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The Impact of Green and Product Innovations on Competitive Advantage: A Case Study of Medium and Small-Scale Distilleries in Thailand

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ABSTRACT

This study investigates the interrelationships among green innovation, product innovation, competitive advantage, and business survival in Thailand's small and medium-sized distillery sector. Drawing on the Resource-Based View and Dynamic Capabilities Theory, the research explores how environmentally sustainable practices serve as a strategic foundation for product differentiation and long-term viability in a heavily regulated market. The study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze survey data collected from SME distilleries across Thailand. The findings confirm that green innovation has a strong positive effect on product innovation, which in turn significantly influences competitive advantage and SME survival. Product innovation also independently impacts survival outcomes, highlighting its dual strategic role. Competitive advantage is shown to be a critical mediator linking innovative efforts to long-term business resilience. These results underscore the need for SMEs to embed sustainability and innovation into core strategies while also highlighting the importance of regulatory reform to support local entrepreneurial ecosystems. The study contributes to the literature on SME innovation in emerging economies and offers practical recommendations for policymakers, including easing production quotas and investing in green technology support systems. The findings suggest that fostering a policy environment conducive to small-scale innovation can enhance the competitiveness and sustainability of Thailand's craft distillery industry.

Keywords: Green Innovation, Product Innovation, Competitive Advantage, SME Survival, Distillery Industry, Thailand, PLS-SEM
JEL Classifications: L25, O31, Q55

1. INTRODUCTION

Small and medium-sized enterprises (SMEs) play a vital role in Thailand's distillery sector, contributing to local identity, economic activity, and innovation. However, they face significant challenges related to regulatory restrictions and limited access to resources. While large corporations enjoy structural and legislative advantages, SMEs must depend on innovation, agility, and differentiation to compete and survive (Porter, 2008; Liu, 2013).

In this context, innovation, particularly green and product innovation has become essential. Green practices not only improve environmental compliance and brand image but also help distilleries meet rising consumer expectations for sustainability. Meanwhile, product innovation supports market differentiation, customer retention, and competitive positioning (Huang and Li, 2017; Liu and Atuahene-Gima, 2018). These strategies are especially crucial for Thai SMEs amid evolving environmental policies and shifting consumer preferences (Srisathan et al., 2023).

Despite the rising demand for craft spirits and artisanal alcohol, strict regulations continue to favor large-scale producers through licensing constraints, high production thresholds, and limited distribution rights (Kaewpramkusol et al., 2018; Aphinan, 2022). However, growing public interest and recent policy debates signal potential reforms aimed at empowering small distillers, encouraging rural entrepreneurship, and leveraging local heritage for sustainable tourism and economic resilience (Limjaroenrat, 2024; Forbes Asia, 2024).

Given the increasing urgency of environmental concerns and the global shift toward sustainable business practices, green innovation has emerged as a vital strategy for SMEs (Chen et al., 2006; Dangelico and Pujari, 2010). These businesses, often operating with constrained capabilities, must respond to regulatory pressure and sustainability demands (Hojnik and Ruzzier, 2016). When properly integrated, green innovation can enhance environmental performance, drive product innovation, and contribute to long-term survival through competitive advantage (Wagner, 2009; Albort-Morant et al., 2016). Yet, the precise mechanisms linking green innovation to these strategic outcomes remain underexplored particularly in developing economies like Thailand (González-Moreno et al., 2015). To address this gap, the following review examines key literature on green innovation, its connection to product innovation, and their combined impact on competitive advantage and the survival of SMEs in the distillery sector.

2. LITERATURE REVIEW

Green innovation refers to the adoption of environmentally sustainable practices in production and product development. This includes initiatives such as waste reduction, energy efficiency, and the use of renewable or biodegradable materials. In manufacturing contexts, these practices not only reduce environmental impact but also improve operational efficiency and align with the preferences of environmentally conscious consumers (Huang and Li, 2017; Sarkar, 2013).

Green innovation is closely linked to product innovation. By integrating ecological concerns into design and production processes, firms often develop novel products with improved functionality, materials, or processes. For example, circular economy models promote the reuse of waste and by-products, leading to sustainable product development that responds to both environmental and market needs (Ottman, 2017; de Jesus and Mendonça, 2018). In this way, green practices can serve as a catalyst for new product ideas that reinforce firm differentiation.

