity in this study was conducted through three procedures commonly used in SEM-PLS, namely the Fornell–Larcker Criterion, cross loadings, and HTMT (Heterotrait–Monotrait Ratio) (Fornell & Larcker, 1981; Henseler et al., 2015; Hair et al., 2022). In the Fornell–Larcker approach, discriminant validity is considered adequate if the AVE square root value of a construct is higher than the correlation of that construct with other constructs, thus indicating that the construct has a stronger explanatory power for its own indicators than for other constructs (Fornell & Larcker, 1981; Hair et al., 2022). Furthermore, through cross-loading examination, each indicator is expected to have the highest loading value in its original construct compared to the loading in other constructs, indicating that the indicator best represents the construct that should be measured (Hair et al., 2022). Additionally, HTMT testing is used to assess the level of similarity between constructs through correlation ratios, with an HTMT threshold of ≤ 0.85 as a more conservative criterion or ≤ 0.90 as a more lenient criterion; meeting these thresholds indicates that the constructs in the model can be empirically distinguished (Henseler et al., 2015; Hair et al., 2022). If all three procedures meet the required criteria, the constructs in the model are declared to have good discriminant validity and are suitable for structural model testing (Hair et al., 2022).

Table 5. Fornell Lacker Criterion

Variables	X1	X2	Y	Z
Operational Efficiency (X1)	**0.754**			
Business Diversification (X2)	0.446	**0.789**		
Financial Sustainability (Y)	0.683	0.665	**0.766**	

Cash Flow Resilience (Z)	0.556	0.625	0.717	**0.789**

Test results in Table 5 (Fornell–Larcker Criterion), the values on the diagonal (AVE roots) for each construct are 0.754 for Operational Efficiency (X1), 0.789 for Business Diversification (X2), 0.766 for Financial Sustainability (Y), and 0.789 for Cash Flow Resilience (Z). All AVE root values are greater than the correlation of the construct in question with other constructs (e.g., X1 with X2 = 0.446; X1 with Y = 0.683; X1 with Z = 0.556; X2 with Y = 0.665; X2 with Z = 0.625; and Y with Z = 0.717). Thus, it can be concluded that each construct is able to explain its indicators better than its relationship with other constructs, so that the discriminant validity in this research model is considered to be fulfilled.

Table 6. Cross Loading

Item	X1	X2	Y	Z
X1.1	**0.774**	0.342	0.534	0.452
X1.3	**0.798**	0.415	0.555	0.504
X1.5	**0.736**	0.334	0.493	0.359
X1.6	**0.743**	0.348	0.547	0.396
X1.8	**0.734**	0.365	0.492	0.331
X1.9	**0.751**	0.307	0.467	0.449
X1.10	**0.739**	0.341	0.511	0.420
X2.1	0.372	**0.829**	0.522	0.501
X2.2	0.356	**0.780**	0.496	0.492
X2.3	0.398	**0.794**	0.530	0.501
X2.4	0.353	**0.798**	0.561	0.517
X2.5	0.362	**0.802**	0.532	0.529
X2.7	0.372	**0.783**	0.521	0.418
X2.8	0.385	**0.781**	0.521	0.474
X2.9	0.371	**0.786**	0.549	0.531
X2.10	0.414	**0.829**	0.538	0.514
Y1	0.546	0.575	**0.776**	0.521
Y2	0.545	0.475	**0.728**	0.522
Y3	0.532	0.473	**0.776**	0.513
Y6	0.550	0.444	**0.766**	0.577
Y.8	0.482	0.555	**0.747**	0.569
Y.9	0.564	0.503	**0.763**	0.504
Y.10	0.475	0.484	**0.779**	0.521
Y.12	0.491	0.560	**0.790**	0.592
Z.1	0.452	0.414	0.579	**0.792**
Z.2	0.384	0. 484	0.515	**0.770**
Z.3	0.506	0.491	0.547	**0.805**
Z.6	0.448	0.510	0.551	**0.814**
Z.7	0.442	0.562	0.568	**0.772**
Z.9	0.442	0.484	0.524	**0.765**
Z.10	0.488	0.441	0.604	**0.759**
Z.11	0.404	0.546	0.646	**0.847**
Z.12	0.378	0.496	0.545	**0.771**

