Strategic Branding and Sustainable Packaging as Financial Assets: Evidence from Community-Based Biomass Briquettes

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Abstract: - This study investigates the impact of brand identity and packaging on repurchase intentions for community-produced biomass briquettes in Thailand, treating these elements as strategic financial assets. It tested three hypotheses concerning consumer income (H1), brand identity (H2), and packaging satisfaction (H3). This research examines the influence of brand identity and packaging on the repurchase intention for biomass briquettes, produced by a community in Thailand as strategic financial assets. It proposed three testing hypotheses concerning consumer income (H1), brand identity (H2), and packaging satisfaction (H3). Utilizing a mixed-methods approach involving 15 manufacturers and a survey of 400 customers, the research identifies branding as a crucial common factor influencing market value. A significant model was identified through multiple regression analysis ($F = 29.926$, $p < 0.05$). On the other hand, H2 and H3 got support, with packaging sustainability being the best predictor ($\beta = 0.368$; $p <. 001$) and brand self-image being the second best ($\beta = 0.245$, $p <. 01$).The model shows a gross profit margin of 54.3% and an estimated break-even point of 158 kg/month. These results indicate that there is empirical support for strategic branding 49.4% and eco-friendly packaging, resulting in important assets, as well as value-based pricing, which in turn contributes to the bottom line of registered enterprises, and increases competition in the community enterprises market.

Key-Words: - Strategic Brand, Sustainable Packaging, Financial Assets, Value-based Pricing, Biomass Briquettes, Brand Identity, Repurchase Intention, Community Enterprise, Circular Economy.

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1 Introduction

Today, branding and packaging are becoming a strategic tool as they create value for the consumer, providing them a competitive edge in the global market. This is having an impact now more than ever, as consumers are increasingly demanding sustainability and responsible consumption. Recent global research demonstrates that packaging design, brand identity indicators, environmental cues, and circular design principles profoundly affect consumer perceptions and purchasing intentions, [1], [2]. Specifically, packaging design and the ensuing brand experiences have been recognized as vital intermediaries that enhance brand loyalty and foster enduring consumer engagement, [3]. From a business and economic standpoint, packaging is no longer regarded merely as a protective function; it is now seen as a communication tool that imparts symbolic, ethical, and sustainability-related value, [4]. Global circular economy and low-carbon policy frameworks
increasingly emphasize sustainable branding as an essential factor for long-term competitiveness and market differentiation, [5], [6]. Branding and packaging are no longer just design tasks; they are now seen as important parts of modern international business strategy.

The One Tambon One Product (OTOP) initiative in Thailand helps to strengthen the grassroots economy and bring in money for the local economy by making community-based products. Despite this potential, many OTOP products continue to have problems with weak brand identity, old packaging,

and a lack of marketing focus, which makes them less competitive in markets outside of their own, [7]. Recent empirical studies in Thailand indicate that consumers increasingly expect community products to integrate local identity with modern design and environmental responsibility, [8]. Without systematic branding and packaging development, community products risk being perceived as low-value commodities rather than differentiated offerings, [9]. This issue is particularly important in the context of Thailand's Bio-Circular-Green (BCG) economic policy, which emphasizes value-added production, sustainability, and innovation-driven community enterprises, [10], [11].

Biomass briquettes represent a technically viable and environmentally sustainable solution for managing agricultural residues and reducing PM2.5 emissions, which remain a chronic environmental and economic problem in northern Thailand. There are reports from both the US and other countries that show that burning agricultural waste outside is a major cause of haze pollution. This costs a lot of money in lost productivity and health care, [12], [13]. Making briquettes from biomass waste can help the environment and give businesses in the community new ways to make money. But being technically good doesn't mean you'll be successful in the market from a business point of view. Business and marketing studies say that eco-friendly products need good branding and packaging to show how valuable they are and why they cost more. Previous laboratory studies have demonstrated that biomass briquettes from agricultural residues achieve calorific values of approximately 15–20 MJ/kg and significantly reduce particulate emissions compared to traditional charcoal, [14]. Recent research on renewable energy technologies and community-based renewable energy development in developing economies validates the feasibility and scalability of biomass-based community enterprises, [15]. Biomass briquettes produce much less particulate matter and are more thermally efficient than traditional open burning, [12], [14]. So, for a business to be successful, it is important to combine technical solutions with branding and economic factors.

1.1 Research Objectives

1) To analyze the brand identity and market potential of community-based products (OTOP) in Mae Waen Subdistrict, Phrao District, Chiang Mai Province.

2) To create a brand identity and a prototype for eco-friendly packaging for biomass briquettes by combining local identity with design ideas that focus on sustainability.

3) To conduct an empirical study on the influence of brand identity and packaging characteristics on consumers' repurchase intention, and on the economic feasibility of biomass briquette products.

