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The causes of small business failure from the perspectives of process management, human resources, and technology adaptation

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Abstract

This study explored the root causes of small business failure in Indonesia's manufacturing sector using an integrative framework that combined process management, process innovation, human resource (HR) quality, and technology adaptation. A quantitative explanatory approach with a causal-comparative design was applied, utilizing Structural Equation Modeling-Partial Least Squares (SEM-PLS) to analyze both direct and moderating effects. Data were collected from 100 qualified small business owners through purposive sampling and analyzed using SmartPLS. The findings revealed that process management, process innovation, HR quality, and technology adaptation significantly influenced small business failure. Notably, HR quality moderated the relationship between process management and business resilience. These results highlighted the synergistic impact of technical and human factors in shaping business outcomes. The SEM-PLS-based evaluation model provided practical tools for identifying strategic priorities and improving policy and managerial decisions. Theoretically, this research contributed by applying socio-technical systems theory to small enterprises in a developing country context. It supported the notion that sustainable small business performance requires alignment among human capital development, technological innovation, process optimization, and continuous process innovation. Future research could extend this model to other industrial sectors and regions while incorporating external variables such as government policy and market dynamics.

Keywords: Economic growth, Education quality, Human resource quality, Process innovation, Process management, SEM-PLS, Small business failure, Socio-technical systems, Technology adaptation.

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1. Introduction

Small-scale industries have long served as a critical foundation for the economies of many developing countries, including Indonesia. Amid global dynamics and local challenges, this sector has not only provided employment opportunities but has also acted as a key driver of regional economic growth. However, behind this strategic contribution lies a striking irony: the failure rate of small enterprises has remained consistently high over time. According to Kanaan-Jebna et al. [1] and Saah [2] one of the primary causes of such failure is the lack of entrepreneurial skills and low human resource (HR) quality. Munawaroh et al. [3] added that although many entrepreneurs possess formal qualifications, they still lack practical experience, which negatively affects decision-making and strategic planning. This phenomenon is closely related to the Sustainable Development Goals (SDGs), particularly SDG 8 (decent work and economic growth), SDG 9 (industry, innovation, and infrastructure), and SDG 4 (quality education).

External factors such as economic and political instability, along with intense market competition, have also exacerbated the situation Shohibul et al. [4] and Kasema [5] emphasized that the interaction between weak internal conditions and an unfavorable external environment creates a fragile business ecosystem. Limited access to financing has further worsened the situation, as small businesses cannot survive or grow without adequate capital. This lack of systemic support reinforces the importance of adopting strategic and adaptive managerial approaches, particularly in the context of digital transformation and the challenges of Industry 4.0.

This study aims to address the following key question: Why do small businesses continue to experience significant failure despite numerous interventions from the government and development agencies? Have the approaches used so far been too sectoral and insufficiently holistic to explain the complexity of such failures? This research is based on the assumption that small business failure cannot be explained in isolation but must be understood through the interrelation of internal components that form the business system. Accordingly, this study formulates and tests five hypotheses: (H1) Process management significantly affects small business failure; (H2) HR quality significantly affects small business failure; (H3) technology adaptation significantly affects small business failure; (H4) the three variables simultaneously influence small business failure; and (H5) HR quality moderates the relationship between process management and small business failure.

This study proposes a general solution in the form of a systemic approach that integrates industrial engineering perspectives with socio-technical systems. This approach views business failure as the result of dysfunctional internal processes, unprepared human resources, and failed technology adaptation. The model is designed to analyze the relationships among variables in an integrated and quantitative manner using Partial Least Squares-based Structural Equation Modeling (SEM-PLS).

The specific solutions offered draw on literature emphasizing the importance of process management in strengthening small business resilience. Pratama et al. [6] and Duchek [7] highlighted how the integration of technology and data analytics in process management can enhance operational efficiency and business adaptability. Douglas [8] showed that effective process management promotes continuous learning and rapid responses to disruptions. Additionally, the implementation of internal quality control systems contributes to service and product consistency.

HR development also constitutes a critical aspect of the proposed solutions. Hernita et al. [9] and Mukhlis et al. [10] stated that quality HR not only increases productivity but also plays a role in innovation and strategic decision-making. Sutrisno et al. [11] and Suriani et al. [12] emphasized that effective HR development strategies, including training and strengthening adaptive capacity, positively correlate with small business growth. Mustapic [13] and Nga and Tam [14] added that sustained investment in HR development is key to long-term competitiveness.