Table 6 shows the Cross Loading results. It can be seen that each indicator has the highest loading value in its original construct compared to the loading in other constructs. Operational Efficiency indicators (X1) such as X1.1, X1.3, X1.5, to X1.10 show the highest loading in the X1 column (around 0.734–0.798) and lower in the X2, Y, and Z columns. The same thing also occurs in Business Diversification indicators (X2) such as X2.1 to X2.10, which have the highest loading on the X2 construct (around 0.780–0.829) and smaller on other constructs. For the Financial

Sustainability construct (Y), all indicators (e.g., Y1, Y2, Y3, Y6, Y.8, Y.9, Y.10, Y.12) also show the highest loadings in column Y (around 0.726–0.790) compared to X1, X2, and Z. Similarly, Cash Flow Resilience (Z) indicators such as Z.1, Z.2, Z.3, Z.6, Z.7, Z.9, Z.10, Z.11, and Z.12 have the highest loadings in the Z column (around 0.759–0.847) and lower loadings in other constructs. Thus, the Cross Loading criterion is met, so it can be concluded that each construct has good discriminant validity because the indicators represent their own constructs rather than other constructs.

Table 7. HTMT (Heterotrait-Monotrait Ratio)

Variables	X1	X2	Y	Z
Operational Efficiency (X1)				
Business Diversification (X2)	0.516			
Financial Sustainability (Y)	0.769	0.725		
Cash Flow Resilience (Z)	0.614	0.672	0.784	

Table 7 shows the HTMT results, with all correlation ratios between constructs below the specified limits, both conservative criteria (≤ 0.85) and more lenient criteria (≤ 0.90). The HTMT value between Operational Efficiency (X1) and Business Diversification (X2) is 0.516, between X1 and Financial Sustainability (Y) is 0.769, and between X1 and Cash Flow Resilience (Z) is 0.614. Furthermore, the HTMT value between X2 and Y is 0.725, between X2 and Z is 0.672, and between Y and Z is 0.784. Since all of these values are < 0.85, it can be concluded that the discriminant validity in this research model is fulfilled, which means that each construct has clear differences and there is no overlap in measurement between constructs.

Structural Model Evaluation

Structural model evaluation focuses on testing hypotheses regarding the relationships and influences between research variables, and is carried out through three main stages. The first stage assesses the potential for multicollinearity between constructs using the Inner VIF value, where a VIF value below 5 indicates no multicollinearity problems at the construct level, allowing for reliable interpretation of path coefficient estimates (Hair et al., 2021). The second stage tests the significance of the relationship between variables through bootstrapping results by referring to the t-statistic and p-value values, namely the relationship is considered significant if the t-statistic > 1.96 or p-value < 0.05, and is supplemented by reporting a 95% confidence interval to ensure the accuracy of the path coefficient estimation (Hair et al., 2021). The third stage evaluates the effect size (f^2) to assess the relative contribution of direct influence at the structural level, with interpretation criteria of 0.02 as a small effect, 0.15 as a moderate effect, and 0.35 as a large effect (Hair et al., 2021). In addition, the strength of the mediating effect is assessed using upsilon v (ϒV), which is calculated from the square of the mediating path coefficient, with categories of 0.02 as weak mediation, 0.075 as moderate mediation, and 0.175 as strong mediation (Lachowicz et al., 2018; Ogbeibu et al., 2022).

Table 8. Inner VIF

Variables	X1	X2	Y	Z
Operational Efficiency (X1)			1.497	1.277
Business Diversification (X2)			1.696	1.277
Financial Sustainability (Y)				
Cash Flow Resilience (Z)			1.932	

Table 8 shows the results of Inner VIF Values in the structural model. All VIF values between constructs are below the limit of 5 and also meet the ideal criteria of ≤ 3. The VIF values that appear are X1 against Y of 1.497 and against Z of 1.277; X2 against Y of 1.696 and against Z of 1.277; and Z against Y of 1.923. Since all values are < 3, it can be concluded that there is no multicollinearity problem between constructs in the model, so that testing the relationship/influence between variables (path coefficient) can be continued and interpreted more accurately.

