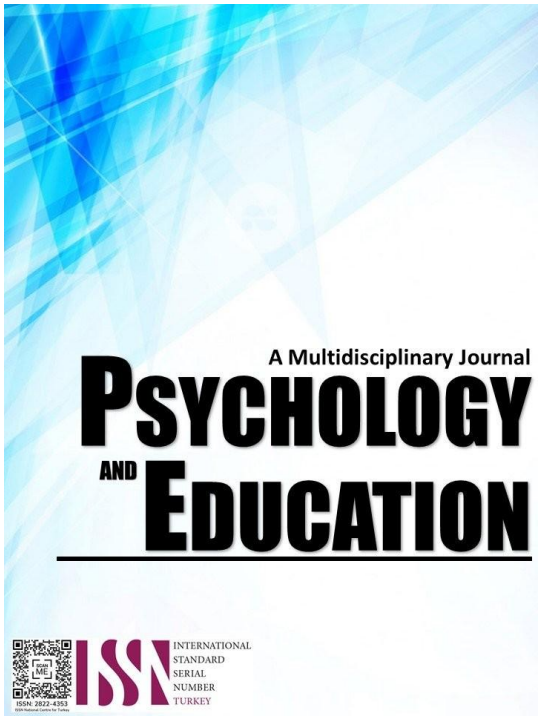
FRUGAL INNOVATION OF SELECTED BUSINESSES IN RIZAL PROVINCES



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Research Article

Frugal Innovation of Selected Businesses in Rizal Provinces

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Abstract

This study explores the impact of sustainable development and frugal innovation on small and medium-sized enterprises (SMEs) in Rizal Province, Philippines. Focusing on manufacturing businesses, the research examines how frugal innovation—through substantial cost reduction, concentration on core functionalities, and optimized performance—enhances competitiveness and sustainability. Findings indicate that while businesses generally perceive frugal innovation positively, challenges such as scalability, regulatory compliance, and balancing cost with quality persist. Significant differences in cost reduction were observed based on years of existence and ownership structure, whereas other factors like business type and capital source showed no notable influence. The study highlights the role of SMEs in economic development, particularly in rural areas where they drive employment and innovation. However, issues such as limited infrastructure, funding constraints, and cultural resistance hinder the widespread adoption of frugal solutions. Recommendations include establishing knowledge-sharing platforms, improving regulatory support, and developing funding mechanisms to enhance frugal innovation adoption. By addressing these barriers, SMEs in Rizal can better leverage sustainable practices to strengthen market positioning and resilience in a post-pandemic economy. Ultimately, this research contributes to the discourse on sustainable business models by providing empirical insights into frugal innovation's applicability in emerging economies. The findings underscore the need for targeted interventions to support SMEs in overcoming implementation challenges while maximizing the economic and social benefits of sustainable development.

Keywords: *frugal innovation, sustainable development, SMEs, manufacturing businesses, Rizal Province*

Introduction

The study highlighted the transformative impact of sustainable development on society and the economy, particularly through inclusive businesses that attracted low-income customers and contributed to community development. It explored how small companies could align with these development goals while maintaining financial independence (J. Rendtorff, 2019). It pointed out that integrating sustainable supply chains allowed businesses to innovate in new markets and gain a competitive edge in global trade. The study asserted that connecting to sustainability objectives benefited small and medium-sized enterprises (SMEs), enhancing their brand image, resilience, and resource efficiency (D. Ortiz-Avram et al., 2018).

Frugal innovation, discussed in the study, was identified as having a lower carbon footprint and fewer emissions, aligning with its primary aim of promoting social and economic sustainability (Albert, 2019). The research underscored how frugal innovation could improve the standard of living for low-income customers by creating cost-saving opportunities and reducing spending, thereby contributing to social sustainability (Rosca et al., 2017; Wohlfart et al., 2016). The study established a clear connection between innovation and sustainability, addressing the market's tendency to overlook sustainable innovation due to externalities. Frugal innovation emerged as a strategy to mitigate negative environmental effects and foster social and economic sustainability.

The background of the study situated the importance of small and medium-sized enterprises (SMEs) in both developed and developing countries, emphasizing their role in employment, wealth creation, and innovation (Shafeek Sha, 2006). In the context of the Philippines, the study highlighted the significance of rural areas, where over 75% of the population resided. Small businesses were acknowledged as substantial contributors to the nation's development and local economies, creating employment opportunities, particularly in rural areas (Victor, 2016). The research aimed to explore the perspectives of small business owners in the province of Rizal regarding sustainable development and frugal innovation, aligning with the broader theme of the study.

