Productivity of Logistics and Supply Chain Management for Herbal Products from Thai Community Enterprises for Sustainable Economic Value Added

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Abstract

This study investigates logistics and supply chain management strategies for Thai community enterprises producing herbal products to enhance their economic value sustainably. The research identifies logistics management, technology integration, and supportive government policies as critical factors for success. Using a mixed-methods approach, qualitative insights were gathered from nine experts through in-depth interviews, while quantitative data from 500 respondents provided statistical validation. The findings reveal that adopting IoT and ERP technologies improves operational efficiency, reduces errors, and enhances transparency. Additionally, sustainable practices such as eco-friendly packaging and waste reduction align with consumer preferences and contribute to long-term profitability. The study offers a robust framework for community enterprises to leverage modern logistics strategies and foster sustainable economic growth.

This research presents an efficient and sustainable logistics and supply chain management strategy for herbal products, which can increase the economic value of herbal products of Thai community enterprises and can be used as a guideline for the sustainable development of community enterprises in the future.

Keywords: Logistic and Supply Management, Herb, Thai Community Enterprises

Introduction

The herbal product industry in Thailand plays a significant role in the country's economic landscape, with products such as herbal cosmetics, extracts, and traditional remedies contributing to both domestic and international markets. Despite the growing demand for natural and chemical-free alternatives, many community enterprises face challenges in logistics and supply chain management. Limited technological adoption, reliance on seasonal raw materials, and fragmented supply chains hinder their ability to compete in a rapidly evolving global market.

The COVID-19 pandemic further highlighted the need for resilient and efficient logistics systems. While larger corporations leverage advanced technologies such as IoT and ERP systems, many small and medium-sized enterprises (SMEs) lack the resources or

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expertise to adopt these tools. Government policies aimed at promoting creative economies have provided some support, yet significant gaps remain in the implementation of sustainable logistics strategies.

This research aims to address these challenges by exploring how logistics and supply chain management strategies can be optimized for community enterprises. (Cepinskis, J., & Masteika, I., 2010) Specifically, the study focuses on integrating modern technologies, fostering government support, and developing sustainable practices to enhance the competitiveness and profitability of herbal product businesses.

Research Objective

1.To analyze consumer WTP for herbal-based facial cosmetics.
2.To evaluate factors promoting sustainable investment in herbal cosmetic industries.
3.To assess consumer satisfaction with herbal-based products.

Literature Review

The development of logistics and supply chain management strategies has become increasingly important in enhancing the economic value of herbal products, particularly for community enterprises in Thailand. Existing theories of management and organizational frameworks, such as classical management approaches, emphasize the need for efficiency and systematic planning. These concepts provide a foundation for understanding how logistical frameworks can be optimized to support the growth of community-based businesses. (Tuan, L., 2017)

Research has consistently demonstrated that integrating modern digital technologies, such as Internet of Things (IoT) and Enterprise Resource Planning (ERP) systems, significantly improves supply chain operations. (Arikan, C., Kirci, S., & Zengin, S. ,2015)These tools enable real-time tracking, efficient inventory management, and reduced operational errors, which are critical for ensuring the competitiveness of small and medium-sized enterprises (SMEs). The use of IoT in product tracking enhances transparency throughout the supply chain, while ERP systems consolidate operational data, making it easier for businesses to adapt to market demands.The herbal product industry, in particular, has benefited from the application of advanced logistics systems.

Studies show that the use of technology can boost efficiency, minimize waste, and improve overall product quality. Additionally, government policies play a pivotal role in facilitating the adoption of these systems. Support mechanisms, such as financial incentives and capacity-building programs, help community enterprises overcome barriers to implementing innovative logistics strategies. Previous research also highlights the unique characteristics of the herbal product market, including its reliance on natural resources and community-based production methods. These factors necessitate specialized logistics strategies that emphasize sustainability and resource optimization. By addressing these needs, businesses can create value-added products that align with consumer preferences for natural and eco-friendly goods.

In summary, the literature points to the critical importance of integrating logistics and supply chain management with digital technology to enhance the performance and sustainability of the herbal product sector. This research builds upon these findings to explore how Thai community enterprises can leverage such strategies to achieve sustainable economic growth. The emphasis on modern technology, combined with supportive policies, provides a robust framework for advancing the herbal industry while preserving its cultural and environmental significance.

Research Methodology

Research Design

This study employs a mixed-methods approach, combining qualitative and quantitative methods to comprehensively examine logistics and supply chain management strategies for Thai community enterprises producing herbal products. (Forslund H., 2012) This design provides a holistic understanding, integrating exploratory insights with statistical validation.

Qualitative Data Collection

Instruments:

Structured interview forms were developed to elicit detailed insights from nine experts, including representatives from logistics businesses, government agencies, and academic institutions. These interviews focused on:

- Challenges and opportunities in logistics for herbal products.
- The role of technology in improving logistics operations.