2 Research Context and Literature Review

This section is organized into three parts: Thailand's Charcoal Industry Context, Theoretical Frameworks, and Conceptual Framework & Hypotheses

2.1 Thailand's Charcoal Industry Context

Thailand's charcoal industry exhibits a significant structural gap between its formal and informal sectors, a situation that aligns with the nation's BCG policy and global sustainability trends, particularly within the biomass briquette sector, [16]. Domestic demand is approximately 5.26 million tons annually. However, officially registered producers account for only 0.55% of this, while the informal sector, comprising mainly small-scale household producers, supplies 99.45%, with an estimated market value of THB 78.45 billion per year, [17]. This disparity highlights a substantial untapped economic opportunity. This research, therefore, focuses on branding and packaging as strategic market mechanisms to upgrade informal charcoal products into value-added community goods.

Government policy combines promotion through DEDE's high-efficiency kilns with regulation (130 kg possession limit), constraining producer scalability. Concurrently, the Department of Alternative Energy Development and Efficiency (DEDE) has promoted high-efficiency kilns to reduce emissions, [17]. Nevertheless, technological promotion alone is insufficient without product differentiation, branding, and market access. This study investigates whether branding and packaging for biomass briquettes, a product with higher quality standards and value-added potential, can help community producers overcome regulatory hurdles and align with national products with enhanced economic value. This aligns with recent findings on sustainable biomass utilization and community-based energy development in rural Southeast Asia, which confirm the potential of integrating local resources with structured energy enterprises, [15].

2.2 Theoretical Frameworks

2.2.1 Brand Identity Prism

A brand is a distinction or sign that differentiates a product, and the impression people have about it. This study employs Kapferer's Brand Identity Prism [18], consisting of six dimensions: 1) Physique, 2) Personality, 3) Culture, 4) Relationship, 5) Reflection, and 6) Self-image. This model is well-suited for community products as it can systematically convey local wisdom through brand elements. Related research confirms that creating a brand that reflects a community's identity helps the product stand out and be better remembered, [18].

However, most studies focus on the design process and lack quantitative measurement linking brand identity to concrete repurchase intention, which this study aims to investigate further.

2.2.2 Packaging Theory & Sustainability

[19] say that packaging has three main purposes: to protect, to make things easier, and to communicate. In today's market, people are putting more and more value on packaging that is good for the environment and lasts a long time. This is a very important factor in their buying decisions, [20].

Research indicates that visual elements on packaging directly influence purchase intention [21], and creative design can motivate consumer purchasing decisions [22]. For briquette products, consumers desire packaging that is not only aesthetically pleasing but also convenient and durable [23]. This research integrates these concepts with the trend of Green Packaging to develop a more comprehensive success model.

2.2.3 Repurchase Intention

Repurchase intention is a cornerstone of a product's sustainable success, especially for community enterprises transitioning from commodity sales to building strong brand equity. It results from overall customer satisfaction with both the functional and emotional value of a product, [4]. For eco-friendly products like biomass briquettes, repurchase behavior often correlates positively with the perceived social value, [23]. Designs that clearly communicate a sustainability identity can significantly trigger psychological motivations that influence repurchase intention, [3], [21]. This aligns with the context of community products in Thailand, where consumers are willing to support and repurchase products that have been modernized to tell their local story, [24].

2.3 Conceptual Framework & Hypotheses

Based on the literature review and contextual analysis, the researcher proposes three hypotheses to study the relationships between variables influencing the repurchase intention for biomass briquettes:

Hypothesis 1 (H1): Different consumer income factors have varying effects on the intention to repurchase biomass briquettes.

Hypothesis 2 (H2): Elements of brand identity positively influence the intention to repurchase biomass briquette products.

Hypothesis 3 (H3): Packaging satisfaction, including aesthetics, functionality, communication, and sustainability, positively influences consumers' intention to repurchase biomass briquette products.

3 Research Methodology

This research study employed a mixed-methods R&D approach by combining quantitative methods with Participatory Action Research (PAR). The experimental approach of this process set out to formalize connections between business innovation and sustainable community development in a way that was directed, empirical, systematic and participatory, receiving approval from the Research Ethics Committee of Rajamagala University of Technology Lanna (RUMUL-IRB 166/2025).

3.1 Population and Sample

The study population comprised two groups:

a) Primary Informants (Producers) included 15 purposively selected community product producers and leaders in Mae Waen Subdistrict, Chiang Mai. They participated in identity exploration, co-design processes, and brand prototype selection.

b) Consumer Sample consisted of 400 consumers in Chiang Mai Province who had previously purchased briquette products. The sample size was determined using Cochran's formula [25] (95% confidence, 5% error), with an additional 4% to account for potential data loss. Accidental sampling was used for data collection at community product outlets and OTOP trade fairs.