Recent studies have highlighted the strategic role of innovation in enhancing competitive advantages. Wahyono (2020) and Kuncoro and Suriani (2018) found that product innovation significantly strengthens SMEs' ability to respond to market shifts, improve quality, and sustain long-term performance. Furthermore, combining green and product innovation provides firms with a dual edge: improving compliance and reputation while enabling agile responses to evolving consumer trends (Albort-Morant et al., 2016; Srisathan et al., 2023).

In the beverage industry particularly among SMEs innovation is increasingly seen as a pathway to differentiation and resilience. For example, small-scale distilleries that introduce eco-friendly packaging, reduce emissions, or create unique flavor profiles using locally sourced ingredients can appeal to niche markets and stand out in competitive landscapes (Limjaroenrat, 2024; Forbes Asia, 2024). These innovative approaches not only help firms comply with strict regulations but also unlock opportunities in sustainable tourism and premium market segments.

Competitive advantage, as Porter (2008) emphasized, is a crucial factor in SME survival. Firms that successfully adopt innovative strategies are more likely to develop unique capabilities, maintain customer loyalty, and withstand economic or policy-related shocks. Especially in developing economies, where SMEs often operate with limited resources, the strategic use of innovation can significantly influence their ability to sustain operations and grow (Rabal-Conesa et al., 2022; González-Moreno et al., 2015).

Overall, existing literature supports the view that green and product innovation are not only interconnected but also jointly contributes to building competitive advantage and ensuring long-term survival particularly for SMEs navigating environmental regulations and resource constraints in emerging markets.

2.1. Hypotheses Development

- H_1: Green innovation has a positive effect on product innovation.
- H_2: Green innovation has a positive effect on competitive advantage.
- H_3: Product innovation has a positive effect on competitive advantage.
- H_4: Competitive advantage has a positive effect on SME survival.
- H_5: Green innovation has an indirect positive effect on SME survival through product innovation and competitive advantage.

3. RESEARCH METHODOLOGY

3.1. Research Design

This study employed a quantitative research design using a survey-based approach to examine the effects of green innovation and product innovation on competitive advantage and the survival of small and medium-sized enterprises (SMEs) in Thailand's distillery sector. The research aimed to test hypothesized relationships among latent constructs within a structural framework, making Partial Least Squares Structural Equation Modeling (PLS-SEM) the preferred analytical method due to its suitability for complex models with relatively small sample sizes (Hair et al., 2021).

3.2. Population and Sample

The target population consisted of owners, managers, or senior staff of SMEs operating in the distillery and beverage production sector in Thailand. A purposive sampling method was used to identify respondents with sufficient knowledge of their firm's innovation practices and strategic orientation. A total of 220 questionnaires were distributed, and 190 valid responses were retained for analysis, exceeding the minimum threshold recommended for PLS-SEM analysis (Hair et al., 2021).

3.3. Instrumentation

The survey instrument was developed based on validated scales from previous studies and adapted to fit the context of Thai SMEs in the distillery industry:

- Green Innovation (GI): Adapted from Chen et al. (2006) and Dangelico and Pujari (2010), including items measuring environmentally friendly product design, waste reduction, and resource efficiency.
- Product Innovation (PI): Based on Liu and Atuahene-Gima (2018) and Wahyono (2020), measuring aspects such as novelty, product improvement, and differentiation.
- Competitive Advantage (CA): Items reflecting brand uniqueness, market responsiveness, and operational efficiency were adapted from Porter (2008) and Kuncoro and Suriani (2018).
- Sustainability and Survival (SS): Measured based on long-term strategic resilience and adaptation to environmental or market changes, following Rabal-Conesa et al. (2022).

All items were measured using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.4. Data Collection Procedure

Data were collected between November 2024 and March, 2025, using self-administered online and offline surveys. The questionnaire was pretested with a small group of industry participants and academic experts to ensure clarity and content validity. Participation was voluntary and anonymous, with ethical approval obtained from the affiliated institution.