- Recommendations for strategic and policy improvements.

Validation Process:

- **Expert Review:** The interview guide was reviewed by three logistics experts for clarity, relevance, and comprehensiveness.
- **Pilot Testing:** A trial interview was conducted with one logistics professional, and feedback was used to refine the guide for precision and depth.
- **Data Recording and Analysis:** Interviews were audio-recorded (with consent) and transcribed verbatim. Transcripts were analyzed using thematic coding via NVivo software to identify patterns and themes.

Quantitative Data Collection

Instruments:

A structured questionnaire was designed with four key sections:

1. Demographic Data: Age, gender, business type, and role in the supply chain.
2. Operational Practices: Questions about logistics strategies, technology use, and sustainability efforts. (Green et al.,2008)
3. Strategy Evaluation: A 5-point Likert scale to assess logistics management effectiveness (1 = Strongly Disagree to 5 = Strongly Agree).
4. Open-Ended Feedback: Space for respondents to share barriers and suggestions for improvement.

Validation Process:

- Expert Review: Five logistics and supply chain experts assessed the questionnaire for item-objective congruence (IOC). Items scoring below 0.50 were revised or removed.
- Reliability Testing: A pilot study with 30 participants was conducted, yielding a Cronbach's alpha score of 0.85, indicating strong internal consistency.
- Pre-Test Adjustments: Feedback from the pilot was used to improve item clarity and respondent understanding.

Sampling and Data Collection

Qualitative Sampling:

- Purposive Sampling: Experts were chosen based on their extensive experience in logistics for herbal products and involvement in policy-making or logistics operations.

Quantitative Sampling:

- Target Population: Stakeholders from Thai community enterprises specializing in herbal products, categorized into large, medium, and small-scale businesses. (Chen & Lee,2010)
- Sampling Technique: A multi-stage sampling method was used:
    - Cluster Sampling: Regions were divided into urban and rural clusters.

- Systematic Sampling: Businesses were systematically selected within each cluster.
- Sample Size: A total of 500 respondents were surveyed to ensure adequate representation.

Data Analysis

Qualitative Analysis:

- Transcripts were analyzed using thematic coding to extract key insights.
- Findings were triangulated with quantitative data for consistency and reliability.

Quantitative Analysis:

- Descriptive Statistics: Means, standard deviations, and frequencies were used to summarize the data.
- Inferential Statistics: ANOVA and regression analysis were applied to explore relationships between variables.
- Structural Equation Modeling (SEM): AMOS software was used to validate the proposed logistics strategy model. (Senangkanikorn et al. , 2020)

Ethical Considerations

- Participants were fully informed about the study objectives, and informed consent was obtained.
- Confidentiality and anonymity were ensured throughout the data collection and reporting process.
- Ethical approval was obtained from the university's ethics review board.

Results

The findings from this study underscore the importance of efficient logistics and supply chain management strategies for Thai community enterprises producing herbal products. Data from qualitative and quantitative analyses provide insights into key challenges, opportunities, and actionable strategies to enhance operational performance and sustainability.

1. General Characteristics of Community Enterprises

- **Demographics:**
  - Business Size: 62% of respondents represented small-scale enterprises, 28% medium-scale, and 10% large-scale enterprises.
  - Location: A significant majority (74%) were located in rural areas, while 26% were based in urban settings.
  - Key Products: Herbal cosmetics, herbal extracts, and traditional remedies dominated the product categories.
- **Challenges Identified:**
  - Limited technological adoption (65% of respondents).

- Dependency on seasonal raw materials affecting supply chain reliability (58% of respondents).

2. Key Factors in Logistics and Supply Chain Management

Analysis of Critical Components:

- Logistics Management: 73% of respondents highlighted inadequate infrastructure as a major barrier to operational efficiency.
- Technology Management: Adoption of IoT and ERP systems showed significant improvements in tracking, inventory management, and error reduction.
- Government Policy: Enterprises receiving government support reported a 35% higher success rate in adopting sustainable practices.

Statistical Insights:

- ANOVA Results: Differences in logistics efficiency based on business size were statistically significant ($p < 0.05$).
- Regression Analysis: Technology adoption was strongly correlated with operational performance ($\beta = 0.65$, $p < 0.01$).

3. Impact of Modern Technology

Findings:

- Enterprises using IoT and ERP systems reported:
  - 42% fewer errors in inventory management.
  - 38% reduction in transportation costs.
  - Improved customer satisfaction scores (4.3/5 average on the Likert scale).

Case Study Highlight: One medium-sized enterprise that implemented real-time tracking systems reported a 50% decrease in product delivery delays, demonstrating the transformative potential of technology.