3.2 Research Instruments

This research utilized a mixed-methods approach, employing two primary research instruments. In the qualitative phase, a participatory methodology utilizing semi-structured interviews and focus groups was employed to investigate community

potential and collaboratively develop brand concepts, informed by the Brand Identity Prism framework.

a) Participatory Process: Semi-structured interviews and focus group discussions based on the Brand Identity Prism framework were conducted to examine community potential and brand identity. We had brainstorming sessions to work together on ideas for the brand and the packaging.

b) Evaluation: A questionnaire was developed based on a review of the literature. It consisted of four sections: 1) Demographics, 2) Brand Identity Satisfaction (30 items), 3) Packaging Satisfaction (20 items covering aesthetics, functionality, communication, and sustainability), and 4) Repurchase Intention (3 items). A five-point Likert scale was applied to sections 2–4.

The Brand Identity Satisfaction scale was operationalized based on Kapferer's [18] six-dimensional framework. Physique (physical traits like shape, size, color, and material), Personality (brand traits like modernity and friendliness), Culture (values related to community heritage and sustainability), Relationship (emotional connection between consumers and the brand), Reflection (how users see themselves when using the product), and Self-image (how consumers see themselves when using the product). The Packaging Satisfaction scale consisted of four dimensions, each with five items. Aesthetics assessed the product's visual appearance and perceived quality. Functionality evaluated durability and ease of use. Communication examined the clarity and comprehensibility of product information. Sustainability assessed recyclability and environmental impact.

3.3 Validity and Reliability of the Instruments

Instrument quality was systematically assessed. For qualitative data, trustworthiness was ensured through data triangulation. The quantitative questionnaire's content validity was determined by three experts through the Index of Item-Objective Congruence (IOC) to ensure that each item matched the research objectives. All items yielded IOC values above 0.50, indicating an acceptable level of content validity, [26]. A pilot study with 30 participants resulted in a Cronbach's Alpha of 0.85, indicating good reliability, [27]. Confirming high reliability for statistical analysis.

3.4 Data Collection Procedures

The R&D process followed four stages:

(1) Contextual inquiry involved collecting qualitative data on costs and cultural values through interviews with 15 purposively selected key informants, including the enterprise president, board members, production team, and local sages, to establish the foundation community context.

(2) Participatory design used the collected data in collaborative design sessions with the community members to develop brand and packaging concepts and strengthen local ownership.

(3) Evaluation validated the developed prototypes through a survey of 400 consumers in Chiang Mai. For an unknown population, Cochran's formula [25] suggested a minimum sample of 385 respondents, which was increased to 400 (approximately 4%) to reduce the risks of incomplete responses. Convenience sampling at OTOP trade fairs targeted active buyers to evaluate satisfaction and repurchase intention.

(4) Business feasibility looked at costs and break-even points to make sure the business was viable and that the prices were based on value.

Qualitative data underwent processing via content analysis to amalgamate thematic insights. Quantitative data were examined through descriptive statistics (frequency, percentage, mean, and standard deviation) and inferential statistics, particularly multiple regression analysis, to ascertain the key determinants of repurchase intention.

3.5 Financial Feasibility and Sensitivity Analysis

A full financial feasibility study was done to find out if the community business could make money and to figure out how much money it could lose. This analysis extended beyond simply searching for costs and potential profits to determine whether a value-based pricing strategy could be viable over the long term, which is fundamental for success in the longer run. The methodology consisted of multiple phases. First, a detailed cost-volume-profit (CVP) analysis was performed, integrating data on local material costs, production overheads, and market competition to establish a baseline cost structure as shown in Table 1. Second, a break-even point (BEP) analysis was conducted to determine the minimum sales volume required to cover all costs under the proposed pricing structure.

It is important to note that this study employed a deterministic one-variable-at-a-time (OAT) sensitivity approach, not stochastic simulation (e.g., Monte Carlo) . The ±30% variation range was adopted as a standard benchmark for sensitivity testing in SME and community enterprise feasibility studies, representing a plausible range of market

fluctuations for agricultural commodity-based products in Thailand. The cost data used in the baseline scenario (Table 1) were derived from actual community enterprise records collected during Stage 1 fieldwork (Section 3. 4) , thereby ensuring consistency between the theoretical projections and real operational data. Future research may employ Monte Carlo simulation to generate probability-based confidence intervals for financial projections.

A financial analysis assessed commercial viability by integrating actual community production costs with market data. A price of 3 5 Baht/ kg was set based on the product's increased sustainability and perceived value.