3.5. Data Analysis

The data were analyzed using SmartPLS 4.0 to assess both the measurement model and the structural model. The analysis included:

- Assessment of the measurement model: Reliability, convergent validity (using factor loadings and Average Variance Extracted or AVE), and discriminant validity (using the Fornell-Larcker criterion).
- Assessment of the structural model: Path coefficients, coefficient of determination (R^2), effect sizes (f^2), and predictive relevance (Q^2).

Bootstrapping with 10,000 resamples was used to test the significance of the hypothesized paths.

4. DATA ANALYSIS AND RESULTS

The collected data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS software. This method is suitable for exploratory models with latent constructs and non-normal data, particularly in SME research contexts where sample sizes may be modest (Hair et al., 2021). The analytical process follows two stages: assessment of the measurement model and the structural model, based on the conceptual framework adapted

4.1. Measurement Model Assessment

The reliability and validity of each latent construct were evaluated using multiple criteria:

- Internal consistency reliability: All constructs met the threshold for Cronbach's alpha (> 0.70), indicating strong internal consistency.
- Composite reliability (CR): Values ranged between 0.87 and 0.91, confirming internal reliability.
- Convergent validity: All items had standardized loadings above 0.70, and Average Variance Extracted (AVE) values exceeded the 0.50 benchmark.
- Discriminant validity: Assessed through both Fornell-Larcker and HTMT criteria. The square roots of AVE were greater than inter-construct correlations, and all HTMT ratios were below the 0.85 threshold, confirming discriminant validity.

To evaluate the reliability and validity of the measurement model, four key indicators were examined: Cronbach's alpha, composite reliability (rho_a and rho_c), and average variance extracted (AVE). The results are summarized in Table 1.

All constructs demonstrate strong internal consistency reliability, as indicated by Cronbach's alpha and both composite reliability values (ρ_a and ρc), which all exceed the commonly recommended threshold of 0.70 (Hair et al., 2019). Notably, values for composite reliability range from 0.903 to 0.938, reflecting a high level of reliability across all constructs.

Moreover, the average variance extracted (AVE) for all constructs surpasses the minimum criterion of 0.50, confirming adequate convergent validity (Fornell and Larcker, 1981). Specifically, AVE values range from 0.626 to 0.771, indicating that a substantial portion of the variance in the indicators is explained by the latent constructs.

To evaluate discriminant validity, the Heterotrait-Monotrait (HTMT) ratios were calculated. As shown in Table 2, all HTMT values are below the threshold of 0.90, suggesting that discriminant validity is established among all constructs (Henseler et al., 2015). Specifically, the highest HTMT value observed was between Competitive Advantage (CA) and SMEs Survival (SS) at 0.798, which remains within the acceptable range. These results confirm that the constructs used in the study are conceptually distinct and suitable for further structural model analysis.

Table 1: Construct reliability and convergent validity assessment

Construct	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CA	0.914	0.918	0.930	0.626
GI	0.901	0.908	0.931	0.771
PI	0.917	0.918	0.938	0.750
SS	0.875	0.903	0.909	0.670

Table 2: Heterotrait-Monotrait (HTMT) ratios of constructs

	CA	GI	PI	SS
CA	1			
GI	0.648	1		
PI	0.693	0.793	1	
SS	0.798	0.474	0.508	1

4.2. Structural Model Assessment

Figure 1 illustrates the structural model with standardized path coefficients and P-values obtained from the PLS-SEM analysis. The structural model was tested using bootstrapping with 10,000 subsamples to evaluate the significance of the path coefficients. The results indicate that all hypothesized relationships are statistically significant ($P < 0.05$). Specifically, GI significantly influences both PI ($\beta = 0.726$, $P = 0.000$) and CA ($\beta = 0.275$, $P = 0.005$), while PI also has a significant effect on CA ($\beta = 0.445$, $P = 0.000$). CA strongly predicts SS ($\beta = 0.729$, $P = 0.000$), indicating its crucial role in the model.