The study on the innovation of online businesses in Rizal Province made a substantial contribution to understanding the interplay between sustainable development and frugal innovation in small enterprises. However, it identified several crucial research gaps. Firstly, it predominantly focused on the potential benefits of sustainable development and frugal innovation without thoroughly exploring the implementation challenges faced by small business owners in Rizal Province, hindering the development of effective interventions. Secondly, while acknowledging the importance of rural areas and small businesses in the Philippines, the research lacked an in-depth analysis of the unique challenges experienced by businesses in rural contexts, limiting the understanding of how geographical and infrastructural constraints impacted the adoption of sustainable practices. Thirdly, the study briefly mentioned age-related and time constraints qwithout delving into their implications on perspectives and practices regarding sustainable development and frugal innovation, which were crucial for tailoring interventions to specific demographic groups. Additionally, the dynamics between frugal innovation and various dimensions of sustainability, such as social and economic aspects, were underexplored. Lastly, the study's focus on businesses operating for at least three years provided a snapshot, but a research gap existed in understanding the longitudinal effects of sustainable development and frugal innovation, necessitating a more extended research duration for a nuanced

comprehension of their long-term impact. Addressing these research gaps was imperative to augment the study's robustness and provide more nuanced insights into the challenges and opportunities associated with sustainable development and frugal innovation in the specific context of small businesses in Rizal Province.

Research Questions

This study aimed to assess the perceived sustainable development and frugal Innovation of the small business owners in the province of Rizal to gather relevant data to improve further the existing plan to enhance the small business owner's market position and competitive advantage in grounding for the current post-pandemic situation. Specifically, the study sought to answer the following question:

1. What is the organizational profile of selected manufacturing businesses in terms of;
    1.1 years of existence;
    1.2 type of operations;
    1.3 form of ownership;
    1.4 start-up capital;
    1.5 present capital;
    1.6 average anual sales; and
    1.7 source of capital?
2. What are the frugal Innovations concerning;
    2.1 substantial cost reduction;
    2.2 concentration on core functionalities; and
    2.3 optimised performance level/
3. Is there a significant difference between the profile of the selected manufacturing businesses in Rizal when grouped according to frugal Innovation?
4. What are the problems encountered with frugal Innovation?

Literature Review

Concept and Principles of Frugal Innovation

Frugal innovation is defined as the process of creating cost-effective, high-value solutions by minimizing resource use while maintaining quality (Bhatti, 2012). This approach is particularly relevant in developing economies like the Philippines, where businesses must adapt to budget constraints and limited infrastructure. According to Radjou and Prabhu (2015), frugal innovation is not merely about cutting costs but involves rethinking production, distribution, and consumption to serve low-income markets effectively. In Rizal Provinces, small enterprises often apply these principles by simplifying product designs or using locally available materials to reduce expenses.

The core principles of frugal innovation—affordability, sustainability, and scalability—are critical for MSMEs in Rizal (Zeschky et al., 2011). For instance, local manufacturers may repurpose waste materials or adopt shared-resource models to lower operational costs. A study by Tiwari and Herstatt (2012) highlights that frugal innovation enables businesses to remain competitive despite financial limitations, making it a viable strategy for entrepreneurs in emerging markets.

Frugal Innovation in Emerging Markets

Emerging markets, including the Philippines, have become key hubs for frugal innovation due to economic constraints and high demand for affordable products (Agarwal & Brem, 2012). Businesses in these regions often develop low-cost alternatives, such as budget-friendly household goods or pay-as-you-go services, to cater to price-sensitive consumers. In Rizal, small enterprises leverage frugal innovation by offering modular products (e.g., sachet-sized goods) or community-based distribution networks to enhance accessibility.

Research by George et al. (2012) shows that frugal innovation in Southeast Asia often stems from necessity-driven entrepreneurship. Examples include Thailand's use of bamboo for sustainable packaging and Indonesia's low-cost solar solutions. These cases suggest that Rizal-based businesses can adopt similar strategies, such as collaborative consumption or DIY repair services, to address local market gaps while maintaining profitability.

Role of MSMEs in Frugal Innovation

Micro, small, and medium enterprises (MSMEs) are pivotal in driving frugal innovation due to their flexibility and close customer relationships (Lim et al., 2013). In Rizal, MSMEs often lack access to large-scale funding, forcing them to innovate through resourcefulness—such as upcycling materials or bartering services. A study by Pison et al. (2018) found that Filipino MSMEs excel in improvisation, enabling them to compete with larger firms despite limited capital.

