



Lean Management Implementation in Pineapple Fiber Processing Community Enterprises for Sustainable Development

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Abstract

This study investigates lean management approaches within a community enterprise that processes pineapples, with the aim of reducing operational costs through structured business management assessments. The following research uses qualitative methodology, incorporating statistical methods in financial management and Lean management principles, along with in-depth interviews of three community enterprises regarding the non-food products from pineapple waste. The research findings were as follows:

1. The lean management approaches include the design of a business logo by the community enterprise owners, symbolizing the organizational identity and strategic directions. The enterprise reduces environmental pollution and contributes to long-term economic development through the Prachuap Khiri Khan province's green economy development initiative by processing discarded pineapple peels and crowns into non-food goods. This method enhanced and optimized management procedures, diminished dependency on labor, and prioritized work delegation according to instructions from the community enterprise leader. As a result, work processes were accelerated, and operational efficiency then improved.

2. The business management assessment has shown a reduction in operating cost value through the production process modifications. Especially, the enterprise transitioned from chemical-based methods to plant-based biological degradation for extracting those pineapple fibers, leading to reduced pollution and environmental impact. Following the implementation of the lead process management, a cost reduction of 7.67% was achieved. The failure to reach the 10% target was attributed to economic conditions, including the declining sales and persistently high operating costs, particularly in production. The researcher proposed several solutions to address these problems, including intensifying marketing efforts, designing modern products to appeal to more younger consumers, and emphasizing the product's nature-derived from natural materials to increase sales volume and enhance competitiveness.

Keywords: 1) Lean management 2) community enterprise 3) pineapple fiber paper 4) agricultural waste valorization 5) business sustainability

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Introduction

The main source for pineapples is located near the coast in Prachuap Khiri Khan province. It is one of the top provinces in terms of pineapple cultivation, having the largest pineapple cultivation fields in the country, totaling 402,905 rai. It's also known as the world's largest producer of pineapples for consumption and export, generating at least 20 billion baht annually, earning the title of "Pineapple Capital." The most popular pineapple species grown is the "Batavia," which is also known as the "factory" species. (Agricultural Technology, 2016, p. 1). Promoting the use of pineapples to produce other products requires consideration of production capacity, cost of studies, and product quality to ensure its competitiveness. Such that potential pineapple-based products can be categorized as processed pineapple food products and non-food products like processed pineapple fiber for household use. Additionally, Prachuap Khiri Khan's economic recovery is proof of its economic progress, as the economic and business confidence index clearly shows an upward trend, rising to 3.76% between 2022 and 2023. The total product value of the province is 107,761.34 million baht (Office of Provincial Commercial Affairs Prachuapkhirikun, 2025, p. 1). From the positive factors, such as the country's reopening measures, supporting confidence in the economy and businesses, the economic recovery after the COVID-19 situation has seen an increase in income for entrepreneurs.

The approach of interest in the development of the production potential of prod-

ucts associated with pineapple as the main raw material of the province can be used to produce processed pineapple products other than paper at low costs. In 2025, the province's companies received about 622,000 tons of pineapple annually, which had an effect on the waste produced by pineapple peels and heads in factories. (Chanmaha-na (2012, p. 1) This is one of the primary concerns that academics are trying to address by implementing Lean theory. The reduction of loss in production can increase the value of products more, according to Lean theory, in terms of management, production, and marketing, acting like a guideline to increase the potential of processed pineapple products. (Morais and Ferreira, 2020, pp. 62-77) It is a hypothesis that suggests community enterprises engaged in processing non-food pineapple products can achieve operational improvements through the application of lean management principles. With the anticipation of such an application, it will result in a cost reduction of 10 percent, contributing to business sustainability and ensuring the stability of business operations for the community.

Objective of the Study

1. To study the management guidelines for the lean pineapple processing community enterprise in Prachuap Khiri Khan Province

2. To study the management of the pineapple processing community enterprise in Prachuap Khiri Khan Province through the assessment of business management that can reduce the cost of doing business.



Literature Review

The concept of community enterprise refers to the business or activities of people in a community that are carried out commercially to create commercial and social benefits for the community. It is an effort to develop the community in a way that emphasizes the sustainability of livelihoods based on community resources. 'Community-based enterprise' (CBE) is the vehicle in which the community creates an entity that constitutes the community as both an entrepreneur and an enterprise addressing economic, social, and environmental challenges holistically. (Peredo and Chrisman, 2006, p. 309)

Lean manufacturing is a manufacturing process or concept that focuses on maximizing production efficiency by reducing waste or unnecessary work processes, including cost reduction, resources, and production time. At the same time, the production development process also aims to create new products of higher quality and greater value. (Sawasdee and Masaed, 2020, p. 122)