Table 1. Cost Structure of Biomass Briquette

Cost/Benefit	Price (Baht/kg)
Raw Materials (Agricultural Waste)	3.00
Production cost	6.00
Processing Cost (Electricity/Fuel)	4.00
Packaging and Labeling	3.00
Total Cost per kilogram (kg)	16.00
Selling price per kilogram	35.00
Gross Profit per kilogram	19.00
Gross Profit Margin (%)	54.3%

Source: Created by Authors

Before performing the regression analysis, the assumptions underlying ordinary least squares (OLS) regression were evaluated. A histogram and a normal P–P plot were used to check for normality, and they showed that the residuals were roughly normally distributed. A scatterplot of standardized residuals against predicted values was examined to assess homoscedasticity. The plot did not show any clear pattern. These results indicate that the regression assumptions were adequately met, thereby affirming the validity of the analysis.

The Durbin–Watson statistic was also used to check the independence of the residuals. The value of 2.122 we got is in the acceptable range, which means there is no sign of autocorrelation. This satisfies a fundamental assumption of the OLS regression model and supports the reliability of the estimated coefficients.

Stepwise regression was performed to enhance the robustness of the results. The analysis showed that Sustainability (X10), Self-image (X5), and Reflection (X1) were the only significant predictors (Adjusted $R^2 = 0.418$), confirming the stability and consistency of the Enter-method results presented in Table 2 (Appendix).

Cost data were obtained from community enterprise records during the contextual inquiry phase (Section 3.4, Stage 1). Prices for products were based on how much people thought they were worth.

4 Research Results

This section presents the research findings covering field synthesis, brand and packaging design, consumer evaluation, and financial feasibility analysis for biomass briquette products. The research findings are detailed as follows:

4.1 Results of Field Data Analysis and Qualitative Data Synthesis

The SWOT analysis revealed that the community's primary strengths lie in the year-round abundance of raw materials and consistent support from local authorities. Especially through the BCG (Bio-Circular-Green) Economy, these internal strengths have large external opportunities in the increasing market demand for eco-friendly smokeless fuels. The project also has problems on the inside, such as not having good branding, packaging design, and financial management skills. On the outside, there are threats from manufacturers who make things on a large scale and the fact that the cost of raw materials changes with the seasons. The latter supports that building a strong professional brand is an important part of the next step in the project.

4.2 Brand and Packaging Design

Building upon the qualitative insights obtained during Phase 1, community-based brand identity and packaging prototypes were created to reflect the local identity of communities with environmental sustainability. User-friendly, durable, and effective as a marketing tool, the design process integrated producers' needs and community feedback. Figure 1 (a) A basic Layered structure of a cultural object (b) Integrate that into the visual identity of the packaging based on eco-friendly design ideas.

(a) Original (b) Proposed

Fig. 1: Biomass briquette brand and packaging.

Source: Created by Authors

The package design uses recyclable materials and features a clear PET window to increase product visibility, giving consumers confidence in the order. The new design communicates the necessary information to consumers clearly in order to reinforce brand identity and increase appeal for market entry, action benefits of smokeless acting as a competitive advantage.

4.3 Results of Brand and Packaging Prototype Evaluation

Following prototype development, satisfaction and repurchase intentions were evaluated among 400 respondents in Chiang Mai using a Likert-scale questionnaire (Cronbach's alpha > 0.80). Grounded in Kapferer's Brand Identity Prism and Perceived Brand Value frameworks, the data were analyzed via descriptive statistics, ANOVA, and multiple regression. The sample was predominantly female (57.8%), aged over 41 (46.3%), married (51.7%), and highly educated (81.5% degree holders). Primarily employed in sales or farming, with a median monthly income of 10,001–30,000 Baht, these participants represent a diverse consumer base using briquettes for both domestic and productive purposes.

4.3.1 Satisfaction and Repurchase Intention

Consumer evaluation showed above average satisfaction through all dimensions, with the brand reaching an overall mean of 3.65; self-image (3.68) and personality (3.68) were especially strong in projecting a current eco-friendly experience for consumers. The highest mean satisfaction scores after Quality were for Packaging (3.62), followed primarily by Sustainability (3.67) and Esthetics (3.66), which emphasizes the importance of eco-friendly design. Equally, the repurchase intention also stood high at a mean of 3.78, and with an inclination towards Product Recommendation (3.79), the need for positive word-of-mouth is evident.

4.3.2 Analysis of Differences and Variable Correlations

Hypothesis 1 was tested using a one-way ANOVA to compare consumer perception of businesses across four income groups. Results revealed no statistically significant difference for all ten dimensions ($F = 0.103–1.502$; $p = 0.213 – 0.959$), nor for general brand identity ($F = 0.519$, $p = 0.670$) or purchase intention ($F = 0.782$, $p = 0.505$). This indicates that income level may not have a substantial impact on consumer attitudes towards the product, implying wide market appeal across income groups.