Additionally, MSMEs contribute to inclusive growth by providing affordable goods and generating local employment (Arunachalam

et al., 2020). For example, Rizal-based food vendors may use biodegradable packaging or bulk-purchase discounts to reduce costs. These practices align with the findings of D'Costa and Sridharan (2014), who argue that frugal innovation empowers small businesses to thrive in resource-scarce environments.

Sustainability and Frugal Innovation

Frugal innovation often aligns with sustainable practices by promoting waste reduction and energy efficiency (Bocken et al., 2014). In Rizal, businesses may adopt eco-friendly production methods, such as using agricultural waste for handicrafts or solar-powered tools, to minimize environmental impact. According to Rosca et al. (2017), frugal and sustainable innovations are interdependent, as both prioritize long-term resource efficiency over short-term profits.

Local case studies, such as those by Agnihotri (2015), demonstrate how frugal innovations—like water-saving devices or low-emission stoves—address both economic and ecological challenges. Rizal's entrepreneurs could replicate these models by integrating circular economy principles (e.g., repair-reuse-recycle) into their operations, as suggested by Murray et al. (2017).

Challenges and Opportunities for Frugal Innovation in Rizal

While frugal innovation offers cost-saving benefits, businesses in Rizal face challenges such as limited access to technology and funding (Sánchez & Ricart, 2010). Small enterprises often struggle to scale their innovations due to fragmented supply chains or lack of government support. However, studies by Prahalad (2012) emphasize that these constraints can spur creativity, leading to disruptive solutions like mobile-based payment systems or community co-ops.

Opportunities exist through partnerships with academic institutions or NGOs to pilot frugal innovations (Govindarajan & Trimble, 2012). For instance, Rizal's local government could facilitate training programs on lean manufacturing or crowdfunding platforms, as recommended by OECD (2019). By addressing these barriers, businesses can harness frugal innovation to enhance competitiveness and resilience.

Methodology

Research Design

A quantitative, survey-descriptive design will be employed to systematically examine frugal innovation and sustainable development practices. This approach allows for standardized data collection across the128 respondents, ensuring measurable and comparable results. The design aligns with the study's goal of identifying trends and correlations between demographic variables and frugal innovation adoption.

Stratified random sampling, a probability-based method, will minimize bias by dividing the population into subgroups before random selection. This enhances the validity of findings, ensuring each stratum's unique characteristics are reflected in the analysis.

Respondents

The study will involve 128 respondents from qualified small businesses in Rizal Provinces, selected through stratified random sampling. To ensure relevance, businesses must have been operational for at least three years, representing diverse sectors (e.g., retail, agriculture, handicrafts). This stratification guarantees proportional representation across industries, enabling generalized insights into frugal innovation practices. Participants will include owners or managers responsible for decision-making, ensuring data accuracy regarding cost-saving strategies and sustainability efforts.

Ethical recruitment will prioritize voluntary participation, with respondents briefed on the study's objectives and confidentiality measures. The sample size, determined via Slovin's formula (with a 0.5 margin of error), balances statistical reliability with practical feasibility, capturing a representative snapshot of Rizal's MSME landscape.

Data Analysis

Data will be analyzed using IBM SPSS Version 20, with frequency distribution and weighted mean calculations to summarize demographic profiles and survey responses. ANOVA will test for significant differences in frugal innovation practices across business types or locations, providing insights into sector-specific trends.

The statistical rigor ensures objective interpretation, transforming raw survey data into actionable findings. For instance, ANOVA results may reveal whether agricultural businesses adopt more resource-efficient innovations compared to retail sectors, guiding targeted policy recommendations.

Ethical Considerations

Prior to data collection, written consent will be obtained from municipal authorities and business owners, emphasizing voluntary participation and anonymity. Respondents will be informed of their right to withdraw and the study's academic purpose, preventing coercion. Data will be securely stored, with identifiers removed to protect confidentiality.

Additionally, the research will adhere to institutional ethical guidelines, ensuring transparency in methodology and reporting. Permission from employers will be secured to avoid workplace disruptions, and findings will be shared with participants to foster trust and accountability.

Results and Discussion

Profile of the Business

Years of Existence;

Table 1. *Frequency and Percentage Distribution of the Respondents by Years of Existence*

Years of Existence	*Frequency*	*Percentage*	*Rank*
Three (3) years	48	37.5%	1
Four (4) Years	45	35.1%	2
Five (5) Years–	35	27.3%	3
Others, please specify	0	0%	
Total	128	100%	

The majority of small businesses in the study have been in existence for three years, comprising 37.5% of the sample. The second most common duration is four years, representing 35.1% of the respondents. Businesses with a duration of five years or more constitute 27.3% of the sample. Interestingly, there are no respondents in the "Others, please specify" category, indicating a clear categorization for all respondents.