The concept of cost theory can be summarized as the key to determining the 4 factors of success: cost and efficiency. The business will succeed by maintaining lower costs than its competitors while also ensuring the quality of its goods and services. Radulovich, Javalgi and Scherer, 2018, p.113) The business must be able to deliver goods and services on time with innovation. (Rekhi, 2026, p. 1)

The concept of probability in generating income and appropriate profits: Analyze the appropriate income generation model

because every business idea must take into account the structure of the business model. Writing a concrete business plan will be an important basis for calculating the cost-effectiveness of the investment or organizing the business model of the Business Canvas. (Ma, 2024, p. 220)

Theory of Return on Investment: In the case of multiple investment projects, it may not be possible to invest in them all due to limited funds and long investment periods. Therefore, these projects must be evaluated to select the best investment project. There are many methods of investment evaluation. In this study, seven return on investment analysis methods were used: Payback Period (PB), Net Present Value (NPV), Return on Investment (ROI), Profitability Index (PI), Return on Sales (ROS), and Interest Rate (IRR). (Gilli, Maringer and Schumann, 2019, pp. 3-15.)

Concepts and theories about marketing mix: The marketing equation has only 4 variables (4Ps): Product, Price, Place or distribution channel, and Promotion. Three additional variables—People, Physical Evidence, and Process—were later introduced to align with key concepts in modern marketing. (Haddoud, Jones, and Newbery, 2020. pp. 107-135)

Research literature on lean management in SMEs, including studies like those by Alkhoraif, Rashid and McLaughlin, indicates that the implementation of lean practices in Small and Medium Enterprises (SMEs) has not been thoroughly explored. (Alkhoraif, Rashid and McLaughlin (2019, p. 13) show that researchers have not extensively explored lean implementation among Small and Medium

Enterprises (SMEs). This paper attempts to bridge this gap by reviewing the literature that discussed Lean implementation in SMEs with a perspective of identifying the main challenges faced. This study is to establish the current position of global understanding of Lean implementation in SMEs, including examining the main categories of Lean implementation in the context of SMEs. Another one is that (Widiwati, Liman and Nurprihatin, 2025, p. 611) Lean Six Sigma is an integrated approach between lean thinking and the Six Sigma method. Lean is a way of thinking and a principle used to improve the performance of a process through waste and error to reduce waste in the production process of a food manufacturing industry, such as the bakery industry in Indonesia. Another one is lean implementation frameworks: the challenges for SMEs can bring many benefits, such as reducing waste and improving operating efficiency. (Womack and Jones, 2003, p. 151) However, lean implementation is not a straightforward process. Although a number of frameworks have been presented, many companies still find it difficult to implement lean. (Wichianpradit, 2020, p. 52) Furthermore, unsuccessful implementation can have a great impact on an organization's resources, but even more importantly, it can affect employees and their confidence in lean philosophy. (AlManei, Salonitis and Xu, 2017, p. 750).

Topic of community enterprises in developing economies (Rodjam, et al., 2026, pp. 23-33) Development of community enterprises to enhance the community economy has concepts and results of studies related to the development of community enterprises in

order to create guidelines for the development of community enterprises to affect the upgrading of the community economy, including (1) organizational structure development and (2) human resource development. (3) Relationship building, (4) quality and productivity system development, and (5) the use of social capital. Another piece of literature research, Promoting Community Enterprises in Thailand: Challenges and Opportunities, examines how policy implementation, policy network management, and capacity building can help promote community enterprises in Thailand. (Chandra, Paul and Chavan, 2020, p. 1281) This qualitative study highlights the importance of tailoring policies to local contexts, fostering collaboration among stakeholders, and addressing capacity-building needs in a comprehensive manner to promote the success of community enterprises in Thailand. The findings underscore the importance of context-sensitive policies, strong collaboration among stakeholders, and a holistic approach to capacity building. (Nakhonsong and Chamruspanth, 2024. pp. 1-2)

Research on agro-processing value chains and methodology, such as agro-processing, value chains, and regional integration in Southern Africa, shows that only regional integration is underway but ongoing and requires that the gains be widely spread. Constraints include barriers, weak infrastructure, demanding quality standards, and weakly developed local suppliers. Policies to promote the development of suppliers outside of South Africa are required, along with more genetic measures such as improvement in the regulatory and



investment environment and better infrastructure. (Black, et al., 2020, p. 1) Another research study, Case Study Analysis on Agri-food Value Chain: A Guideline-Based Approach, has identified the methods and associated indicators that are commonly used in value chain analyses (VCA) and determined the areas of interest that have been excluded. There are four different dimensions, which are institutional/functional, economic/financial, social, and environmental. This research concentrated on the mapping of agents, core activities, marketing channels, and flows of products. (Akyuz, et al. 2023. p. 1). The Research of Agro-Processing: Adding Value to Agriculture Products refers to the set of activities and techniques through which raw agricultural materials are transformed into value-added products for consumption, trade, and industrial use. This sector bridges agriculture and industry, creating employment, improving farmers' incomes, reducing post-harvest losses, and fostering rural development. (Salvi, 2025, p. 17)