Pearson correlation analysis was used to confirm that all ten independent variables were positively and significantly correlated ($r = 0.511–0.833$, $p < .01$). Since all of the coefficients remained below the 0.85 threshold, multicollinearity was not an issue that would compromise the validation of variables for multiple regression analysis in subsequent processes.

4.3.3 Regression Diagnostics and Assumption Testing

Residual analysis (Figure 2, Appendix) was performed to validate the model against OLS assumptions. The Histogram and Normal P-P Plot showed that residuals follow a normal distribution. The Scatterplot displays a random distribution of residuals, which is what we expect and indicates homoscedasticity. A Durbin–Watson statistic of 2.122 verified the absence of autocorrelation.

There is no concern of multicollinearity because all VIF values (2.575 – 4.846) are below the usual threshold of 5. Casewise diagnostics also found only two outliers, which made up 0.5% of the sample. Because they make up such a small part of the model, these cases don't have a big effect on its stability.

The specifics in Residuals Statistics indicate that the model is adequate: The predicted values were between 2.083 and 4.871 (Mean = 3.783, SD = 0.501), and the standardized residuals were between –2.486 and 4.492 (Mean=0.000, SD=0.987). Investigators at Casewise Diagnostics found 2 observations representing only 0.5% of the overall sample (n = 400) with standardized residuals that exceeded a threshold of ±3 (Case 300 = 4.492; Case 348 = 3.695). As the proportion of outliers is small and there are no influential points, these cases were kept in as they do not destabilize the regression model.

4.3.4 Multiple Regression Analysis and Hypothesis Testing

Table 2 (Appendix) shows the result of multiple regressions on predictors of repurchase intention. The model was statistically significant ($F = 29.926$, $p < .001$), wherein $R = 0.659$ and $R^2 = 0.435$; that is, the ten predictors accounted for 43.5% of its variance. The values of all VIF (2.575–4.846) show that multicollinearity is not a problem. While several VIFs tend to exceed 4.8 (Cultural X3 = 4.846, Relationship X4 = 4.812), they all stay far away from the classical cut-off of 10 [28], and also all Pearson correlation coefficients do not reach

values over 0. 85, proving that multi-collinearity does not represent a danger for model stability. Thus, the regression coefficients may be interpreted with confidence. This further confirms that the 95% confidence intervals do not cross zero for Reflection (X1) [0.020, 0.309], Self-image (X5) [0.103, 0.442], and Sustainability (X10) [0.240, 0.522]. By contrast, the 95% confidence interval for Physique (X6) [−0. 349, 0. 010] includes zero, which is thus in line with its p-value of 0.064, also being marginally non-significant (i.e., rejected only at $\alpha = .05$).

The analysis supports the research hypotheses:

Hypothesis 2 (Supported): While brand identity significantly depicts repurchase intention, this effect is most significant through Self-image ($\beta = 0.245$, $p < .01$) and Reflection ($\beta = 0.151$, $p < .05$). This would indicate that consumers use the brand to showcase an eco-conscious identity.

Hypothesis 3 (Supported): Packaging satisfaction, especially Sustainability ($\beta = 0.368$, $p < .001$), is the strongest predictor. This suggests that environmental features play an important role in long-term commitment.

The model shows that a 1-unit increase in Reflection (X1), Self-image (X5), and Sustainability (X10) increases repurchase intention with values of 0.164, 0.273, and 0.381 units, respectively. On the other hand, a 1-unit increase in Physique (X6) reduced it by 0.170 units. Our findings corroborate that repurchase intention is strongly driven by perceptions of sustainability, self-positivity, and brand use reflecting their identity.

The negative coefficient of Physique ($\beta = -0.159$, $p = .064$) requires special treatment. This suggests that for this community product, consumers care more about intangible brand attributes like sustainability identity (Self-image) and social meaning (Reflection) than the external physical attributes alone. Consumers paying attention only to the product's tangible function may find a misalignment between the product's physical shape and its premium-brand positioning, leading to lower repurchase intention. This coefficient is only marginally non-significant at $\alpha = 0.05$; note that, and so, strategically, this means brands should not only use their voices to further flatten stakeholders' attempts at understanding the product' s environmental and cultural value—they also shouldn't waste money on updating boring physical designs of beautiful things.

Similarly, the negative but non-significant coefficients for Personality ($\beta = -0.084$, $p = .277$) and Relationship ($\beta = -0.063$, $p = .449$) do not indicate conceptual invalidity. Rather, they suggest that these dimensions are absorbed by the stronger predictors (Self-image and Sustainability) in the full model, consistent with the moderate intercorrelations observed ($r = 0.798–0.833$ among Brand Identity Prism dimensions).