Table 9. Hypothesis Testing: Direct Effect

Hypothesis	Path Coefficient	p-value	95% Confidence Interval for the Path Coefficient		F Square
			Lower Bound	Upper Bound	
H1. Operational Efficiency (X1) → Cash Flow Resilience (Z)	0.338	0.000	0.156	0.526	0.173
H2. Business Diversification (X2) → Cash Flow Resilience (Z)	0.467	0.000	0.247	0.633	0.329
H3. Operational Efficiency (X1) → Financial Sustainability (Y)	0.364	0.002	0.177	0.625	0.275
H4. Business Diversification (X2) → Financial Sustainability (Y)	0.285	0.007	0.094	0.490	0.149
H5. Cash Flow Resilience (Z) → Financial Sustainability (Y)	0.337	0.014	0.058	0.583	0.184

The results of hypothesis testing led to the following findings:

H1 (Operational Efficiency → Cash Flow Resilience). The test results show that operational efficiency (X1) has a positive and significant effect on cash flow resilience (Z), with a path coefficient of $\beta = 0.338$ and p-value = 0.000. The 95% confidence interval is in the range of 0.156 to 0.526 and does not cross zero, so the resulting effect is consistent and statistically acceptable. The f^2 value of 0.173 indicates that the effect of X1 on Z is in the moderate category, meaning that an increase in operational efficiency contributes significantly to strengthening cash flow resilience. Thus, H1 is accepted.

H2 (Business Diversification → Cash Flow Resilience). The test results show that business diversification (X2) has a positive and significant effect on cash flow resilience (Z), with a path coefficient of $\beta = 0.467$ and a p-value = 0.000. The 95% confidence interval is in the range of 0.247 to 0.633 and does not cross zero, so the estimated effect is considered consistent and statistically acceptable. The f^2 value of 0.329 indicates a moderate to large effect size, meaning that business diversification contributes relatively strongly to improving cash flow resilience. Thus, H2 is accepted.

H3 (Operational Efficiency → Financial Sustainability). The test results show that operational efficiency (X1) has a positive and significant effect on financial sustainability (Y), with a path coefficient of $\beta = 0.364$ and a p-value = 0.002. The 95% confidence interval is in the range of 0.177 to 0.625 and does not cross zero, so the estimated effect is consistent and statistically significant. The f^2 value of 0.275 indicates a moderate effect size, suggesting that improvements in operational efficiency contribute significantly to strengthening financial sustainability. Thus, H3 is accepted.

H4 (Business Diversification → Financial Sustainability). The test results show that business diversification (X2) has a positive and significant effect on financial sustainability (Y), with a path coefficient of β = 0.285 and a p-value = 0.007. The 95% confidence interval is in the range of 0.094 to 0.490 and does not cross zero, so the estimated effect is significant and consistent. The f^2 value of 0.149 indicates a small to moderate effect size, meaning that business diversification contributes significantly to improving financial sustainability, although the magnitude of the effect is relatively lower than some other paths. Thus, H4 is accepted.

H5 (Cash Flow Resilience → Financial Sustainability). The test results show that cash flow resilience (Z) has a positive and significant effect on financial sustainability (Y), with a path coefficient of β = 0.337 and a p-value = 0.014. The 95% confidence interval is in the range of 0.058 to 0.583 and does not cross zero, so the estimated effect is statistically significant and consistent. The f^2 value of 0.184 indicates a moderate effect size, suggesting that an increase in cash flow resilience contributes significantly to strengthening financial sustainability. Thus, H5 is accepted.

Table 10. Hypothesis Testing: Indirect Effect

Hipotesis	Path Coefficient	p-value	95% Confidence Interval for the Path Coefficient		Upsilon V
			Lower Bound	Upper Bound	
H6. Operational Efficiency (X1) → Cash Flow Resilience (Z) → Financial Sustainability (Y)	0.114	0.048	0.016	0.232	0.0129
H7. Business Diversiication (X2) → Cash Flow Resilience (Z) → Financial Sustainability (Y)	0.157	0.022	0.023	0.299	0.0247

H6 (Operational Efficiency → Cash Flow Resilience → Financial Sustainability). The results of the indirect effect test show that operational efficiency (X1) has a positive and significant effect on financial sustainability (Y) through cash flow resilience (Z), with an indirect path coefficient of β = 0.114 and a p-value = 0.048. The 95% confidence interval is in the range of 0.016 to 0.232 and does not cross zero, so the mediating effect is declared significant. The value of Upsilon V (ϒV) = 0.0129 indicates a weak mediation strength, so that cash flow resilience acts as a mediator but the amount of mediation contribution is relatively small. Thus, H6 is accepted.