Research on defining and developing measures of lean production identifies a key set of measurement items by charting the linkages between measurement instruments that researchers have used to measure its various components in past literature, employing a rigorous, two-stage empirical method and data from a large set of manufacturing firms. Configuration theory provides the theoretical underpinnings and helps explain the synergistic relationships among its underlying components. (Shah and Ward, 2007, p. 785)

Research on Green Lean and the need for Six Sigma indicated that the Green Lean

integration may have inherited the same limitations as the individual green and lean approaches, but these may be overcome through the integration of Six Sigma. It also identified key similarities among the main attributes of green, lean, and Six Sigma, demonstrating their compatibility for integration into a unified approach. (Garza-Reyes, 2015, p. 226)

Research Conceptual Framework

The research framework and development of lean pineapple processing community enterprises in Prachuap Khiri Khan Province are based on the use of lean production system theory for waste reduction management in business operations. The development of the theory was adapted into a research framework for evaluating business processes, including marketing, production, and management, leading to lean business. (Dynamic intelligence Asia, 2024, p. 1) The variables used in the research were revenue, sales, and profit. The financial assessment results, both before and after implementing lean business practices, can illustrate the financial potential that informs business performance, production capabilities, and marketing strategies aimed at increasing revenue, as depicted in figure 1:

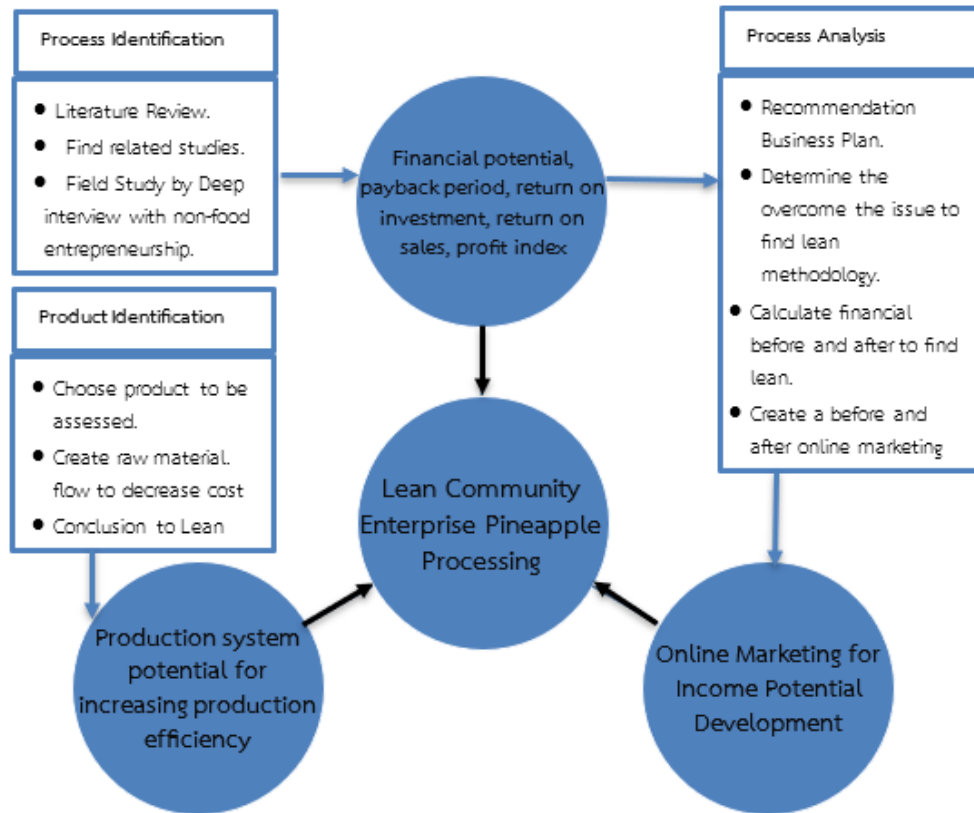


Figure 1 Local research framework for studying community enterprise leanness
Research Methodology