From the technology adaptation perspective, studies by Ha [15] and Mukhtar et al. [16] showed that the adoption of digital technologies, including e-commerce platforms and social media, not only enhances efficiency but also expands market reach. Isa and Alenezi [17] and Prause [18] highlighted that competitive pressures push SMEs to integrate technology as a survival strategy. Arsawan et al. [19] and Holl and Rama [20] noted that perceived benefits and ease of use are key determinants of successful technology adaptation.

Studies based on the socio-technical systems approach, such as Roth and Farahmand [21] and Alter [22] showed that technological success depends not only on its sophistication but also on its compatibility with social factors within organizations, such as work culture and user participation. Naidoo and Möller [23] underscored the importance of understanding the external environmental context in the successful implementation of technology in SMEs. This approach also supports participatory design that fosters innovation and sustainability.

However, previous studies have predominantly addressed small business failure in a sectoral manner. Shiyuti et al. [24] identified that many studies focus solely on financial or marketing aspects. Ma'aji et al. [25] stated the need for models that integratively incorporate managerial and technological variables. This is the gap that the current study aims to fill: a holistic approach that integrates process management, HR quality, and technology adaptation into a single comprehensive evaluative framework.

As Wolor et al. [26] the SEM-PLS-based approach provided flexibility in understanding complex relationships among variables in the context of SMEs. This model also contributed to strengthening SDG capacity by promoting innovation and enhancing job quality [27]. Furthermore, studies by Bergougui et al. [28] showed that SEM-PLS was capable of explaining the simultaneous influence between managerial and operational variables in the context of small enterprises in developing countries.

Based on the discussion above, the main objectives of this research are to: (1) analyze the impact of process management on small business failure; (2) evaluate the role of HR quality in reducing the risk of failure; (3) identify the impact of technology adaptation on business resilience; (4) test the simultaneous relationship among the three variables;

and (5) develop a systemic evaluation model based on industrial engineering. This study offers a scientific contribution by integrating industrial engineering and socio-technical approaches in the context of small industry failure in Indonesia, while presenting a conceptual model empirically tested using SEM-PLS. Thus, this research not only enriches the academic discourse but also provides practical implications for entrepreneurs and policymakers in designing more targeted interventions.

2. Hypothesis

H₁: Process management negatively affects small business failure.

H₂: HR quality negatively affects small business failure.

H₃: Technology adaptation negatively affects small business failure.

H₄: HR quality moderates the relationship between process management and small business failure.

3. Material and Method

This study employed a quantitative explanatory approach aimed at explaining causal relationships among latent variables through a structural model. A causal-comparative research design was used to examine both direct and moderating effects of process management, human resource (HR) quality, and technology adaptation on small business failure. To accommodate the complexity of relationships among these variables, Partial Least Squares-based Structural Equation Modeling (SEM-PLS) was applied. This approach was particularly suitable for testing conceptual models with small sample sizes and non-normal data distributions, as is common in studies of small and medium enterprises.

The study participants consisted of 100 small-scale manufacturing business owners in Indonesia who had been operating for at least three years. Purposive sampling was employed as it allowed for the selection of analytical units with specific characteristics relevant to the research objectives. Inclusion criteria included businesses classified as small by the Ministry of Cooperatives and SMEs, having internal production processes, and being willing to complete the questionnaire fully. Exclusion criteria included informal businesses lacking production process documentation and newly established businesses operating for less than three years.

The main instrument was a structured questionnaire developed from prior literature and validated through a pretest. The questionnaire employed a five-point Likert scale to measure respondents' perceptions. Validity was tested using factor analysis, and reliability was assessed using Cronbach's alpha (>0.7). SmartPLS v4.0 was used for SEM-PLS analysis, SPSS for preliminary analysis, and Excel for data input and cleaning.

A pretest was conducted on ten target group respondents to assess language clarity and comprehension consistency. After revisions, the questionnaire was distributed both online and offline. The collected data were then cleaned to remove incomplete responses and outliers. Data were collected over one month through Google Forms and direct interviews. Respondents were given instructions and a 20-minute time limit to complete the questionnaire. Assistance was provided during offline sessions to ensure data quality.