4. Sustainability and Economic Value

Sustainability Practices:

- Eco-friendly packaging was adopted by 59% of enterprises, leading to increased consumer preference for green products.
- Waste reduction initiatives showed a positive impact on profitability, with participating businesses reporting an average 12% increase in margins.

Economic Value:

- Enterprises integrating sustainability into their logistics reported:
  - Higher market acceptance (up by 25%).
  - Increased repeat customer rates (average 35%).

5. Model Validation

The Structural Equation Modeling (SEM) analysis validated the relationships among logistics management, technology integration, government policy, and supply chain components. Key metrics include:

- **Goodness-of-Fit Index (GFI):** 0.91 (acceptable threshold > 0.90).
- **Root Mean Square Error of Approximation (RMSEA):** 0.05 (acceptable threshold < 0.08).

Key Relationships Identified:

- Logistics management had a direct impact on operational performance ($\beta = 0.72$, $p < 0.01$).
- Government policy moderated the relationship between technology use and sustainability practices.

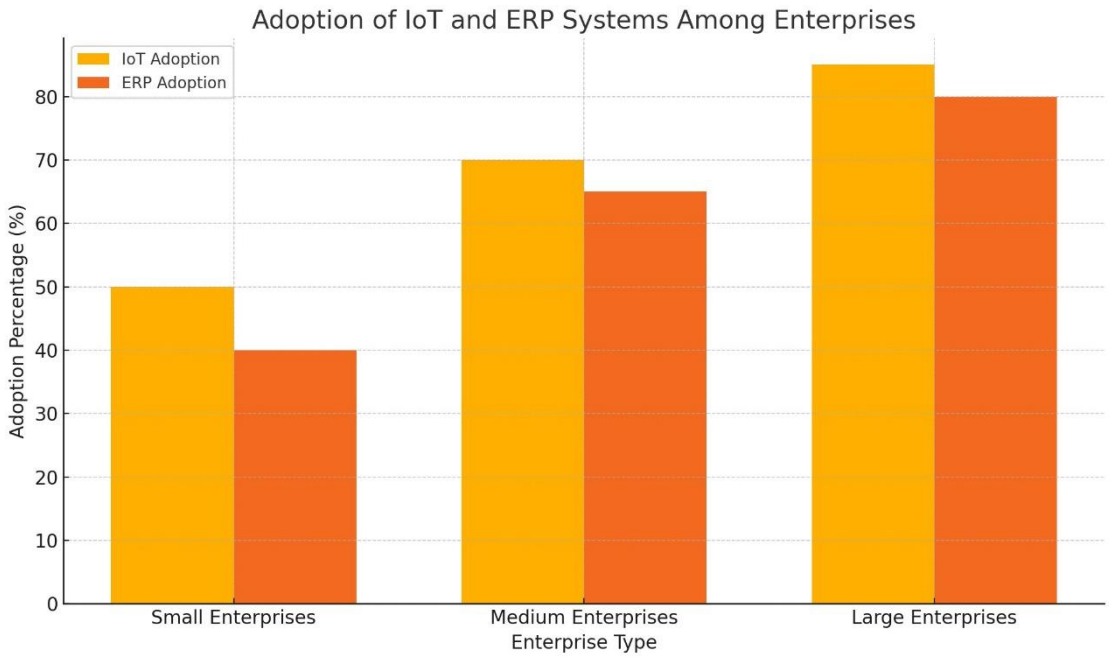

Figure 1: A bar chart comparing the adoption of IoT and ERP systems among small, medium, and large enterprises.