Target Population: This research is a mixed-methods design that separates qualitative (content analysis) to find descriptive qualitative evidence for the business plan as the Business Model Canvas and business administration to develop processing products and marketing and underlies finding explanations to reduce pollution from production processing. Additionally, the quantitative research, which involves descriptive financial analysis, transitions from a pre-post framework for lean management. This approach increases the number of observations by utilizing data collected over time from in-depth interviews to conduct financial estimates. The reason for choosing this method is that the study of lean management in the production system of

non-food pineapple processed products emphasizes the importance of analyzing the business process. Determining the sample size and obtaining it according to the research methodology involved selecting from 63 community enterprises in Prachuap Khiri Khan Province. Among these, only three enterprises process non-food pineapple products, while 60 community enterprises focus on food products and other raw materials, including those from coconuts and aloe vera, for food processing. The selection of interviewees for the sample group is based on criteria that are recognized at the community, provincial, and national levels, as reflected in the statistics of community enterprises. The qualification of community enterprises is that they have been in operation

for more than 3 years. There are only three community enterprises of the same size, both in income and sale volume, in Prachuap Khiri Khan Province that process pineapple paper and use pineapple as the main raw material for their non-food businesses. The informants must be at least 20 years old and have more than three years of experience as the president

of a community enterprise, along with experience in a business that processes pineapple paper. The interview period is within 3 months. Data analysis In-depth interviews were conducted with the target group using quantitative and qualitative analysis, which can be divided into the following formats:

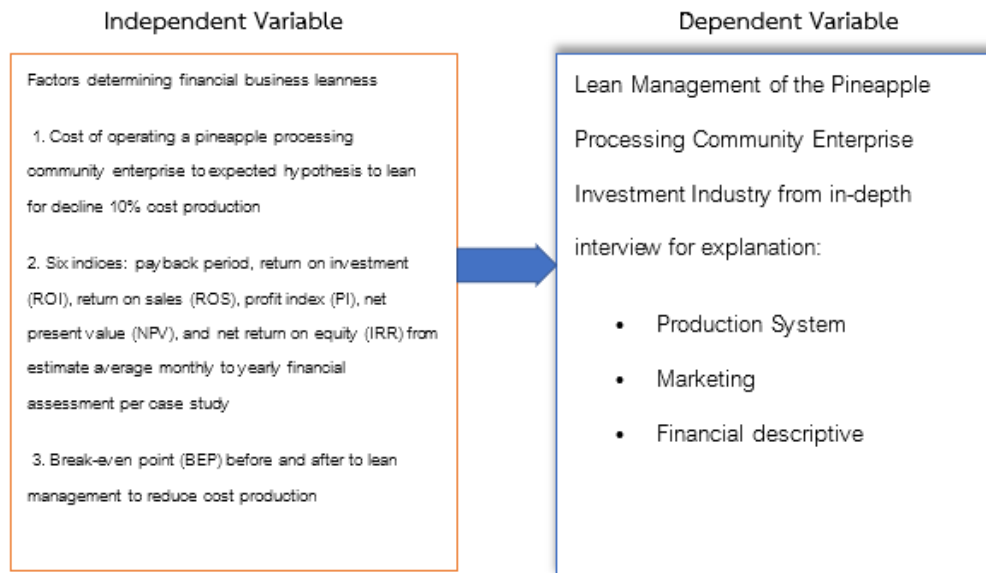


Figure 2 Quantitative research framework to calculate financial administrated Business from interview

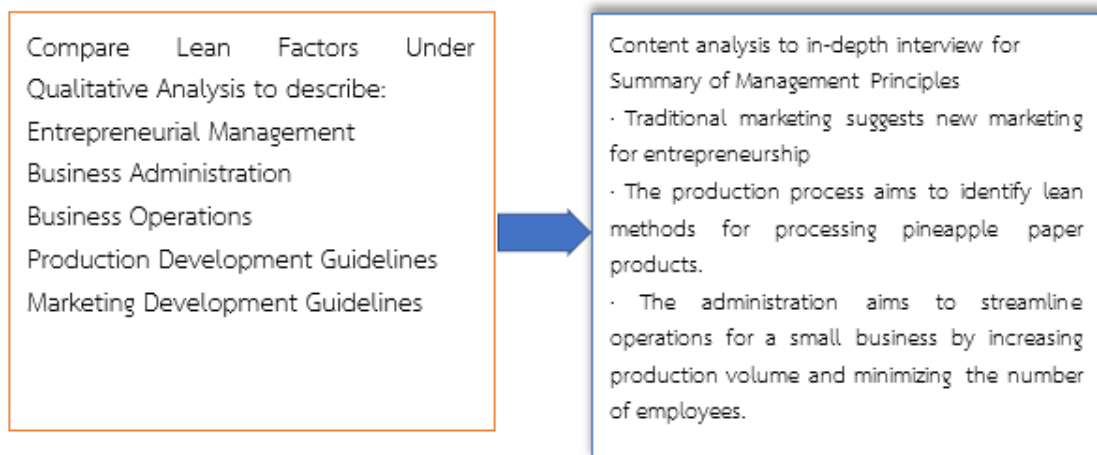


Figure 3 Qualitative analysis by content analysis

Data collection from in-depth interviews occurred monthly to estimate yearly financial descriptions since the year 2025. Additionally, the analysis of data includes information and assessments about the “before lean” baseline period and the “after lean” measurement period analysis to conclude whether the business is lean or not from this research. The statistical methodology explains content analysis procedures for qualitative data from in-depth interviews with 3 entrepreneurs to summarize the process of business management. After the data information of the content analysis describes the financial assessment report about “before lean” to analyze “after lean” for the 2026 expectation. The implementation of this research methodology has been granted ethical approval for human research for the year 2025.