4.4 Hypotheses and Overall Feasibility

The results of the previous hypothesis testing and business feasibility assessment work are synthesized here to provide a holistic conclusion. The results are summarized in Table 3, demonstrating that brand and packaging matter for commercial success, but demographic factors such as income do not.

The rejection of Hypothesis 1 (H1) is a strong result because it implies that the product has demand not limited to one specific income class, meaning potential for a wider market. In contrast, the robust support for Hypotheses 2 (H2) and 3 (H3), points to empirical support for the business model at its heart. The factors that drive repurchase intention, namely brand self-image and packaging sustainability, are the very elements that justify the premium, value-based pricing strategy.

Table 3. Summary of Hypotheses, (*H*)

	Statistical Evidence	Result
H1	$F = 0.103–1.502$; $p > .05$	Not Supported
H2	$\beta = 0.245, 0.151$; $p < .05$	Supported
H3	$\beta = 0.368$, $p < .01$	Supported

Note: One-way ANOVA was used to test H1, and multiple regression analysis was used to test H2 and H3.
Source: Created by Authors

This conclusion connects the marketing and financial components of the study. We found that the selling price was identified as the most sensitive factor for profitability. H2 and H3 underpin the importance of investing in branding and sustainable packaging as the main defensive mechanism for this price point so that it remains financially viable. This consolidates that brand equity is an acceptable financial asset to a business model.

4.5 Sensitivity Analysis of the Biomass Briquette Business Model

Introduction This section summarizes a detailed sensitivity analysis of a community-based biomass briquette enterprise. The study assesses the financial feasibility of the project in a volatile market, while also recognizing key variables behind its profitability and success. These results are providing a strong quantitative justification for making strategic decisions, and they fit an academic publication focused on sustainable community business models. Figure 3 shows that the

tornado analysis definitively identifies selling price as the most critical variable affecting profitability. A ±30% fluctuation in selling price creates a 21.00 Baht swing in gross profit, an impact 5.8 times greater than the next most sensitive variable, Production Cost. This underscores that the enterprise's ability to command its premium price is the central pillar of its financial success.

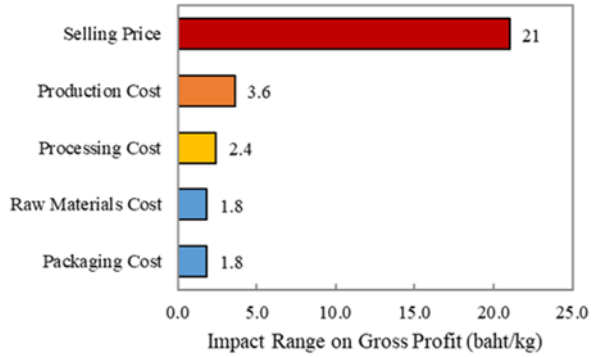

Fig. 3: Tornado analysis ranking variables by their impact on gross profit. The horizontal axis represents gross profit per kilogram (Baht/kg), while each bar shows the impact of a ±30% change in the corresponding variable. The variation range follows standard deterministic sensitivity practice for SME feasibility studies.
Source: Created by Authors

The break-even point (BEP) analysis (Figure 4) accentuates the operational risks related to price volatility. Even though the baseline BEP of 158 kg/month is feasible, a 30% reduction in selling price would require the enterprise to escalate sales to 353 kg/month, approximately a 124% increase, just to pay the bills. This demonstrates an extreme vulnerability to price erosion, making brand and value proposition defense a critical strategic priority.

Brand as Financial Asset: The study provides hardcore evidence that marketing (branding, packaging) is not an ancillary cost but a core financial asset. They shape the value-based pricing strategy supporting the model's viability, building a buffer against market risk.

Risk metric Quantification: The analysis highlights clear thresholds that need to be crossed for strategic planning, and determines that a drop in price below 31.50 Baht/kg (10% decrease) causes an 18.4% increase in losses, and decreasing the value to 24.50 Baht/kg (30% drop) makes the model untenable, with a requirement of sales volume at an obscene 124% increase

Price Dominates Cost: In terms of profitability, price inflation is far more important than cost containment. The contribution to the bottom line of selling price (110.53%) dwarfs all components of cost landed together and further challenges traditional usability-based feasibility studies for businesses like fashion.