This distribution provides insights into the temporal aspect of the small businesses in the study, allowing for an exploration of potential correlations between the duration of existence and perceptions of sustainable development and frugal innovation among these business owners.

Type of Business Operations;

Table 2. *Frequency and Percentage Distribution of the Respondents by Type of Business Operations*

Type of Business Operations	*Frequency*	*Percentage*	*Rank*
Retail	24	18.7%	3
Manufacturing	45	35.1%	2
Hospitality	49	38.2%	1
Technology (IT)	10	7.81%	4
Total	128	100%	

The majority of small businesses in the study fall under the category of "Hospitality," constituting 38.2% of the sample. Manufacturing businesses represent the second most prevalent type, comprising 35.1% of respondents. Retail businesses make up 18.7% of the sample, securing the third position in frequency. Technology (IT) businesses account for 7.81% of respondents, ranking fourth in prevalence.

This distribution provides insights into the diverse landscape of small businesses in Rizal Province concerning their primary operations. Understanding the distribution across these categories is crucial for assessing the prevalence of frugal innovation practices within different business sectors, contributing to a comprehensive understanding of the local business environment.

Form of Ownership;

Table 3. *Frequency and Percentage Distribution of the Respondents by Form of Ownership*

Form of Ownership	*Frequency*	*Percentage*	*Rank*
Sole Proprietorship	39	30.4%	2
Partnership	52	40.6%	1
Limited Liability Company (LLC)	23	17.9%	3
Corporation	9	7.03%	4
Cooperative	5	3.90%	5
Total	128	100%	

The most prevalent form of ownership among small businesses is "Partnership," constituting 40.6% of the sample."Sole Proprietorship" follows closely, representing 30.4% of respondents and securing the second position. "Limited Liability Company (LLC)" is the third most common form of ownership, accounting for 17.9% of the sample."Corporation" and "Cooperative" represent 7.03% and 3.90%, respectively, ranking fourth and fifth in prevalence.

This distribution sheds light on the diversity in ownership structures among small businesses. Understanding these ownership patterns is crucial for contextualizing the dynamics of business operations and decision-making processes, contributing to a comprehensive understanding of the local business landscape.

Start-up capital;

Table 4. *Frequency and Percentage Distribution of the Respondents by Start-up capital*

Start-up capital	*Frequency*	*Percentage*	*Rank*
Below 500,000	31	24.2%	2
500,000-750,00	43	33.5%	1
751,000-1,000,000	8	6.25%	4
1,000,001- 1,250,000	17	13.2%	3
1,251,000- 1,500,000	8	6.25%	4
1,501,000- 1,750,000	8	6.25%	4
1,751,000- 2,000,000	6	4.68%	5
2,000,001- 2,500,000	4	3.12%	6
2,5001,000- 2,750,000	1	0.78%	8
2,751,000-3,000,000 and above	2	1.56%	7
Total	128	100%	

The most prevalent range of start-up capital is "500,000-750,000," representing 33.5% of the sample and securing the top rank. The second most common range is "Below 500,000," comprising 24.2% of respondents. Ranges "1,000,001-1,250,000," "751,000-1,000,000," "1,251,000-1,500,000," and "1,501,000-1,750,000" are tied for the third rank, each constituting 6.25% of the sample. The distribution provides insights into the financial foundations of small businesses, showcasing a diverse range of start-up capital investments.

Present capital;

Table 5. *Frequency and Percentage Distribution of the Respondents by Present Capital*

Present capital	*Frequency*	*Percentage*	*Rank*
Below 500,000	14	10.9	5
500,000-750,00	19	14.8	4
751,000-1,000,000	41	32.0	1
1,000,001 - 1,250,000	29	22.6	2
1,251,000 - 1,500,000	24	18.7	3
1,501,000 - 1,750,000	7	5.46	7
1,751,000- 2,000,000	8	6.25	6
2,000,001- 2,500,000	3	2.34	8
2,5001,000- 2,750,000	3	2.34	8
2,751,000-3,000,000 and above	2	1.56	9
Total	128	100%	

The most prevalent range of present capital is "751,000-1,000,000," representing 32.0% of the sample and securing the top rank. The second and third most common ranges are "1,000,001-1,250,000" and "1,251,000- 1,500,000," comprising 22.6% and 18.7%, respectively. Ranges "500,000-750,000" and "Below 500,000" follow, representing 14.8% and 10.9%, respectively. This distribution provides insights into the current financial positions of small businesses, showcasing a diverse range of present capital investments

Average Annual Sales;