H7 (Business Diversification → Cash Flow Resilience → Financial Sustainability). The results of the indirect effect test show that business diversification (X2) has a positive and significant effect on financial sustainability (Y) through cash flow resilience (Z), with an indirect path coefficient of β = 0.157 and a p-value = 0.022. The 95% confidence interval is in the range of 0.023 to 0.299 and does not cross zero, so the mediating effect is declared significant. The value of Upsilon V (ϒV) = 0.0247 indicates a weak mediation effect, although the magnitude of the mediation effect of X2 through Z is higher than that of the mediation path of X1. Thus, H7 is accepted.

Evaluation of Model Goodness and Fit

PLS is a variance-based Structural Equation Modeling (SEM) analysis that focuses on model testing aimed at predictive studies. Therefore, several measures have been developed to determine whether a model is acceptable, such as R square, Q square, SRMR (Hair et al., 2022), and the Goodness of Fit Index (Henseler et al., 2015).

Table 11. R Square and Q Square

Variables	R square	R square adjusted	Q square
Financial Sustainability (Y)	0.679	0.673	0.387
Cash Flow Resilience (Z)	0.480	0.474	0.293

Interpretation of Table 11 shows that the structural model has good explanatory power and predictive relevance. The R^2 value for the Financial Sustainability (Y) variable is 0.679, indicating that 67.9% of the variation in financial sustainability can be explained by operational efficiency, business diversification, and cash flow resilience, while the remaining 32.1% is influenced by other factors outside the model. The adjusted R^2 value of 0.673 reinforces these findings by taking into account the number of predictors used. For the Cash Flow Resilience (Z) variable, the R^2 value of 0.480 shows that 48.0% of cash flow resilience variation is explained by operational efficiency and business diversification, with an adjusted R^2 of 0.474 indicating the consistency of the model's explanatory power. In addition, the Q^2 value for both endogenous variables is positive, namely 0.387 for Financial Sustainability (Y) and 0.293 for Cash Flow Resilience (Z), which indicates that the model has adequate predictive relevance and is able to predict endogenous constructs well.

Table 12. Standardized root mean square residual (SRMR)

	Saturated Model	Model Estimation
SRMR	0.052	0.052

Interpretation of Table 12 shows that the Standardized Root Mean Square Residual (SRMR) value in both the saturated model and the estimation model is 0.052. This value is below the threshold of 0.08, indicating that the level of model fit with empirical data is in the good category. Thus, the estimated structural model has an adequate model fit, which means that the difference between the observed and estimated covariance matrices is relatively small, making the model suitable for testing hypotheses and interpreting relationships between variables.

Table 13. GoF Index

Average Communality	Average R Square	GoF Index
0.340	0.402	0.370

The Goodness of Fit (GoF) Index is a global model evaluation that combines the assessment of both the measurement model and the structural model. The GoF Index can only be calculated for reflective measurement models and is computed as the square root of the product of the average communality and the average R square. According to (Wetzels et al., 2009), the interpretation of the GoF Index value is as follows: 0.1 (low), 0.25 (moderate), and 0.36 (high). Therefore, a GoF value of 0.370 falls into the large category. This means that, in general, the model built has good suitability, both in terms of the ability of the construct to explain the indicator (measurement) and the ability of the exogenous variable to explain the endogenous (structural) variable.