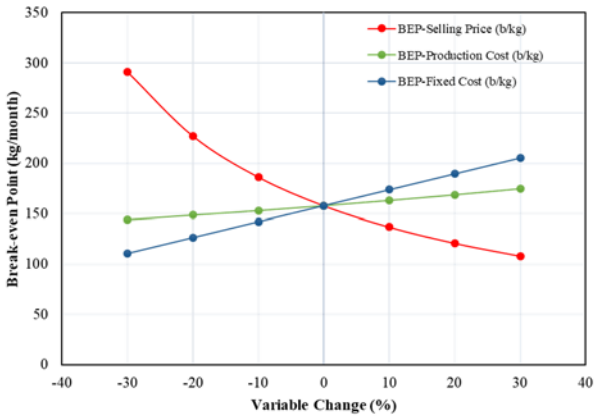

Fig. 4: Sensitivity of the Break-Even Point to variations in crucial factors. The vertical axis depicts the break-even volume (kg/month) necessary under various cost and price scenarios, in which each variable was tested at ±30% variation from the baseline.
Source: Created by Authors

In conclusion, the business model is financially viable with a high gross margin (54.3%) and a low initial BEP. However, success is critically dependent on sustaining a premium price. This finding is the research's most significant contribution, offering a data-driven directive for the long-term economic sustainability of community enterprises.

5 Conclusion and Discussion

This study confirms that strategic branding and sustainable packaging are critical drivers of repurchase intention for community-based biomass briquettes, transcending product functionality. The findings reveal that consumer satisfaction with brand identity (specifically self-image) and packaging sustainability are the most significant predictors of loyalty. This aligns with recent research where consumers increasingly favor products with clear environmental value propositions, [29], [30]. Empirically, for community enterprises, branding and packaging are not operational costs but strategic financial assets that elevate profitability by embedding circular economy principles into business operations, [31].

Though its explanatory power over repurchase intention is 43.5%, the remaining 56.5% of factors,

not addressed in this study, such as eco awareness, perceived functional performance of products (e.g., burning time or level of smoke), ease of access to distribution channels, and price sensitivity, can explain why purchase intention varies significantly for consumers across different regions. These factors are potential opportunities for future research (see Section 7 below). These findings extend prior international evidence. [1] found that environmentally friendly packaging significantly influences consumer response, while [22] demonstrated that creative packaging design motivates purchase decisions. However, the present study extends these findings by demonstrating that sustainability perceptions ($\beta = 0.368$) substantially outweigh aesthetic design ($\beta = 0.040$) in driving repurchase intention for community products—a distinction not clearly established in prior international research focused primarily on mainstream consumer goods. Compared to [23], who focused on customer requirements for charcoal briquette packaging design, this study advances the field by quantifying the actual statistical contribution of packaging dimensions to repurchase behavior. Furthermore, in comparison with [14], who assessed the full life cycle of biomass waste briquettes, the present study contributes a complementary market-demand perspective, demonstrating that consumer willingness to repurchase is primarily driven by perceived sustainability rather than technical product attributes alone. Additionally, [32] established that the mechanical properties and durability of biomass briquettes are comparable to those of conventional charcoal, supporting the premise that community-produced briquettes can compete on technical grounds, while the present study demonstrates their market competitiveness through strategic branding.

The financial analysis demonstrates viability with a 54.3% gross margin and a low break-even point. Success is leveraged on the ability to sustain a premium selling price through a strong value proposition rather than cost minimization alone. This data-driven mechanism allows small-scale producers to connect intangible brand identity with tangible financial performance in alignment with Thailand's BCG policy as well as the global frameworks for a circular economy, [33]. Thus, the strategic green branding acts as a critical mechanism through which locally available resources may be converted into more competitive and higher value-added commodities, and thus ensuring both long-term economic sustainability of community-based enterprises as well as offering differentiation in terms of market advantage.

6 Suggestions and Limitations

While this study provides valuable insights, its single-case focus on one community in Chiang Mai limits the statistical generalizability of the findings to all community enterprises in Thailand, [34]. Future research should expand the geographical scope to validate these results across diverse regions. Secondly, the study relies on self-reported repurchase intentions, which may not perfectly correlate with actual purchasing behaviour due to social desirability bias, a common issue in sustainability research, [35].

Third, this study focuses exclusively on the marketing and financial dimensions of biomass briquettes. Technical performance testing, such as combustion efficiency, emission reduction measurements, and comparative analysis versus traditional charcoal, was beyond the scope of this research. However, these aspects are acknowledged as important complementary dimensions. The integration of technical performance data with consumer perception analysis would provide a more comprehensive evaluation framework and is recommended for future studies (see Section 7).

For marketing and supply chain management, digital transformation should be used by the community-based businesses, [33]. They could further elevate their environmental image and market standing by exploring biodegradable materials and lifecycle assessments. These measures will strengthen and make community-based business models more competitive.

7 Future Work

Next steps of research should expand these findings in multiple ways. To the best of my knowledge, however, first, it would be beneficial to conduct a longitudinal study tracking how performative sustainability affected the brand's market performance and consumer loyalty over several years. Second, comparative case studies across communities with different enterprises in Thailand may unveil best practices for scaling up and local variances in consumer behavior, which will augment the generalization of findings from the current study.