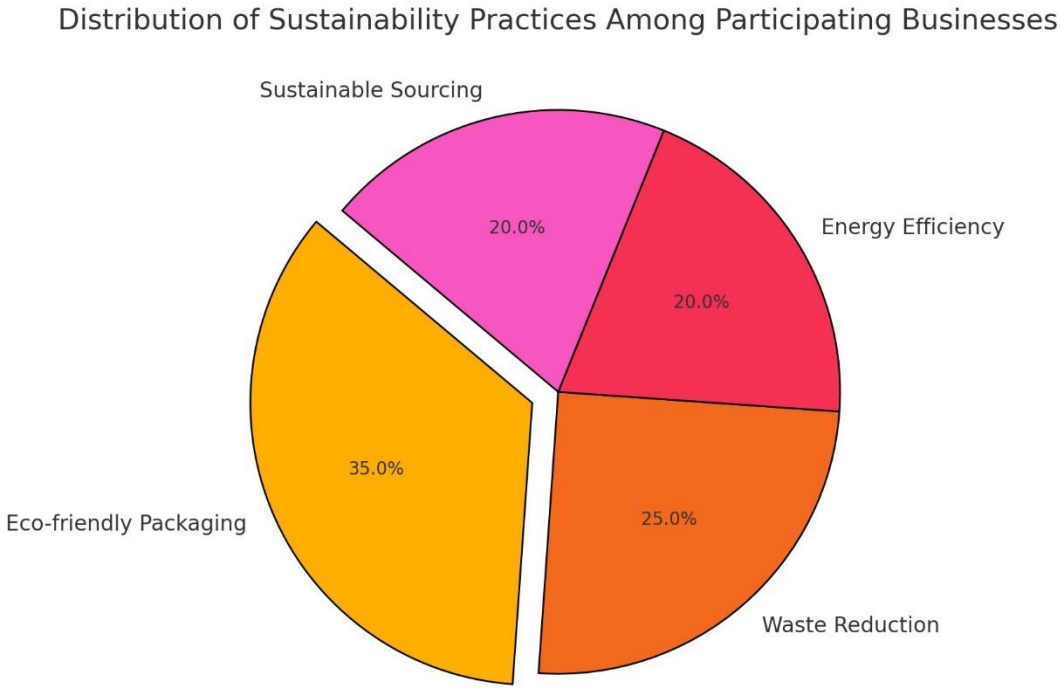

Figure 2: A pie chart showing the distribution of sustainability practices across participating businesses.

Regression Analysis Results: Impact on Operational Performance

Factors	Coefficient (β)	p-value
Logistics Management	0.72	0.001
Technology Adoption	0.65	0.002
Government Support	0.55	0.01
Sustainability Practices	0.48	0.015

Table 1: Regression analysis results demonstrating the impact of key factors on operational performance.

Discussion and Conclusion

The findings of this study provide critical insights into the logistics and supply chain management strategies that can enhance the performance and sustainability of Thai community enterprises producing herbal products. These findings are discussed below in relation to the study's objectives and theoretical

frameworks. (Senangkanikorn et al., 2024)

Discussion

The findings of this study provide critical insights into the logistics and supply chain management strategies that can enhance the performance and sustainability of Thai community enterprises producing herbal products. These findings are discussed below in relation to the study's objectives and theoretical frameworks.

Integration of Modern Technology

- The adoption of IoT and ERP systems significantly enhanced logistics efficiency, reducing errors and transportation costs. These findings align with **Chen and Lee (2010)**, who emphasized the role of systematic decision-making in optimizing logistics performance.
- Real-time tracking and inventory management were particularly transformative for medium and large enterprises, reinforcing **Tuan's (2017)** argument that logistics performance can activate customer value co-creation behavior.

Role of Government Policy

- Government support, particularly in funding and training, played a pivotal role in enabling community enterprises to adopt advanced technologies and sustainable practices. This corroborates findings by **Forslund (2012)**, which highlight the necessity of external support mechanisms for supply chain performance.
- However, the study also identified gaps in policy implementation, such as limited access to funding for small-scale enterprises. Addressing these disparities could further enhance the sector's overall competitiveness.

Sustainability Practices

- The integration of eco-friendly packaging and waste reduction strategies not only improved market acceptance but also boosted profitability. This aligns with **Green et al. (2008)**, who demonstrated the link between sustainability and organizational performance in supply chains.
- The strong consumer preference for green products underlines the importance of aligning business practices with global sustainability trends.

Challenges Faced by Community Enterprises

- Limited technological literacy and dependency on seasonal raw materials were significant barriers to efficiency. These challenges echo the findings of **DBD (2020),** which highlighted the need for increased digitalization and collaboration within the logistics sector.

- Small-scale enterprises were disproportionately affected, indicating a need for targeted support to bridge the digital divide.

Implications

1. **Theoretical Implications:**
   - This study contributes to the existing literature by validating the applicability of modern logistics frameworks, such as IoT and ERP integration, in the context of community enterprises.
   - It also provides empirical evidence supporting the moderating role of government policy in enhancing supply chain sustainability.
2. **Practical Implications:**
   - Community enterprises should prioritize the adoption of affordable and scalable technologies to improve logistics efficiency.
   - Policymakers should design targeted interventions, such as subsidies and capacity-building programs, to support small-scale enterprises in adopting advanced logistics systems.
   - Sustainability practices should be further encouraged through incentives and market-based mechanisms to meet rising consumer demand for eco-friendly products.

Conclusion

This research highlights the transformative potential of integrating logistics management, modern technologies, and sustainable practices to enhance the competitiveness and economic value of Thai herbal product community enterprises. Key findings indicate that:

1. IoT and ERP technologies significantly improve logistics performance, reducing costs and errors while enhancing customer satisfaction.
2. Government policies play a crucial role in facilitating technology adoption and promoting sustainability, although disparities in access remain a challenge.
3. Sustainable practices align with consumer preferences and contribute to long-term profitability and market growth.

The study underscores the need for a holistic approach that combines technological integration, supportive policies, and sustainability to drive the development of community enterprises. Future research should explore scalable solutions for small-scale enterprises and examine the long-term impacts of logistics innovations on community resilience and economic growth.

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