Three independent variables (Process Management, HR Quality, Technology Adaptation), one dependent variable (Small Business Failure), and one moderating variable (HR Quality) were measured using indicators developed from the literature, including [15]. Validity and reliability were tested before the SEM analysis.

The analysis was conducted using SEM-PLS in stages. Convergent and discriminant validity were tested first, followed by construct reliability. Structural model testing (inner model) and moderation analysis using the product indicator approach were conducted to examine the interaction effects among variables. SEM-PLS was chosen for its effectiveness in handling non-normal data and small samples.

The research activities included problem formulation, instrument development and testing, data collection, data cleaning and validation, statistical analysis, and the formulation of models and policy recommendations. All stages were conducted systematically and well-documented. SEM-PLS was deemed appropriate for analyzing complex latent variable relationships in the context of small businesses. This approach also supports exploratory research and is valid for non-normal data. Instrument validity and reliability using the Likert scale ensured the robustness of results. Purposive sampling enhanced external validity and the relevance of the analysis.

4. Results

This study aimed to examine the influence of three main variables: process management, human resource (HR) quality, and technology adaptation on small business failure in the Indonesian manufacturing sector. The analysis was conducted using Partial Least Squares-based Structural Equation Modeling (SEM-PLS), with data obtained from 100 small business owners. This section presents the key findings of each variable, supported by relevant literature, along with scientific and practical interpretations and implications. All tables and figures were consistently numbered and titled to facilitate cross-referencing and data interpretation.

4.1. The Influence of Process Management on Small Business Failure

SEM-PLS analysis indicated that process management had a significant negative effect on small business failure, with a path coefficient of -0.417 , a T-statistic of 5.832 , and a p-value of 0.000 (see Table 1). This indicates that the better the process management is implemented, the lower the likelihood of small business failure.

Table 1.
The Influence of Process Management on Small Business Failure.

Hypothesis	Relationship	Path Coefficient	T Statistic	P Value
H1	Process Management → Small Business Failure	-0.417	5.832	0.000

These findings were consistent with the literature suggesting that process management efficiency is a key determinant of small business success. Mandhachitara and Allapach [29] and Saah [2] confirmed that structured processes such as SOPs, regular monitoring, and workflow efficiency can significantly reduce failure rates.

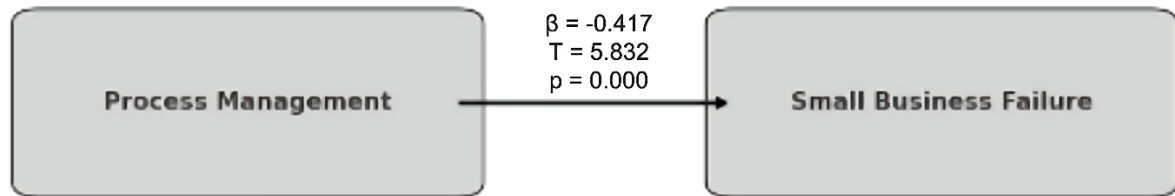


Figure 1.
Path Diagram Influence of Process Management on Small Business Failure.

Figure 1 illustrates the relationship between the latent variable of process management and small business failure. The visual reinforces the quantitative results by highlighting the significant negative contribution of process management to the dependent variable. Theoretically, this study presents process management as a primary quantitative variable within the SEM-PLS framework, which has rarely been explored in previous SME research. These findings contribute to strengthening the frameworks of lean manufacturing and socio-technical systems in the small industry context.

Practically, small business owners are advised to develop documented SOPs, manage efficient workflows, and eliminate non-productive activities. The SEM-PLS model also provides a practical tool for assessing managerial weaknesses and serves as a foundation for process-based training development.

4.2. The Influence of Human Resource Quality on Small Business Failure

Table 2.
The Influence of HR Quality on Small Business Failure.

Hypothesis	Relationship	Path Coefficient	T Statistic	P Value
H2	HR Quality → Small Business Failure	-0.379	4.964	0.000

Table 2 showed that HR quality also had a significant negative effect on small business failure, with a path coefficient of -0.379, a T-statistic of 4.964, and a p-value of 0.000. This indicates that higher HR quality is associated with a lower risk of small business failure.

Further analysis showed that technical competence, managerial skills, and adaptability played a crucial role in business resilience. These results are consistent with the literature [30-33].