Additionally, there is a need to explore the role of digital transformation. Future studies can also measure how e-commerce adoption and social media marketing lead to better brand equity-building, greater loyalty for community-based products, and increased sales. Lastly, future research must use more accurate sustainability indicators,

specifically full Life Cycle Assessments (LCA) for the briquettes and their packaging, which would give a more complete picture of the environmental impact of these products. This would not only bolster the brand's green credentials but also keep it in line with increasingly stringent global standards when it comes to environmental claims.

In the end, from this line of investigation may emerge a model that will serve as a universal toolbox for the toolkits of international development agencies and NGOs. Such research may be crucial to developing self-sustaining, profit-earning community enterprises around the world that can evolve from aid dependency to sustained economic independence through strategic, market-driven branding.

Moreover, cross-disciplinary studies that treat technical performance evaluations (combustion efficiency and calorific values measurements as well as particulate emissions analysis) of biomass briquettes in the same context as consumer perceptions will pave the way for a more holistic evaluation framework for this emerging product. Furthermore, the modeled unexplained variance (56.5%) also implies that other variables such as environmental knowledge, perceived product performance, convenience at distribution channels, and price sensitivity should be adapted in future studies to develop a complete predictive model of repurchasing intention related to community-based sustainability products.

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- Peeraya Somsak: Supervision, Conceptualization, Data calculation, Writing original draft, Writing review and editing.
- Teerasak Somsak: Formal analysis.
- Ronnachai Kamonthipwong: Design the brand and packaging
- Taechit Sansi: Conceptualization, Field test collecting, Writing review and editing.

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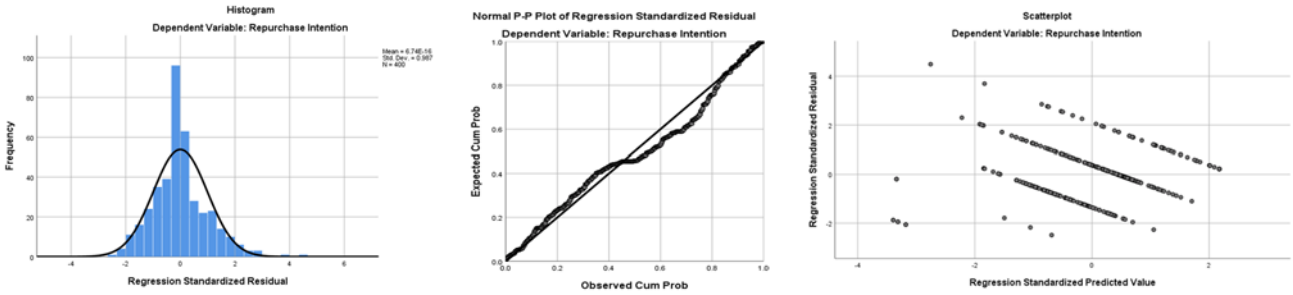
Conflict of Interest

The authors have no conflicts of interest to declare**.**

APPENDIX



(a) (b) (c)

Fig. 2: Regression Diagnostic Plots for Repurchase Intention: (a) Histogram of standardized residuals confirming normal distribution (Mean = 6.74E-16, SD = 0.987, N = 400), (b) Normal P-P Plot showing residuals closely following the diagonal reference line, and (c) Scatterplot of standardized residuals vs. predicted values demonstrating homoscedasticity with no systematic pattern

Source: Created by Authors

Table 2. Multiple Regression Results for Factors Predicting Repurchase Intention for Ban Waen Biomass Briquettes

	Unstandardized Coefficients		Standardized Coefficients	t	P-Value	VIF
	B	Std. Error	Beta			
(Constant)	0.844	0.184		4.582	.000*	
Reflection (X1)	0.164	0.073	0.151	2.238	.026*	3.124
Personality (X2)	-0.092	0.085	-0.084	-1.088	.277	4.118
Cultural (X3)	0.117	0.089	0.110	1.311	.191	4.846
Relationship (X4)	-0.067	0.088	-0.063	-0.758	.449	4.812
Self-image (X5)	0.273	0.086	0.245	3.169	.002*	4.114
Physique (X6)	-0.170	0.091	-0.159	-1.860	.064	4.827
Esthetics (X7)	0.040	0.067	0.040	0.601	.548	3.047
Functionality (X8)	0.046	0.063	0.045	0.734	.464	2.575
Communication (X9)	0.113	0.076	0.109	1.486	.138	3.723
Sustainability (X10)	0.381	0.072	0.368	5.308	.000*	3.301
Statistically significant R = 0.659, R^2 = 0.435, Adj R^2 = 0.420, S.E. = 0.57818, F= 29.926, P < .001 *Statistically significant at p < .05. All VIF values are below the commonly accepted threshold of 10, confirming the absence of severe multicollinearity, [28].						

Source: Created by Authors