Table 6. *Frequency and Percentage Distribution of the Respondents by Average Annual Sales*

Present capital	*Frequency*	*Percentage*	*Rank*
Below 500,000	0	0%	
500,000-750,00	0	0%	
751,000-1,000,000	6	4.68%	5
1,000,001 - 1,250,000	7	5.46%	4
1,251,000 - 1,500,000	11	8.59%	2
1,501,000 - 1,750,000	7	5.46%	4
1,751,000- 2,000,000	7	5.46%	4
2,000,001- 2,500,000	6	4.68%	5
2,5001,000- 2,750,000	9	7.03%	3
2,751,000-3,000,000 and above	82	64.6%	1
Total	128	100%	

The predominant range of average annual sales is "2,751,000-3,000,000 and above," representing a substantial 64.6% of the sample and securing the top rank. The second most common range is "1,251,000-1,500,000," with a percentage of 8.59%. Ranges "1,000,001-1,250,000," "1,501,000-1,750,000,"and "1,751,000-2,000,000" follow, each comprising 5.46% of the sample and tied for the fourth rank.

This distribution provides valuable insights into the varying levels of sales performance among small businesses, emphasizing the prominence of higher sales brackets.

Source of Capital;

Table 7. *Frequency and Percentage Distribution of the Respondents by Source of Capital*

Source of Capital	*Frequency*	*Percentage*	*Rank*
Personal Savings	48	37.5%	1
Bank Loans	42	32.8%	2
Investor Contributions	25	19.5%	3
Revenue Generation	13	10.1%	4
Total	128	100%	

The most common source of capital among small businesses is "Personal Savings," representing 37.5% of the sample. "Bank Loans" constitute the second most prevalent source, accounting for 32.8% of respondents. "Investor Contributions" rank third, representing 19.5% of the sample."Revenue Generation" serves as a source of capital for 10.1% of businesses, securing the fourth position. This distribution underscores the diverse strategies employed by small businesses to acquire capital. It indicates a reliance on personal resources and external financing options, contributing valuable insights into the financial resilience and strategic planning of these enterprises.

What are the frugal Innovations concerning

Substantial cost reduction;

Table 8. *Mean Responses of the Respondents In Terms of Substantial Cost Reduction*

Indicators	*Mean*	*Verbal Interpretation*	*Standard Deviation*	*Rank*
Renegotiating contracts with suppliers	2.68	Acceptable (A)	1.291	4
Implementing technology solutions for efficiency	2.88	Acceptable (A	0.963	3
Optimizing supply chain processes	3.79	Highly Acceptable (HA)	0.415	1
Profit Margins	3.69	Highly Acceptable (HA)	0.422	2
Overall Mean	3.37	Highly Acceptable (HA)		

The mean score of 2.68 indicates an acceptable level of implementation in renegotiating contracts with suppliers. However, the relatively high standard deviation (1.291) suggests some variability in responses. This indicates that while there is an acceptable level of implementation, there may be diverse perceptions among respondents.

The mean score of 2.88 suggests an acceptable level of implementation in adopting technology solutions for efficiency. The lower standard deviation (0.963) compared to renegotiating contracts implies a more consistent perception among respondents regarding technology implementation.

The highest mean score of 3.79 indicates that optimizing supply chain processes is perceived as highly acceptable. The low standard deviation (0.415) suggests a high level of agreement among respondents, indicating a consistent positive perception of the effectiveness of supply chain optimization.

The mean score of 3.69 suggests a highly acceptable level of impact on profit margins. The standard deviation of 0.422 indicates a relatively low level of variability in responses, reflecting a consistent positive perception of the impact on profit margins.

The overall mean of 3.37 reinforces the highly acceptable nature of the cost reduction initiatives collectively. This aligns with the individual indicators, indicating that, on average, the implemented strategies are perceived positively by the respondents.

The results suggest that while there is a generally positive perception of the cost reduction initiatives, there is variability in the acceptance levels, particularly in renegotiating contracts with suppliers. The most successful initiatives, according to the rankings, are optimizing supply chain processes and improving profit margins, both perceived as highly acceptable. These findings provide valuable insights for further refining and prioritizing cost-reduction strategies within the business.

Concentration on core functionalities;

The highest mean score of 3.70 indicates that performance monitoring of core functionalities is perceived as highly acceptable. The low standard deviation (0.504) suggests a high level of agreement among respondents, indicating a consistent positive perception of

the effectiveness of performance monitoring mechanisms.