In addition, all outer loadings of the measurement model were statistically significant ($P < 0.001$), confirming indicator reliability. The R^2 values for PI (0.527), CA (0.450), and SS (0.531) demonstrate that the model explains a moderate to substantial proportion of variance in the endogenous constructs.

4.3. Path Coefficients and Hypothesis Testing

The structural model was evaluated through bootstrapping with 10,000 subsamples to examine the significance of the hypothesized relationships. Table 3 presents the results, including path coefficients, sample means, standard deviations, t-statistics, and P-values.

All five hypotheses were supported at the 0.05 significance level ($P < 0.05$), indicating a well-fitting structural model. The findings reveal that green innovation has a strong and significant effect on product innovation ($\beta = 0.726$, $t = 15.542$, $P < 0.001$), confirming that firms adopting environmentally friendly innovations are more likely to engage in product development. Furthermore, green innovation also exerts a direct and significant impact on competitive advantage ($\beta = 0.595$, $t = 11.255$, $P < 0.001$), underscoring its dual role in driving both innovation and strategic positioning. In addition, product innovation significantly influences competitive advantage ($\beta = 0.444$, $t = 3.696$, $P < 0.001$), suggesting that continuous product development enhances a firm's ability to compete effectively. Competitive advantage, in turn, has a strong and statistically significant effect on SME survival ($\beta = 0.730$, $t = 15.266$, $P < 0.001$), highlighting its vital role in supporting long-term business sustainability. Notably, the indirect effect of green innovation on SME survival mediated by product innovation and competitive advantage is also statistically significant ($\beta = 0.235$, $t = 3.392$, $P < 0.001$). These results collectively emphasize that both green and product innovations are critical drivers of competitive advantage and long-term survival among SMEs, particularly in dynamic and environmentally conscious business environments.

4.4. Predictive Relevance and Effect Size

To assess the predictive relevance of the model, the Q^2 values were examined using the blindfolding procedure. As a rule of thumb, Q^2 values greater than zero indicate that the model has predictive relevance for a given endogenous construct (Hair et al., 2019). The results show that all three constructs Product Innovation (PI), Competitive Advantage (CA), and SME Survival (SS) exhibited Q^2 values above zero, confirming that the model has meaningful predictive capability. Specifically, PI demonstrated the highest predictive relevance ($Q^2 = 0.520$), followed by CA ($Q^2 = 0.336$) and SS ($Q^2 = 0.173$). These results suggest that the model is particularly strong in predicting product innovation and competitive advantage, while still maintaining acceptable predictive power for SME survival. Additionally, the RMSE and MAE values for each construct support the model's reliability in prediction accuracy, further validating its practical applicability.

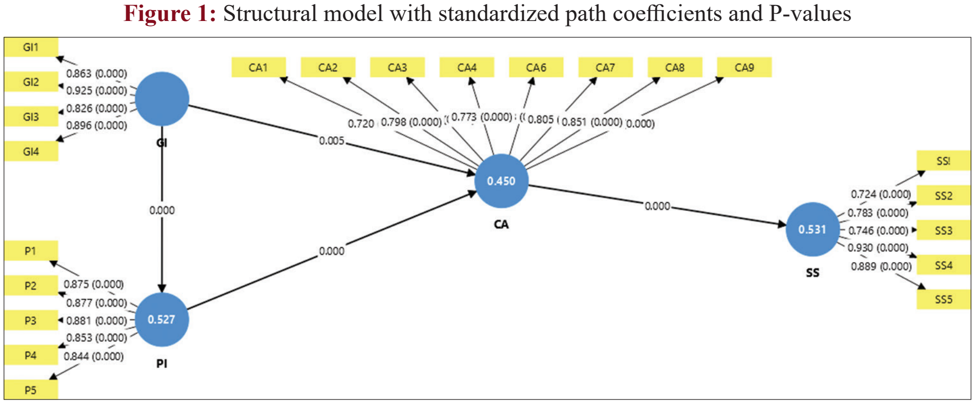
5. DISCUSSION

The findings of this study validate the hypothesized model and provide strong empirical support for the argument that green innovation is a foundational driver of product innovation and