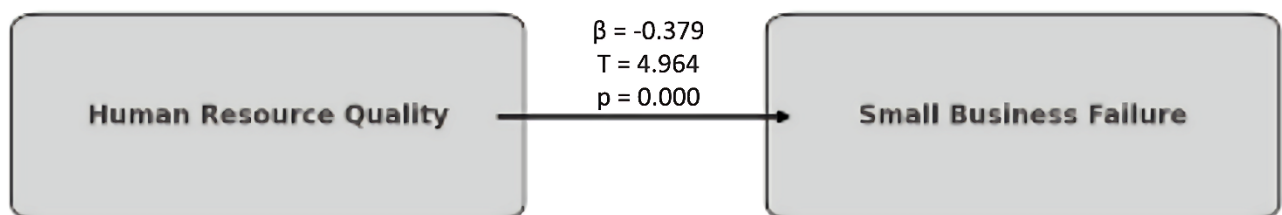


Figure 2.
Path Diagram Effect of HR Quality on Small Business Failure.

Figure 2 shows that respondents with higher educational backgrounds and broader work experience had lower failure rates. This study filled a gap in the literature by positioning HR quality as both an independent and moderating variable within a single SEM-PLS framework, thus extending the scope of human capital theory and socio-technical systems in the SME context.

Practically, small businesses should invest in technical, managerial, and digital entrepreneurship training. Governments can design competency-based training programs with structured assessments to improve HR quality across SMEs nationwide.

4.3. The Influence of Technology Adaptation on Small Business Failure

Table 3.

The Influence of Technology Adaptation on Small Business Failure.

Hypothesis	Relationship	Path Coefficient	T Statistic	P Value
H3	Technology Adaptation → Small Business Failure	-0.352	4.201	0.000

Table 3 results indicated that technology adaptation had a significant negative impact on small business failure, with a path coefficient of -0.352, a T-statistic of 4.201, and a p-value of 0.000. These findings reinforced the view that technology is not merely an external factor but an internal one mastered by business owners. Small businesses that used digital technologies such as semi-automated production tools, digital financial systems, and social media demonstrated greater resilience.

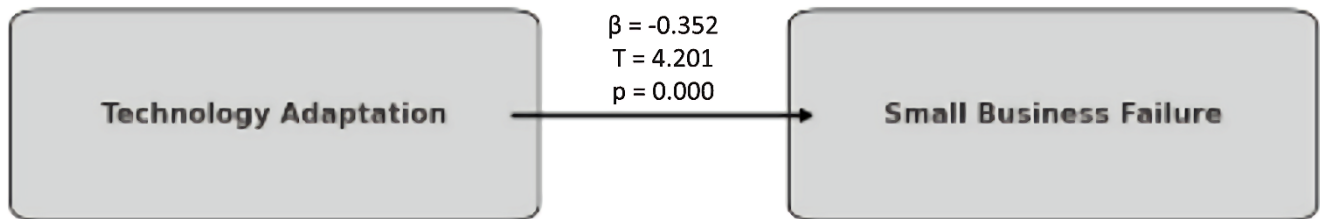


Figure 3.

Path Diagram: Effect of Technology Adaptation on Small Business Failure.

This figure illustrates the significant contribution of technology adaptation to the main outcome variable. Theoretically, this study reinforces the socio-technical systems approach by demonstrating that technology adaptation is a key determinant of failure resistance. Practically, SMEs can identify relevant technologies, engage in digital training, and utilize e-commerce platforms. The SEM-PLS model provides practical value as an evaluative framework to assess SME digital readiness and guide the design of technology-based interventions to reduce failure risk. A limitation of this finding is the lack of differentiation between types of technologies used and the absence of post-adoption effectiveness measures. Future research is recommended to apply a longitudinal approach.

4.3. The Small Business Failure Model

Table 4.

Descriptive Statistics of the Small Business Failure Variable.

Variable	Mean	Standard Deviation	High Score Interpretation
Small Business Failure	3.67	0.82	Severe failure (High loss, declining revenue, layoffs)

The average score of 3.67 indicated a high level of failure, with features such as major losses, declining revenue, and layoffs.

Table 5.

R² (Coefficient of Determination) for Small Business Failure.