Table 9. *Mean Responses of the Respondents In Terms of Substantial Cost Reduction*

Indicators	*Mean*	*Verbal Interpretation*	*Standard Deviation*	*Rank*
Employee Training and Skill Development	3.37	Highly Acceptable (HA)	0.696	2
Outsourcing	2.78	Acceptable (A)	1.280	4
Resource Allocation	2.90	Acceptable (A)	0.961	3
Performance Monitoring	3.70	Highly Acceptable (HA)	0.504	1
Overall Mean	3.37	Highly Acceptable (HA)		

With a mean score of 3.37, employee training and skill development for core functionalities are also perceived as highly acceptable. The slightly higher standard deviation (0.696) compared to performance monitoring suggests a moderate level of variability in responses, though the overall perception remains positive.

The mean score of 2.90 indicates that resource allocation to core functions is perceived as acceptable. The higher standard deviation (0.961) suggests a more diverse range of perceptions among respondents compared to performance monitoring and employee training.

The mean score of 2.78 suggests that outsourcing non-core activities is perceived as acceptable. However, the relatively high standard deviation (1.280) indicates a wider range of opinions, reflecting diverse perceptions about the effectiveness of outsourcing in concentrating on core functionalities.

The overall mean of 3.37 reinforces the highly acceptable nature of the concentration on core functionalities collectively. While there is variability in perceptions, especially in resource allocation and outsourcing, the positive overall mean suggests a generally favorable view of the business's focus on core functions.

The results highlight the effectiveness of performance monitoring and employee training and skill development in ensuring a concentrated approach on core functionalities. Resource allocation, although acceptable, shows more diverse perceptions, and outsourcing, while also acceptable, demonstrates a wider range of opinions among respondents. These findings provide valuable insights for refining strategies related to concentration on core functionalities within the business.

Optimised performance level;

Table 10. *Mean Responses of the Respondents In Terms of Optimised Performance Level*

Indicators	*Mean*	*Verbal Interpretation*	*Standard Deviation*	*Rank*
Supply Chain Optimization	3.37	Highly Acceptable (HA)	0.696	2
Financial Performance Metrics	2.78	Acceptable (A)	1.280	4
Adaptability to Market Changes	2.90	Acceptable (A)	0.961	3
Efficiency in Resource Utilization	3.70	Highly Acceptable (HA)	0.504	1
Overall Mean	3.37	Highly Acceptable (HA)		

The highest mean score of 3.70 indicates that efficiency in resource utilization is perceived as highly acceptable. The low standard deviation (0.504) suggests a high level of agreement among respondents, indicating a consistent positive perception of the business's effectiveness in optimizing resources for maximum output.

With a mean score of 3.37, supply chain optimization is also perceived as highly acceptable. The slightly higher standard deviation (0.696) compared to efficiency in resource utilization suggests a moderate level of variability in responses, though the overall perception remains positive.

The mean score of 2.90 indicates that adaptability to market changes is perceived as acceptable. The higher standard deviation (0.961) suggests a more diverse range of perceptions among respondents, reflecting varied opinions on the effectiveness of the business in responding to market dynamics.

The mean score of 2.78 suggests that financial performance metrics are perceived as acceptable. However, the relatively high standard deviation (1.280) indicates a wider range of opinions, reflecting diverse perceptions about the effectiveness of the business in financial performance measurement.

The overall mean of 3.37 reinforces the highly acceptable nature of the optimized performance indicators collectively. While there is variability in perceptions, especially in financial performance metrics and adaptability to market changes, the positive overall mean suggests a generally favorable view of the business's optimized performance.

The results highlight the effectiveness of the business in resource utilization and supply chain optimization, both perceived as highly acceptable. However, there is more variability in perceptions regarding financial performance metrics and adaptability to market changes. These findings provide valuable insights for refining strategies related to optimizing performance within the business.

Significant difference between the profile of the selected manufacturing businesses in Rizal when grouped according to frugal Innovation

Table 11. *Computed F-value on the Significant Difference on the the profile of the selected manufacturing businesses in Rizal when grouped according to frugal Innovation*