Results

The conclusion of qualitative methodology to content analysis: The Pineapple Fiber Paper Community Enterprise was established through community collaboration aimed at improving the quality of life and generating income for community members, maximizing the benefits of the local natural resources. Producing paper from pineapple fiber not only creates valuable products but also promotes the use of local raw materials and reduces agricultural waste, fostering a circular economy within the community. The enterprise's operations focus on utilizing appropriate technology and training to enhance community members' skills, resulting in the production of high-quality paper that meets market demands for both

quality and sustainability. Furthermore, the enterprise aims to create jobs and generate income for the community, strengthening the local economy. In the long term, the Pineapple Fiber Paper Community Enterprise hopes to expand its market both domestically and internationally, as well as develop new products using natural materials to create opportunities and sustainable growth for the community. Therefore, the Pineapple Fiber Paper Community Enterprise is an important step in both community economic development and environmental conservation, believing that “generating income from nature can lead to sustainable community growth.”

**Table 1** Canvas's business model analysis table

Key Partners - Purchaser of equipment producing - Purchaser of Raw Material as waste from pineapple processing factory - Purchaser of make product	Key Activities - Finding Raw Material to make processing pineapple products from pineapple peels and crowns - Controlling product standards by lost waste from the pineapple processing factory - Customer Services to communicate pineapple paper to reduce bad environment	Value Proposition - Quality Standards of producing by pineapple paper without bad pollution - The diversity of pineapple fiber paper is convenient and easy to use and beauty suitable to be come to naturally. - The product is easily biodegradable, without wasting raw material because pineapple paper processing make by natural processing production	Customer Relationships - Care for each other equally. - Warm and Friendly Services - Customer known for processing pineapple products to be green business	Customer Segments - Group of Green Product Entreprises - Group of High Aged Persons - Customer known for processing pineapple products to be green business - Tourists both of Thai and Foreigner interest method to make natural processing product
	Key Resources - processing pineapple products - Raw Material to make processing pineapple products by waste products from pineapple processing factory - Place to make products from community development meeting that gather to the village.		Channels - Contacts to Enterprise Place - Telephone Number - Facebook, Instagram, Tiktok, Social Media - Organize exhibitions according to various markets.	
Cost Structure			Revenue Stream	
- Raw Material then after lean to free - Expenditure to make product - Expenditure for sale an service - Public Expenditure - Marketing to promote			- Income from pineapple processing	

The content analysis explains the pattern of marketing: Before implementing Lean management, the business lacked continuity in marketing development because community and business leaders were only just recovering from COVID-19. After implementing lean management, the business began using online platforms to sell to both domestic and inter-

national customers interested in eco-friendly products. Marketing strategies include establishing community enterprises as learning centers for pineapple paper production and inviting students from domestic and international schools and educational institutions for study visits. Utilizing social media to promote products through online platforms like Face-

book, Instagram, and YouTube by using social media influencers and participating in various festivals for community business. Community public relations focused on environmental awareness can help build brand recognition for community-based pineapple processing enterprises. Collaboration with environmental organizations: Establish partnerships with environmentally related organizations or projects to build customer trust in our social responsibility.

From the interviews, the pineapple paper production process can show the results before and after leaning. According to the production steps before leaning, chemicals were used, while after leaning, plants were used to soften the pineapple fibers to make them into paper, as shown in the top figure 4 illustrating the production steps. The part done after leaning avoids using chemicals to soften the pineapple fibers before making them into paper, as shown in the bottom figure 4.



Figure 4 Pineapple paper process Flowchart.

The lean manufacturing process of pineapple paper gift boxes discovered by the research team can reduce operating costs as follows: reducing water and environmentally friendly chemicals and using “Litsea Glutinosa Leaves” or “Lauraceae” or “Indian laurel” to help break down pineapple fibers for paper production. The properties of Lauraceae, which aid digestion, are native to Asia, specifically South Asia, such as Sri Lanka, India, and Nepal, and Southeast Asia. In Thailand, Lauraceae can be found in all regions in evergreen forests, mixed deciduous forests, and dry dipterocarp forests and are commonly found in Prachuap Khirikhan Province. One practical use is that the