Discussion

The financial sustainability of 3 kg subsidized LPG stations in this study is more accurately understood as a consequence of strategic choices and the quality of internal management, rather than simply the result of coincidentally favorable market conditions. Operational efficiency plays a fundamental role as a strategy because it is related to the station's ability to organize work processes, control costs, and maximize resource utilization so that the business has stronger financial leeway to survive and adapt when facing operational pressures. This logic is in line with the resource-based view, which emphasizes that business sustainability is supported by consistently managed internal capabilities, including the ability to reconfigure resources to remain relevant in a changing environment (Barney, 1991; (Teece, 2016)). In the context of LPG stations, which generally operate on relatively limited profit margins, efficiency is a key lever for maintaining cost stability and reducing waste. Therefore, it is theoretically reasonable that efficiency contributes to strengthening cash flow resilience and long-term financial sustainability (Essuman et al., 2020; Song et al., 2020). In addition to efficiency, business diversification can be positioned as an adaptive strategy that is both mitigative and growth-enhancing, as diversification expands revenue sources and reduces dependence on a single main revenue stream. In the subsidized LPG sector, dependence on a single commodity makes businesses vulnerable to fluctuations in demand, supply constraints, or changes in distribution policies; therefore, diversification is a rational effort to build a more stable income "buffer." This argument is consistent with diversification strategy theory, which emphasizes diversification as an approach to growth and risk reduction through product/market expansion (Ansoff, 1948; Hitt & Duane Ireland, 2017), as well as empirical findings that income differentiation can reduce volatility and strengthen financial stability (Saliba, 2024). In other words, diversification in the subsidized LPG base is not merely about adding new types of businesses, but rather an instrument to expand the cash inflow base, minimize the impact of disruptions in one line, and improve the business's financial resilience.

The role of cash flow resilience in this framework can be understood as a mechanism that explains how efficiency and diversification translate into financial sustainability. Stable cash flows strengthen a business's ability to finance daily operations, meet obligations, and maintain decision-making flexibility when external pressures arise (Almeida, 2021). Therefore, efficiency that reduces cash-out and diversification that strengthens cash-in will conceptually contribute to strengthening cash flow resilience, which in turn supports financial sustainability (Satriani et al., 2024). However, partial mediation can also be understood argumentatively: financial sustainability is not only determined by liquidity, but also by factors that work directly, such as service quality, customer loyalty, supply stability, the ability to maintain distribution networks, and policy changes that affect costs and revenues. these factors mean that efficiency and diversification still have a direct influence on financial sustainability, not solely through cash flow (Schwab, 2020; Thomas & Mantri, 2022). The practical implication is that LPG bases need to implement efficiency and diversification simultaneously—efficiency to stabilize cost structures, diversification to build revenue buffers—and strengthen cash management discipline so that both strategies consistently lead to long-term financial sustainability.

CONCLUSIONS

The conclusion of this study confirms that the financial sustainability of 3 kg subsidized LPG stations bases in Bangkalan Regency is primarily shaped by internal strategies, namely operational efficiency and business diversification, both directly and thru strengthening cash flow resilience. Operational efficiency and business diversification are proven to increase cash flow resilience, and at the same time, both also contribute to financial sustainability, while cash flow resilience itself plays a role in strengthening financial sustainability. The role of cash flow resilience mediation is partial and tends to be complementary, so financial sustainability is not only determined by cash stability, but also by the direct mechanisms of efficiency and diversification. Overall, the model has strong explanatory power for financial sustainability and adequate predictive relevance, indicating that improvements in efficiency, targeted diversification, and cash management discipline are key to maintaining the base's business sustainability.

The practical implications for owners or managers of 3 kg subsidized LPG stations highlight the importance of simultaneously implementing operational efficiency and business diversification to strengthen cash flow resilience and maintain financial sustainability. Efficiency should focus on controlling operational costs, improving service processes, and optimizing resource use to enhance financial flexibility, while diversification should be carried out in a measured and relevant way—such as by adding supporting retail products or additional services—to build multiple income streams and reduce reliance on a single cash flow. However, diversification must be supported by disciplined cash management, as diversification alone is insufficient without strong efficiency and cash flow practices (Essuman et al., 2020; Githaiga, 2022). For policymakers and related institutions, this research provides a basis for strengthening base development programs through training in operational efficiency, mentoring for appropriate business diversification, and education in cash flow management as a bridge between operational strategies and long-term financial outcomes. This policy direction is relevant because LPG bases operate within the subsidized energy distribution sector, which is prone to supply-demand fluctuations and margin constraints, thereby requiring adaptive, efficient, and sustainable business strategies (Essuman et al., 2020; Githaiga, 2022). For future research, it is recommended to broaden the geographical scope or compare multiple districts to enhance generalizability, and to include additional theoretically relevant variables such as supply stability, financing access, or service quality to capture external influences on financial sustainability. Further studies may also explore the mediating role of cash flow resilience in other sectors, as stable cash flow conceptually enhances the effectiveness of efficiency and diversification strategies in achieving financial sustainability (Almeida, 2021; Satriani et al., 2024).

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