Years of existence	*Fcomp*	*p-value*	*Ho*	*Verbal Interpretation*
Substantial cost reduction	3.847	0.011	Rejected	Significant
Concentration on core functionalities	1.146	0.332	Accepted	Not Significant
Optimised performance level	0.862	0.462	Accepted	Not Significant
Type of operations	*Fcomp*	*p-value*	*Ho*	*Verbal Interpretation*
Substantial cost reduction	0.022	0.883	Accepted	Not Significant
Concentration on core functionalities	0.160	0.689	Accepted	Not Significant
Optimised performance level	0.934	0.335	Accepted	Not Significant
Form of Ownership	*Fcomp*	*p-value*	*Ho*	*Verbal Interpretation*
Substantial cost reduction	3.417	0.010	Rejected	Significant
Concentration on core functionalities	1.097	0.360	Accepted	Not Significant
Optimised performance level	1.843	0.123	Accepted	Not Significant
Start-up capital	*Fcomp*	*p-value*	*Ho*	*Verbal Interpretation*
Substantial cost reduction	0.537	0.708	Accepted	Not Significant
Concentration on core functionality	0.134	0.970	Accepted	Not Significant
Optimised performance level	0.296	0.880	Accepted	Not Significant
Present capital	*Fcomp*	*p-value*	*Ho*	*Verbal Interpretation*
Substantial cost reduction	0.844	0.471	Accepted	Not Significant
Concentration on core functionalities	0.529	0.663	Accepted	Not Significant
Optimised performance level	0.839	0.475	Accepted	Not Significant
Average Annual Sales	*Fcomp*	*p-value*	*Ho*	*Verbal Interpretation*
Substantial cost reduction	0.930	0.508	Accepted	Not Significant
Concentration on core functionalities	0.973	0.469	Accepted	Not Significant
Optimised performance level	0.766	0.662	Accepted	Not Significant
Source of Capital	*Fcomp*	*p-value*	*Ho*	*Verbal Interpretation*
Substantial cost reduction	0.908	0.528	Accepted	Not Significant
Concentration on core functionalities	1.292	0.240	Accepted	Not Significant
Optimised performance level	1.205	0.292	Accepted	Not Significant

The F-test for Substantial Cost Reduction in relation to Years of Existence is significant (p-value = 0.011), indicating that there are significant differences in perceived substantial cost reduction across different years of existence for the small businesses.

The F-test for Concentration on Core Functionalities in relation to Years of Existence is not significant (p-value = 0.332), suggesting that there are no significant differences in perceived concentration on core functionalities across different years of existence for the small businesses.

The F-test for Optimized Performance Level in relation to Years of Existence is not significant (p-value = 0.462), indicating that there are no significant differences in perceived optimized performance level across different years of existence for the small businesses.

The F-test for Substantial Cost Reduction in relation to Type of Operations is not significant (p-value = 0.883), suggesting that there are no significant differences in perceived substantial cost reduction across different types of business operations.

The F-test for Concentration on Core Functionalities in relation to Type of Operations is not significant (p-value = 0.689), indicating that there are no significant differences in perceived concentration on core functionalities across different types of business operations.

The F-test for Optimized Performance Level in relation to Type of Operations is not significant (p-value = 0.335), suggesting that there are no significant differences in perceived optimized performance level across different types of business operations.

The F-test for Substantial Cost Reduction in relation to Form of Ownership is significant (p-value = 0.010), indicating that there are significant differences in perceived substantial cost reduction across different forms of ownership for the small businesses.

The F-test for Concentration on Core Functionalities in relation to Form of Ownership is not significant (p-value = 0.360), suggesting that there are no significant differences in perceived concentration on core functionalities across different forms of ownership.

The F-test for Optimized Performance Level in relation to Form of Ownership is not significant (p-value = 0.123), indicating that there are no significant differences in perceived optimized performance level across different forms of ownership.

Start-up Capital, Present Capital, Average Annual Sales, Source of Capital: For these variables, the F-tests indicate that there are no significant differences in perceived Substantial Cost Reduction, Concentration on Core Functionalities, and Optimized Performance Level across different categories or groups.

Substantial Cost Reduction is significantly influenced by the Years of Existence and Form of Ownership. Concentration on Core

Functionalities and Optimized Performance Level do not show significant differences based on the studied variables.

These results provide valuable insights into the factors influencing perceived business performance aspects, guiding businesses in strategic decision-making and resource allocation.

Problems encountered with frugal Innovation

In the province of Rizal, where frugal innovation is gaining attention as a strategy to address economic constraints and promote sustainable development, several challenges have been identified in the implementation of frugal innovation initiatives. One prominent issue is the limited scalability and standardization of frugal solutions within the province. The context-specific nature of these innovations makes replication and widespread adoption challenging, hindering their potential impact across diverse sectors.

Balancing cost and quality remains a significant concern for frugal innovators in Rizal. The imperative to reduce costs should not compromise the quality of products or services, as maintaining consumer trust is essential for the long-term success of these innovations. Achieving this delicate equilibrium while addressing local needs is an ongoing challenge faced by practitioners of frugal innovation within the province.