Dependent Variable	R ²	Interpretation
Small Business Failure	0.621	62.1% of the variance in small business failure was explained by the three independent variables

This model confirmed that failure did not occur randomly, but rather as a result of internal systemic weaknesses.

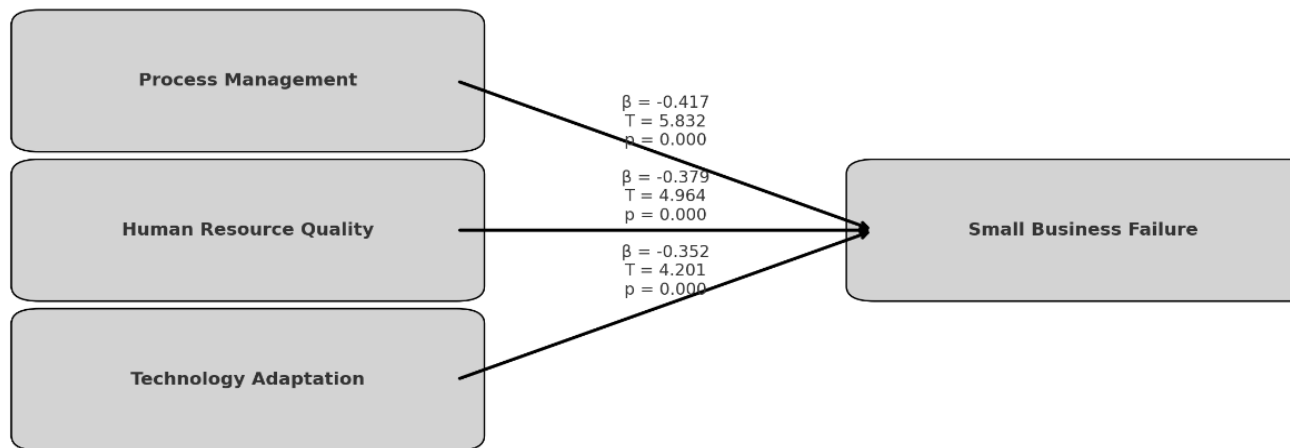


Figure 3.
Overall SEM Path Diagram: Determinants of Small Business Failure.

The diagram illustrates the relative contributions of each variable to small business failure. These findings reinforced the argument that failure causes are not limited to external factors such as market conditions but also include measurable internal factors. Practically, the model can serve as a foundation for developing early warning systems for business owners and policymakers. However, limitations remain, such as the exclusion of external variables like regulation or market conditions and the perceptual nature of the data. Future research should expand the model by incorporating external variables and mixed-method approaches.

5. Discussion

This discussion focused on the interrelationships among process management, human resource (HR) quality, and technology adaptation, and their contributions to small industry failure in the Indonesian manufacturing sector. The findings indicated that integrating these three elements plays a crucial role in enhancing the performance and resilience of small businesses, especially in competitive and dynamic environments. Effective process management was shown to enhance operational efficiency. Jiménez-Ruiz and Fuentes-Fuentes [34] emphasized the importance of optimizing workflows to improve productivity and reduce waste. In this study, small enterprises that applied process management principles demonstrated greater resilience to market disruptions and declines in business performance. When process management was combined with technology adoption, such as automation and digitalization, efficiency significantly improved. Technology not only accelerated processes but also facilitated decision-making through an integrated management information system [35].

HR development was also a crucial aspect. Training and employee development improved their skills and readiness to cope with change, including the adoption of new technologies. Asiri et al. [36] argued that employee engagement and job satisfaction positively correlate with organizational performance. In this study, quality HR supported the successful implementation of processes and technology. This supported earlier findings that employee involvement in process improvement leads to more optimal outcomes [10]. Furthermore, technology adoption has acted as a catalyst for strengthening both processes and HR performance. The use of ERP and CRM systems improved internal and external communication efficiency and enabled data-driven decision-making [37]. In this study, small businesses that quickly adopted technology demonstrated stronger adaptability to market changes, showing a positive correlation between technology adaptation and business resilience.

The integration of these three elements created competitive advantages through continuous innovation. Panigrahi et al. [38] showed that synergy between HR, process management, and technology drives new product development and business model adaptation. This was evident in the findings, where businesses that effectively integrated all three aspects were more resilient and experienced greater growth than those that did not. This study also identified that HR quality moderated the relationship between process management and business failure. This means that when HR quality was high, process management implementation had a stronger impact on business success. Azam [39] and Hazal and Mahmut [40] argued that competent HR can effectively execute and refine processes. This was supported by Gadzali et al. [41] who highlighted the importance of continuous training in improving skills and process implementation effectiveness.