Lauraceae leaves can be crushed and mixed with rice water to make shampoo, which helps prevent dandruff and hair loss and makes hair soft, thick, and black because it contains mucilage, which can act as a protective coating for the skin and hair to provide moisture to both. (Pimpraporn, 2015, p.3) Currently, extracts from the Lauraceae leaves of the Terminalia chebula plant are also used as an important ingredient, possessing properties that increase viscosity in cosmetic products and digest pineapple fiber to become softer by mixing them with the mucilage to make pineapple fiber paper. From in-depth interviews to the concept of lean production as the utilization of pineap-

ple paper, the research team recognized the importance of reducing pollution and provided recommendations for minimizing chemical use, which is crucial for sustainable business operations. Using chemical-free raw materials helps reduce community pollution, addresses sustainability needs, and saves production costs. Commonly found Lauraceae leaves

were used for lean production in this research. This provides more guidance for creation marketing to environmentally conservative consumers or tourists, both domestically and internationally. The picture shows the Lauraceae leaves used to digest pineapple fiber from the experimental knowledge community into pineapple paper.



Figure 5 Experimental knowledge community into pineapple paper

A quantitative research study comparing the financial management practices of three small-scale businesses, based on interviews and financial performance calculations, revealed that before implementing Lean management, the top three community businesses (ranked 1-3 in order of similar size) implemented Lean management practices by adjusting marketing strategies, enhancing logo design, planning post-Lean implementation, adding a vision, mission, and policies to establish business goals, and utilizing pol-

lution-reducing materials in pineapple paper production by suggestion from the research team. Regarding the performance after implementing Lean management, the community enterprise generated revenue by reducing operational costs through Lean measures. This included marketing efforts to promote community enterprises, increase online marketing, and develop marketing management models to increase revenue. However, the business has diverse products but focuses on and generates its primary income from pineapple paper

products. This makes the executive summary of community enterprises important in transforming waste materials into value, playing a significant role in the business, serving as a symbol of Prachuap Khiri Khan province, and gaining popularity in community businesses, as shown in the before-and-after comparison table of quantitative financial lean manage-

ment. According to the research results, the study compares financial reports in two pre-and post-Lean transformation scenarios within the pineapple paper industry. Based on interviews, a summary of the business performance assessment can be presented in the following table.

Table 2 Comparison of financial and business management performance before and after Lean implementation in three pineapple-fiber paper community enterprises of similar size

Lists of Financial Report	Before Lean Management			After Lean Management			Average Before Lean	Average after Lean	Percentage change of lean
	1 st Community Enterprise	2 nd Community Enterprise	3 rd Community Enterprise	1 st Community Enterprise	2 nd Community Enterprise	3 rd Community Enterprise			
Break Even Point (Unit)	64,879.00	8,757.00	21,930.00	61,175.00	8,028.00	21,599.00	31,855.33	30,267.33	-4.99
Break Even Point (Baht)	1,621,975.00	1,050,840.0	877,200.00	1,528,375.00	963,360.00	863,960.00	1,183,338.33	1,118,565.00	-5.47
Break Even Point (Month)	43.00	15.00	14.00	40.00	13.00	14.00	24.00	22.33	-6.94
Income Per Year	150,000.00	216,000.00	144,000.00	165,000.00	226,800.00	155,520.00	170,000.00	182,440.00	7.32
Expenditure per year	112662	115762.5	64307.52	102,420.00	110,250.00	59,544.00	97,577.34	90,738.00	-7.01
Net Profit	47,580.00	105,750.00	84,456.00	52,338.00	111,037.50	91,212.48	79,262.00	84,862.66	7.07
PayBack Period (month)		25.00			21.00		25.00	21.00	-16.00
Rate on Investment:ROI		48.57			56.69		48.57	56.69	16.72
Rate on SalesROS		46.63			49.47		46.63	49.47	6.09
Net Present Value:N-PV		8,660.49			10,689.70		8,660.49	10,689.70	23.43



Lists of Financial Report	Before Lean Management			After Lean Management			Average Before Lean	Average after Lean	Percent- age change of lean
	1 st	2 nd	3 rd	1 st	2 nd	3 rd			
	Community Enterprise	Community Enterprise	Community Enterprise	Community Enterprise	Community Enterprise	Community Enterprise			
Profitability:PI		1.02			1.01		1.02	1.01	-0.98
Interest Rate:IRR		21.11			31.51		21.11	31.51	49.27

Source: From the calculations of the research qualitative analysis by interview

The results of business testing of community enterprise groups on lean management practices, before and after the implementation of lean management, show that all financial variables have an impact on the viability of the business. A quantitative research study comparing the financial management practices of three small-scale businesses, based on interviews and financial performance calculations, revealed that before implementing Lean management, the top three community businesses (ranked 1-3 in order of similar size) implemented Lean management practices by adjusting marketing strategies, enhancing logo design, planning post-Lean implementation, adding a vision, mission, and policies to establish business goals, and utilizing pollution-reducing materials in pineapple paper production by suggestion from the research team. Regarding the performance after implementing Lean management, the community enterprise generated revenue by reducing operational costs through Lean measures. This included marketing efforts to promote community enterprises, increase online marketing, and develop marketing management models to increase revenue. However, the business has diverse products but focuses on and generates its primary income from pineapple paper

products. This makes the executive summary of community enterprises important in transforming waste materials into value, playing a significant role in the business, serving as a symbol of Prachuap Khiri Khan province, and gaining popularity in community businesses, as shown in the before-and-after comparison table of quantitative financial lean management.