Navigating regulatory and compliance issues poses another hurdle for frugal innovators in Rizal. Meeting legal requirements and obtaining necessary certifications demands resources that may offset the cost advantages associated with frugal solutions. Overcoming these regulatory hurdles is essential for gaining market acceptance and ensuring sustained success in a region characterized by evolving regulatory frameworks.

Technological and infrastructural barriers are notable challenges in the province, impacting the effectiveness of frugal innovations. Limited access to advanced technologies and inadequate infrastructure in certain areas hinder the adoption of frugal solutions. Bridging this technological gap is imperative to ensure that frugal innovations are applicable and accessible throughout the diverse communities in Rizal.

The province's cultural and behavioral landscape presents additional challenges for frugal innovators. Acceptance and adoption of frugal solutions are influenced by cultural preferences, and resistance to change may impede the successful integration of these innovations into local communities. Understanding and addressing these cultural nuances are crucial for the effective implementation of frugal innovation initiatives in Rizal. Moreover, funding and investment constraints have been observed as impediments to the development and scaling of frugal innovations within the province. The perception that low-cost solutions yield lower returns may discourage financial support for these initiatives. Overcoming these funding challenges is essential for fostering an environment conducive to frugal innovation and its potential positive impact on economic development and sustainability in the province of Rizal.

Conclusion

The profile of small businesses in Rizal Province, particularly concerning years of existence, type of business operations, form of ownership, start-up capital, present capital, average annual sales, and source of capital, provides a comprehensive understanding of the diverse landscape within which frugal innovation initiatives are implemented. Notably, businesses with a duration of three years constitute the majority, and the hospitality sector is the most prevalent type of operation. Partnerships emerge as the most common form of ownership, and start-up capital predominantly falls within the range of 500,000 to 750,000. The concentration of businesses with higher average annual sales in the 2,751,000-3,000,000 and above range underscores the economic diversity among the sampled enterprises. Regarding frugal innovation, the study identifies three key areas of focus: substantial cost reduction, concentration on core functionalities, and optimized performance level. The findings reveal that while there is a generally positive perception of these frugal innovation strategies, variability exists in the acceptance levels across different indicators. Supply chain optimization and efficiency in resource utilization are particularly highlighted as highly acceptable strategies.

The analysis of significant differences between the profiles of selected manufacturing businesses in Rizal, grouped according to frugal innovation, indicates that the years of existence and form of ownership significantly influenced perceived substantial cost reduction. However, no significant differences were observed in the concentration on core functionalities and optimized performance levels across different categories or groups. Finally, challenges encountered with frugal innovation in Rizal Province included limited scalability and standardization, concerns about balancing cost and quality, navigating regulatory and compliance issues, technological and infrastructural barriers, cultural and behavioral challenges, and funding constraints. Addressing these challenges is crucial for fostering a conducive environment for frugal innovation and maximizing its potential positive impact on economic development and sustainability in the province of Rizal.

Establish a platform for knowledge sharing, create a centralized platform or network where businesses, entrepreneurs, and innovators in Rizal can share insights and best practices related to frugal innovation for SME’s owners. This can help overcome the challenge of limited scalability and standardization.

Develop quality assurance guidelines, work collaboratively with industry experts and regulatory bodies to establish guidelines for maintaining quality standards while implementing frugal innovations. This will ensure that cost-reduction efforts do not compromise the overall quality of products or services.

Regulatory advisory services, provide businesses with advisory services to navigate regulatory and compliance issues. This may include workshops, training sessions, or a dedicated support system to assist businesses in understanding and complying with evolving regulatory frameworks.

Technological infrastructure development, invest in improving technological infrastructure in the province, focusing on areas with limited access to advanced technologies. This can enhance the adoption of frugal solutions and support businesses in overcoming technological barriers.

Establish a frugal innovation fund, create a dedicated fund to support frugal innovation initiatives in SME's in the province of Rizal. This fund can provide financial assistance, grants, or low-interest loans to businesses engaged in developing and scaling frugal solutions.

Establish a monitoring framework, implement a robust system for monitoring and evaluating the impact of frugal innovation initiatives in the SME's in Rizal. Regularly assess the effectiveness of implemented strategies and make data-driven adjustments to address emerging challenges.

Periodic reviews and updates, conduct periodic reviews of the frugal innovation landscape in the province of Rizal in particular to SME's. Stay informed about changing dynamics, emerging trends, and evolving needs to ensure that support mechanisms remain relevant and effective.

By addressing these recommendations, stakeholders in Rizal can contribute to the sustainable growth of frugal innovation, fostering economic development while overcoming the challenges associated with implementation. Continuous collaboration, adaptability, and a strategic focus on community engagement will be essential for the success of frugal innovation initiatives in the province.

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