Table 3: Results of hypothesis testing for the structural model

Hypothesis	Path	Path coefficient	Sample mean	Standard deviation	t-statistics	P-Value
H_1	Green Innovation → Product Innovation	0.726	0.727	0.047	15.542	0.000
H_2	Green Innovation → Competitive Advantage	0.595	0.602	0.053	11.255	0.000
H_3	Product Innovation → Competitive Advantage	0.444	0.448	0.120	3.696	0.000
H_4	Competitive Advantage → SME Survival	0.730	0.737	0.048	15.266	0.000
H_5	Green Innovation → Product Innovation → Competitive Advantage → SME Survival	0.235	0.240	0.069	3.392	0.000

Figure 1: Structural model with standardized path coefficients and P-values



broader strategic outcomes among small and medium-sized distilleries in Thailand. These results reaffirm the critical role that sustainability and innovation play in shaping the long-term survival of SMEs in emerging markets (Huang and Li, 2017; Wahyono, 2020).

Firstly, the strong and significant relationship between green innovation and product innovation (β = 0.726, t = 15.542, P < 0.001) reinforces previous research indicating that environmentally conscious practices often trigger the development of new products, production methods, or materials (Ottman, 2017; Sarkar, 2013). In the Thai distillery context where regulatory constraints demand cleaner production green innovation not only enables legal compliance but also inspires creative reformulation and differentiation in the market.

Secondly, green innovation also has a substantial direct impact on competitive advantage (β = 0.595, t = 11.255, P < 0.001), reflecting its dual role in environmental stewardship and strategic positioning. This supports the notion that sustainability is not merely a cost center but a value creation mechanism when embedded effectively.

Thirdly, product innovation significantly enhances competitive advantage (β = 0.444, t = 3.696, P < 0.001), in line with Liu and Atuahene-Gima's (2018) assertion that innovative offerings improve a firm's differentiation and consumer appeal. For small distilleries competing in a niche yet growing market for craft spirits, innovation in flavor, packaging, or production technology becomes a strategic lever for market success.

The pathway from competitive advantage to SME survival also demonstrates a strong effect (β = 0.730, t = 15.266, P < 0.001), aligning with Porter's (2008) competitive strategy framework and confirming that strategic capabilities such as agility, branding, and customer retention are vital in withstanding environmental and regulatory pressures.

Interestingly, the study finds that green innovation exerts a significant indirect effect on SME survival (β = 0.235, t = 3.392, P < 0.001) through its influence on product innovation and competitive advantage. This confirms that innovation-oriented sustainability is not only beneficial in its own right but also acts as a conduit to downstream outcomes critical for long-term viability.

Collectively, these findings support the conceptual framework proposed in Phatsanat_Thesis.pdf and contribute to the broader discourse on SME resilience through innovation. They underscore that sustainability, innovation, and competitive agility are mutually reinforcing drivers of performance in tightly regulated and resource-constrained environments.

6. CONCLUSION AND IMPLICATIONS

This study advances understanding of how green innovation, product innovation, and competitive advantage interact to influence the survival of SMEs in Thailand's distillery sector. The results demonstrate that green innovation acts as a catalyst for product development and strategic differentiation, both of which play direct and indirect roles in enhancing business resilience.

From a theoretical standpoint, the study reinforces the relevance of the Resource-Based View (RBV) and Dynamic Capabilities Theory, showing that internal competencies such as eco-innovation and responsiveness can translate into external market success and organizational longevity.

From a practical perspective, SME owners are encouraged to embed green practices and product innovation into their core strategy. These actions not only ensure regulatory compliance but also resonate with environmentally conscious consumers, opening avenues for brand differentiation.

6.1. Policy Recommendations

Regulatory reform to eliminate disproportionate licensing and production quotas that disadvantage small distilleries. Government support for R&D, eco-innovation, and green certification especially for rural SMEs.

Entrepreneurial training programs that combine digital literacy, sustainable business practices, and product innovation aligned with international market trends.

In summary, the findings suggest that fostering an enabling ecosystem where sustainability, innovation, and regulatory fairness coexist is vital for unlocking the potential of Thailand's SME distillery industry. Strategic innovation, especially when rooted in green practices and product development, will be key to long-term survival and global competitiveness.

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