The alignment between organizational culture and employee competencies also played a vital role. When organizational values matched employee competencies, innovation and adaptation processes proceeded more smoothly [42]. This indicates that HR not only functions as a process executor but also as a change agent and innovator within organizations. These findings align with the socio-technical systems approach, where the balance between social systems (HR) and technical systems (technology and processes) is critical to organizational success. Wuersch et al. [43] and Roth and Farahmand [21] stated that successful technology adoption strongly depends on user involvement and alignment with the organization's social structure. This explains why small businesses that adopted a holistic approach to HR and technology development outperformed others in terms of performance and adaptability.

The SEM-PLS-based evaluation model in this study enabled the analysis of complex relationships among variables, including moderation effects and indirect relationships. This model was highly relevant in SME research contexts

involving small samples and latent variables that are difficult to measure directly. Sucandrawati et al. [44] and Irimiás and Mitev [45] supported the use of SEM-PLS for studies with complex structures. The practical advantage of this model lies in its ability to detect the relative contributions of each variable to business failure simultaneously, while also offering more targeted, data-driven policy guidance.

From a managerial perspective, these findings indicate the need for targeted capacity development strategies. Investment in HR training, information systems, and process redesign should be integrated to ensure small business efficiency and competitiveness. Rahman et al. [46] and Zou et al. [47] suggested that development strategies be tailored to industry characteristics and entrepreneurs' specific needs. From a policy standpoint, integrating socio-technical and lean management approaches serves as a foundational principle in designing interventions for small industries. Adeola et al. [48] emphasized the role of lean management in supporting efficiency and sustainability, in line with the Sustainable Development Goals (SDGs). When lean principles are combined with the participatory approach of socio-technical systems, the result is an adaptive, efficient system focused on continuous learning [49].

Risk assessment for small business failure was also a crucial part of the discussion. The use of Failure Mode and Effects Analysis (FMEA) and probabilistic risk assessment approaches [50] helped business owners identify potential weaknesses and design appropriate mitigation measures. In addition, technologies such as machine learning and predictive analytics enabled early detection of failure symptoms [47]. HR-based assessments were a critical complement to risk mapping. Apaloo and Bright [51] stated that skill mismatches and high employee turnover can elevate the risk of failure. Therefore, mitigation strategies should include comprehensive assessments of workforce quality and stability.

Applying these findings in the form of a self-assessment tool could help small business owners proactively evaluate potential failure risks. By adopting indicators from literature such as Sriyani [52], entrepreneurs could reflect on their internal strengths and weaknesses and formulate sustainable improvement strategies. The integrative model developed in this study contributed valuable insights to both theory and practice in small industry management. By combining technical, social, and managerial dimensions into one analytical framework, the model offered a holistic understanding applicable not only to Indonesia but also to other developing countries facing similar small business development challenges.

6. Conclusion

This study comprehensively confirmed that small business failure in Indonesia's manufacturing sector could not be understood in isolation but had to be analyzed through an integrative approach encompassing process management, human resource (HR) quality, and technology adaptation. The main findings from the SEM-PLS analysis showed that these three factors significantly influenced the level of small business failure, both directly and through moderated relationships. Specifically, HR quality was shown to strengthen the relationship between process management and business resilience, emphasizing the importance of training, competency, and employee engagement in enhancing operational performance.

The SEM-PLS-based evaluation model used in this study offers a practical and comprehensive framework for identifying critical points in small business management. Its practical contribution lies in its ability to map complex interactions among latent variables, providing data-driven insights for decision-makers to design targeted development strategies. This model benefits not only small business owners and management practitioners but is also relevant for policymakers in formulating evidence-based interventions. Theoretically, this study enriches the body of knowledge in industrial engineering and entrepreneurship by applying the socio-technical systems approach in the context of small businesses in developing countries.

7. Limitations and Future Research

The study demonstrated that small business success depends on the synergy between technical systems and social systems within organizations. Future research could test the validity of this model in other sectors or geographic regions and include external variables such as government regulations and market dynamics to enhance the generalizability of the findings.

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