The research hypothesis is that the lean management approach for community enterprises processing pineapples in Prachuap Khiri Khan province generates profitable operations. Furthermore, through business management evaluation, lean management of these enterprises can reduce operating costs and ultimately increase profits by 10%. The result of the estimate after lean management by the research team's calculations was that the selling price remained unchanged, and business operations, including production volume, remained the same. However, lean management resulted in a 6.97% reduction in unit costs. The break-even point per unit decreased by 4.99 percent, while the break-even point per product value decreased by 5.47 percent. This indicates that cost reduction led to a faster return on investment after implementing lean management practices at the pineapple paper community enterprise. The payback

period accelerated by 6.94%, resulting in a 7.32% increase in annual revenue. In addition, expenses also decreased by 7.01% due to cost savings in both main raw materials and non-main raw materials and reduced labor costs, especially for the community enterprise labor group that operates within the business. Nevertheless, pre-tax profits for community enterprises, which are exempt from trade tax due to their economic value qualifying. The net profit of all community enterprises increased by an average of 7.07%. When the average feasibility of all community enterprises was assessed using financial feasibility theory, it was found that the payback period for the entire business after implementing lean management was 16.00% shorter, 4 months. The Rate of Investment (ROI) increased, meaning that net profit on investment increased by 16.72%. The Rate of Sales (ROS) increased only slightly, at 6.09%. This was due to higher operating expenses in selling, resulting in a smaller increase in net profit as a percentage of sales. The present value of net profit relative to investment expenditure increased by 23.43%. The company's profit index decreased by 0.98% due to the decrease in the ratio of the present value of net profit relative to investment expenditure. However, the incremental costs that would increase the present value of net profit were lower, resulting in a 49.27% increase in the net return.

Conclusion and Discussion

Objective 1: Study the lean management approach for a community pineapple processing enterprise in Prachuap Khiri Khan

Province by qualitative analysis research from in-depth interviews. This community enterprise specializes in producing high-quality, market-accepted pineapple fiber paper. The raw materials are pineapple peels and stems, available near the production site and inexpensive. Pineapple peels and stems are waste that can be processed to create value and strengthen the community enterprise's career. However, they are not valued as raw materials. Before implementing lean management, in terms of community enterprise leadership management after the COVID situation, they were still not adjusting their business operations using a consignment system, setting up booth events near the community, and relying on word-of-mouth marketing. In production, they used chemicals as a cost to aid the fiber-breaking process to produce pineapple paper. For after implementing lean management, in terms of community enterprise leadership, they expanded their vision, mission, and marketing strategy to make it more widely known; added online marketing; and created a learning center for tourists, students, or pupils to visit and demonstrate to make eco-pineapple paper production at the community enterprise. In the production process. The use of chemicals was stopped, utilizing the Lauraceae leaves available in the community. By applying knowledge from experimenting with softening pineapple fibers, costs were reduced, environmental pollution was decreased, and the number of laborers was reduced to match productivity, resulting in eco-friendly pineapple paper. The reduction in unit costs can be attributed to three specific lean interventions: (1) elimina-



tion of chemical decomposition processes for consistent research with Alkhoraif, Rashid and McLaughlin (2019, p. 13), Widiwati, Liman and Nurprihatin (2025, p. 611), and AlManei, Salonitis and Xu (2017, p. 750); (2) streamlined workflow reducing labor hours by 10%, supporting the hypothesis to reduce all costs for consistent research with Salvi (2025, p. 17), (3) creation of eco-pineapple paper, and (4) adjusting online marketing strategies to be consistent with Akyuz, et al. (2023, p. 16). Furthermore, pineapple fiber paper can be further developed into gift wrapping or to enhance product quality by incorporating natural materials into the packaging. The growing popularity of natural products and the elimination of agricultural waste have led to the increasing use

of pineapple waste as a source of value-added paper production. These findings extend lean manufacturing theory by demonstrating its applicability to community-based enterprises in developing country contexts, where community enterprises adopt the approach for sustainable development consistent with Rodjam, et al. (2026, p. 23) and Nakhonsong and Chamruspanth (2024, pp. 4-1).

Objective 2: To study the management of the pineapple processing community enterprise in Prachuap Khiri Khan Province through the assessment of business management to reduce the cost of doing business through in-depth interviews and quantitative analysis research as financial reports. It can be summarized in the following table:

Table 3 Comparison of the results before and after leaning on the pineapple processing community enterprise.

Business financial statements	Before lean management	After lean management
Total payback period	2 Years 1 Month	1 Year 9 Months
ROI	48.57 percent	56.69 Percent
ROS	46.63 Percent	49.47 percent
NPV	8,660.49 Baht	10,689.7 Baht
PI	1.02 Times	1.01 Times
IRR	21.11 Percent	31.51 Percent

Source: From the calculations of the research team

The feasibility of continuing the business according to the industrial feasibility study criteria will lead to the continued growth of the community enterprise that processes non-food pineapple efficiently. From the financial summary report on the feasibility of the enterprise according to the research findings, the research team summarized the assessments both before and after implementing lean

management. Based on in-depth interviews with the pineapple fiber paper community enterprise, it was found that the payback period became faster, and the return on investment, the return on sales, the present value of net profit, the profit index, and the net return all increased significantly after lean management. As for sustainability, the research indicates that it depends on the continuity of operations and

the desire to explore new markets through online marketing to continuously generate additional income.

The conclusion of substantial business for community enterprises expands the discussion: (1) Compare findings with prior lean implementation studies in SMEs/community enterprises, comparing financial reports before and after lean management based on research findings from qualitative evaluations of three community enterprises producing pineapple paper, which are small-sized businesses. The business performance indicates the feasibility of sustainable expansion under eco-friendly pineapple paper production, transforming the production process from using chemicals to using plant leaves to reduce pollution. This is part of generating sustainable income for community enterprise members, supplementing the main income of the community, and fostering long-term sustainability. (2) Discuss theoretical contributions; it focuses on quality consistency and how to fulfill feasibility business in community enterprises to create methodology as an approach to reduce waste in the production of non-food manufacturing enterprises. Combined, Lean and Lean administration will be beneficial for business in determining the most suitable method for identifying and adapting business marketing until profit can be increased or cost can be decreased at the same time. And use the feasibility theory of the business to evaluate in order to reach a conclusion on the lean operation of the business to achieve operational results. (3) Add practical implications grounded in findings: the research has replaced the old chemical-based

production processes with the use of plants discovered in the community to modify production processes to address waste reduction and environmental conservation and expand marketing perspectives for eco-friendly products to create future business sustainability. (4) Add a dedicated limitations section addressing 3 small sample sizes as community enterprises, especially pineapple paper production; a single province, Prachuap Khiri Khan province, where case study research aims to examine the feasibility of the business before and after the lean management approach for the potential application and expansion to other community enterprises; and a specific product type, eco-friendly pineapple paper, which is a product that can transform the way community businesses operate, change the image of the community to become an eco-friendly community, and gain acceptance from community members and tourists. It can strengthen the community economy to be stable and sustainable, and due to statistical limitations, due to the limitation of a small sample size, the research team focused on qualitative research to analyze the financial aspects of the business performance both before and while exploring post-implementation lean management methods. This was to compare the results after discovering production processes that create business sustainability through eliminating the use of chemicals in production. Therefore, the statistics used were only to study the financial feasibility in order to summarize business performance and anticipate that lean management could generate profit and reduce business costs as hypothesized.



Suggestions

The response to the master plan under the national strategy on entrepreneurs and SMEs in the new era aims to strengthen smart entrepreneurs, create opportunities for access to financial services, create market access, create an ecosystem conducive to the operations of entrepreneurs and SMEs in the new era, enhance entrepreneurial potential, create an environment and mechanisms that promote grassroots economic development, create sustainable growth in a green economy, and manage environmentally impactful pollution and chemicals in the agricultural sector in accordance with international standards. Recommendations can be guided by relevant agencies as follows:

3.1. The community entrepreneur base for pineapple processing enterprises and related businesses, or those in the surrounding area, recognizes the importance of creating sustainable business operations that will help transform the area into a green economy, preserve the environment, maintain a balance of social coexistence, and foster efficient and contented community business growth in a society with reduced pollution, enabling happier and safer lives. This is a case study in which the research team successfully conducted a feasibility assessment of the business.

3.2 Government agencies with a stake in the pineapple processing community enterprise's lean economy prioritize not only profitability for local businesses but also cost reduction and pollution reduction from chemical use. This initiative recognizes the importance of campaigning for chemical reduction and

environmental protection. They also receive support from government agencies to promote the local economy and promote environmental conservation in the community.

3.3 To develop lean management of pineapple processing community enterprises for future research, the research team considered the use of contemporary technology to modernize the community enterprises' products and produce them faster, bypassing the use of human labor and using technology to enhance production operations to increase production capacity.

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